

Industrial Automation Headquarters

Delta Electronics, Inc.
Taoyuan Technology Center
No.18, Xinglong Rd., Taoyuan District,
Taoyuan City 33068, Taiwan
TEL: 886-3-362-6301 / FAX: 886-3-371-6301

Asia

Delta Electronics (Shanghai) Co., Ltd.
No.182 Minyu Rd., Pudong Shanghai, P.R.C.
Post code : 201209
TEL: 86-21-6872-3988 / FAX: 86-21-6872-3996
Customer Service: 400-820-9595

Delta Electronics (Japan), Inc.
Tokyo Office
Industrial Automation Sales Department
2-1-14 Shibadaimon, Minato-ku
Tokyo, Japan 105-0012
TEL: 81-3-5733-1155 / FAX: 81-3-5733-1255

Delta Electronics (Korea), Inc.
Seoul Office
1511, 219, Gasan Digital 1-Ro., Geumcheon-gu,
Seoul, 08501 South Korea
TEL: 82-2-515-5305 / FAX: 82-2-515-5302

Delta Energy Systems (Singapore) Pte Ltd.
4 Kaki Bukit Avenue 1, #05-04, Singapore 417939
TEL: 65-6747-5155 / FAX: 65-6744-9228

Delta Electronics (India) Pvt. Ltd.
Plot No.43, Sector 35, HSIIDC Gurgaon,
PIN 122001, Haryana, India
TEL: 91-124-4874900 / FAX : 91-124-4874945

Delta Electronics (Thailand) PCL.
909 Soi 9, Moo 4, Bangpoo Industrial Estate (E.P.Z),
Pattana 1 Rd., T.Phraksa, A.Muang,
Samutprakarn 10280, Thailand
TEL: 66-2709-2800 / FAX : 662-709-2827

Delta Energy Systems (Australia) Pty Ltd.
Unit 20-21/45 Normanby Rd., Notting Hill Vic 3168, Australia
TEL: 61-3-9543-3720

Americas

Delta Electronics (Americas) Ltd.
Raleigh Office
P.O. Box 12173, 5101 Davis Drive,
Research Triangle Park, NC 27709, U.S.A.
TEL: 1-919-767-3813 / FAX: 1-919-767-3969

Delta Greentech (Brasil) S/A
São Paulo Office
Rua Itapeva, 26 – 3° Andar - Bela Vista
CEP: 01332-000 – São Paulo – SP - Brasil
TEL: 55-11-3530-8642 / 55-11-3530-8640

Delta Electronics International Mexico S.A. de C.V.
Mexico Office
Vía Dr. Gustavo Baz No. 2160, Colonia La Loma,
54060 Tlalnepanitla Estado de Mexico
TEL: 52-55-2628-3015 #3050/3052

EMEA

Headquarters: Delta Electronics (Netherlands) B.V.
Sales: Sales.IA.EMEA@deltaww.com
Marketing: Marketing.IA.EMEA@deltaww.com
Technical Support: iatechnicalsupport@deltaww.com
Customer Support: Customer-Support@deltaww.com
Service: Service.IA.emea@deltaww.com
TEL: +31(0)40 800 3800

BENELUX: Delta Electronics (Netherlands) B.V.
De Witbogt 20, 5652 AG Eindhoven, The Netherlands
Mail: Sales.IA.Benelux@deltaww.com
TEL: +31(0)40 800 3800

DACH: Delta Electronics (Netherlands) B.V.
Coesterweg 45, D-59494 Soest, Germany
Mail: Sales.IA.DACH@deltaww.com
TEL: +49(0)2921 987 0

France: Delta Electronics (France) S.A.
ZI du bois Challand 2, 15 rue des Pyrénées,
Lisses, 91090 Evry Cedex, France
Mail: Sales.IA.FR@deltaww.com
TEL: +33(0)1 69 77 82 60

Iberia: Delta Electronics Solutions (Spain) S.L.U
Ctra. De Villaverde a Vallecas, 265 1º Dcha Ed.
Hormigueras – P.I. de Vallecas 28031 Madrid
TEL: +34(0)91 223 74 20
C/Llull, 321-329 (Edificio CINC) | 22@Barcelona, 08019 Barcelona
Mail: Sales.IA.Iberia@deltaww.com
TEL: +34 93 303 00 60

Italy: Delta Electronics (Italy) S.r.l.
Ufficio di Milano Via Senigallia 18/2 20161 Milano (MI)
Piazza Grazioli 18 00186 Roma Italy
Mail: Sales.IA.Italy@deltaww.com
TEL: +39 02 64672538

Russia: Delta Energy System LLC
Vereyskaya Plaza II, office 112 Vereyskaya str.
17 121357 Moscow Russia
Mail: Sales.IA.RU@deltaww.com
TEL: +7 495 644 3240

Turkey: Delta Greentech Elektronik San. Ltd. Sti. (Turkey)
Şerifali Mah. Hendem Cad. Kule Sok. No:16-A
34775 Ümraniye – İstanbul
Mail: Sales.IA.Turkey@deltaww.com
TEL: + 90 216 499 9910

GCC: Delta Energy Systems AG (Dubai BR)
P.O. Box 185668, Gate 7, 3rd Floor, Hamarain Centre
Dubai, United Arab Emirates
Mail: Sales.IA.MEA@deltaww.com
TEL: +971(0)4 2690148

Egypt + North Africa: Delta Electronics
511 Cairo Business Plaza, North 90 street,
New Cairo, Cairo, Egypt
Mail: Sales.IA.MEA@deltaww.com



Delta Elevator Drive VFD-ED Series User Manual



www.deltaww.com

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PLEASE READ PRIOR TO INSTALLATION FOR SAFETY.



- ☑ Disconnect AC input power before connecting any wiring to the AC motor drive.
- ☑ Even if the power has been turned off, a charge may still remain in the DC-link capacitors with hazardous voltages before the POWER LED is OFF. Do NOT touch the internal circuits and components.
- ☑ 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.



- ☑ 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 U/T1, V/T2, and W/T3 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 for AC motor drive must be $\leq 240V$ for 230V series (480V for 460V series) and the mains supply current capacity must be $\leq 5000A$ RMS ($\leq 10000A$ RMS for the ≥ 40 HP (30 kW) models).
- ☑ 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 $56^{\circ}C$ 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**

The content of this manual may be revised without prior notice. Please consult our distributors or download the latest version at http://www.deltaww.com/iadownload_acmotordrive

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Issued Edition: 01
Firmware Version: V1.07
(Refer to Parameter 00-06 on the product to get the firmware version.)
Issued Date: April, 2019

Chapter 1 Introduction

1-1 Nameplate Information

1-2 Model Name

1-3 Serial Number

1-4 Apply After Service by Mobile Device

1-5 RFI Switch

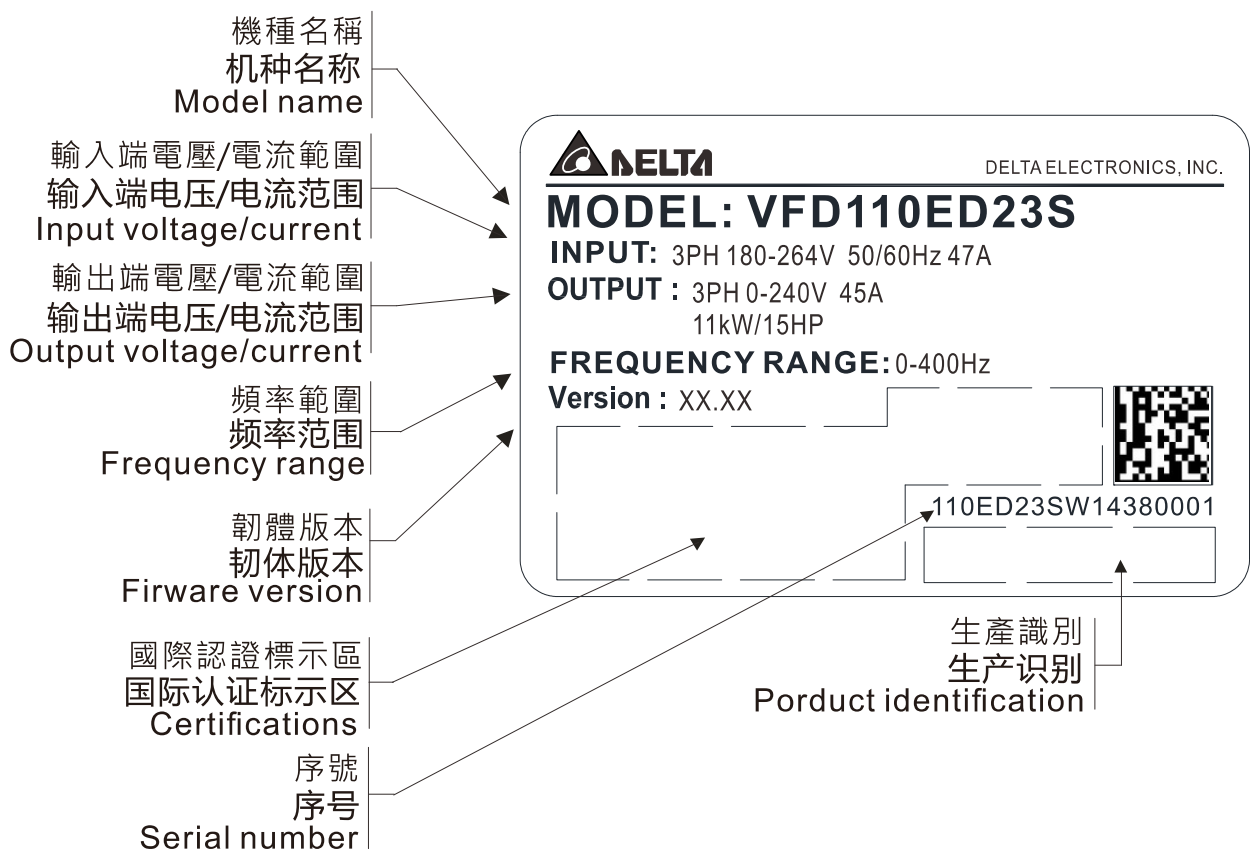
1-6 Dimensions

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

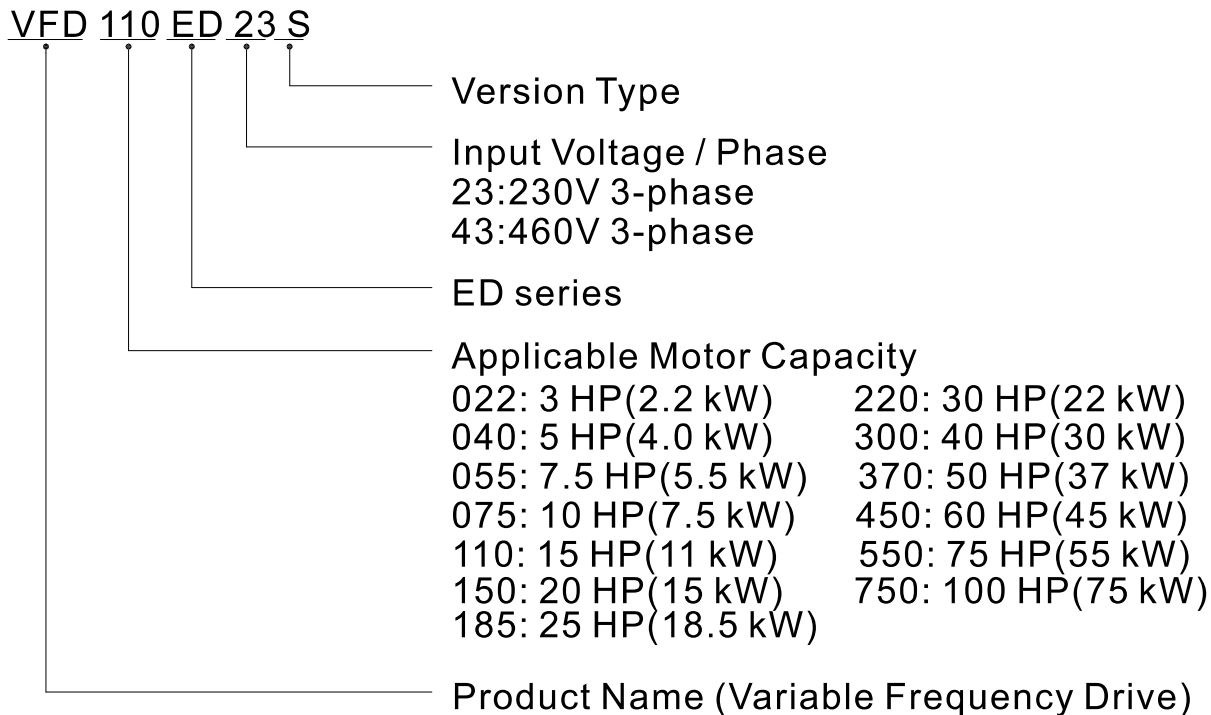
1. Inspect the unit after unpacking to ensure that it was not damaged during shipment. Make sure that the part number printed on the package corresponds with the part number indicated on the nameplate.
2. Make sure that the voltage for the wiring is in the range indicated on the nameplate. Install the 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, select the language and set parameter groups with the digital operation panel (KPED-LE01). 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

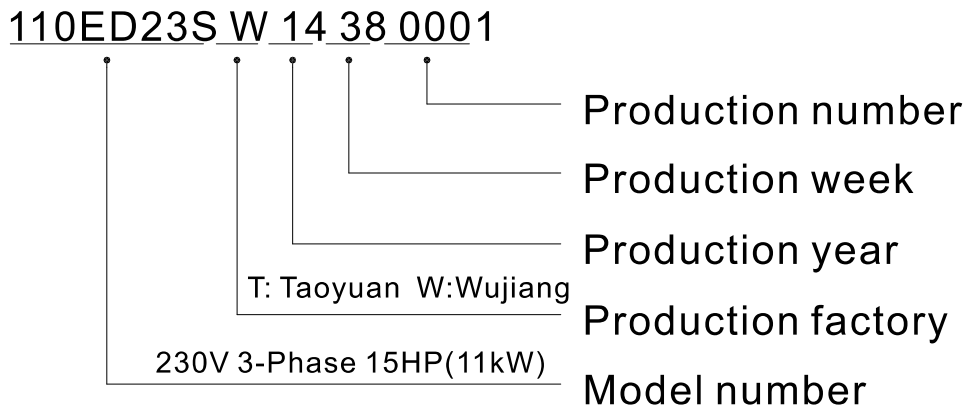
This example uses the 15 HP/11 kW 230 V, 3-phase motor drive.



1-2 Model Name



1-3 Serial Number

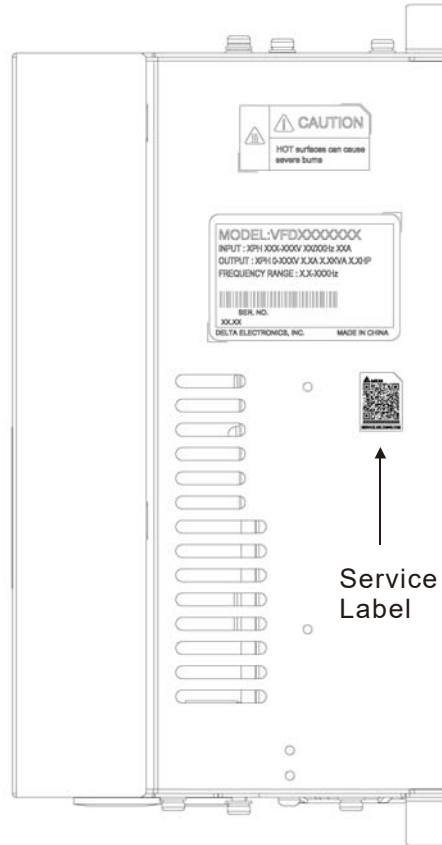


1-4 Apply After Service by Mobile Device

1-4-1 Location of Service Link Label

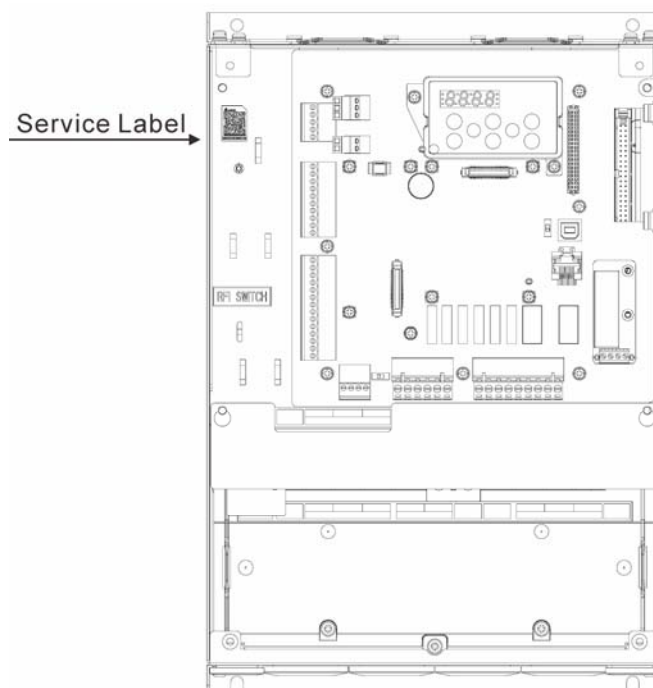
Frame B

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



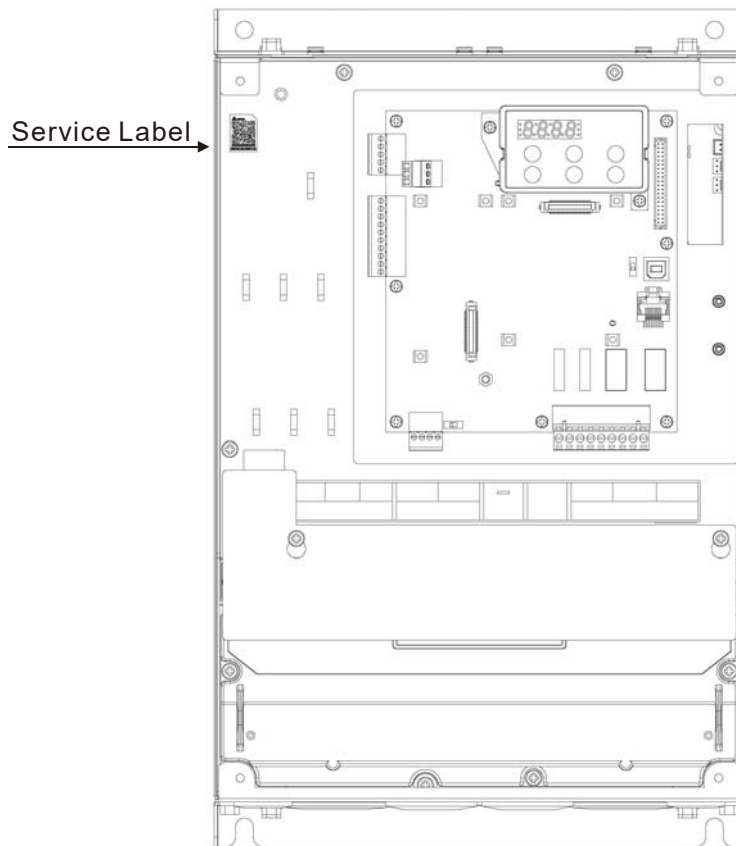
Frame C

Remove the front cover of the case to find the service link label (service label) located on the upper left corner as shown in the following image.



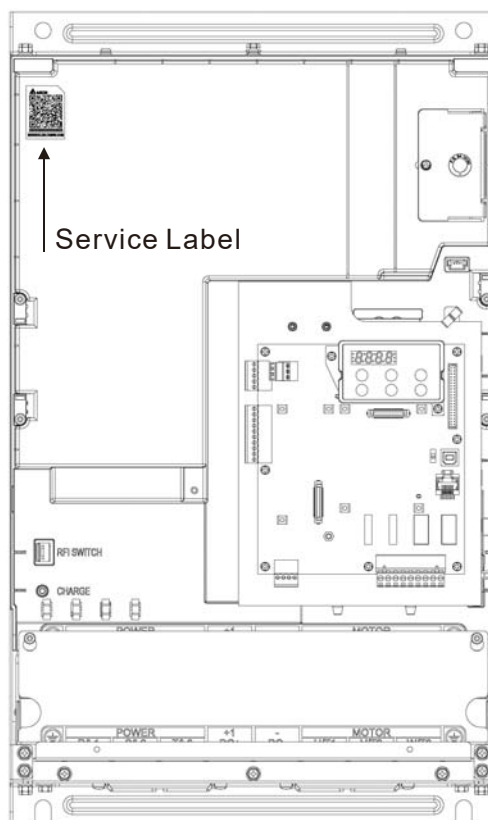
Frame D

Remove the front cover of the case to find the service link label (service label) located on the upper left corner as shown in the following image.

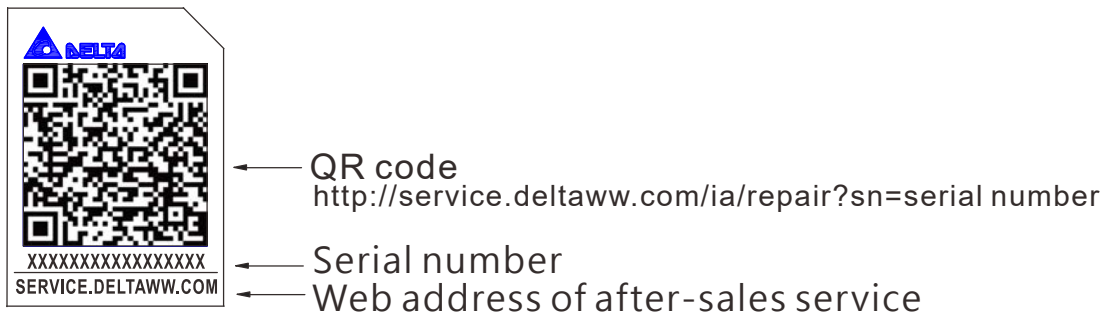


Frame E

Remove the front cover of the case to find the service link label (service label) located on the upper left corner as shown in the following image.



1-4-2 Service Link Label



Scan QR Code to request service

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

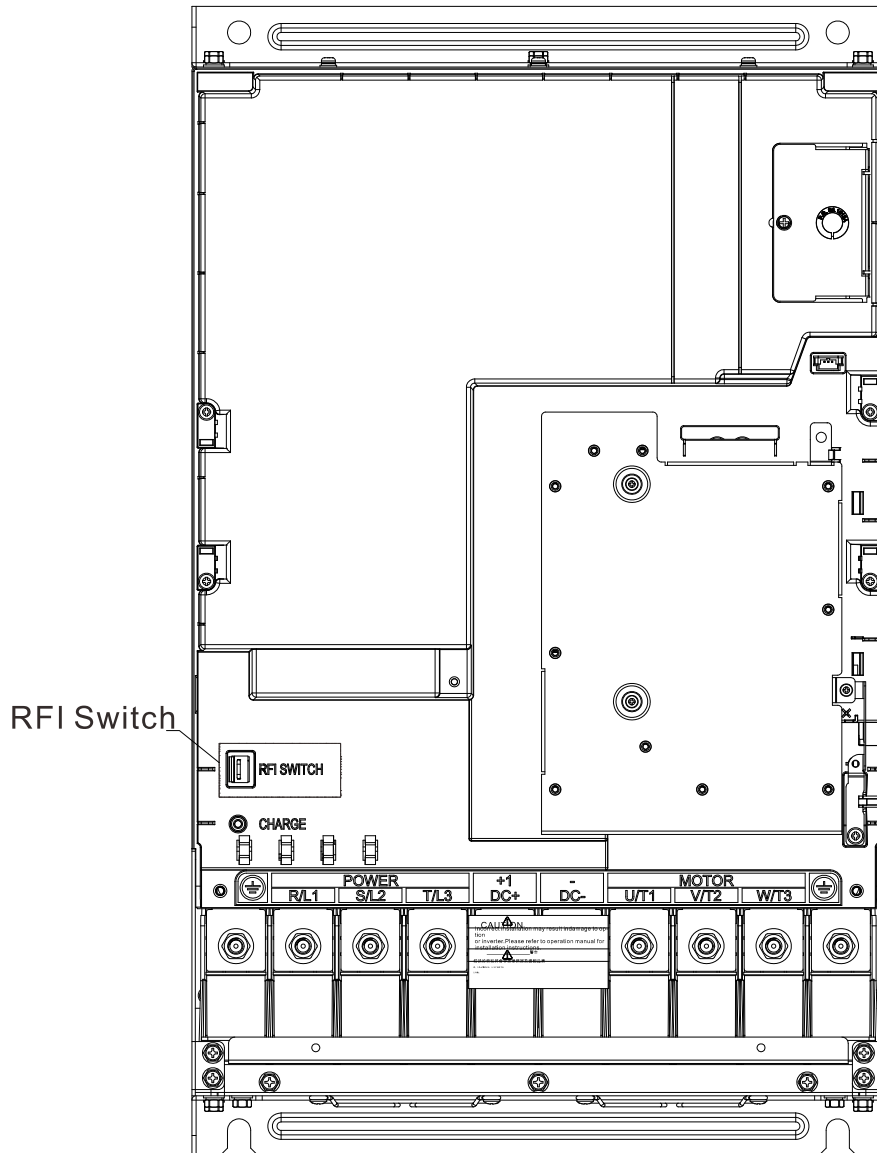
Cannot find the QR Code?

1. Open a web browser on your computer or smartphone.
2. Enter <https://service.deltaww.com/ia/repair> 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.

1-5 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 Frames B, C, D, E are at similar locations. Open the drive's top cover to remove the RFI switch as shown in the following image.

Frame E



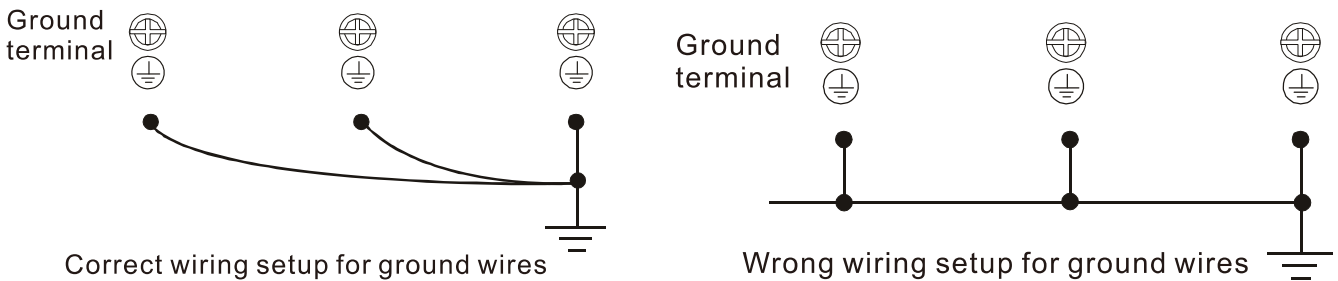
NOTE: The RFI switches on Frames B/C/D/E are at similar locations.

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. Removing the switch also cuts off the internal RFI capacitor (filter capacitor) between the system's frame and the central circuits to avoid damaging the central circuits and reduces the ground leakage current.

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.



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)

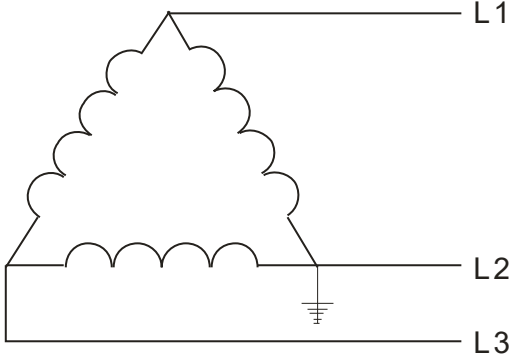
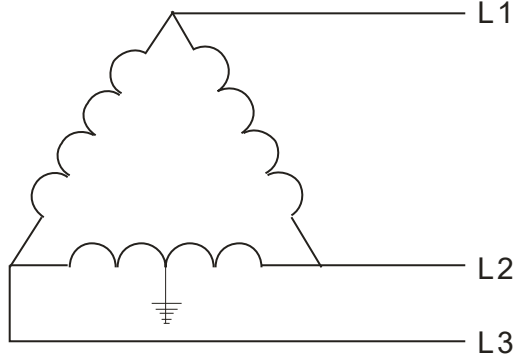
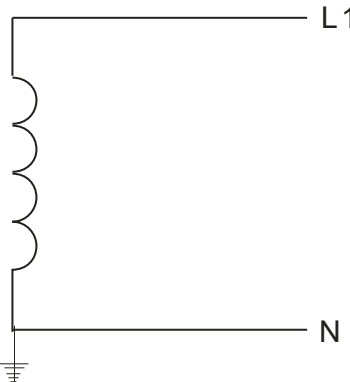
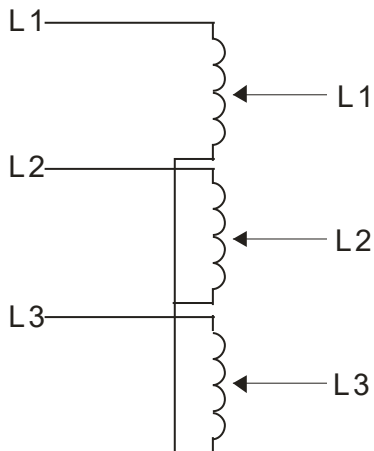
A floating ground system is also called an IT system, ungrounded system, or high impedance/resistance (greater than 30 Ω) grounding system.

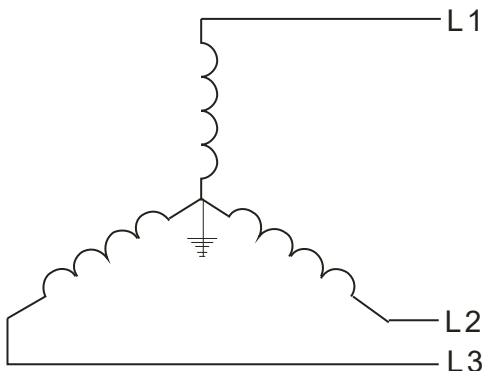
- ☑ Disconnect the ground cable from the internal EMC filter.
- ☑ In situations where EMC is required, check for excess electromagnetic radiation affecting nearby low-voltage circuits. In some situations, the adapter and cable naturally provide enough suppression. If in doubt, install an extra electrostatic 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.

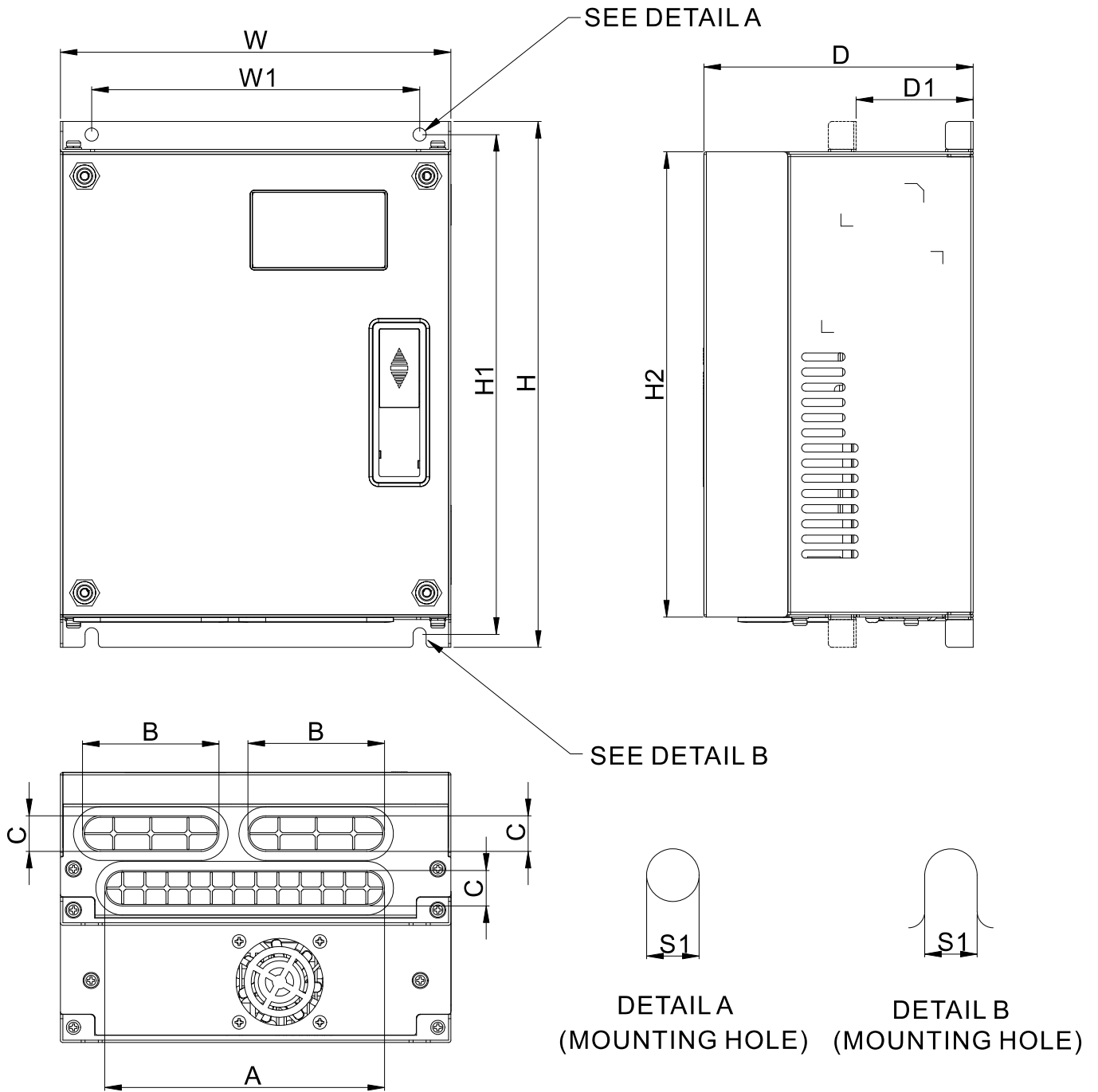
Conditions for removing the RFI switch	
<p>1. Grounding at a corner in a triangle configuration</p> 	<p>2. Grounding at a midpoint in a polygonal configuration</p> 
<p>3. Grounding at one end in a single-phase configuration</p> 	<p>4. No stable neutral grounding in a three-phase autotransformer configuration</p> 

Using the RFI switch	
<p>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.</p>	

1-6 Dimensions

Frame B

VFD022ED21S, VFD037ED21S, VFD040ED23S/43S



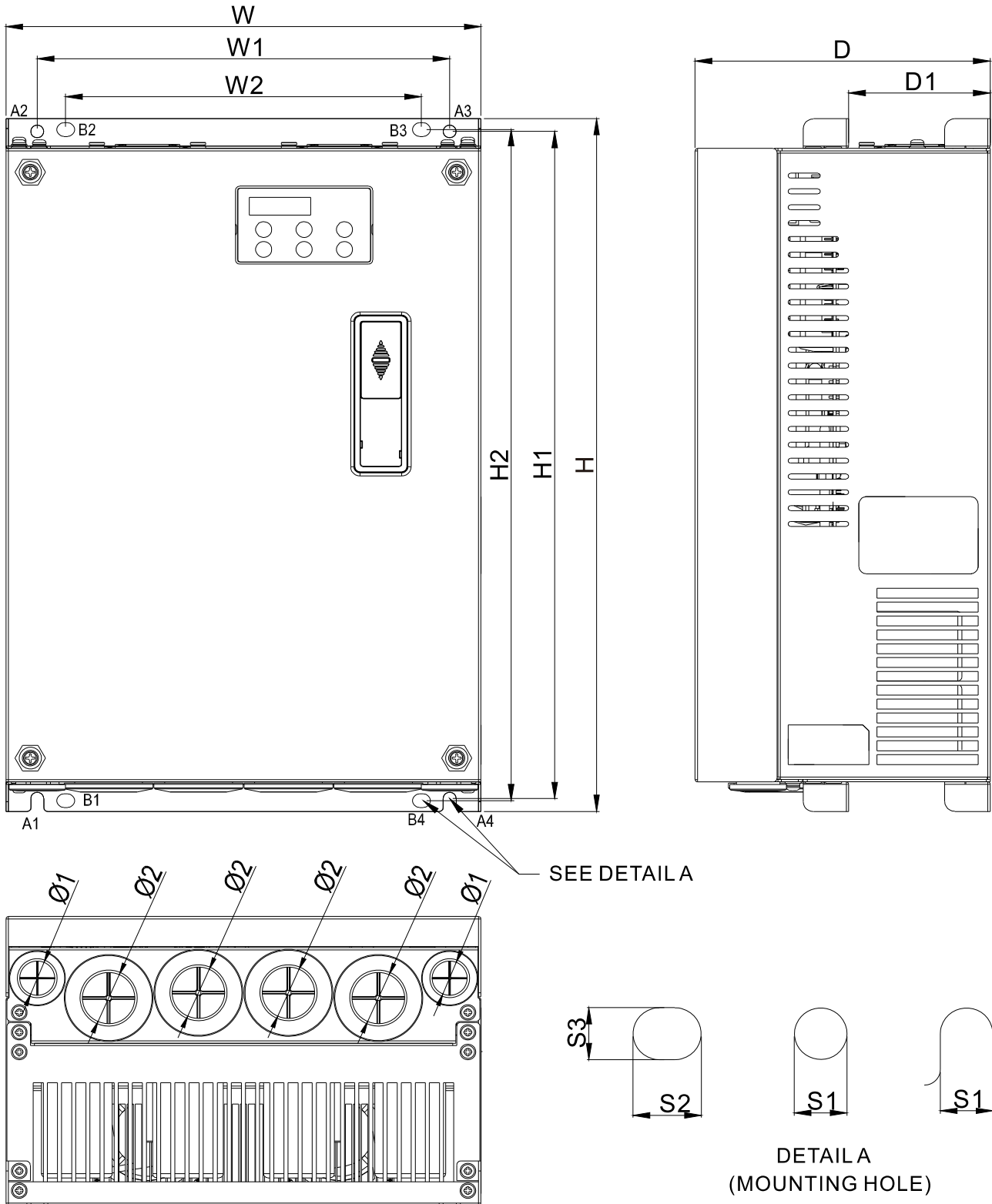
Unit: mm [inch]

Frame	W	W1	H	H1	H2	D	D1*	S1	A	B	C
B	193.5 [7.60]	162.5 [6.39]	260.0 [10.22]	247.0 [9.71]	230.0 [9.04]	133.5 [5.25]	58.0 [2.28]	6.5 [0.26]	138.6 [5.46]	67.2 [2.66]	17.6 [0.69]

*D1: This dimension is for flange mounting application reference.

Frame C

VFD055ED23S/43S, VFD075ED23S/43S, VFD110ED23S/43S, VFD150ED43S, VFD185ED43S



DETAIL A
(MOUNTING HOLE)

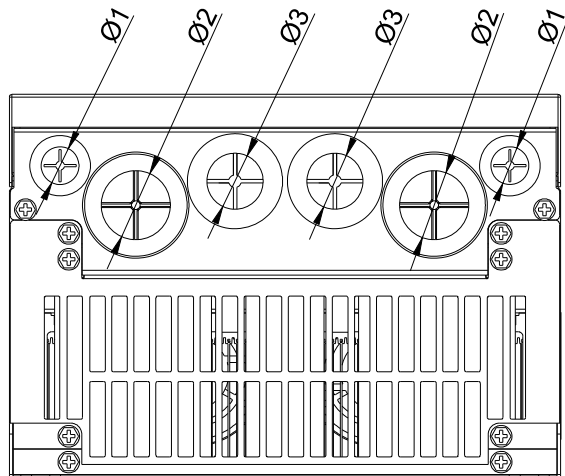
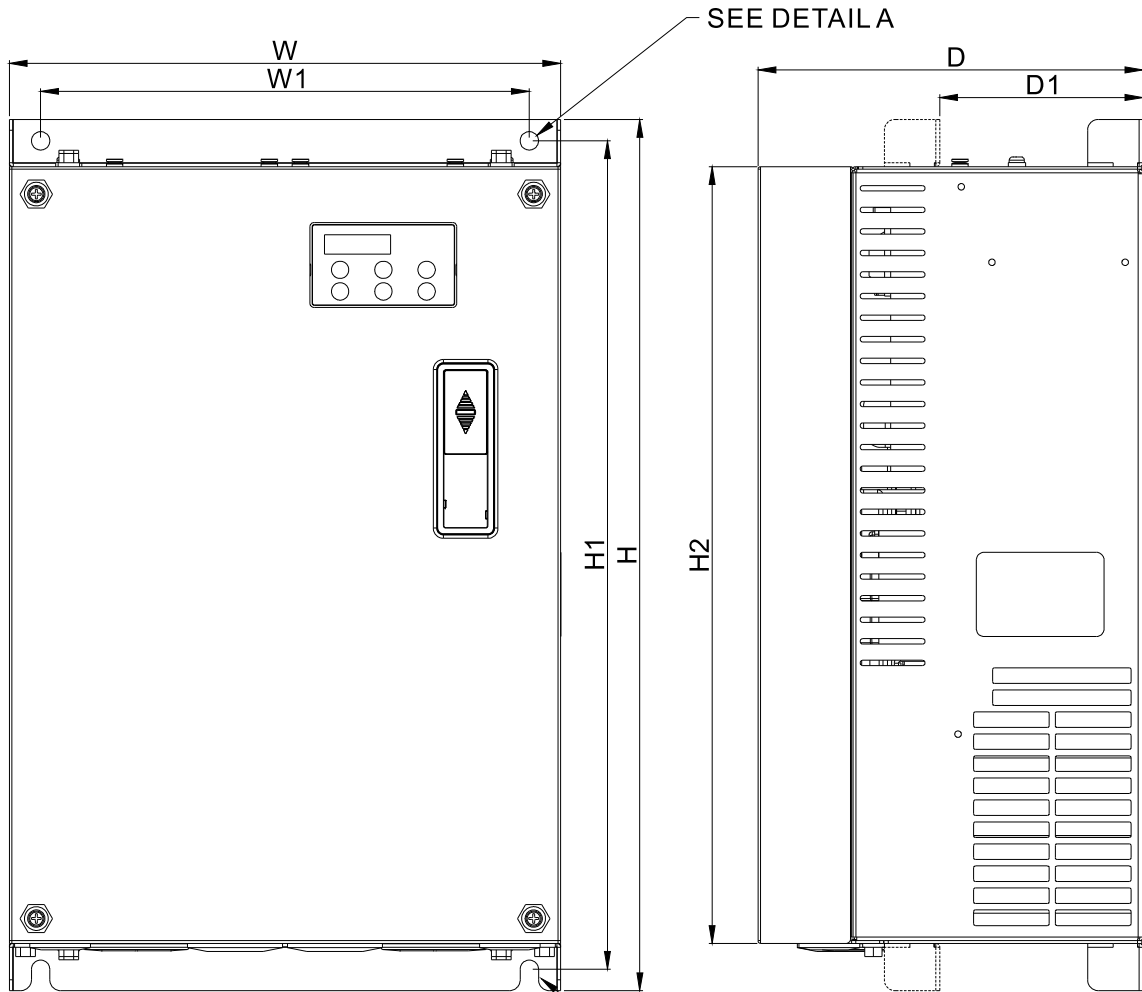
													Unit: mm [inch]	
Frame	W	W1	W2	H	H1	H2	D	D1*	S1	S2	S3	Ø1	Ø2	
C	235.0 [9.25]	204.0 [8.03]	176.0 [6.93]	350.0 [13.78]	337.0 [13.27]	320.0 [15.60]	146.0 [5.75]	70.0 [2.76]	6.5 [0.26]	9.0 [0.35]	7.0 [0.28]	19.7 [0.78]	28.3 [1.11]	

Note: A1–A4 and B1–B4 can be used for screwdriver installation; B1–B4 can also be used for sleeve installation

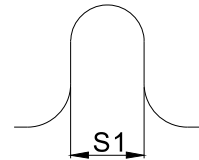
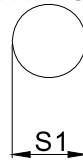
*D1: This dimension is for flange mounting application reference.

Frame D

VFD150ED23S, VFD185ED23S, VFD220ED23S/43S, VFD300ED43S



DETAIL A
(MOUNTING HOLE)



DETAIL B
(MOUNTING HOLE)

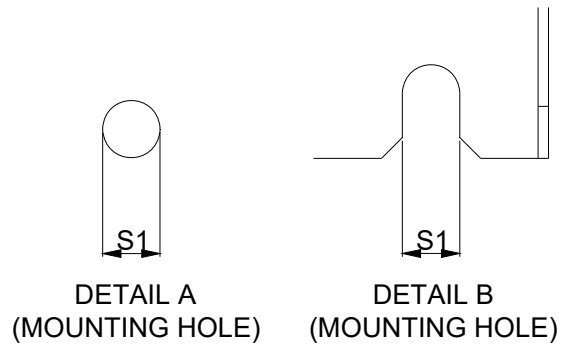
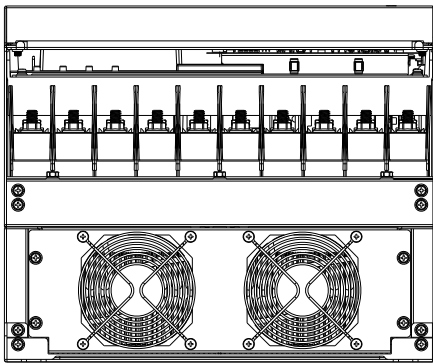
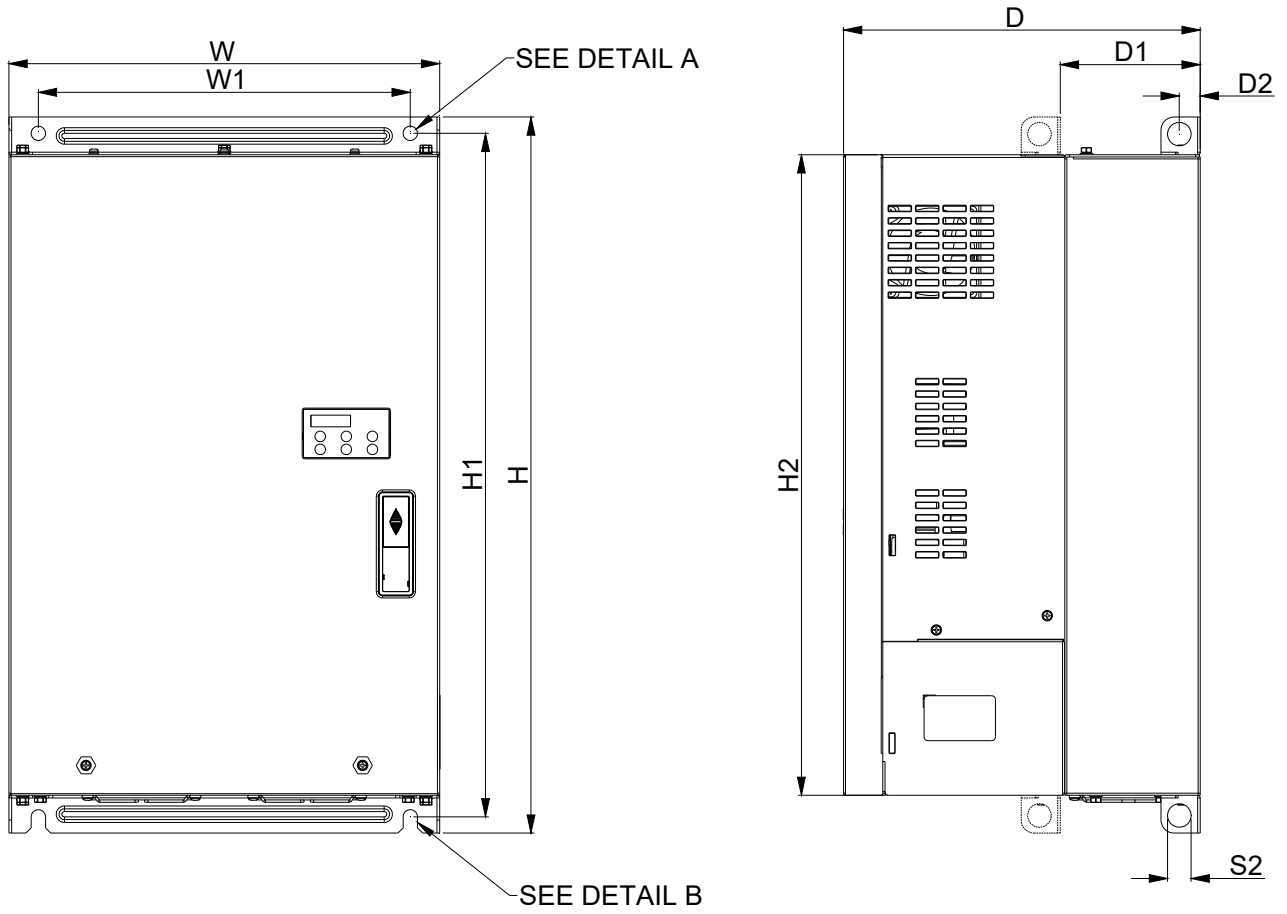
Unit: mm [inch]

Frame	W	W1	H	H1	H2	D	D1*	S1	Ø1	Ø2	Ø3
D	255.0 [10.04]	226.0 [8.90]	403.8 [15.90]	384.0 [15.12]	360.0 [14.17]	178.0 [7.01]	94.0 [3.70]	8.5 [0.33]	17.5 [0.69]	32.0 [1.26]	26.0 [1.02]

*D1: This dimension is for flange mounting application reference.

Frame E

VFD300ED23S, VFD370ED23S/43S, VFD450ED43S, VFD550ED43S, VFD750ED43S



Unit: mm [inch]

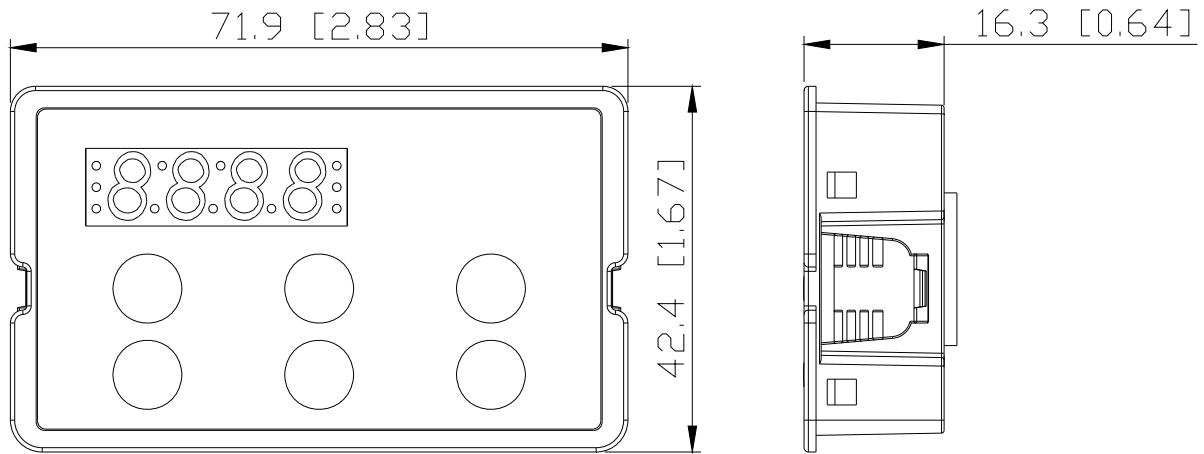
Frame	W	W1	H	H1	H2	D	D1*	D2	S1	S2
E	330.0 [12.99]	285.0 [11.22]	550.0 [21.65]	525.0 [20.67]	492.0 [19.37]	273.4 [10.76]	107.2 [4.22]	16.0 [0.63]	11.0 [0.43]	18.0 [0.71]

*D1: This dimension is for flange mounting application reference.

Built-In Keyboard Panel

KPED-LE01

Unit: mm [inch]



Chapter 2 Installation

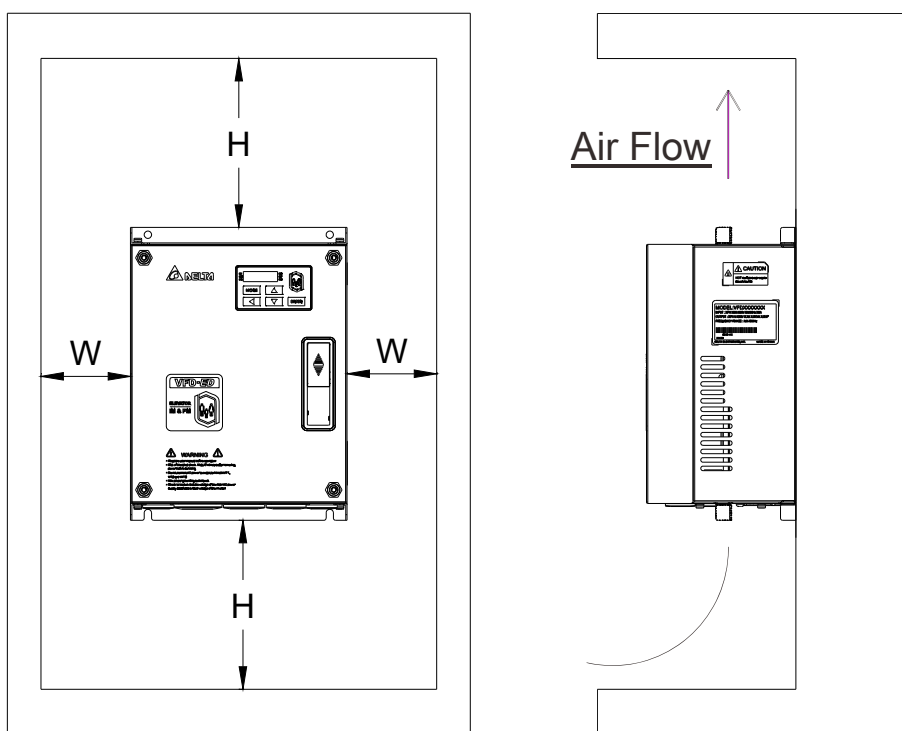
2-1 Mounting Clearance

2-2 Airflow and Power Dissipation

2-1 Mounting Clearance

- ☑ Do not allow material such as fiber particles, scraps of paper, shredded wood, sawdust, and metal particles to adhere to the heat sink.
- ☑ Install the AC motor drive in a metal cabinet. When installing one drive below another one, use a metal separator between the AC motor drives to prevent mutual heating and to prevent the risk of fire.
- ☑ Install the AC motor drive in Pollution Degree 2 (IEC 60664-1) environments only: under normal circumstances only nonconductive pollution occurs and temporary conductivity caused by condensation is expected.

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



Minimum Mounting Clearance

Frame	Capacity	Model No.	W (Width) mm [inch]	H (Height) mm [inch]
B	3.0–5.0 HP (2.2–4 kW)	VFD022ED21S, VFD037ED21S, VFD040ED23S/43S	50 [2]	150 [6]
C	7.5–15 HP (5.5–11 kW)	VFD055ED23S/43S, VFD075ED23S/43S, VFD110ED23S/43S, VFD150ED43S, VFD185ED43S	75 [3]	175 [7]
D	20–40 HP (15–30 kW)	VFD150ED23S, VFD185ED23S, VFD220ED23S/43S, VFD300ED43S	75 [3]	200 [8]
E	40–100 HP (30–75 kW)	VFD300ED23S, VFD370ED23S/43S, VFD450ED43S, VFD550ED43S, VFD750ED43S	75 [3]	200 [8]

 **NOTE**

The minimum mounting clearances stated in the table above apply to AC motor drives frame B, C, D and E. Failure to follow the minimum mounting clearances may cause the motor drive fan to malfunction and cause heat dissipation problems.

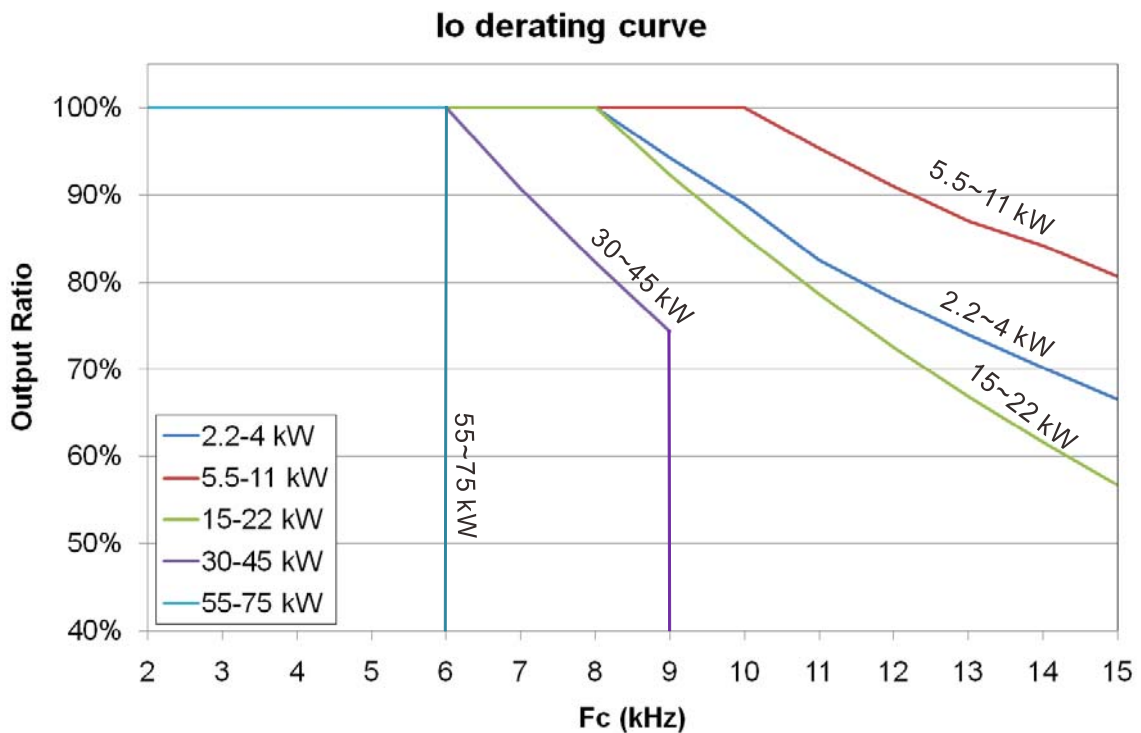
2-2 Airflow and Power Dissipation

Model No.	Airflow Rate for Cooling						Power Dissipation for AC Motor Drive		
	Flow Rate [cfm]			Flow Rate [m3/hr]			Power Dissipation [W]		
	External	Internal	Total	External	Internal	Total	Loss External (Heat Sink)	Internal	Total
VFD022ED21S	13.7	-	13.7	23.3	-	23.3	60	36	96
VFD037ED21S	23.9	-	23.9	40.7	-	40.7	84	46	130
VFD040ED23S	23.9	-	23.9	40.7	-	40.7	133	49	182
VFD055ED23S	48.5	-	48.5	82.4	-	82.4	212	67	279
VFD075ED23S	48.5	-	48.5	82.4	-	82.4	292	86	379
VFD110ED23S	47.9	-	47.9	81.4	-	81.4	355	121	476
VFD150ED23S	64.6	-	64.6	109.8	-	109.8	490	161	651
VFD185ED23S	102.3	-	102.3	173.8	-	173.8	638	184	822
VFD220ED23S	102.8	-	102.8	174.7	-	174.7	723	217	939
VFD300ED23S	179	30	209	304	51	355	932	186	1118
VFD370ED23S	179	30	209	304	51	355	1112	222	1334
VFD040ED43S	13.7	-	13.7	23.3	-	23.3	123	42	165
VFD055ED43S	48.5	-	48.5	82.4	-	82.4	185	55	240
VFD075ED43S	48.5	-	48.5	82.4	-	82.4	249	71	320
VFD110ED43S	47.9	-	47.9	81.4	-	81.4	337	94	431
VFD150ED43S	46.1	-	46.1	78.4	-	78.4	302	123	425
VFD185ED43S	46.1	-	46.1	78.4	-	78.4	391	139	529
VFD220ED43S	102.8	-	102.8	174.7	-	174.7	642	141	783
VFD300ED43S	83.7	-	83.7	142.2	-	142.2	839	180	1019
VFD370ED43S	179	30	209	304	51	355	803	252	1055
VFD450ED43S	179	30	209	304	51	355	1014	270	1284
VFD550ED43S	179	30	209	304	51	355	1244	275	1519
VFD750ED43S	186	30	216	316	51	367	1541	338	1878

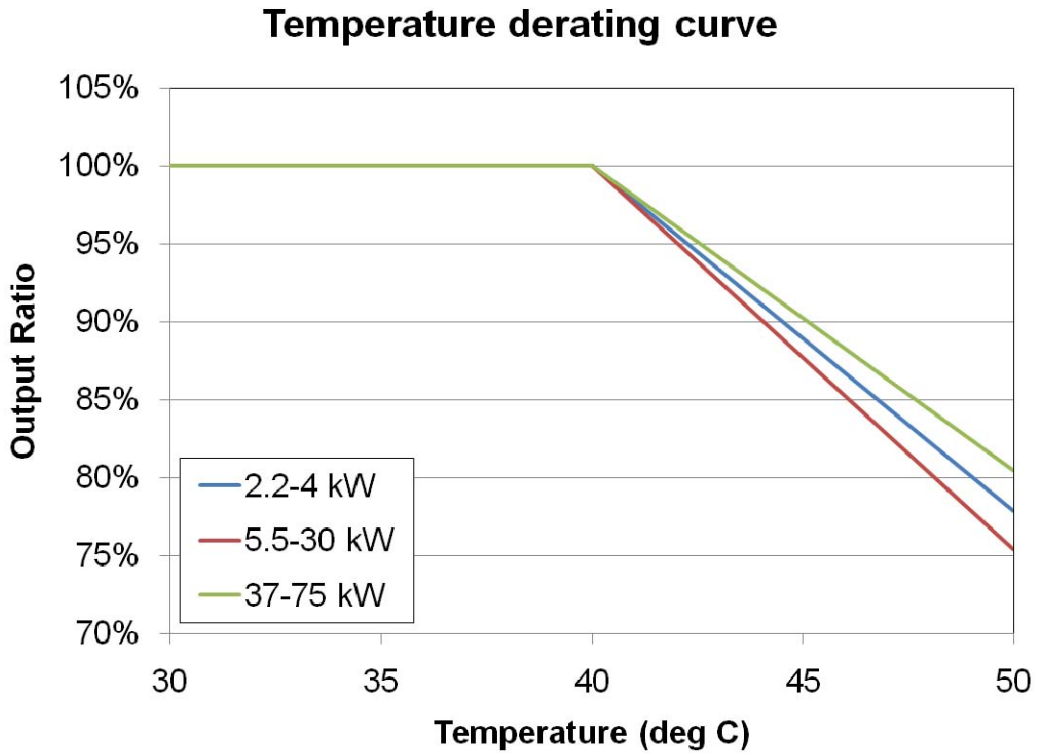
Carrier Frequency Derating Capacity (Fc)

Frame	B	C	D	E	E
Fc (kHz)	2.2~4 kW	5.5~11 kW	15~22 kW	30~45 kW	55~75kW
0	100%	100%	100%	100%	100%
1	100%	100%	100%	100%	100%
2	100%	100%	100%	100%	100%
3	100%	100%	100%	100%	100%
4	100%	100%	100%	100%	100%
5	100%	100%	100%	100%	100%
6	100%	100%	100%	100%	100%
7	100%	100%	100%	90.73%	-
8	100%	100%	100%	82.20%	-
9	94.24%	100%	92.32%	74.31%	-
10	88.92%	100%	85.21%	-	-
11	82.54%	95.35%	78.63%	-	-
12	78.08%	91.02%	72.53%	-	-
13	73.95%	86.98%	66.87%	-	-
14	70.14%	84.14%	61.62%	-	-
15	66.61%	80.67%	56.74%	-	-

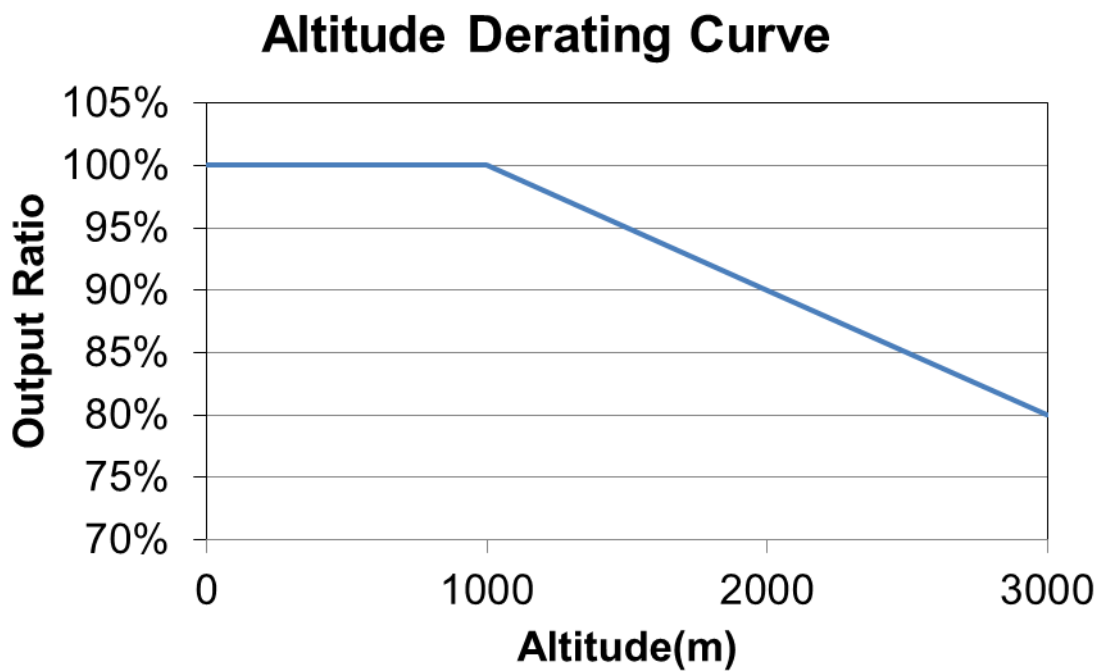
Carrier Frequency Derating Curve (Fc)



Ambient Temperature Derating Curve



Altitude Derating Curve



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Chapter 3 Wiring

3-1 Wiring

3-2 System Wiring Diagram

After removing the front cover, verify that the power and control terminals are clear. Be sure to observe the following precautions when wiring.

- ☑ 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 should be within the range indicated on the AC motor drive nameplate (see Section 1-1 Nameplate Information).
- ☑ All the units must be grounded directly to a common ground terminal to prevent damage from a lightning strike or electric shock.
- ☑ Make sure you correctly tighten the main circuit terminal screws to prevent sparks from screws that have been loosened due to vibration.



- ☑ Turn off the AC motor drive power before installing any wiring. A hazardous charge may still remain in the DC BUS capacitors after the power has been turned off. Measure the remaining voltage before wiring. For your safety, do not perform any wiring before the voltage drops to a safe level $< 25 V_{DC}$. Performing a wiring installation while voltage remains may cause sparks and short circuits.
- ☑ 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.

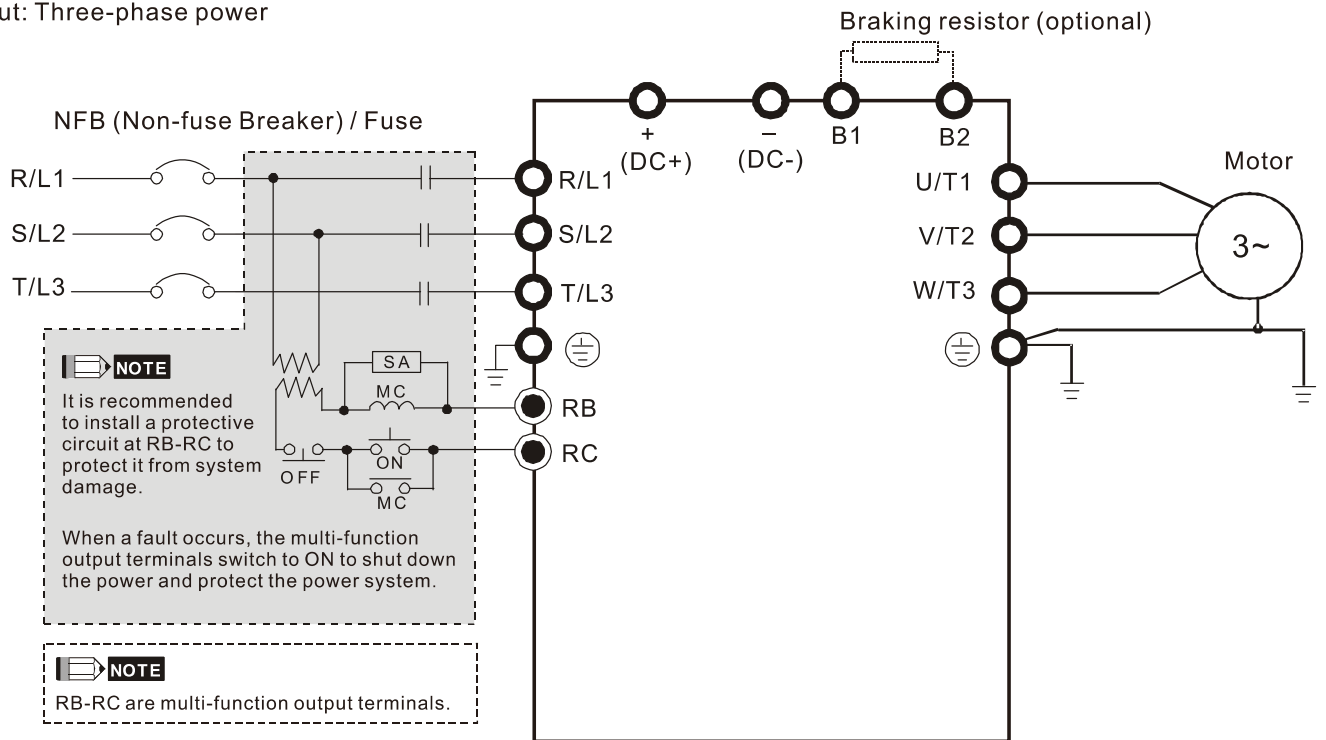


- ☑ When wiring, choose wires that comply with local regulations for your safety.
- ☑ Check the following items after finishing the wiring:
 1. Are all connections correct?
 2. Are there any loose wires?
 3. Are there any short circuits between the terminals or to ground?

3-1 Wiring

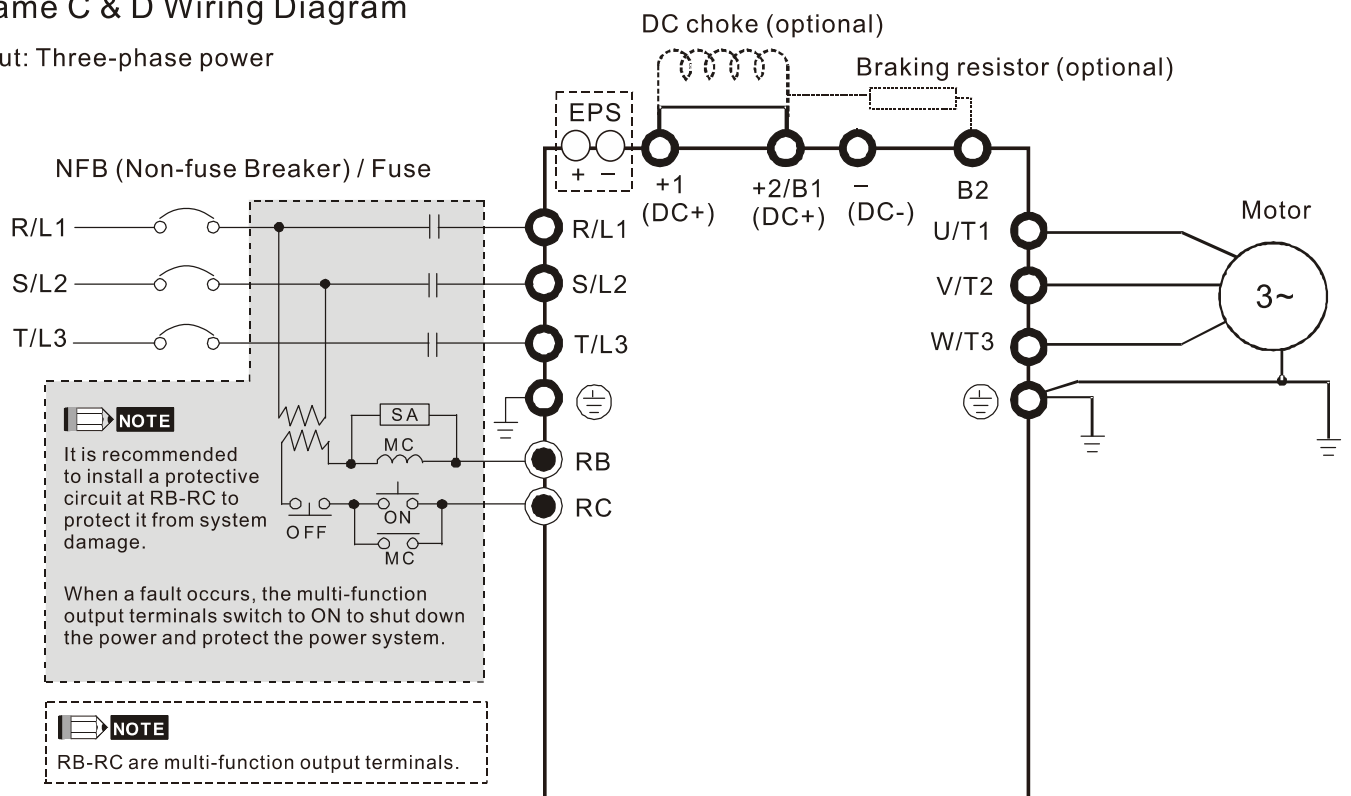
Frame B Wiring Diagram

Input: Three-phase power



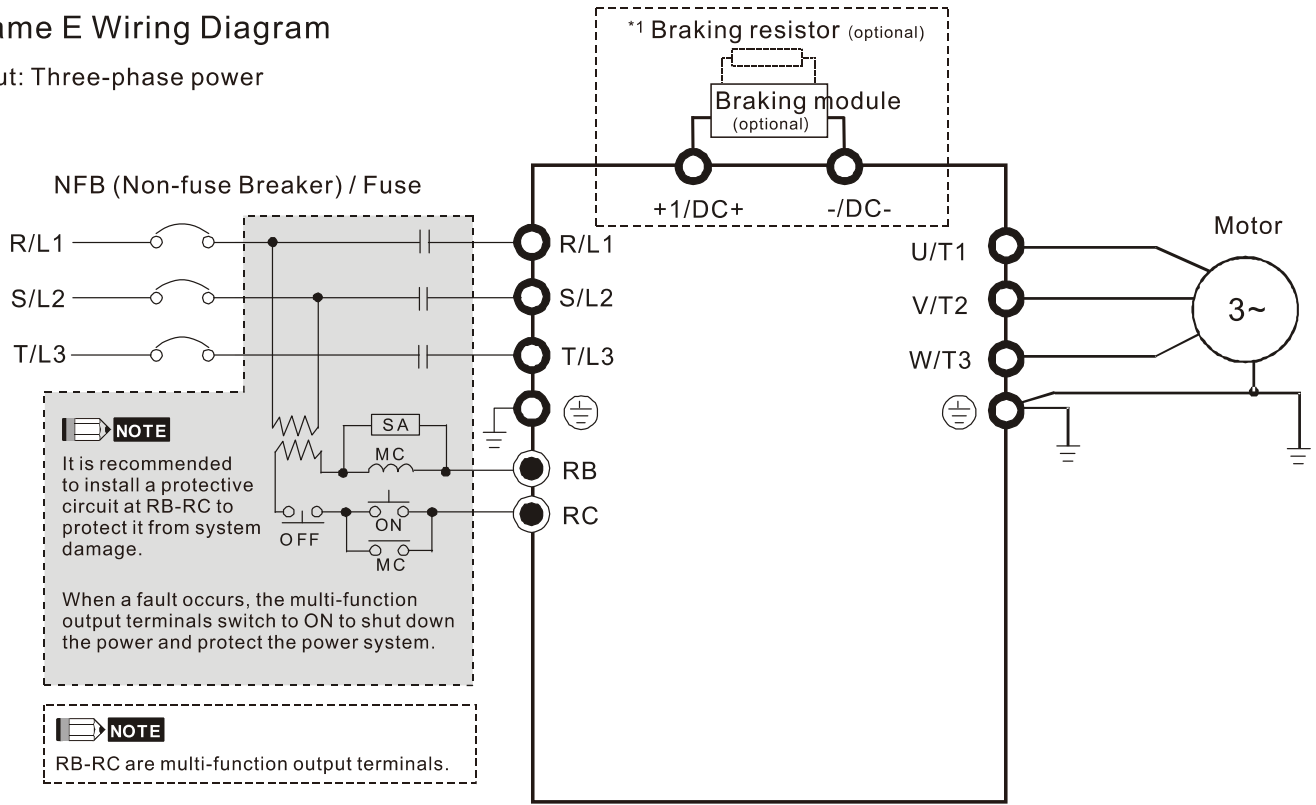
Frame C & D Wiring Diagram

Input: Three-phase power



Frame E Wiring Diagram

Input: Three-phase power



*See Figure 2 on page 3-6 for the Emergency Power Supply (EPS) system wiring diagrams.

*1 See Section 6-1 Brake Resistors & Brake Units Used in AC Motor Drives for details.

Frame B–E Wiring Diagram

Input: Three-phase power

Default: NPN (SINK) Mode

Refer to Figure 1 for NPN & PNP Mode Wirings

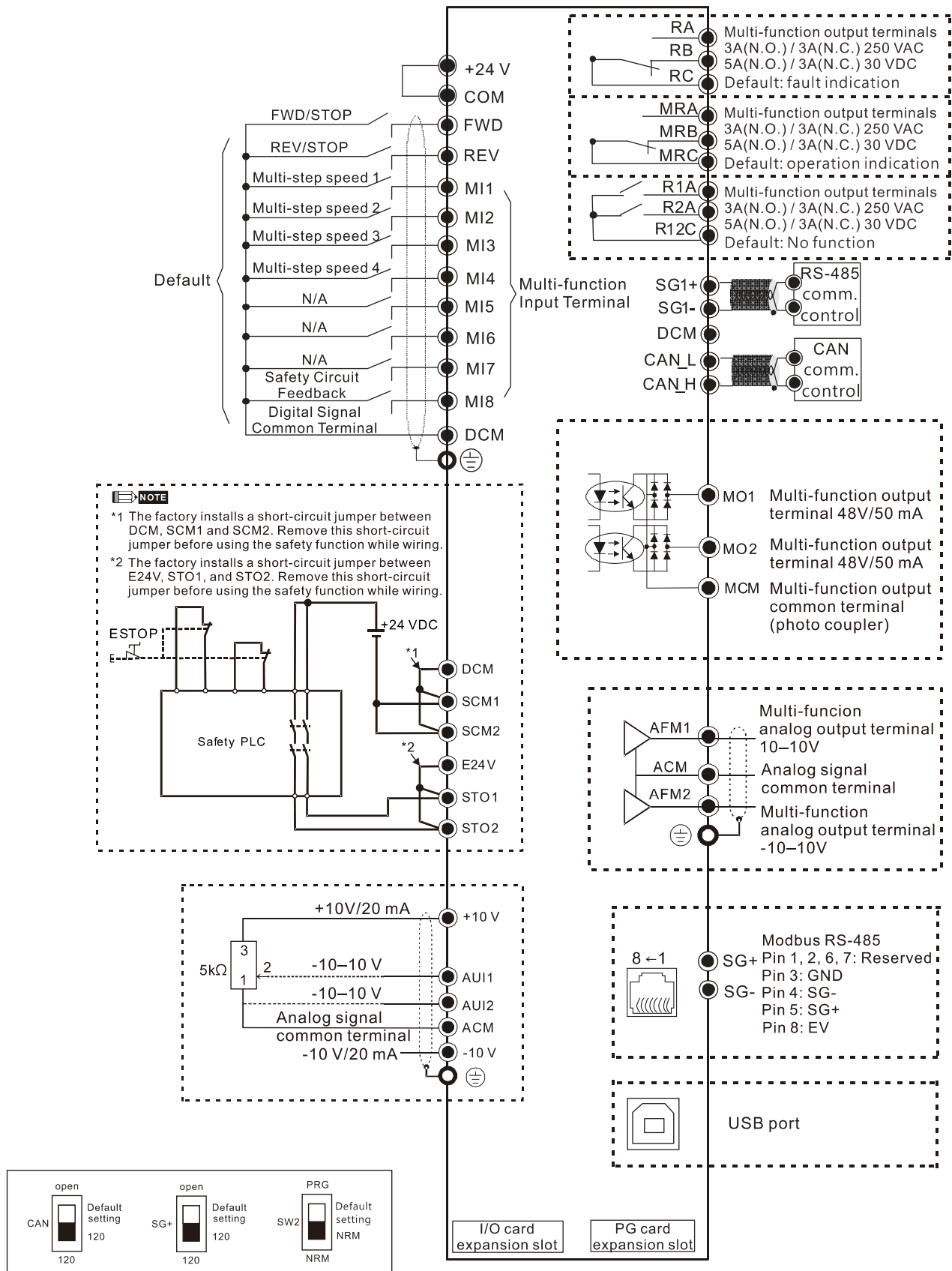


Figure 1

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

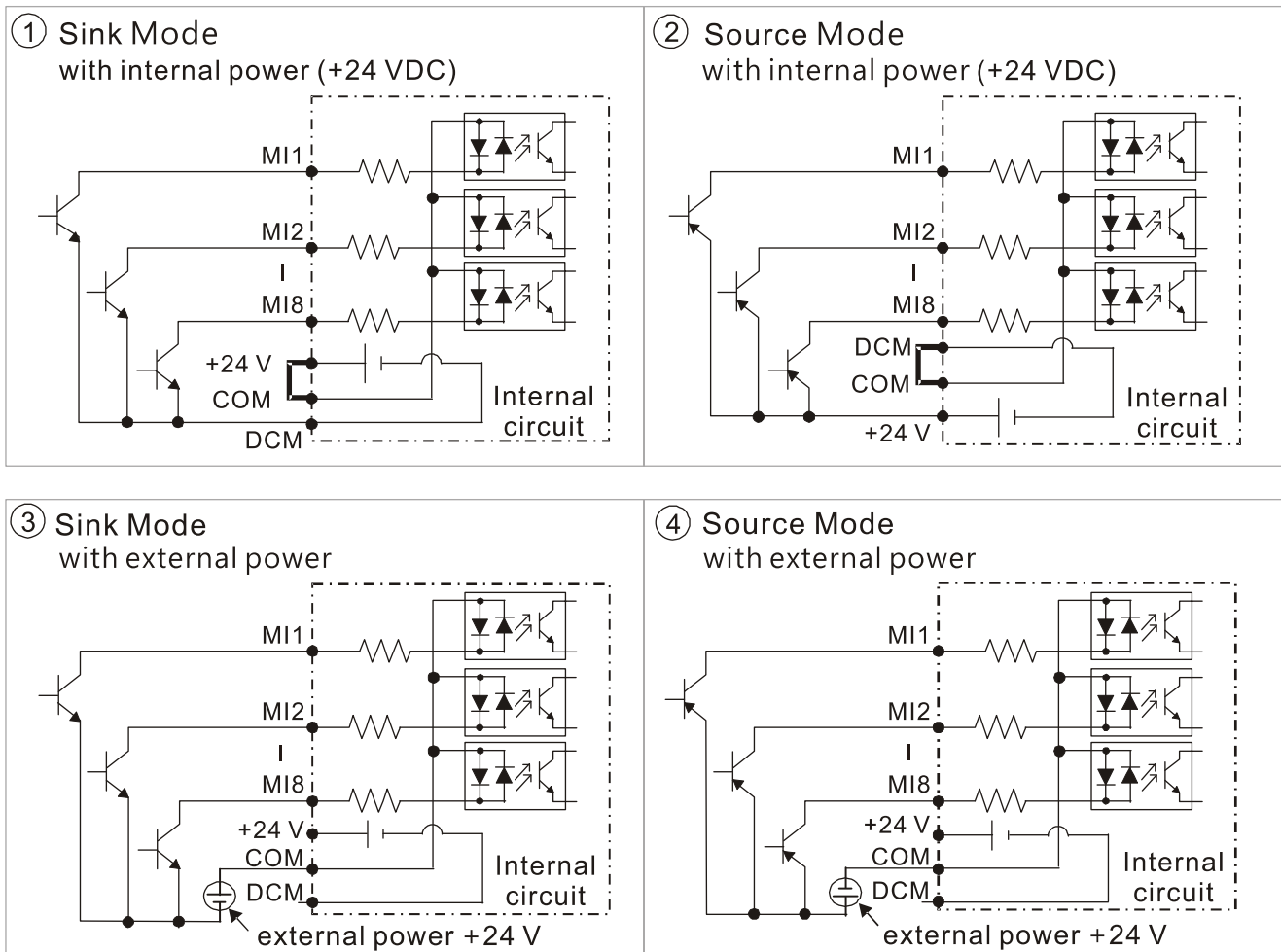
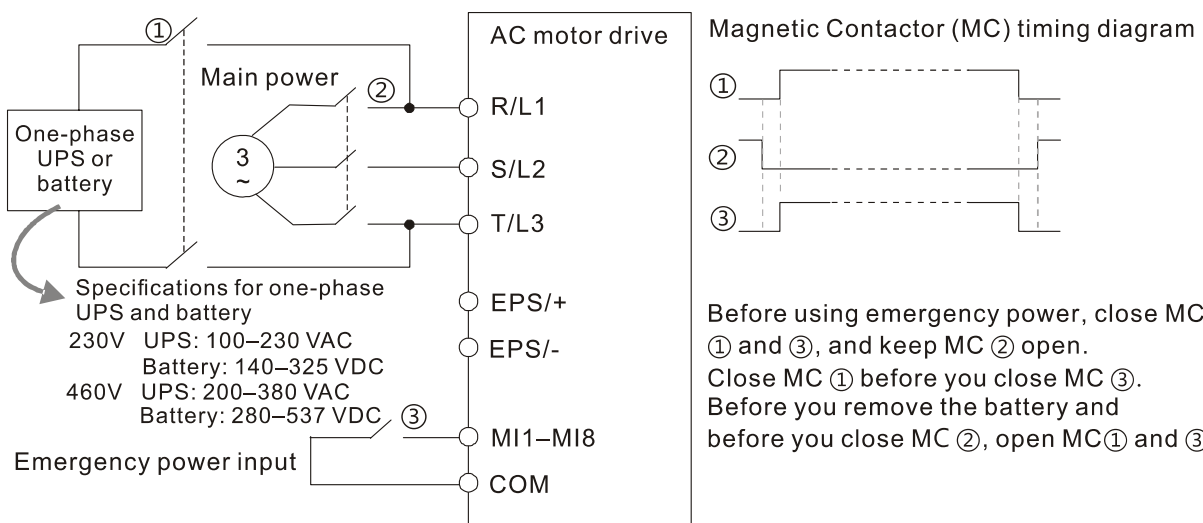


Figure 2

Emergency Power Supply (EPS) system wiring diagrams

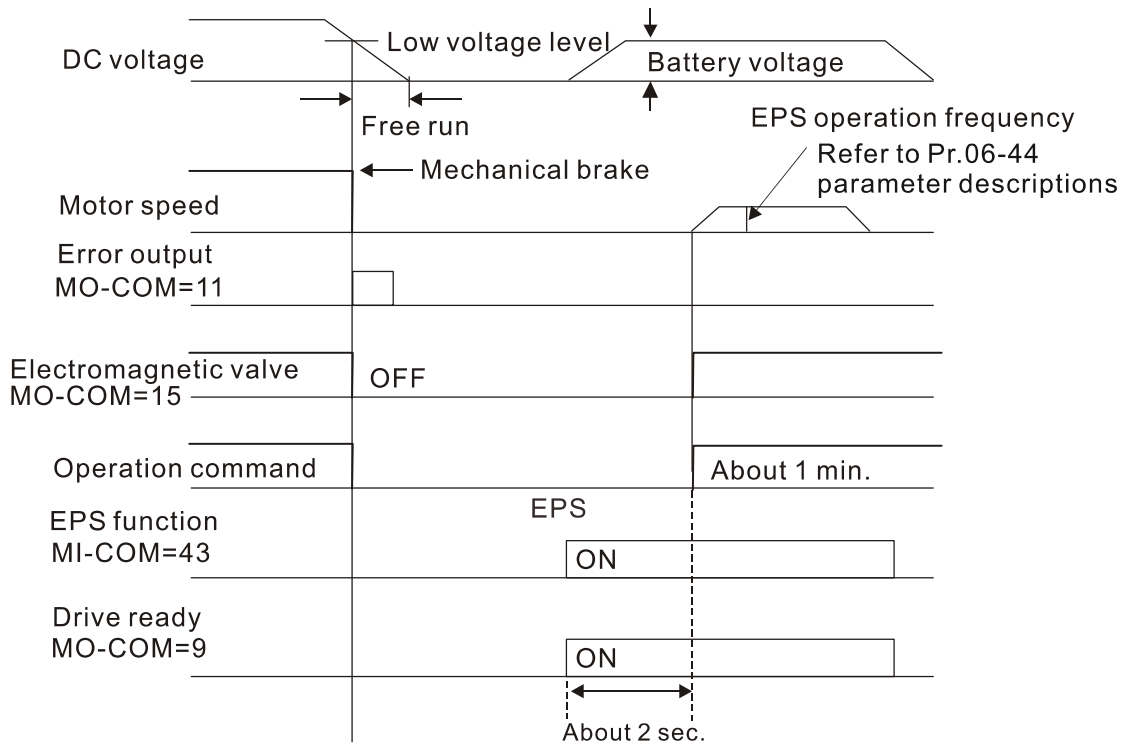
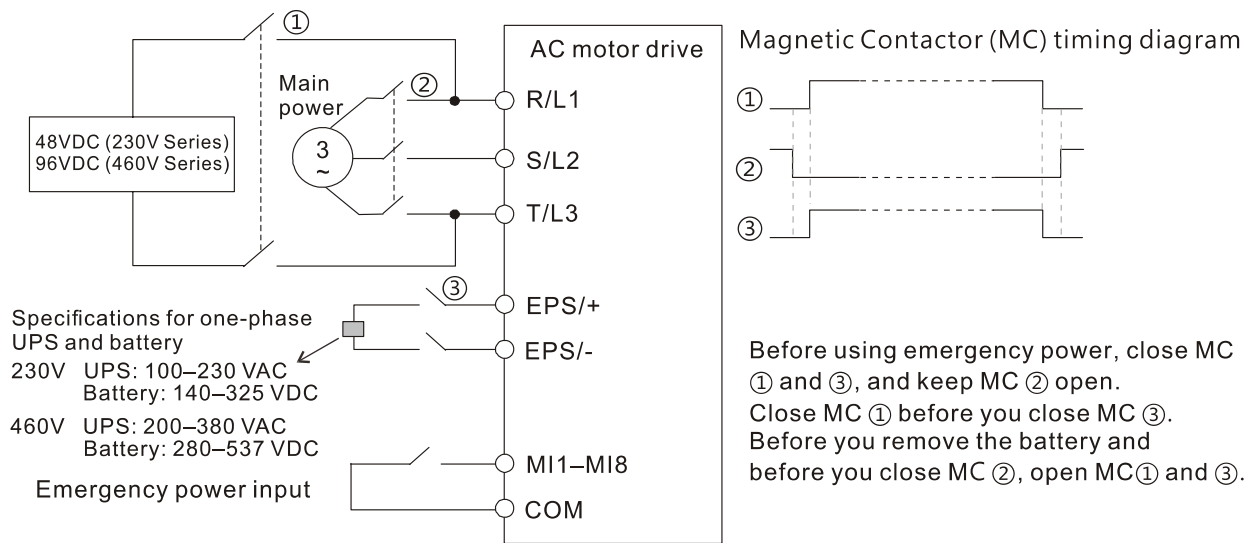
Frames B, C, D & E

1. One-phase UPS or battery can only be used on the main power supply



Frames C & D

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

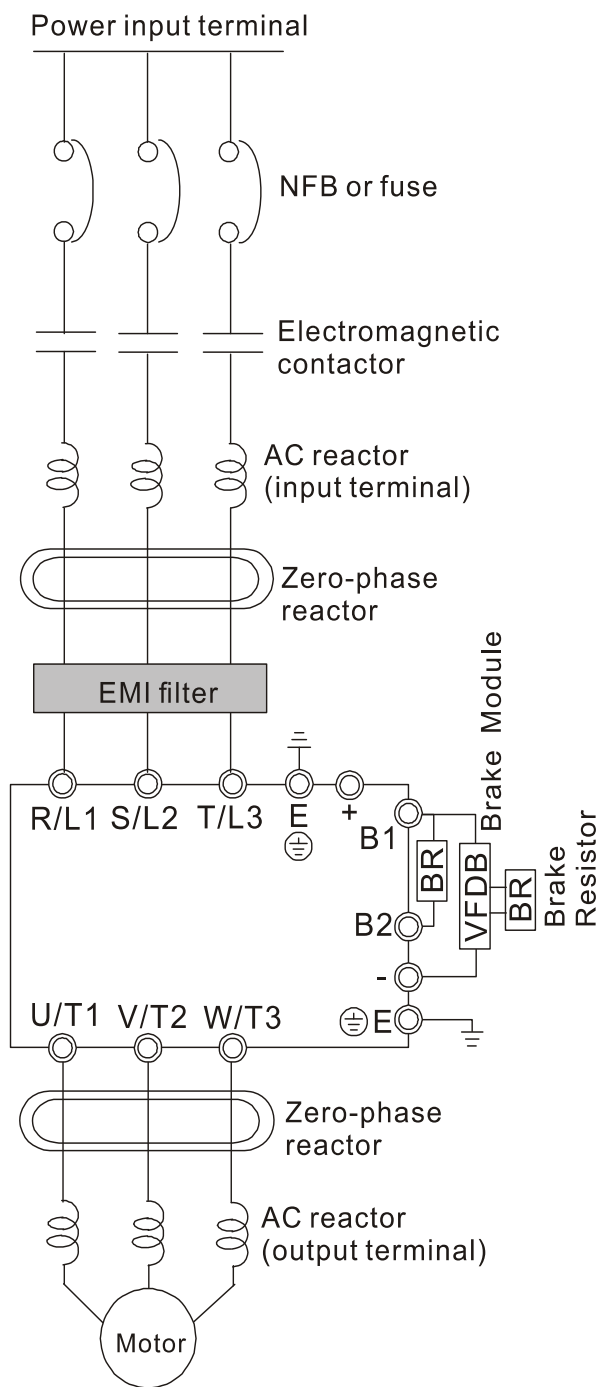


Notes on the emergency power supply (EPS)

Be aware of the following conditions when the emergency power is ON (MI=43):

- The fan does not run in order to prevent voltage drop during EPS.
- The motor drive does not save parameter settings. When the power is turned off and then back on, the parameter settings are lost.
- The motor drive operates at the speed set in Pr.06-44.
- Low voltage and phase loss protections are NOT available.
- You can display the DC BUS voltage with Pr.06-29.

3-2 System Wiring Diagram



Power input terminal	Supply power according to the rated power specifications indicated in the manual (refer to Chapter 08 Specifications).
NFB or fuse	There may be a large inrush current during power on. Refer to Section 6-2 NFB to select a suitable NFB or fuse.
Electromagnetic contactor	Switching the power ON/OFF on the primary side of the electromagnetic contactor can turn the integrated elevator device ON/OFF, but frequent switching can cause machine failure. Do not switch ON/OFF more than once an hour. Do not use the electromagnetic contactor as the power switch for the integrated elevator drive; doing so shortens the life of the integrated elevator drive.
AC reactor (input terminal)	When the main power supply capacity is greater 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 integrated elevator drive. It is recommended that you install an input side AC reactor in the integrated elevator drive. This also improves the power factor and reduces power harmonics. The wiring distance should be within 10 m. Refer to Chapter 06 Optional Accessoires for details.
Zero phase reactor	Use 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. Refer to Chapter 06 Optional Accessoires for details.
EMC filter	Can use to reduce electromagnetic interference.
Brake module & Brake resistor (BR)	Use to shorten the deceleration time of the motor. Refer to Chapter 06 Optional Accessoires 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. Refer to Chapter 06 Optional Accessoires for details.

Chapter 4 Main Circuit Terminals

4-1 Main Circuit Diagram

4-2 Main Circuit Terminal Specifications



Main input power terminals

- ☑ Do not connect a three-phase model to one-phase power. R/L1, S/L2 and T/L3 have no phase-sequence requirement and 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.
- ☑ Tighten the screws in the main circuit terminal to prevent sparks caused by screws loosened due to vibration.
- ☑ Use voltage and current within the specifications in Chapter 08.
- ☑ 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 shielding or conduit.
- ☑ Do NOT run and stop the AC motor drives by turning the power ON and OFF. Run and stop the AC motor drives by sending the RUN and STOP commands through the control terminals or the keypad. If you still need to run and stop the AC motor drives by turning the power ON and OFF, do so no more often than ONCE per hour.

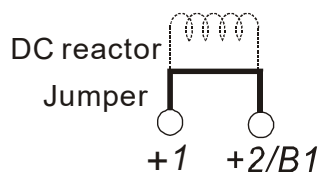
Output terminals of the main circuit

- ☑ 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.
- ☑ DO NOT connect phase-compensation capacitors or surge absorbers at the output terminals of AC motor drives.
- ☑ Use well-insulated motors to prevent any electric leakage from the motors.

Use terminals [+1, +2] for connecting a DC reactor.

Use terminals [+1, +2/B1] for connecting a DC BUS.

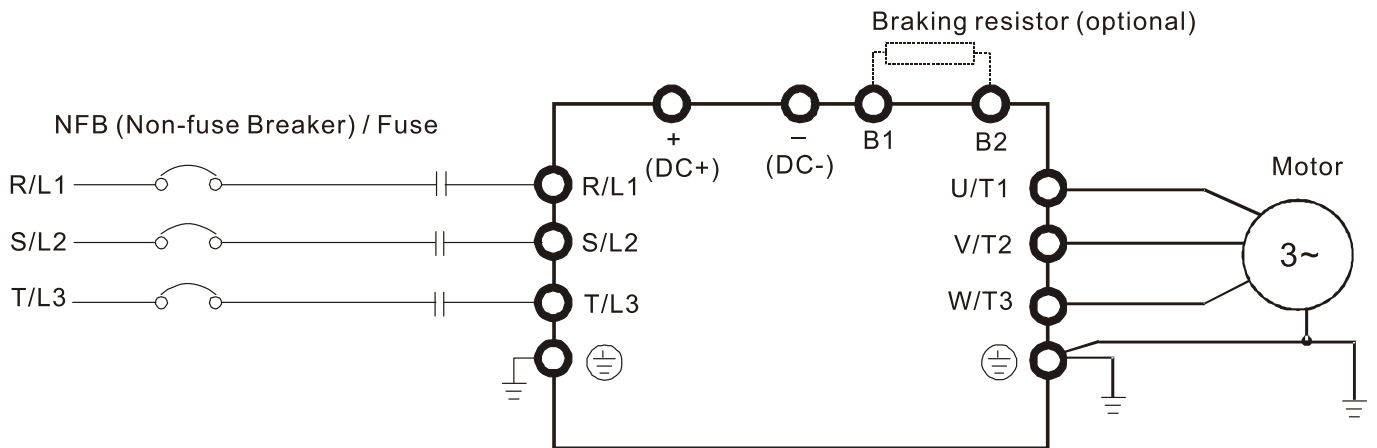
- ☑ Use these terminals to connect a DC reactor to improve the power factor and reduce harmonics. A jumper is connected to these terminals at the factory. Remove that jumper before connecting to a DC reactor.



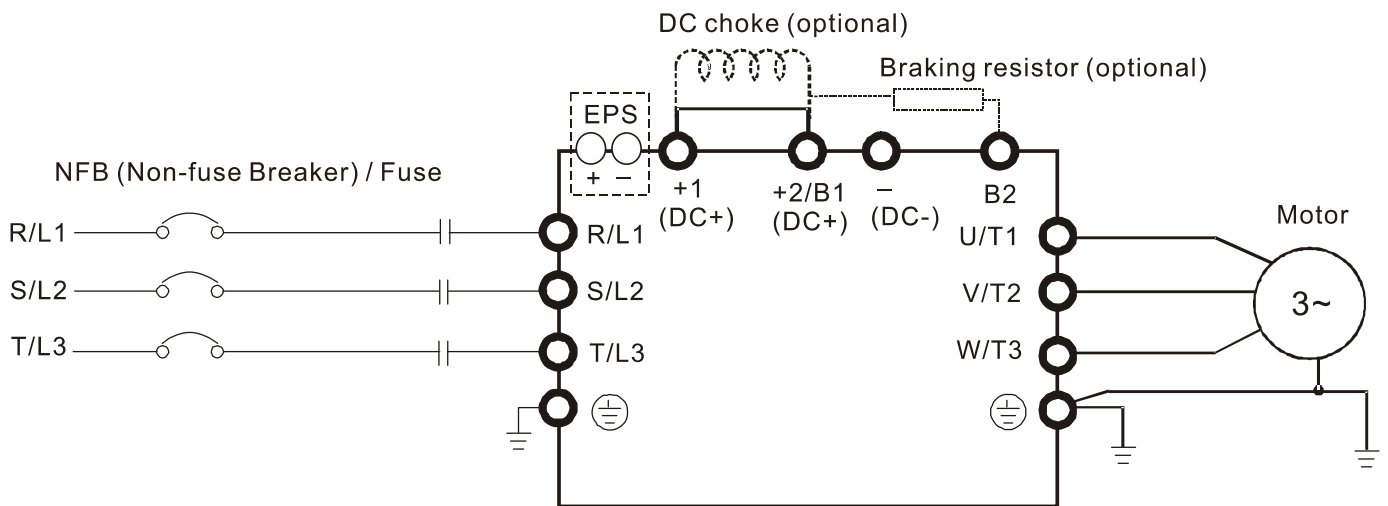
- ☑ Models above 22 kW do not have a built-in brake resistor. To improve resistance braking, connect an optional external brake resistor.
- ☑ When not in use, leave terminals +2/B1, (–) open.
- ☑ Short-circuiting [B2] or [–] to [+2/B1] damages the motor drive. Do NOT short-circuit those terminals.

4-1 Main Circuit Diagram

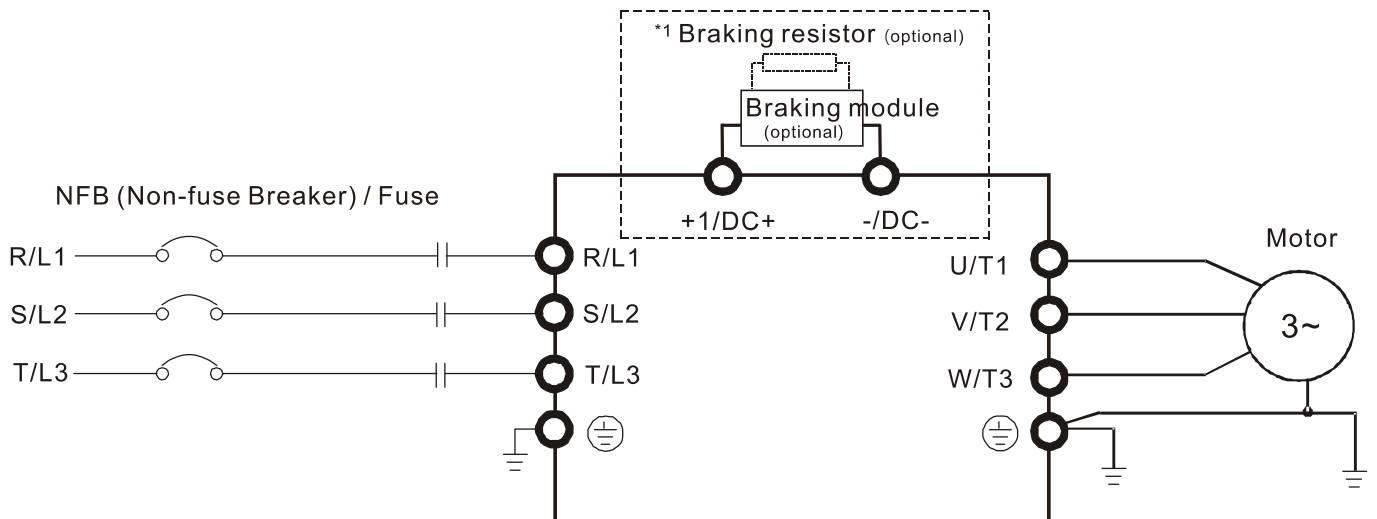
Frame B




Frames C & D



Frame E

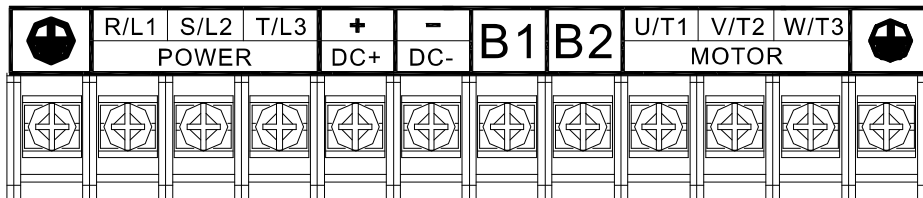
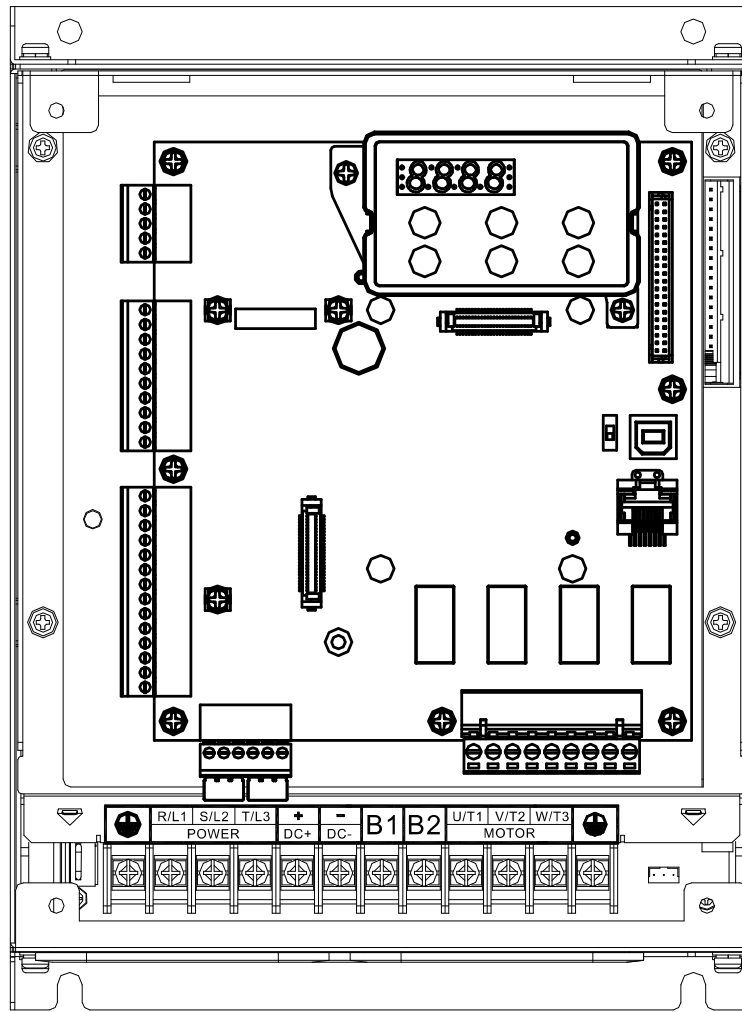


Ch04 Main Circuit Terminals | VFD-ED

Terminal Symbol	Description
EPS (+, -)	Backup power/ Emergency power connection terminal. Note: EPS (Emergency Power Supply) input terminal supports only frames C & D.
R/L1, S/L2, T/L3	Commercial power input terminal.
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. Frame E has a built-in DC reactor.
+2/B1, B2	Connections for brake resistor (optional).
	Ground connection; comply with local regulations.

4-2 Main Circuit Terminal Specifications

Frame B



Frame B				
Model	Main circuit terminals: R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, +(DC+), -(DC-), B1, B2, ⚡			NOTE ● Use Figure 1 to choose terminal wire size. ● As shown in Figure 2, use insulated heat shrink tubing that is resistant to at least 600 V to comply with UL and CSA regulations (600 V, YDPU2).
	Maximum Wire Gauge	Minimum Wire Gauge	Screw Size Tightening Torque (±10%)	
VFD022ED21S	5.3 mm ² [10 AWG]	2.1 mm ² [14 AWG]	M4 18 kg-cm (15.6 lb-in.) (1.7 N-m)	
VFD040ED43S				
VFD037ED21S		3.3 mm ² [12 AWG]		
VFD040ED23S				
For UL installation compliance, select copper wires with voltage rating of 600 V and temperature resistance of 75°C.				

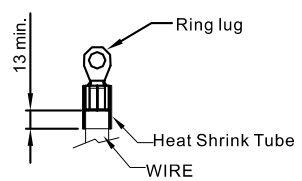
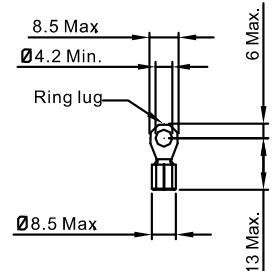
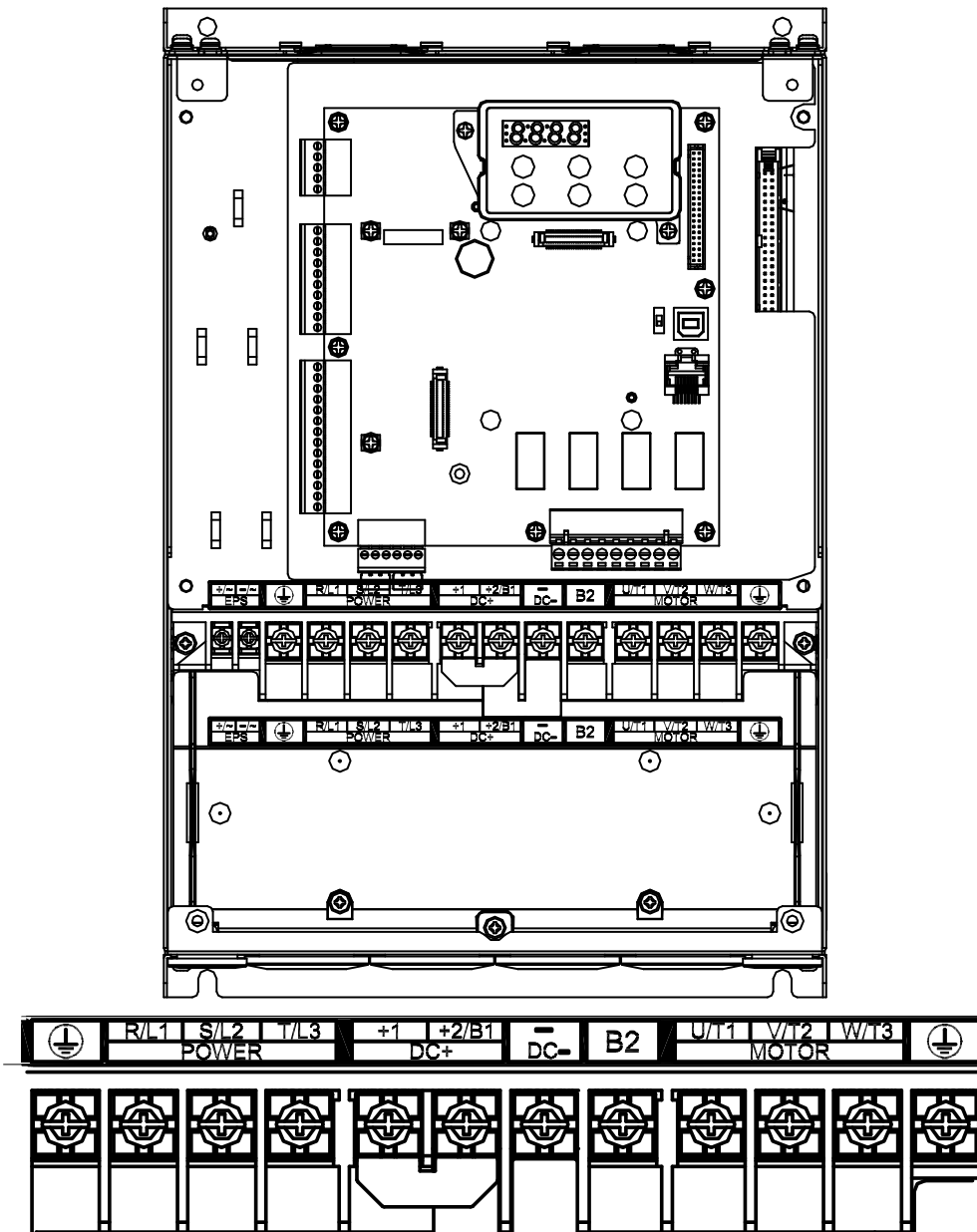


Figure 1

Figure 2

Frame C



Frame C			
Model	Main circuit terminals: R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, +1, +2/B1, -, B2, ⚡		
	Maximum Wire Gauge	Minimum Wire Gauge	Screw Size Tightening Torque (±10%)
VFD055ED23S	13.3 mm ² [6 AWG]	3.3 mm ² [10 AWG]	M5 30 kg-cm (26 lb-in.) (2.9 N-m)
VFD110ED43S		3.3 mm ² [12 AWG]	
VFD055ED43S			
VFD075ED43S		8.4 mm ² [8 AWG]	
VFD075ED23S			
VFD150ED43S		13.3 mm ² [6 AWG]	
VFD185ED43S			
VFD110ED23S			

For UL installation compliance, select copper wires with voltage rating of 600 V and temperature resistance of 75°C.

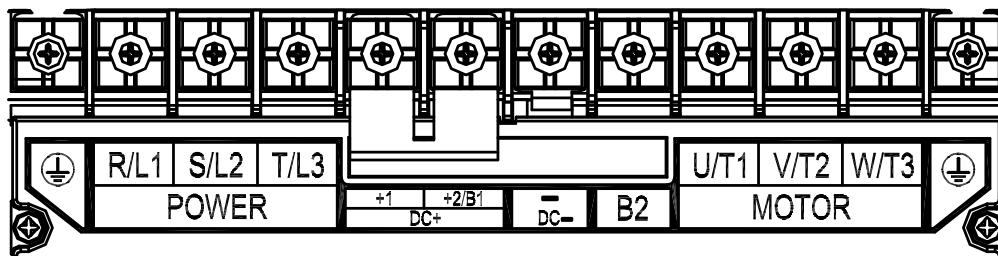
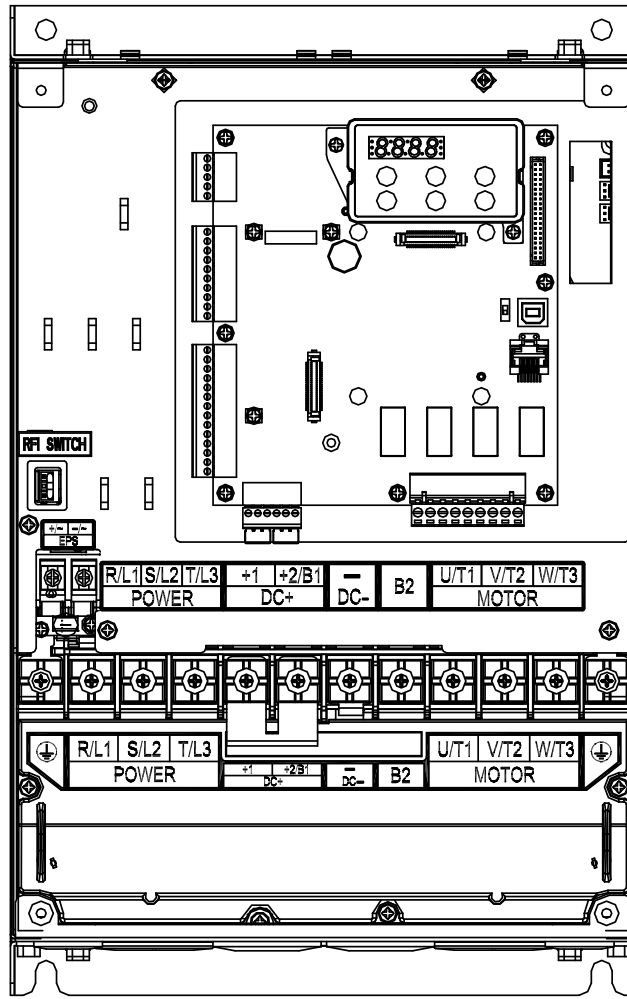
NOTE


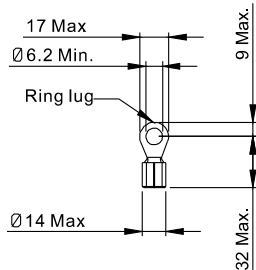
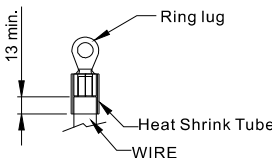
- Use Figure 1 to choose terminal wire size.
- As shown in Figure 2, use insulated heat shrink tubing that is resistant to at least 600 V to comply with UL and CSA regulations (600 V, YDPU2).

Figure 1

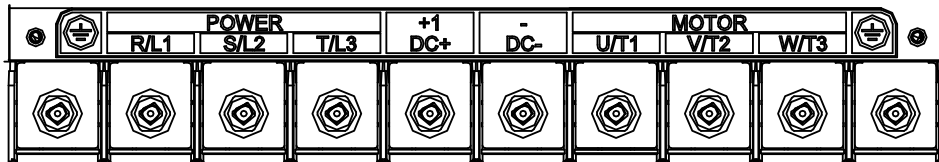
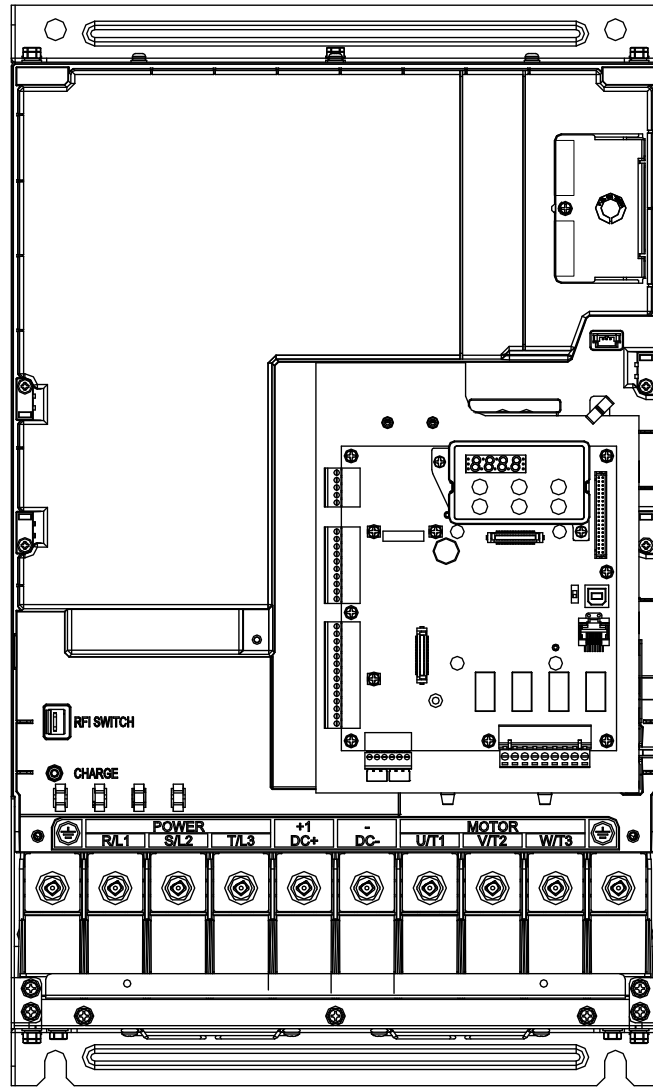
Figure 2

Frame D



Frame D				
Model	Main circuit terminals: R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, +1, +2/B1, -, B2, ⊕			 NOTE ● Use Figure 1 to choose terminal wire size. ● As shown in Figure 2, use insulated heat shrink tubing that is resistant to at least 600 V to comply with UL and CSA regulations (600 V, YDPU2).
	Maximum Wire Gauge	Minimum Wire Gauge	Screw Size Tightening Torque (±10%)	
VFD150ED23S	33.6 mm ² [2 AWG]	21.1 mm ² [4 AWG]	M6 50 kg-cm (43.4 lb-in.) (4.9 N-m)	
VFD300ED43S		26.7 mm ² [3 AWG]		
VFD185ED23S		13.3 mm ² [6 AWG]		
VFD220ED43S		33.6 mm ² [2 AWG]		
VFD220ED23S		33.6 mm ² [2 AWG]		
For UL installation compliance, select copper wires with voltage rating of 600 V and temperature resistance of 75°C.				 <p>Figure 2</p>

Frame E



Frame E

Model	Main circuit terminals: R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, +1(DC+), -(DC-), ⊕			Screw Size Tightening Torque (±10%)	<p>NOTE</p> <ul style="list-style-type: none"> ● Use Figure 1 to choose terminal wire size. ● As shown in Figure 2, use insulated heat shrink tubing that is resistant to at least 600 V to comply with UL and CSA regulations (600 V, YDPU2). 	
	Maximum Wire Gauge	Minimum Wire Gauge				
VFD370ED43S	152 mm ² [300 MCM]	53.5 mm ² [1/0 AWG]	M8 200 kg-cm (173 lb-in.) (19.6 N-m)			
VFD450ED43S		67.4 mm ² [2/0 AWG]				
VFD300ED23S		107 mm ²				
VFD550ED43S		152 mm ²				
VFD370ED23S		152 mm ²				
VFD750ED43S		152 mm ² [300 MCM]				
<p>For UL installation compliance, select copper wires with voltage rating of 600 V and temperature resistance of 75°C.</p>					<p>Figure 1</p>	<p>Figure 2</p>

Chapter 5 Control Terminals


5-1 Remove the Cover before Wiring

5-2 Control Terminal Specifications

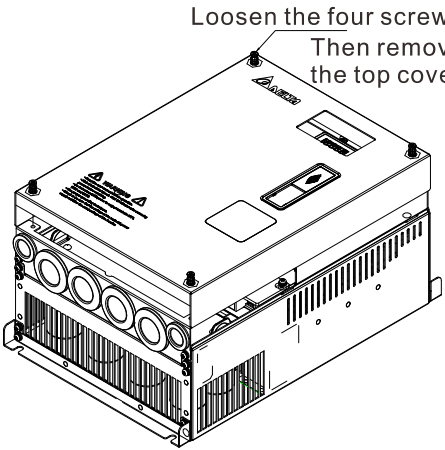
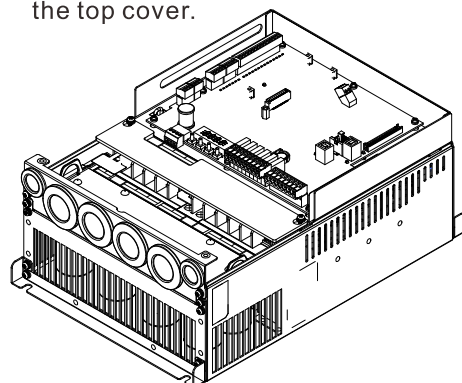
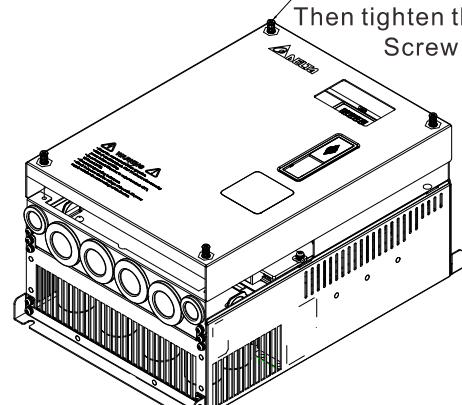
5-3 Control Circuit Terminals

5-1 Remove the Cover before Wiring

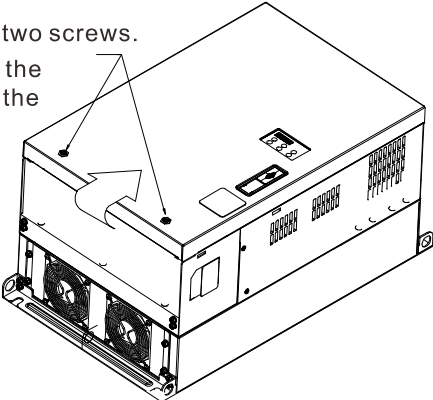
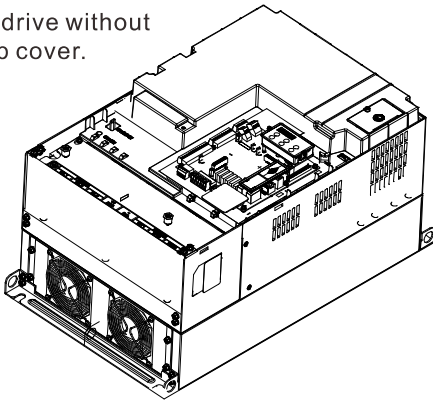
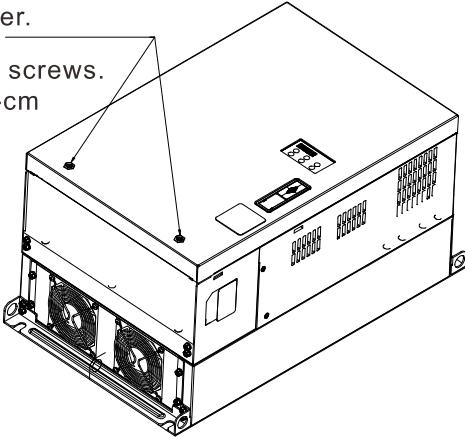
Remove the top cover before wiring the multi-function input and output terminals

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

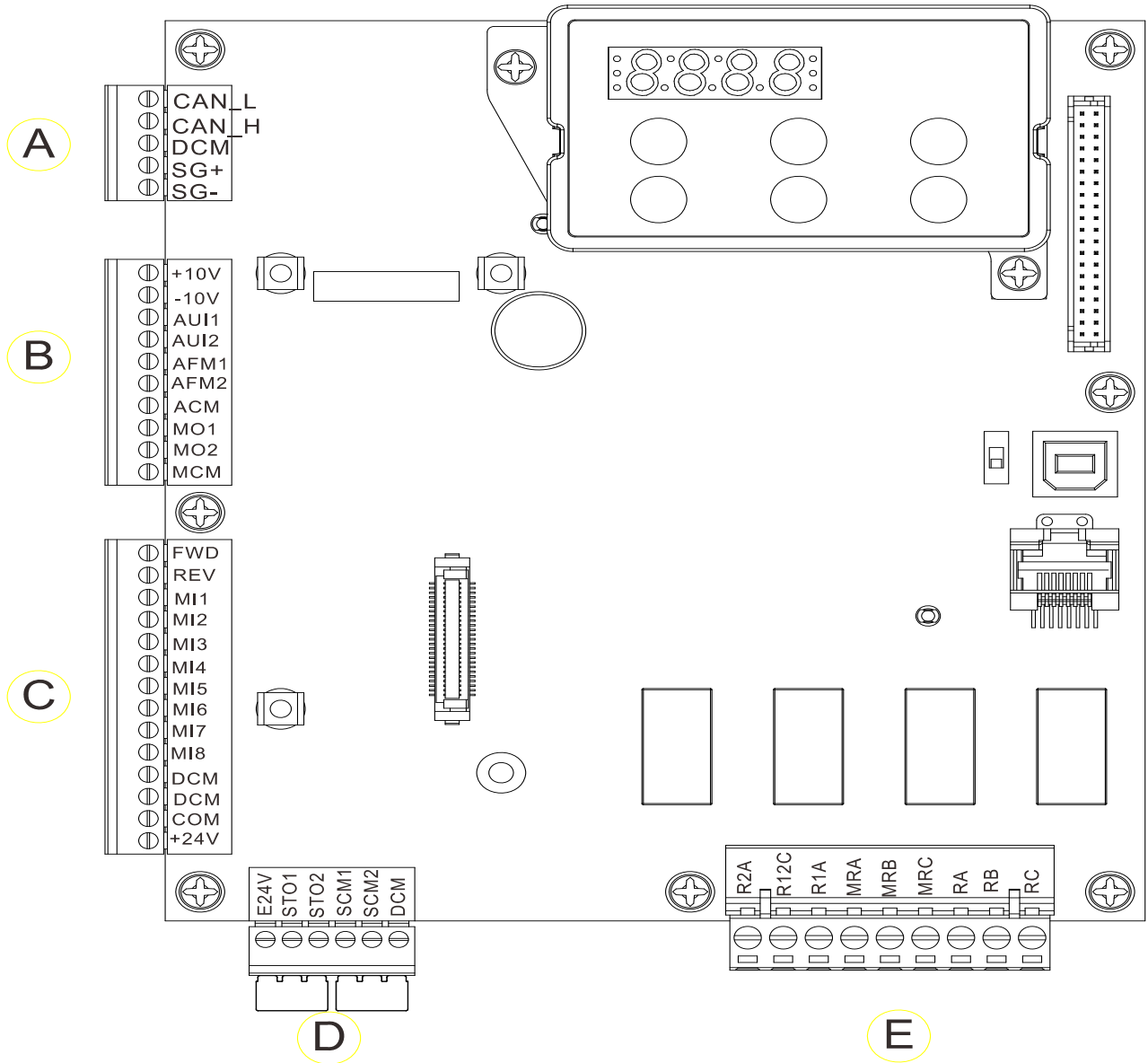
Frames B, C & D

<p style="text-align: center;">Step 1</p> <p>Loosen the four screws. Then remove the top cover.</p> 	<p style="text-align: center;">Step 2</p> <p>Motor drive without the top cover.</p> 
<p style="text-align: center;">Step 3</p> <p>Put back the top cover. Then tighten the four screws. Screw torque: 15kgf-cm</p> 	

Frame E

Step 1	Step 2
<p data-bbox="172 241 448 421">Loosen the two screws. Then follow the direction of the arrow to remove the top cover.</p> 	<p data-bbox="890 232 1118 286">Motor drive without the top cover.</p> 
Step 3	
<p data-bbox="440 714 799 831">Put back the top cover. Then tighten the two screws. Screw torque: 15kgf-cm</p> 	

5-2 Control Terminal Specifications



5-3 Control Circuit Terminals

Terminal sockets A, B, C

Torque: 2 kg-cm [1.7 lb-in.] (0.20 Nm)

Wire gauge: 0.08–2.07 mm² [28–14 AWG]

Terminal socket D

Torque: 2 kg-cm [1.7 lb-in.] (0.20 Nm)

Terminal socket E

Torque: 5.2 kg-cm [4.5 lb-in.] (0.51 Nm)

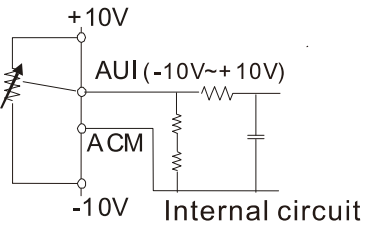
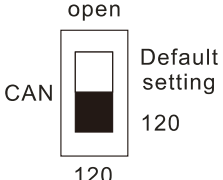
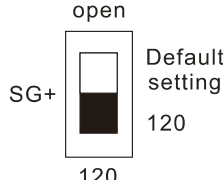
Wire gauge: 0.08–3.33 mm² [28–12 AWG]

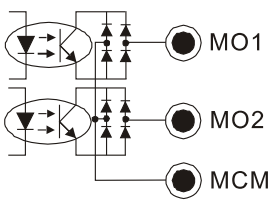
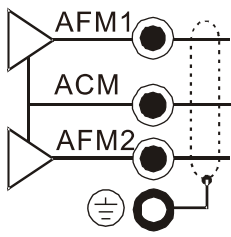
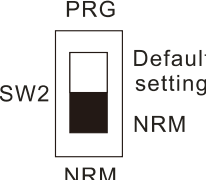
To comply with UL standards, use copper wires in the installation that are able to withstand 600 V, 75°C environments.

Control Board Switch

NRM = Normal

Terminals	Terminal Function	Default (NPN mode)
+24 V / E24 V	Digital control signal common terminal (Source)	+24 V \pm 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 parameters Pr.02-01–Pr.02-08 to program the multi-function inputs MI1–MI8. Source mode: ON: the activation current is 6.5 mA \geq 11 V _{DC} OFF: allowable leakage current 10 μ A \leq 11 V _{DC}
DCM	Digital frequency signal common terminal	
SCM1	The default is short-circuited (E24V/STO1/STO2). The default is short-circuited (SCM1/SCM2/DCM). Power cutoff safety function for EN954-1 and IEC/EN61508. When STO1–SCM1 and STO2–SCM2 are ON, the activation current is 3.3 mA \geq 11 V _{DC} .	
SCM2		
STO1		
STO2		
+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

<p>AUI1</p>	<p>Analog voltage frequency command</p>	<p>Impedance: 20 kΩ Range: -10~10 V_{DC} = 0~Maximum Output Frequency (Pr.01-00)</p>
<p>AUI2</p>		
<p>ACM</p>	<p>Analog signal common terminal control</p>	<p>Analog signal common terminal</p>
<p>RA</p>	<p>Multi-function relay output A (N.O.)</p>	<p>1. User-defined function 2. Resistive Load 3 A (N.O.) / 3 A (N.C.) 250 V_{AC} 5 A (N.O.) / 3 A (N.C.) 30 V_{DC} (minimum 5 V_{DC}, 10 mA)</p> <p>To output different kinds of monitoring signals such as motor drive in operation, frequency reached, and overload indication.</p>
<p>RB</p>	<p>Multi-function relay output A (N.C.)</p>	
<p>RC</p>	<p>Multi-function relay output B (Default: error indication)</p>	
<p>MRA</p>	<p>Multi-function output terminal (N.O.)</p>	
<p>MRB</p>	<p>Multi-function output terminal (N.C.)</p>	
<p>MRC</p>	<p>Multi-function output terminal (Default: operating Indication)</p>	
<p>R1A</p>	<p>Multi-function output terminal A (N.O.)</p>	
<p>R2A</p>	<p>Multi-function output terminal A (N.O.)</p>	
<p>R12C</p>	<p>Multi-function output terminal (Default: no function)</p>	
<p>SG1+</p>	<p>Modbus RS-485</p>	<p>SG1+ switch: terminator 120 ohm (default) / open</p>
<p>SG1-</p>	<p>Modbus RS-485</p>	
<p>CAN</p>		
<p>CAN_L</p>	<p>CAN Bus</p>	<p>DIP switch: terminator 120 ohm (default) / open</p>
<p>CAN_H</p>	<p>CAN Bus</p>	
<p>MO1</p>	<p>Multi-function output terminal 1 (photo coupler)</p>	<p>The AC motor drive outputs various monitoring signals, such as drive in operation, frequency reached, and overload indication through a transistor</p>

<p>MO2</p>	<p>Multi-function output terminal 2 (photo coupler)</p>	<p>(open collector).</p> 
<p>MCM</p>	<p>Multi-function output common terminal (photo coupler)</p>	<p>Maximum 48 V_{DC} 50 mA</p>
<p>AFM1</p>		<p>0-10 V, max. output current: 2 mA, max. load: 5 kΩ -10-10 V, max. output current: 2 mA, max. load: 5 kΩ Maximum output current: 2 mA Resolution: 0-10 V, corresponds to the maximum operating frequency. Range: 0-10 V → -10-10 V</p>
<p>RJ45</p>	<p>PINS 1, 2, 6, 7: Reserved PIN 3: SGND PIN 4: SG- PIN 5: SG+ PIN 8: EV</p>	
<p>SW2</p>	<p>Switching USB port</p>	 <p>DIP switch: 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.</p>

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Chapter 6 Optional Accessories

6-1 Brake Resistors and Brake Units Used in AC Motor Drives

6-2 Non-fuse Circuit Breaker

6-3 Fuse Specification Chart

6-4 AC / DC Reactor

6-5 Zero Phase Reactor

6-6 EMC Filter

6-7 Digital Keypad

6-8 USB / RS-485 Communication Interface IFD6530

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 suggestions.

6-1 Brake Resistors and Brake Units Used in AC Motor Drives

Voltage	Applicable Motor		125% Braking Torque/10% ED * ¹								Max. Braking Torque* ²		
	HP	Model	Braking Torque* ³ (kg-m)	Brake Unit		Delta’s Part No.* ⁴			Min. Braking Power* ⁶ (kW)	Braking Current (A)* ⁷	Min. Resistor Value (Ω)	Max. Total Braking Current (A)	Peak Power (kW)
				VFDB* ⁵	Amt.	Part No.	Amt.	Working Method					
230V	3	VFD022ED21S	1.5			BR300W070	1		0.22	5.4	38.0	10	3.8
	5	VFD037ED21S	2.5			BR400W040	1		0.37	9.5	19.0	20	7.6
	5	VFD040ED23S	2.5			BR500W030	1		0.4	9.5	19.0	20	7.6
	7.5	VFD055ED23S	3.7			BR1K0W020	1		0.55	19.0	15.6	24.4	9.3
	10	VFD075ED23S	5.1			BR1K0W016	1		0.75	19.0	11.5	33	12.5
	15	VFD110ED23S	7.5			BR1K5W013	1		1.1	29.2	9.5	40	15.2
	20	VFD150ED23S	10.2			BR1K0W4P3	2	2 parallel	1.5	44.2	8.3	46	17.5
	25	VFD185ED23S	12.2			BR1K0W016	2	2 serial	1.85	44.2	5.8	66	25.1
	30	VFD220ED23S	14.9			BR1K5W3P3	2	2 parallel	2.2	57.6	5.8	66	25.1
	40	VFD300ED23S	20.3	2015	2	BR1K0W5P1	4	2 serial 2 parallel	3	74.5	4.8	80	30.4
50	VFD370ED23S	25.1	2022	2	BR1K2W3P9	4	2 serial 2 parallel	3.7	97.4	3.2	120	45.6	
460V	5	VFD040ED43S	2.7			BR1K0W075	1		0.4	10.1	54.3	14	10.6
	7.5	VFD055ED43S	3.7			BR1K0W075	1		0.55	10.1	48.4	15.7	11.9
	10	VFD075ED43S	5.1			BR1K0W075	1		0.75	10.1	48.4	15.7	11.9
	15	VFD110ED43S	7.5			BR1K5W043	1		1.1	17.7	30.8	24.7	18.8
	20	VFD150ED43S	10.1			BR1K0W016	2	2 parallel	1.5	23.8	25.0	30.4	23.1
	25	VFD185ED43S	12.5			BR1K0W016	2	2 parallel	1.85	23.8	20.8	36.5	27.7
	30	VFD220ED43S	14.9			BR1K5W013	2	2 parallel	2.2	29.2	19.0	40	30.4
	40	VFD300ED43S	20.3			BR1K0W016	4	2 serial 2 parallel	3	47.5	14.1	54	41.0
	50	VFD370ED43S	25.0	4045	1	BR1K2W015	4	2 serial 2 parallel	3.7	50.7	12.7	60	45.6
	60	VFD450ED43S	30.4	4045	1	BR1K5W013	4	2 serial 2 parallel	4.5	58.5	12.7	60	45.6
75	VFD550ED43S	37.2	4030	2	BR1K0W5P1	4	2 serial 4 parallel	5.5	74.5	9.5	80	60.8	
100	VFD750ED43S	50.7	4045	2	BR1K2W015	8	4 serial 2 parallel	7.5	101.3	6.3	120	91.2	

*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). 10% ED applies for IM motor elevator system.

*² Refer to the Brake Performance Curve for “Operation Duration & ED (%)” versus “Braking Current”.

*³ The calculation of the braking torque is based on a four-pole motor (1800 rpm).

*⁴ To dissipate heat, fix a resistor of 400 W or lower to the frame to maintain the surface temperature below 250°C (482°F). Fix a resistor of 1000 W or higher to a surface to maintain the surface temperature below 600°C (1112°F). If the surface temperature is higher than the temperature limit, install more heat dissipating systems or increase the size of the resistor.

*⁵ Refer to VFDB series Braking Module Instruction for more details on the braking resistor.

*⁶ The braking resistor should be able to endure 10 times the overload capacity.

*⁷ The calculation of the braking current is based on Delta’s braking resistor and default braking voltage (220V: 380V; 440V: 760V).

Voltage	Applicable Motor		125% Braking Torque/30% ED * ¹								Max. Braking Torque* ²		
	HP	Model	Braking Torque* ³ (kg-m)	Brake Unit		Delta's Part No.* ⁴			Min. Braking Power* ⁶ (kW)	Braking Current (A) ⁷	Min. Resistor Value (Ω)	Max. Total Braking Current (A)	Peak Power (kW)
				VFDB* ⁵	Amt.	Part No.	Amt.	Working Method					
230V	3	VFD022ED21S	1.5			BR1K0W050	1		0.66	5.1	38.0	10	3.8
	5	VFD037ED21S	2.5			BR1K5W040	1		1.11	8.8	19.0	20	7.6
	5	VFD040ED23S	2.5			BR1K0W016	2	2 parallel	1.2	8.8	19.0	20	7.6
	7.5	VFD055ED23S	3.7			BR1K0W050	2	2 serial	1.65	10.1	15.6	24.4	9.3
	10	VFD075ED23S	5.1			BR1K0W050	3	3 serial	2.25	15.2	11.5	33	12.5
	15	VFD110ED23S	7.5			BR1K0W050	4	4 serial	3.3	20.3	9.5	40	15.2
	20	VFD150ED23S	10.2			BR1K0W050	5	5 serial	4.5	25.3	8.3	46	17.5
	25	VFD185ED23S	12.2			BR1K0W5P1	6	2 serial 3 parallel	5.55	29.2	5.8	66	25.1
	30	VFD220ED23S	14.9			BR1K2W3P9	6	2 serial 3 parallel	6.6	38.0	5.8	66	25.1
	40	VFD300ED23S	20.3	2015	2	BR1K5W3P3	6	2 serial 3 parallel	9	50.7	4.8	80	30.4
50	VFD370ED23S	25.1	2022	2	BR1K0W5P1	12	4 serial 3 parallel	11.1	63.3	3.2	120	45.6	
460V	5	VFD040ED43S	2.7			BR1K0W050	2	2 parallel	1.2	2.7	54.3	14	10.6
	7.5	VFD055ED43S	3.7			BR1K0W050	2	2 parallel	1.65	5.1	48.4	15.7	11.9
	10	VFD075ED43S	5.1			BR1K0W020	3	3 parallel	2.25	5.1	48.4	15.7	11.9
	15	VFD110ED43S	7.5			BR1K0W050	4	2 serial 2 parallel	3.3	10.1	30.8	24.7	18.8
	20	VFD150ED43S	10.1			BR1K0W5P8	5	5 parallel	4.5	12.7	25.0	30.4	23.1
	25	VFD185ED43S	12.5			BR1K0W020	6	2 serial 3 parallel	5.55	15.2	20.8	36.5	27.7
	30	VFD220ED43S	14.9			BR1K0W050	8	4 serial 2 parallel	6.6	20.3	19.0	40	30.4
	40	VFD300ED43S	20.3			BR1K0W050	10	5 serial 2 parallel	9	25.3	14.1	54	41.0
	50	VFD370ED43S	25.0	4045	1	BR1K0W5P1	12	2 serial 6 parallel	11.1	35.3	12.7	60	45.6
	60	VFD450ED43S	30.4	4045	1	BR1K0W3P7	14	2 serial 7 parallel	13.5	44.2	12.7	60	45.6
75	VFD550ED43S	37.2	4030	2	BR1K5W3P3	12	2 serial 6 parallel	16.5	53.0	9.5	80	60.8	
100	VFD750ED43S	50.7	4045	2	BR1K5W007	16	4 serial 4 parallel	22.5	70.7	6.3	120	91.2	

*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). 30% ED applies for PM motor elevator system.

*² Refer to the Brake Performance Curve for "Operation Duration & ED (%)" versus "Braking Current".

*³ The calculation of the braking torque is based on a four-pole motor (1800 rpm).

*⁴ To dissipate heat, fix a resistor of 400 W or lower to the frame to maintain the surface temperature below 250°C (482°F). Fix a resistor of 1000 W or higher to a surface to maintain the surface temperature below 600°C (1112°F). If the surface temperature is higher than the temperature limit, install more heat dissipating systems or increase the size of the resistor.

*⁵ Refer to VFDB series Braking Module Instruction for more details on the braking resistor.

*⁶ The braking resistor should be able to endure 3.3 times the overload capacity.

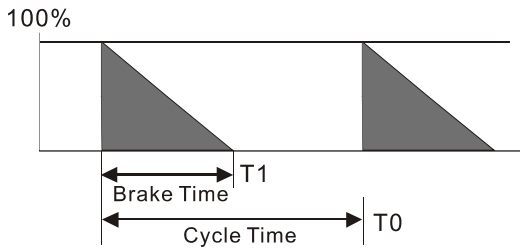
*⁷ The calculation of the braking current is based on Delta's braking resistor and default braking voltage (220V: 380V; 440V: 760V).

06 Optional Accessories | VFD-ED

NOTE

1. Select the resistance value, power and brake usage (ED %) according to Delta rules.

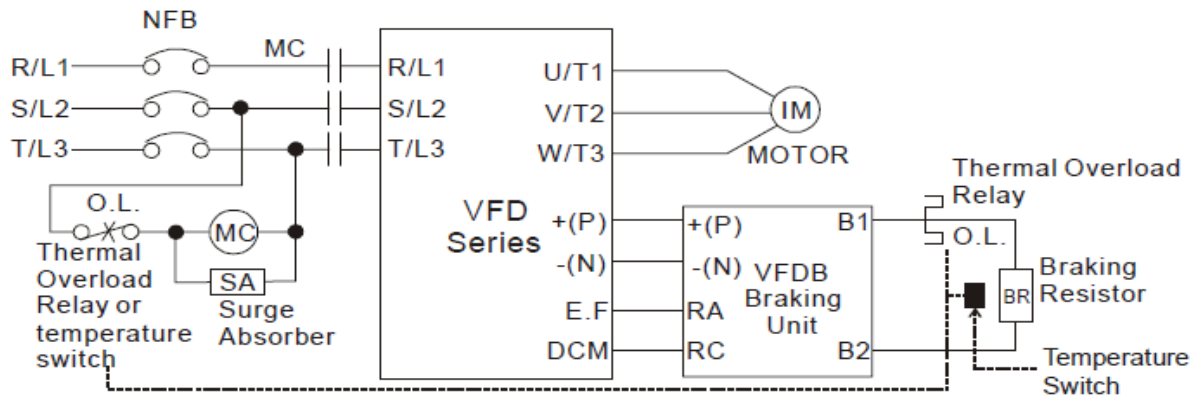
Definition for Brake Usage ED%



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

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.

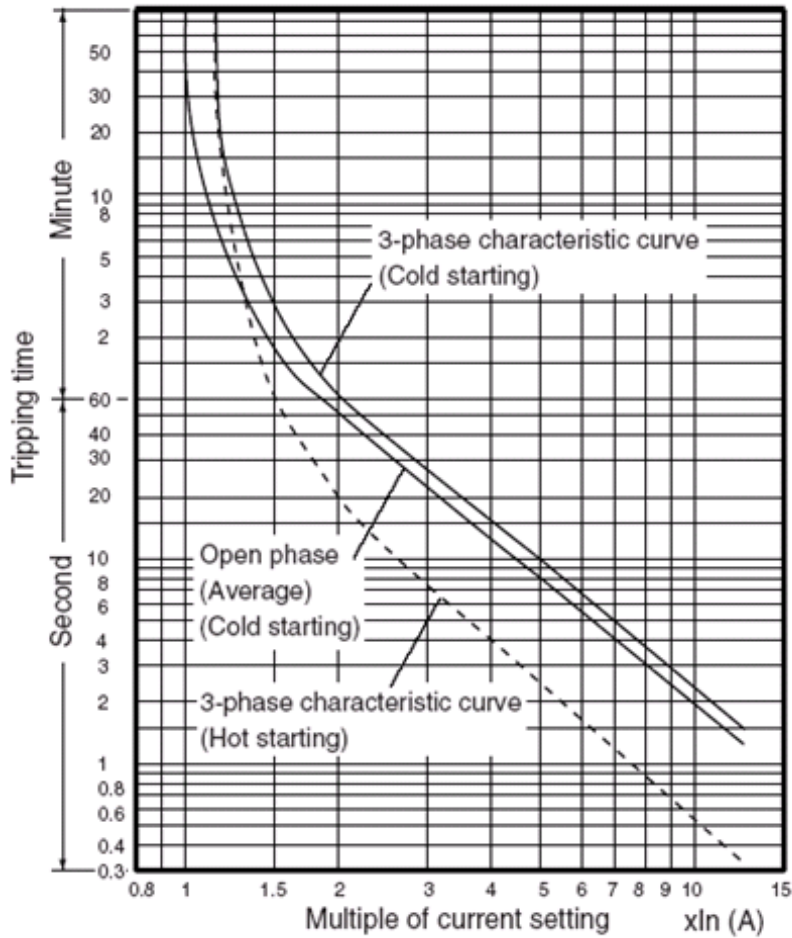
For safety, install a thermal overload relay between the brake unit and the brake resistor in conjunction with the magnetic contactor (MC) before the drive for additional protection. The thermal overload relay protects the brake resistor from damage due to frequent or continuous braking. Under such circumstances, turn off the power to prevent damage to the brake resistor.



Note1: When using the AC drive with DC reactor, please refer to wiring diagram in the AC drive user manual for the wiring of terminal +(P) of Braking unit.

Note2: Do NOT wire terminal -(N) to the neutral point of power system.

2. Any damage to the drive or other equipment caused by using brake resistors and brake modules 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. When using more than two brake units, the equivalent resistor value of parallel brake unit cannot be less than the value in the column "Minimum Resistor Value (Ω)". Read the wiring information in the brake unit user manual thoroughly prior to operation.
5. This chart is for normal use. If the AC motor drive requires frequent braking, increase the Watts by two to three times.
6. Use the following graph to select the thermal relay.



Thermal Relay:

Thermal relay selection is based on its overload capacity. A standard braking capacity of ED is 10% ED (Tripping time = 10 sec.). The figure on the left is an example of a 460V, 110 kW AC motor drive. It requires the thermal relay to take 260% overload capacity for 10 sec. (hot starting) and the braking current is 126 A. In this case, select a thermal relay rated at 50 A. The property of each thermal relay may vary among different manufacturers. Carefully read the thermal relay user guide before using it.

6-2 Non-fuse Circuit Breaker

Comply with the UL standard: Per UL 508, paragraph 45.8.4, part a. The rated current of a breaker shall be two to four times the maximum rated input current of the AC motor drive.

One-phase/Three-phase		Three-phase	
Model	Recommended non-fuse breaker (A)	Model	Recommended non-fuse breaker (A)
VFD022ED21S*	50	VFD040ED43S	30
VFD037ED21S*	75	VFD055ED43S	35
VFD040ED23S	40	VFD075ED43S	40
VFD055ED23S	50	VFD110ED43S	50
VFD075ED23S	60	VFD150ED43S	60
VFD110ED23S	100	VFD185ED43S	75
VFD150ED23S	125	VFD220ED43S	100
VFD185ED23S	150	VFD300ED43S	125
VFD220ED23S	175	VFD370ED43S	150
VFD300ED23S	250	VFD450ED43S	200
VFD370ED23S	300	VFD550ED43S	250
		VFD750ED43S	350

* VFD022ED21S and VFD037ED21S are one-phase models.

6-3 Fuse Specification Chart

Fuse specifications lower than the table below are allowed.

Model	Input Current (A)	Line Fuse	
		I (A)	Bussmann P/N
VFD022ED21S	26	60	JJN-60
VFD037ED21S	37	90	JJN-90
VFD040ED23S	20	50	JJN-50
VFD055ED23S	23	60	JJN-60
VFD075ED23S	30	80	JJN-80
VFD110ED23S	47	125	JJN-125
VFD150ED23S	56	150	JJN-150
VFD185ED23S	73	175	JJN-175
VFD220ED23S	90	225	JJN-225
VFD300ED23S	132	300	JJN-300
VFD370ED23S	161	400	JJN-400
VFD040ED43S	11.5	35	JJS-35
VFD055ED43S	14	40	JJS-40
VFD075ED43S	17	45	JJS-45
VFD110ED43S	24	60	JJS-60
VFD150ED43S	30	80	JJS-80
VFD185ED43S	37	90	JJS-90
VFD220ED43S	47	110	JJS-110
VFD300ED43S	58	150	JJS-150
VFD370ED43S	80	200	JJS-200
VFD450ED43S	100	250	JJS-250
VFD550ED43S	128	300	JJS-300
VFD750ED43S	165	400	JJS-400

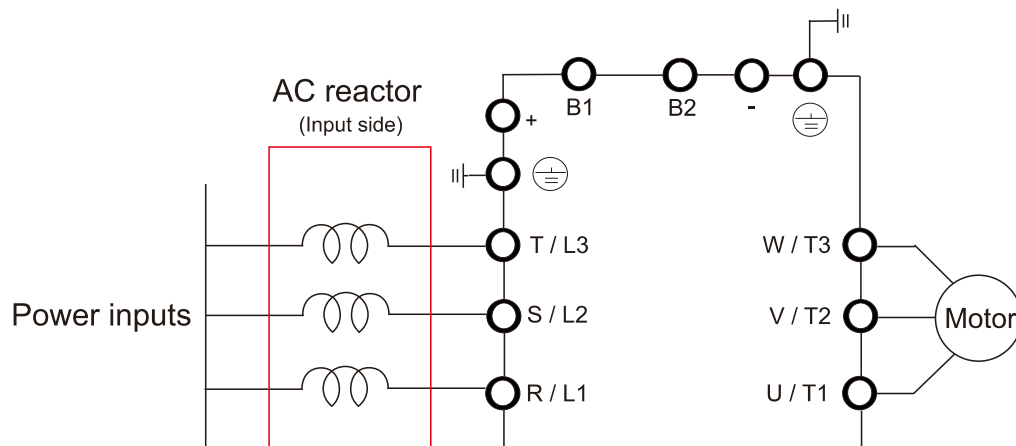
6-4 AC / DC Reactor

AC Input Reactor

Installing an AC reactor on the input side of an AC motor drive can increase line impedance, improve the power factor, reduce input current, increase system capacity, 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 peak voltage and current spikes 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 between the main power and the three input phases R S T, as shown in the figure below:



Connecting an AC Input Reactor

DC Reactor

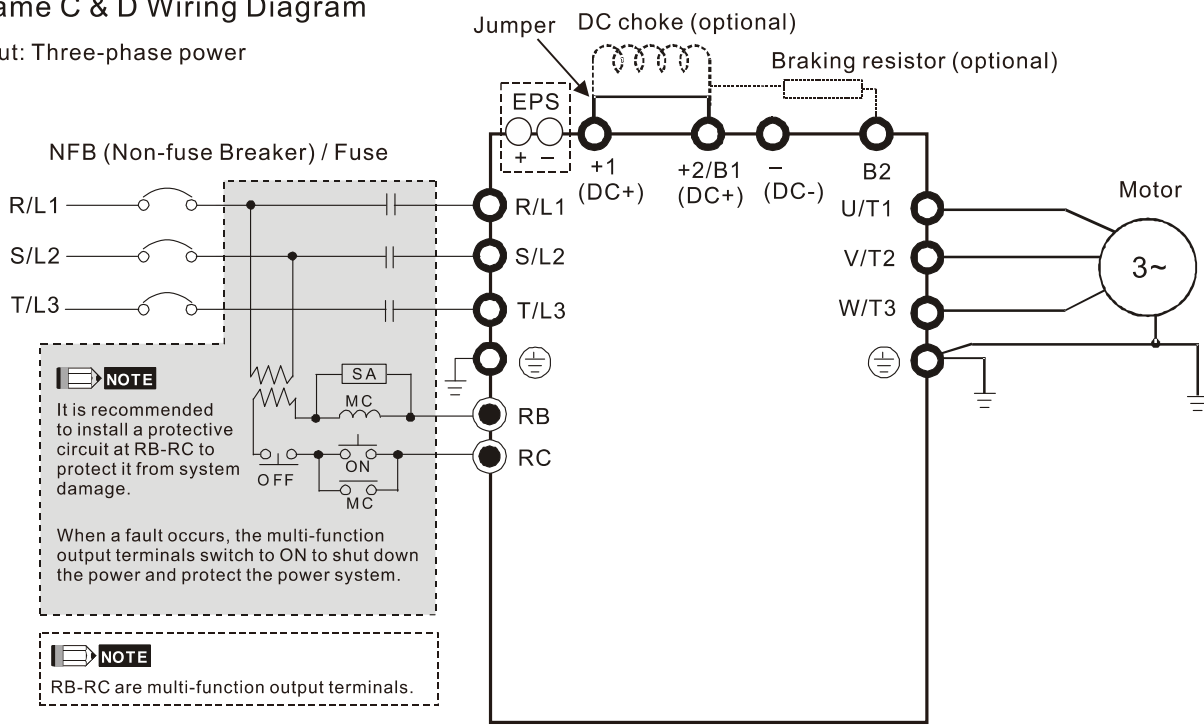
A DC reactor can also increase line impedance, improve the power factor, reduce input current, increase system power, and reduce interference generated from the motor drive. A DC reactor stabilizes the DC BUS voltage. Compared with an AC input reactor, a DC reactor is in smaller size, lower price, and lower voltage drop (lower power dissipation).

Installation

Install a DC reactor between terminals +1(DC+) and +2/B1(DC+). Remove the DC reactor jumper, as shown in the figure below, before installing a DC reactor.

Frame C & D Wiring Diagram

Input: Three-phase power



Installing a DC reactor

THD (Total Harmonic Distortion)

The table below shows the THDi specification 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			Models with Built-in DC Reactors	
		3% Input AC Reactor	5% Input AC Reactor	4% DC Reactor	3% Input AC Reactor	5% Input AC Reactor
5th	73.3%	38.5%	30.8%	25.5%	27.01%	25.5%
7th	52.74%	15.3%	9.4%	18.6%	9.54%	8.75%
11th	7.28%	7.1%	6.13%	7.14%	4.5%	4.2%
13th	0.4%	3.75%	3.15%	0.48%	0.22%	0.17%
THDi	91%	43.6%	34.33%	38.2%	30.5%	28.4%
Note	THDi may vary due to different installation conditions and environment (wires, motors).					

THDi Specification

Note: For three-phase power models, Delta provides 4% DC reactors and 3% AC reactors. Refer to the following sections to select your applicable reactors.

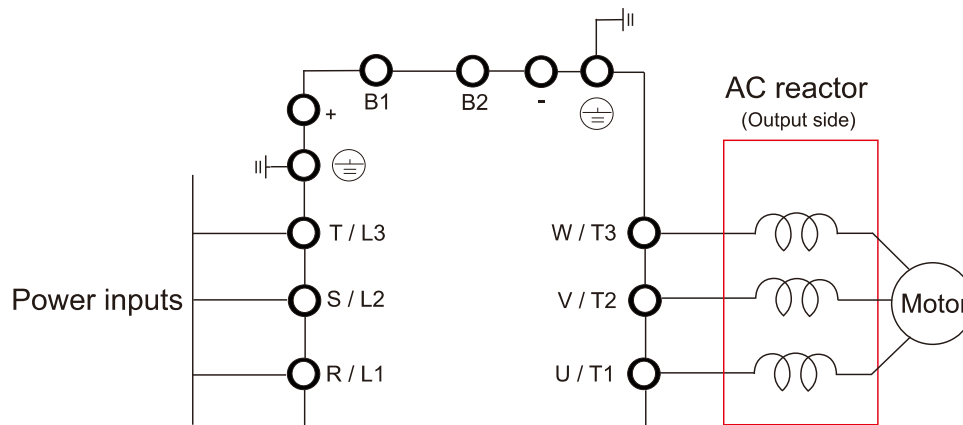
AC Output Reactor

When using drives in long wiring output application, ground fault (GFF), over-current (OC) and motor over-voltage (OV) often occur. GFF and OC cause errors due to the drive's self-protective mechanism; over-voltage damages motor insulation.

The excessive length of the output wires makes the grounded stray capacitance too large, increase the three-phase output common mode current, and the reflected wave of the long wires makes the motor dv/dt and the motor terminal voltage too high. Thus, installing a reactor on the drive's output side can increase the high-frequency impedance to reduce the dv/dt and terminal voltage to protect the motor.

Installation

Install an AC output reactor in series between the three output phases U V W and the motor, as shown in the figure below:



Connecting an AC output reactor

Applicable Reactors

200V–230V/ 50–60Hz (One-phase power)

Model	Rated Current (Arms)	Saturation Current (Arms)	AC Input Reactors (mH)	AC Input Reactors Delta part#	AC Output Reactors (mH)	AC Output Reactors Delta Part #
VFD022ED21S	12	24	1.172	DR025D0117	2.02	DR012L0202
VFD037ED21S	17	34	0.574	DR049DP574	1.17	DR018L0117

200V–230V/ 50–60Hz (Three-phase power)

Model	Rated Current (Arms)	Saturation Current (Arms)	AC Input / Output Reactors (mH)	AC Input / Output Reactors Delta part #	DC Reactors (mH)	DC Reactors Delta Part #
VFD040ED23	20	40	0.507	DR025AP507 DR025LP507	NA*	NA*
VFD055ED23	24	48	0.507	DR025AP507 DR025LP507	1.17	DR025D0117
VFD075ED23	30	60	0.32	DR033AP320 DR033LP320	0.851	DR033DP851
VFD110ED23	45	90	0.215	DR049AP215 DR049LP215	0.574	DR049DP574
VFD150ED23	58	116	0.162	DR065AP162 DR065LP162	0.432	DR065DP432

06 Optional Accessories | VFD-ED

Model	Rated Current (Arms)	Saturation Current (Arms)	AC Input / Output Reactors (mH)	AC Input / Output Reactors Delta part #	DC Reactors (mH)	DC Reactors Delta Part #
VFD185ED23	77	154	0.141	DR090AP141 DR090LP141	0.325	DR090DP325
VFD220ED23	87	174	0.141	DR090AP141 DR090LP141	0.325	DR090DP325
VFD300ED23	132	264	0.087	DR146AP087 DR146LP087	NA**	NA**
VFD370ED23	161	322	0.07	DR180AP070 DR180LP070	NA**	NA**

Note: NA* stands for not being able to install this accessory; NA stands for built-in accessory.**

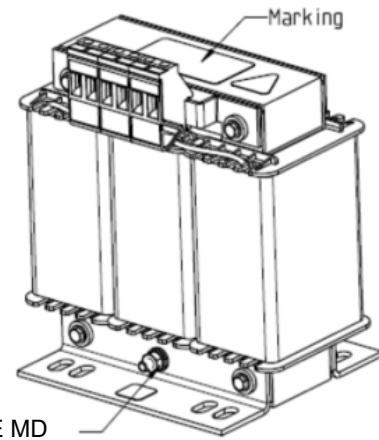
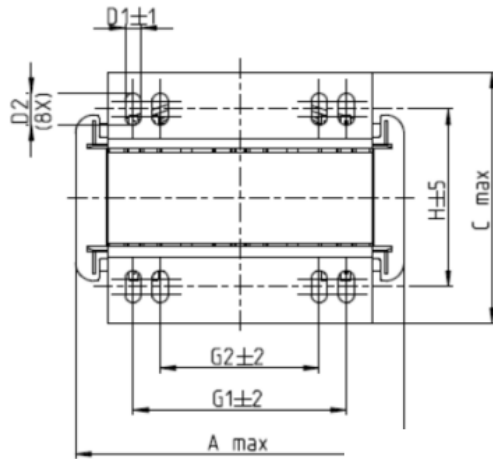
380V–460V/ 50–60Hz (Three-phase power)

Model	Rated Current (Arms)	Saturation Current (Arms)	AC Input / Output Reactors (mH)	AC Input / Output Reactors Delta part #	DC Reactors (mH)	DC Reactors Delta Part #
VFD040ED43S	11.5	23	2.31	DR010A0231 DR010L0231	NA*	NA*
VFD055ED43S	13	26	2.02	DR012A0202 DR012L0202	4.67	DR012D0467
VFD075ED43S	17	34	1.17	DR018A0117 DR018L0117	3.11	DR018D0311
VFD110ED43S	23	46	0.881	DR024AP881 DR024LP881	2.33	DR024D0233
VFD150ED43S	30	60	0.66	DR032AP660 DR032LP660	1.75	DR032D0175
VFD185ED43S	38	76	0.639	DR038AP639 DR038LP639	1.47	DR038D0147
VFD220ED43S	45	90	0.541	DR045AP541 DR045LP541	1.24	DR045D0124
VFD300ED43S	58	116	0.405	DR060AP405 DR060LP405	0.935	DR060DP935
VFD370ED43S	80	160	0.267	DR091AP267 DR091LP267	NA**	NA**
VFD450ED43S	100	200	0.221	DR110AP221 DR110LP221	NA**	NA**
VFD550ED43S	128	256	0.162	DR150AP162 DR150LP162	NA**	NA**
VFD750ED43S	165	330	0.135	DR180AP135 DR180LP135	NA**	NA**

Note: NA* stands for not being able to install this accessory; NA stands for built-in accessory.**

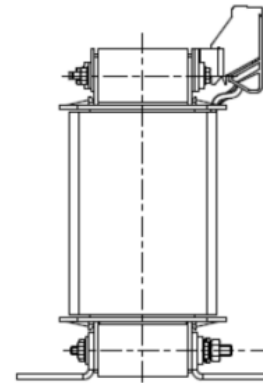
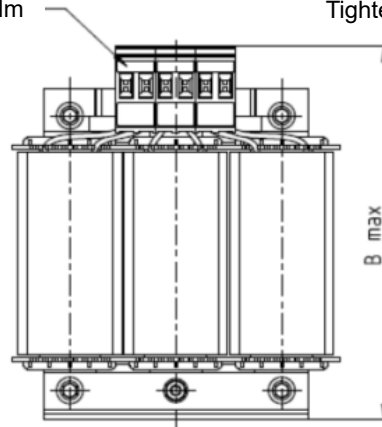
Reactor Dimensions

AC input reactor dimension and specifications:



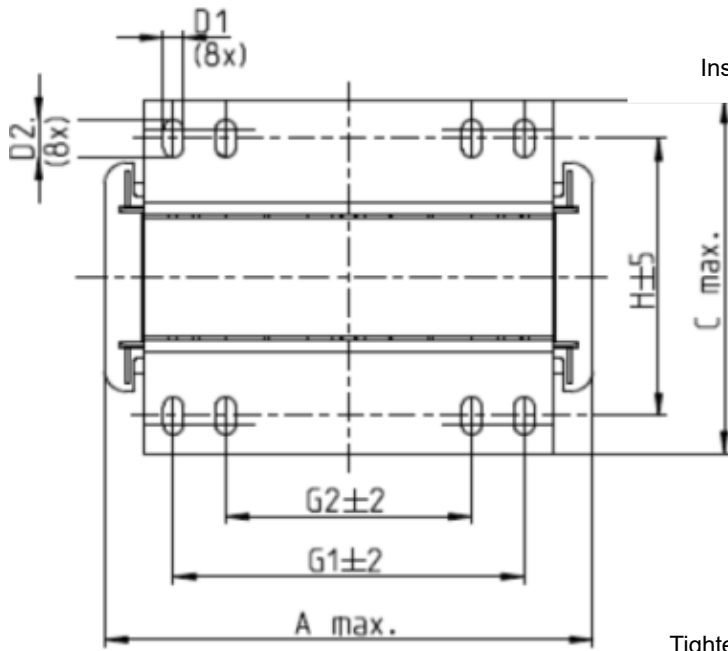
Tightening torque : 0.6–0.8 Nm

Tightening torque: F Nm

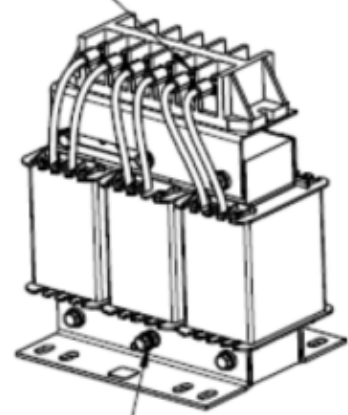


Unit: mm

Input Reactors Delta Part #	A	B	C	D1*D2	E	G1	G2	PE D
DR005A0254	100	115	65	6*9	45	60	40	M4
DR008A0159	100	115	65	6*9	45	60	40	M4
DR011A0115	130	135	95	6*12	60	80.5	60	M4
DR017AP746	130	135	100	6*12	65	80.5	60	M4



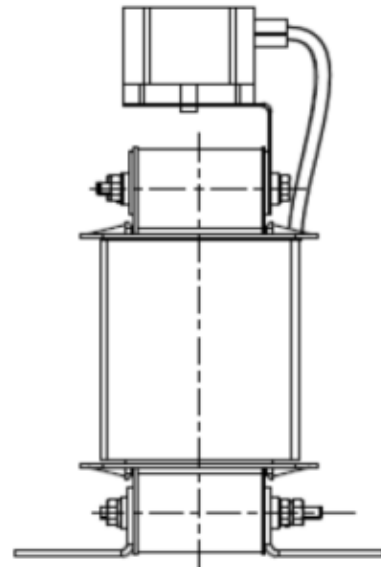
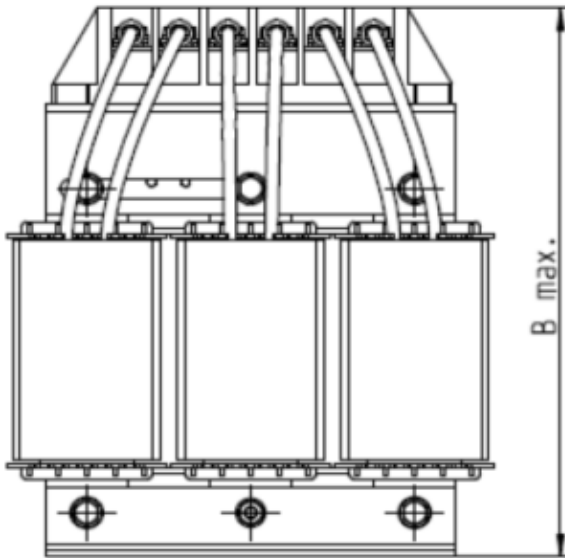
Installing screw: M5



PE MD

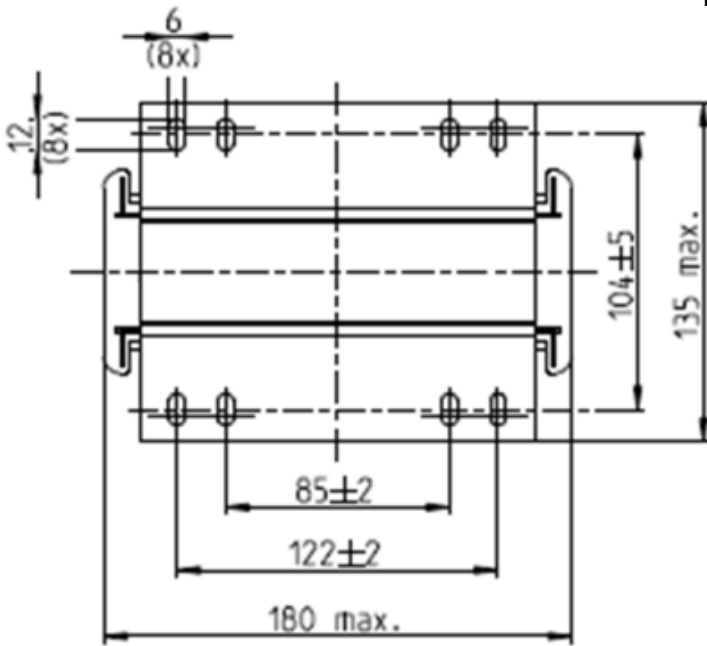
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Tightening torque: F Nm

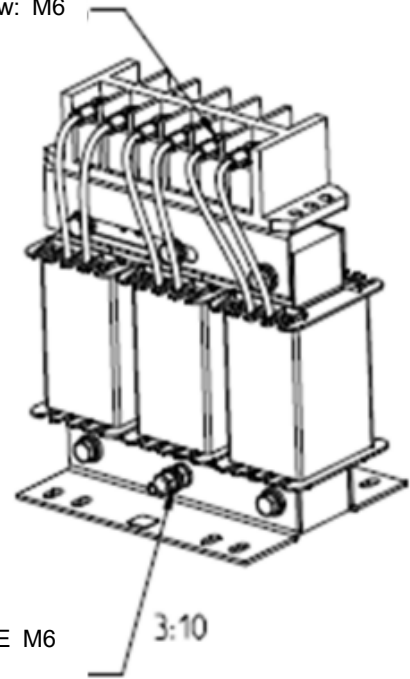


Unit: mm

Input Reactors Delta Part #	A	B	C	D1*D2	H	G1	G2	PE D
DR025AP215	130	195	100	6*12	65	80.5	60	M4
DR033AP163	130	195	100	6*12	65	80.5	60	M4
DR049AP163	160	200	125	6*12	90	107	75	M4



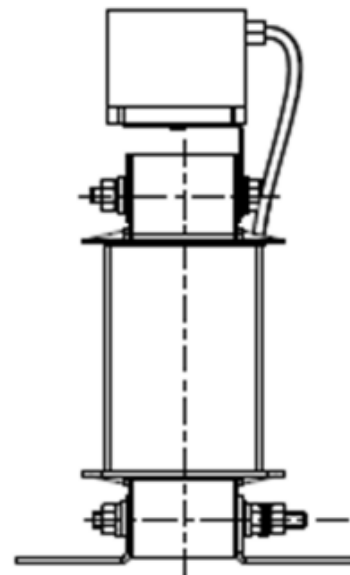
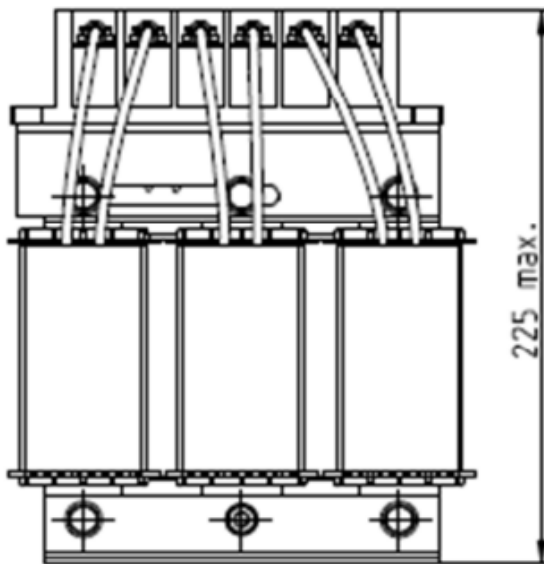
Installing screw: M6



PE M6

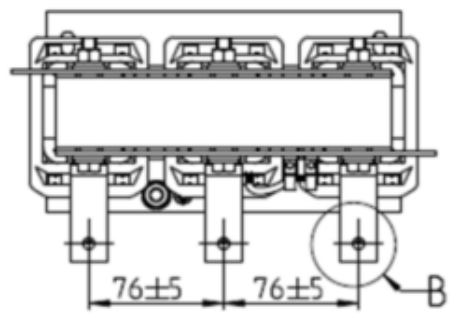
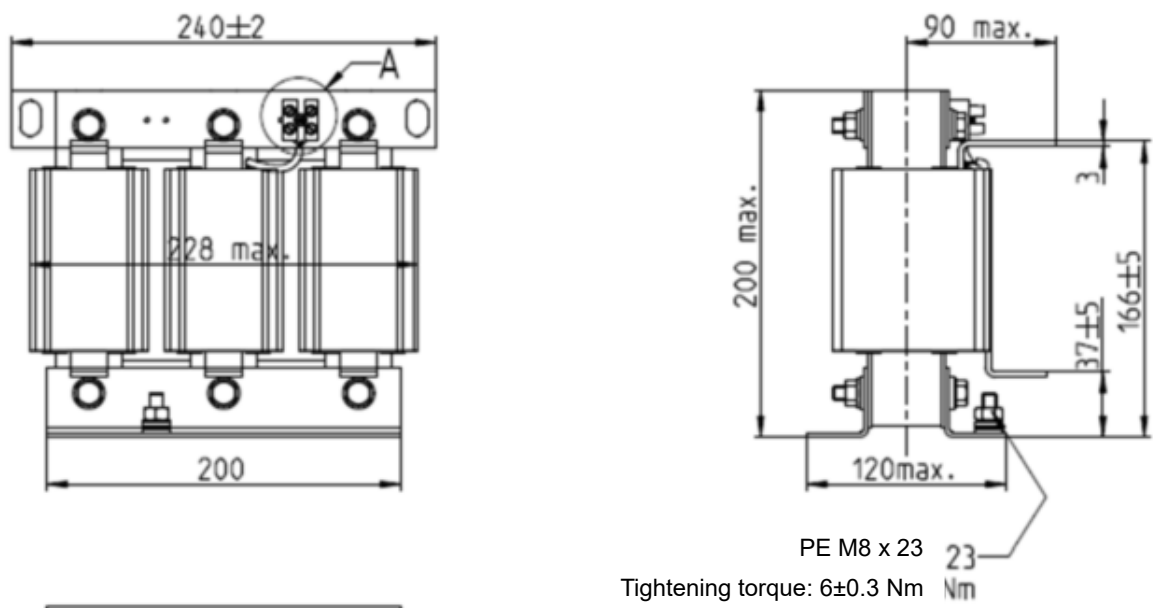
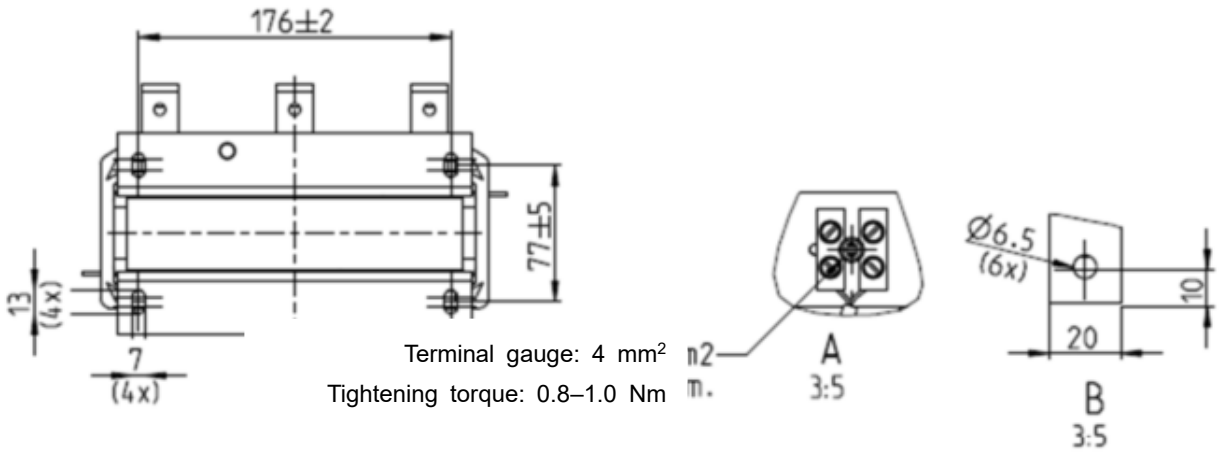
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Tightening torque: 3 ± 1.5 Nm



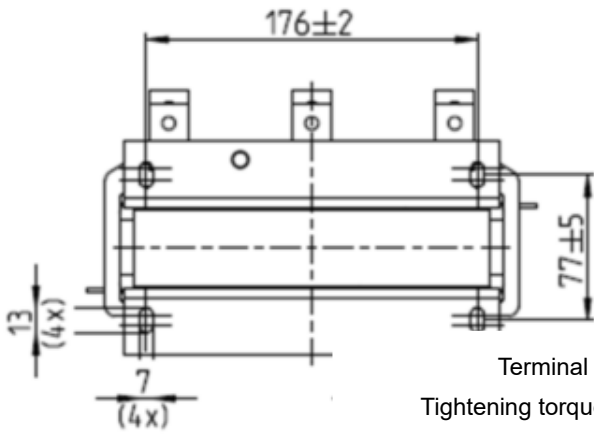
Unit: mm

Input Reactors Delta Part #	
DR065AP162	See above.

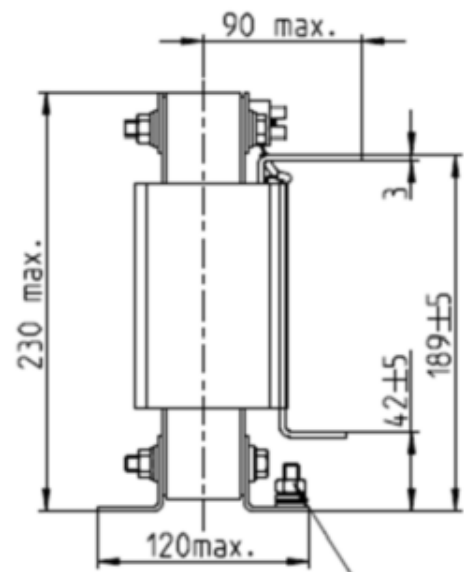
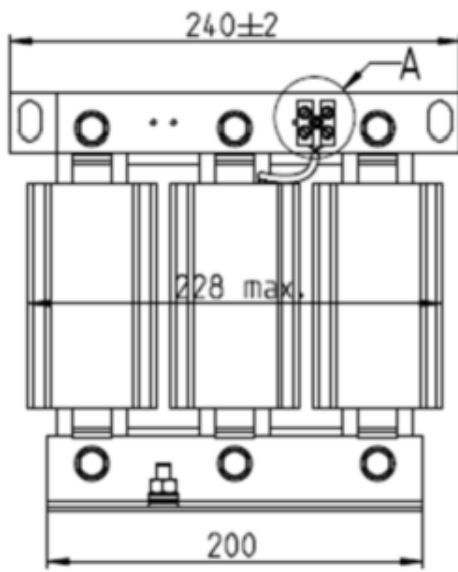
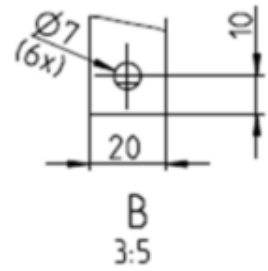
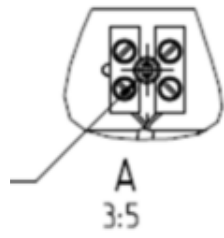


Unit: mm

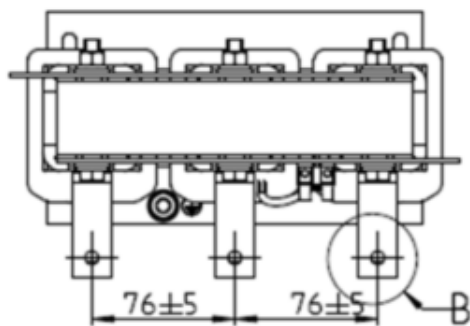
Input Reactors Delta Part #	
DR075AP170	See above.



Terminal gauge: 4 mm²
Tightening torque: 0.8–1.0 Nm

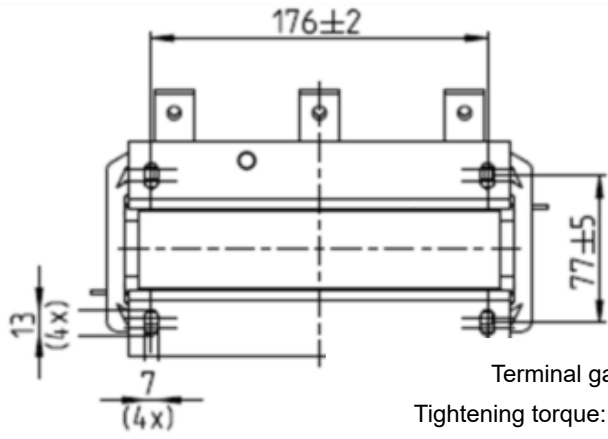


PE M8 x 23
Tightening torque: 6±0.3Nm

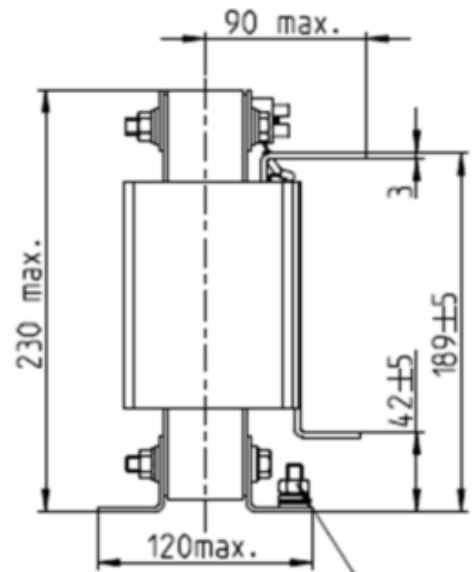
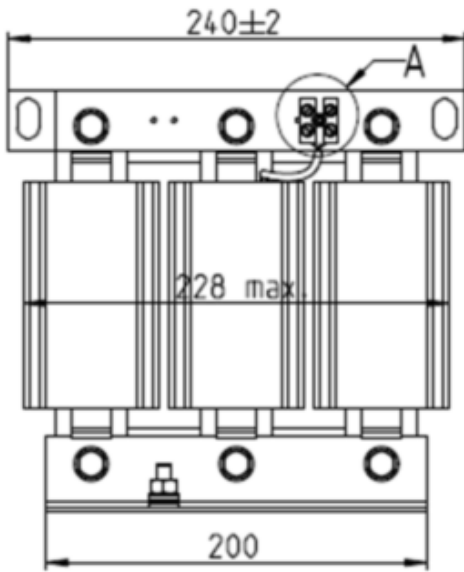
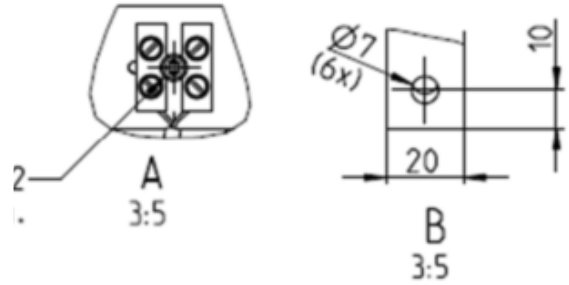


Unit: mm

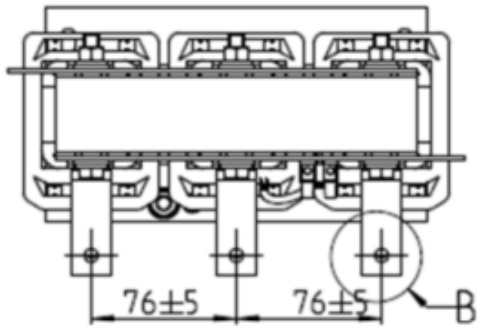
Input Reactors Delta Part #	
DR090AP141	See above.



Terminal gauge: 4 mm²
Tightening torque: 0.8–1.0 Nm

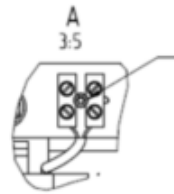
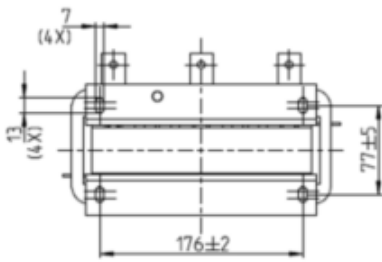


PE M8 x 23
Tightening torque: 6±0.3 Nm

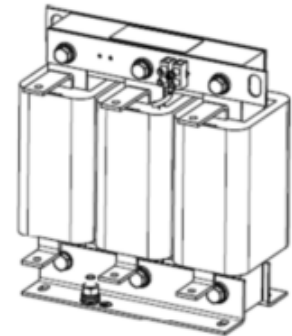
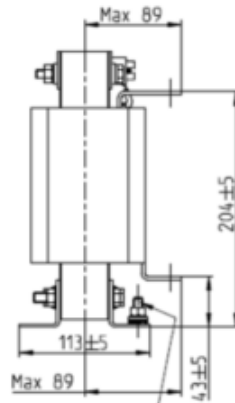
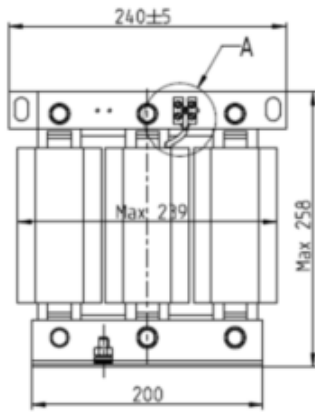


Unit: mm

Input Reactors Delta Part #	
DR105AP106	See above.

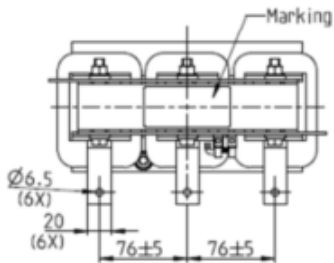


Terminal gauge: 4 mm²
Tightening torque: 0.6–0.8 Nm



PE M8 x 23

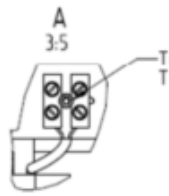
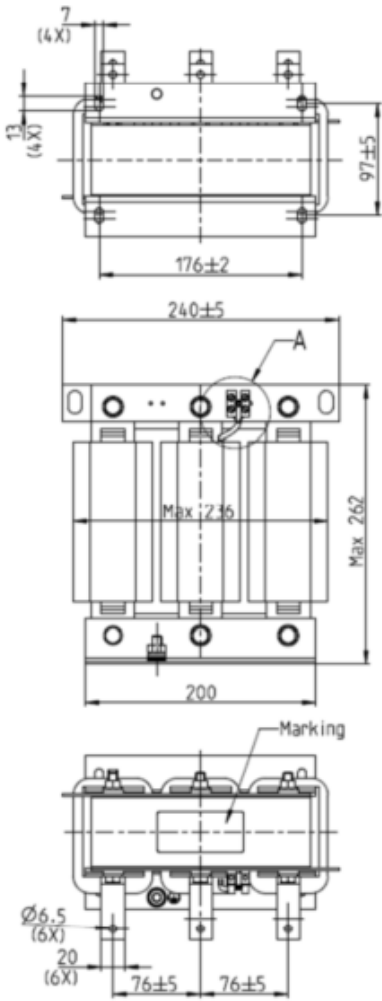
Tightening torque: 6±0.3 Nm



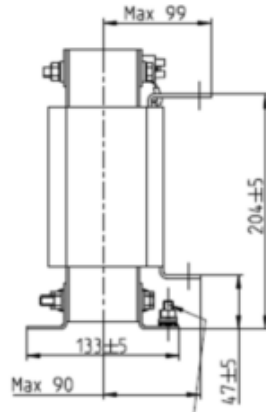
Unit: mm

Input Reactors Delta Part #	
DR146AP087	See above.

06 Optional Accessories | VFD-ED

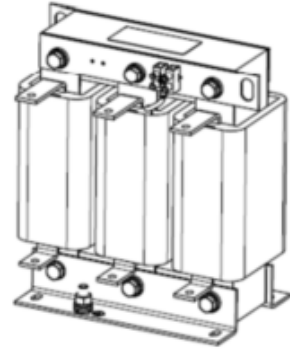


Terminal gauge: 4 mm²
Tightening torque: 0.6–0.8 Nm



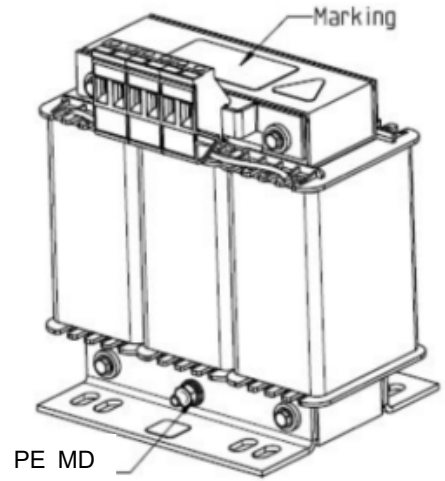
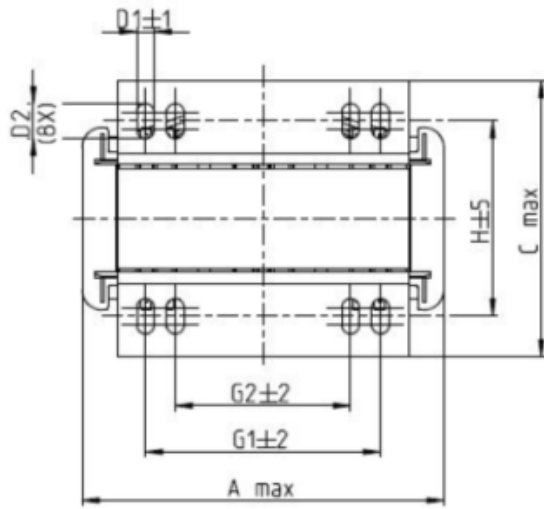
PE M8 x 23

Tightening torque: 6±0.3 Nm



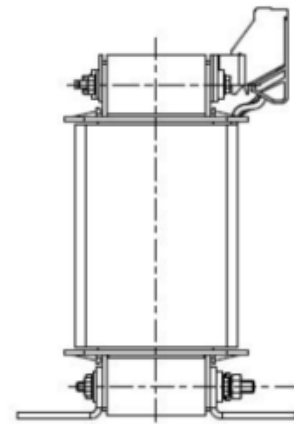
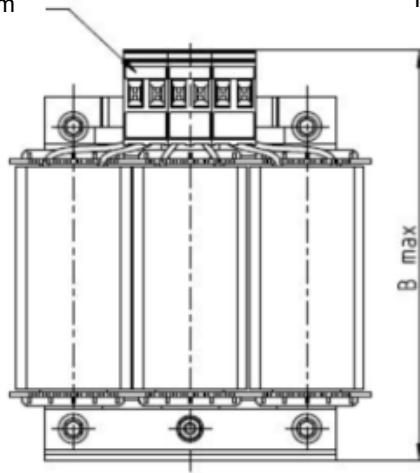
Unit: mm

Input Reactors Delta Part #	
DR180AP070	See above.



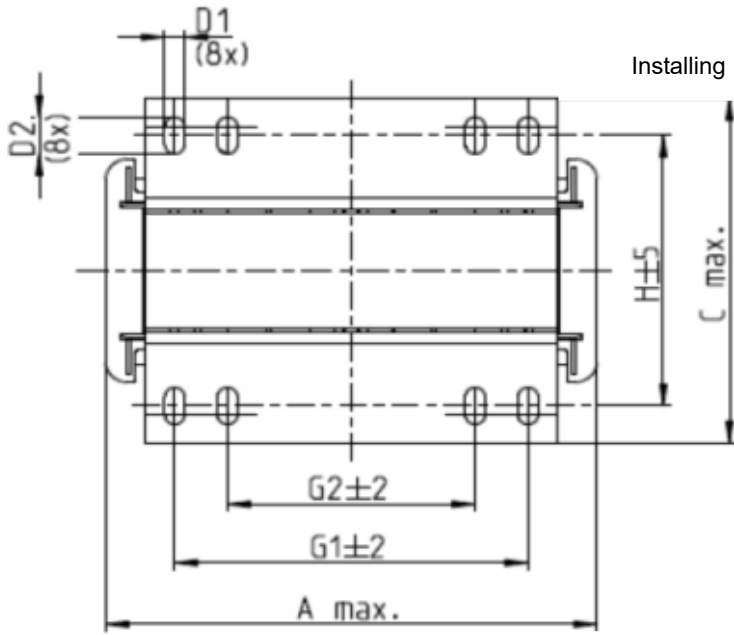
Tightening torque: 0.6–0.8 Nm

Tightening torque: F Nm

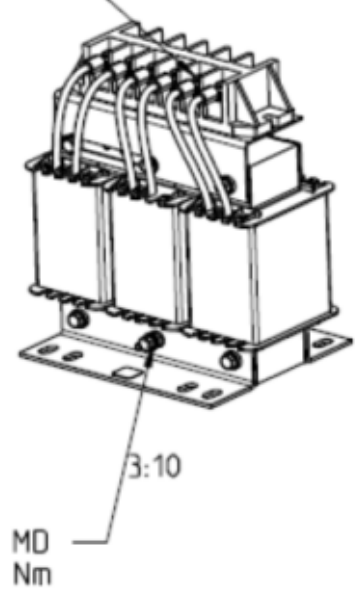


Unit: mm

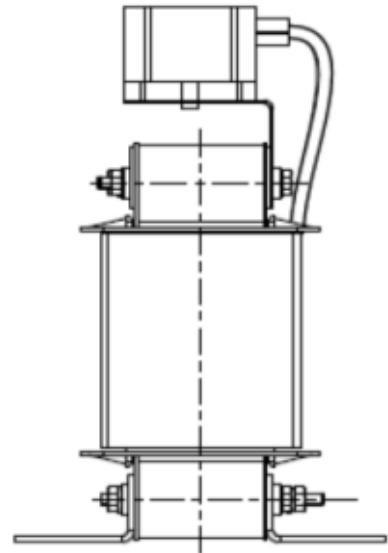
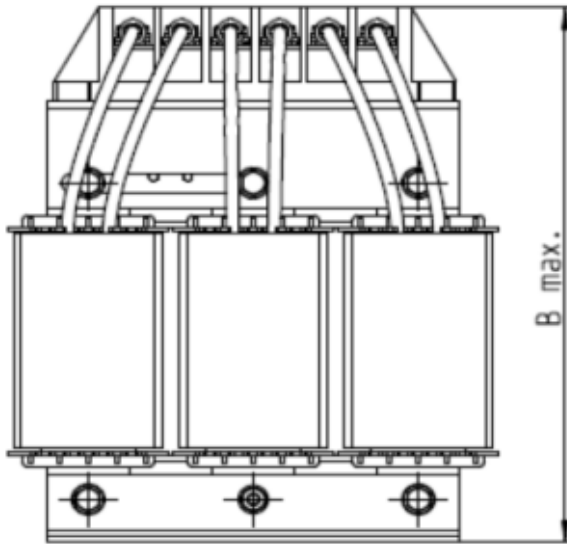
Input Reactors Delta Part #	A	B	C	D1*D2	H	G1	G2	PE D
DR003A0810	100	125	65	6*9	43	60	40	M4
DR004A0607	100	125	65	6*9	43	60	40	M4
DR006A0405	130	15	95	6*12	60	80.5	60	M4
DR009A0270	160	160	105	6*12	75	107	75	M4
DR010A0231	160	160	115	6*12	90	107	75	M4
DR012A0202	160	160	115	6*12	90	107	75	M4
DR018A0117	160	160	115	6*12	90	107	75	M4



Installing screw: M5 w M5

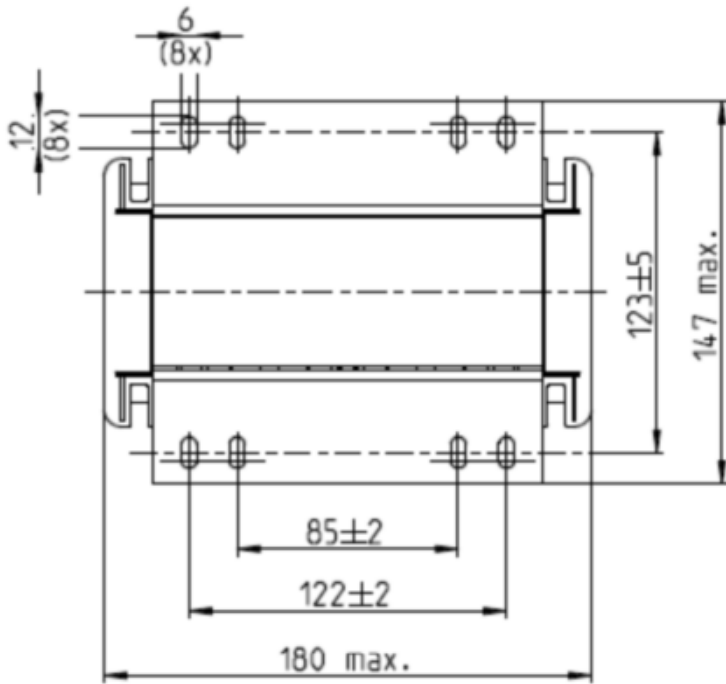


Tightening torque: F Nm

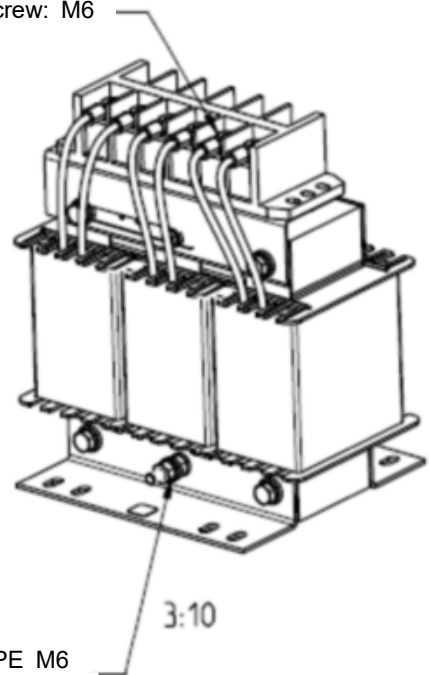


Unit: mm

Input Reactors Delta Part #	A	B	C	D1*D2	H	G1	G2	PE D
DR024AP881	160	175	115	6*12	90	107	75	M4
DR032AP660	195	200	145	6*12	115	122	85	M6
DR038AP639	190	200	145	6*12	115	122	85	M6
DR045AP541	190	200	145	6*12	115	122	85	M6

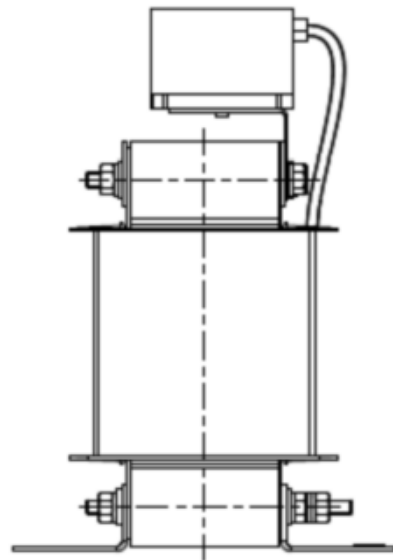
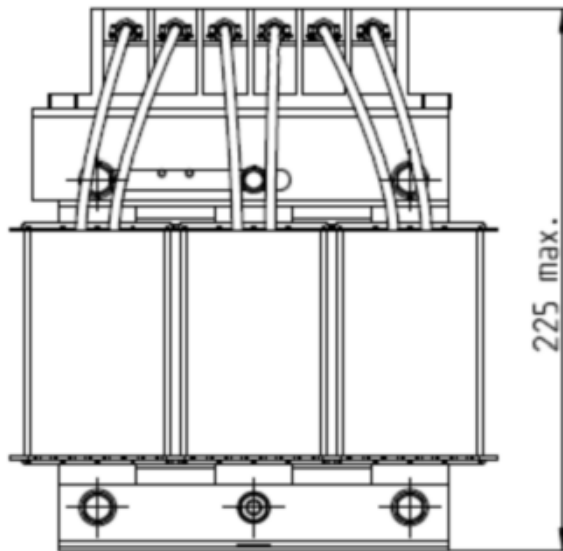


Installing screw: M6



PE M6

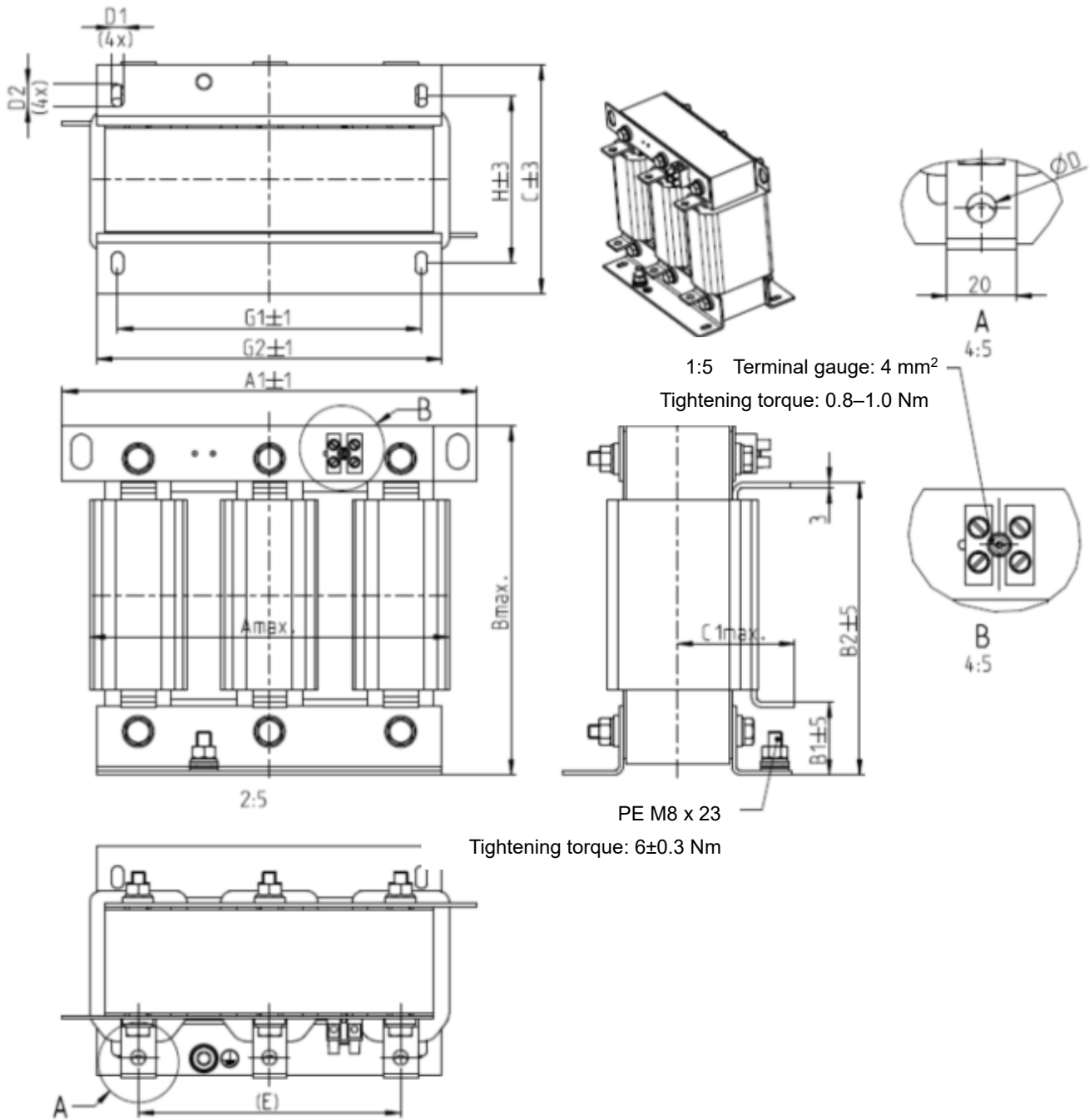
Tightening torque: 3 ± 1.5 Nm



Unit: mm

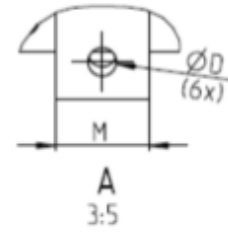
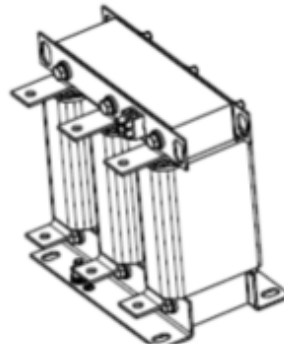
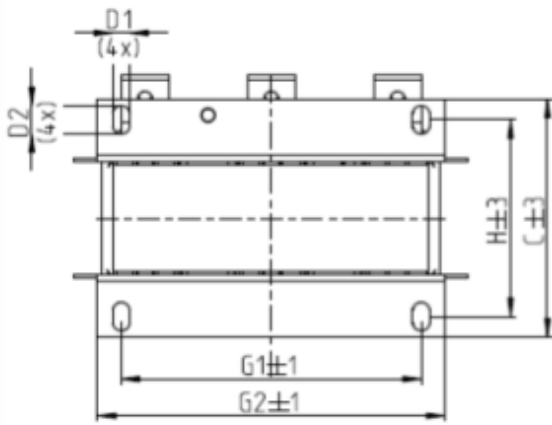
Input Reactors Delta Part #	
DR060AP405	See above.

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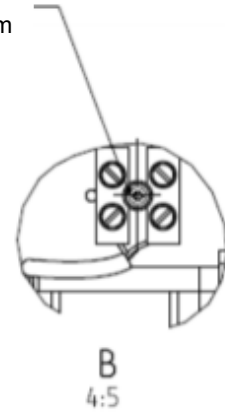
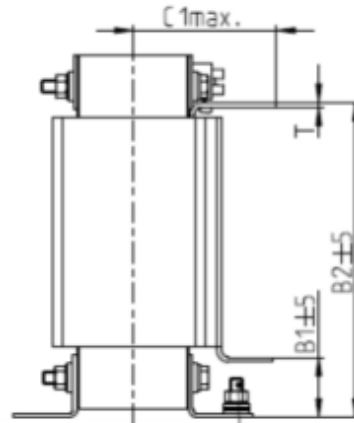
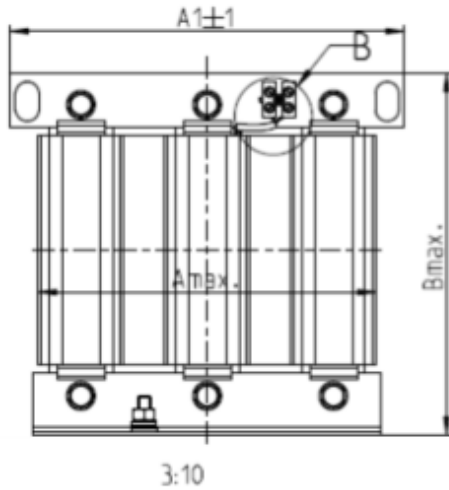


Unit: mm

Input Reactors Delta Part #	A	A1	B	B1	B2	C	D	D1*D2	E	C1	G1	G2	H
DR073AP334	228	240	215	40	170	133	8.5	7*13	152	75	176	200	97
DR091AP267	228	240	245	40	195	133	8.8	7*13	152	90	176	200	97
DR110AP221	228	240	245	40	195	138	8.5	7*13	152	75	176	200	102

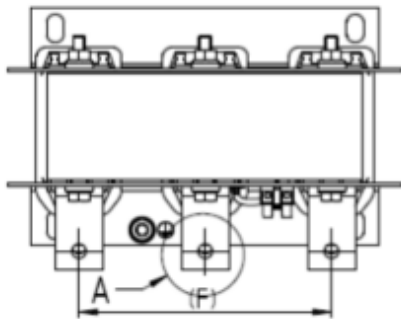


1:5 Terminal gauge: 4 mm²
Tightening torque: 0.8–1.0 Nm



PE M8 x 23

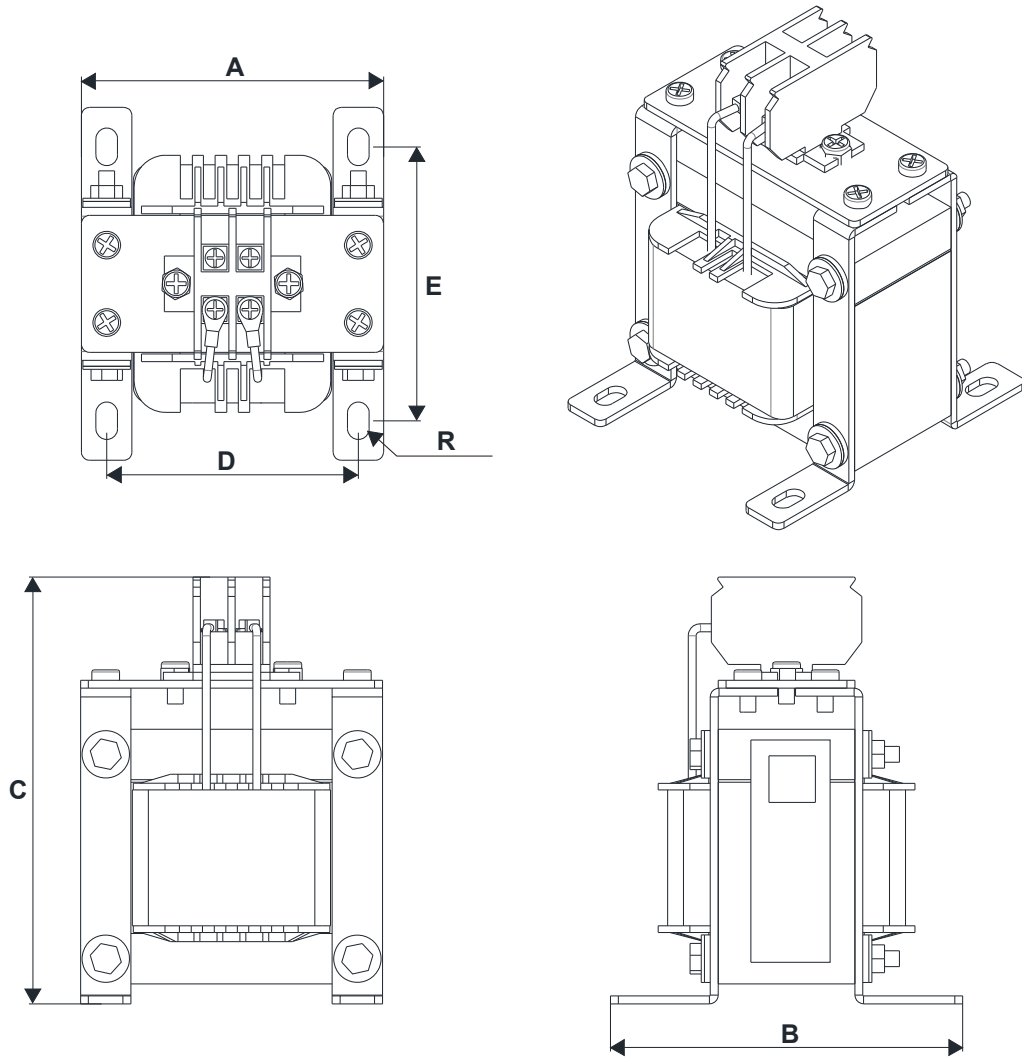
Tightening torque: 6±0.3 Nm



Unit: mm

Input Reactors Delta Part #	A	A1	B	B1	B2	C	C1	D	D1*D2	F	G1	G2	H	M*T
DR150AP162	240	250	245	40	200	151	105	9	11*18	160	190	220	125	20*3
DR180AP135	240	250	245	40	200	151	105	9	11*18	160	190	220	125	20*3
DR220AP110	264	270	275	50	230	151	105	9	10*18	176	200	230	106	30*3
DR260AP098	264	270	285	50	240	151	105	9	10*18	176	200	230	106	30*3
DR310AP078	300	300	345	55	295	153	105	9	10*18	200	224	260	113	30*3
DR370AP066	300	300	345	55	295	158	120	9	10*18	200	224	260	118	50*4

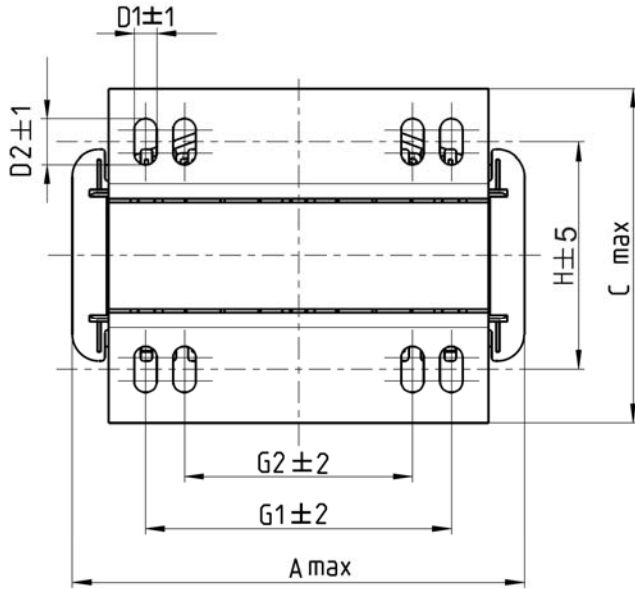
DC reactor dimension and specifications:



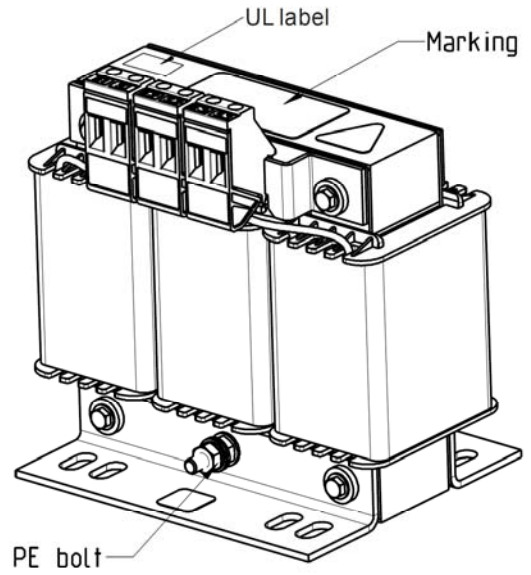
Unit: mm

DC Reactors Delta Part #	A	B	C	D	E	R
DR005D0585	79	78	112	64±2	56±2	9.5*5.5
DR008D0366	79	78	112	64±2	56±2	9.5*5.5
DR011D0266	79	92	112	64±2	69.5±2	9.5*5.5
DR017D0172	79	112	112	64±2	89.5±2	9.5*5.5
DR025D0117	99	105	128	79±2	82.5±2	9.5*5.5
DR033DP851	117	110	156	95±2	87±2	10*6.5
DR049DP574	117	120	157	95±2	97±2	10*6.5
DR065DP432	117	140	157	95±2	116.5±2	10*6.5
DR075DP391	136	135	178	111±2	112±2	10*6.5
DR090DP325	136	135	179	111±2	112±2	10*6.5
DR003D1870	79	78	112	64±2	56±2	9.5*5.5
DR004D1403	79	92	112	64±2	69.5±2	9.5*5.5
DR006D0935	79	92	112	64±2	69.5±2	9.5*5.5
DR009D0623	79	112	112	64±2	89.5±2	9.5*5.5
DR010D0534	99	93	128	79±2	70±2	9.5*5.5
DR012D0467	99	105	128	79±2	82.5±2	9.5*5.5
DR018D0311	117	110	144	95±2	87±2	10*6.5
DR024D0233	117	120	144	95±2	97±2	10*6.5
DR032D0175	117	140	157	95±2	116.5±2	10*6.5
DR038D0147	136	135	172	111±2	112±2	10*6.5
DR045D0124	136	135	173	111±2	112±2	10*6.5
DR060DP935	136	150	173	111±2	127±2	10*6.5

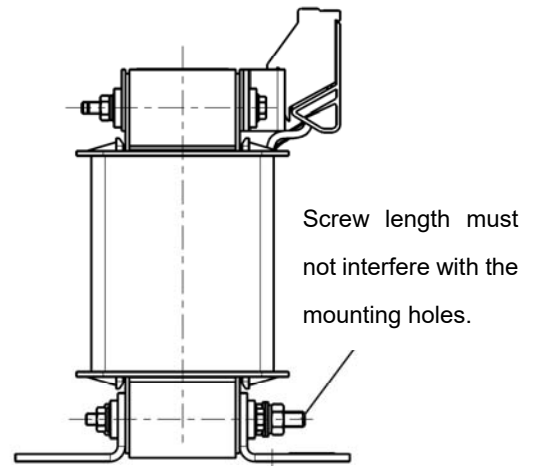
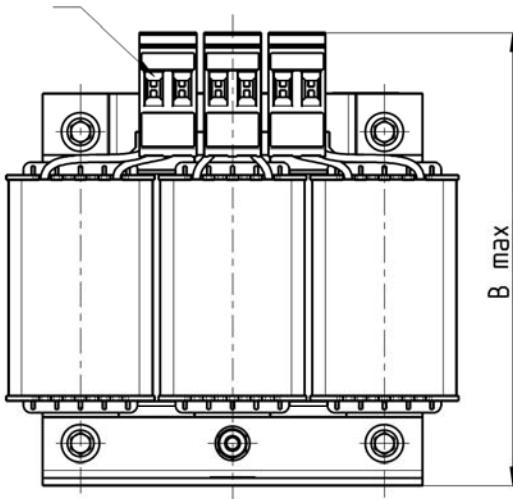
AC output reactor dimension and specifications:



Tightening torque: 0.6–0.8 Nm

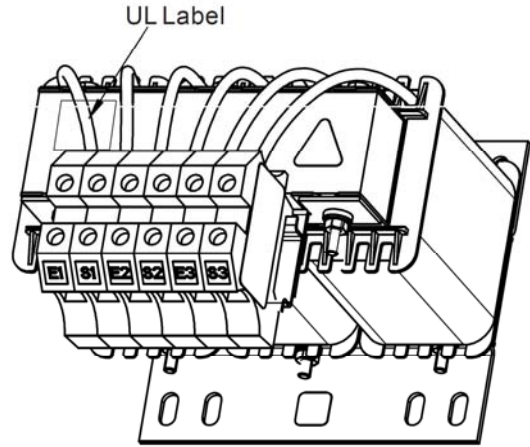
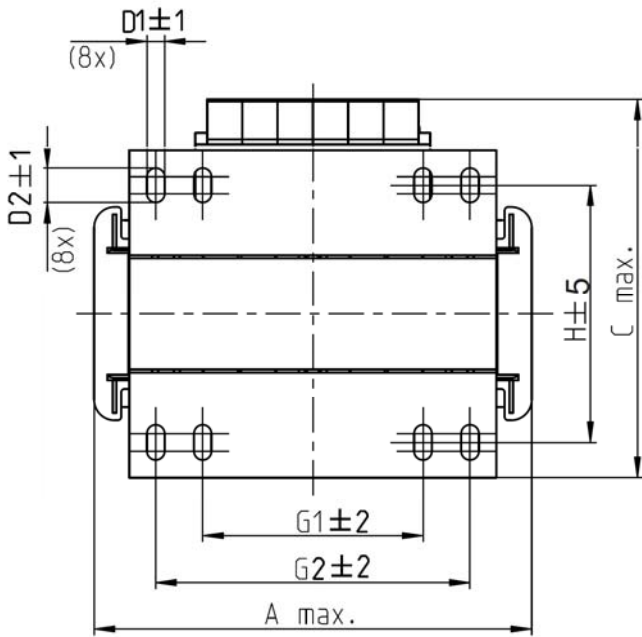


Tightening torque: 1.0–1.2 Nm

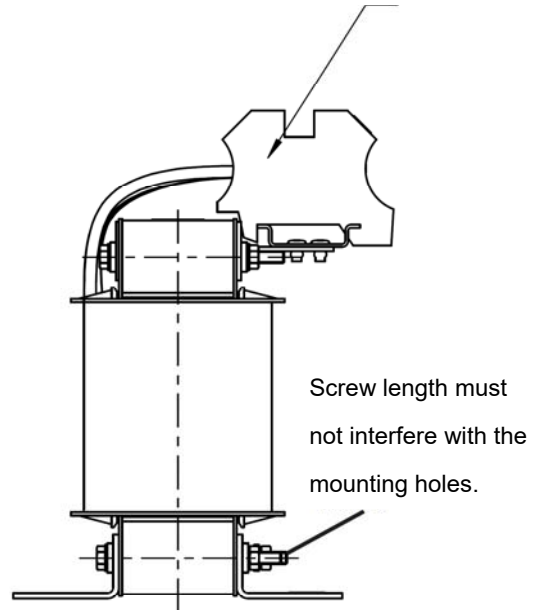
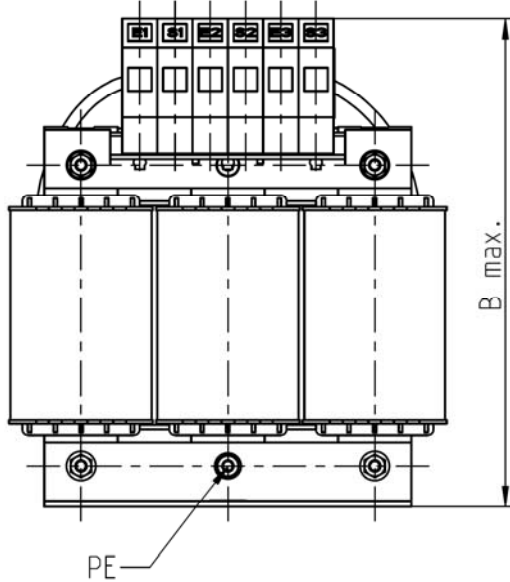


Unit: mm

Output Reactors Delta Part #	A	B	C	D1*D2	E	G1	G2	PE D
DR005L0254	96	110	70	6*9	42	60	40	M4
DR008L0159	120	135	96	6*12	60	80.5	60	M4
DR011L0115	120	135	96	6*12	60	80.5	60	M4
DR017LP746	120	135	105	6*12	65	80.5	60	M4
DR025LP507	150	160	120	6*12	88	107	75	M4
DR033LP320	150	160	120	6*12	88	107	75	M4

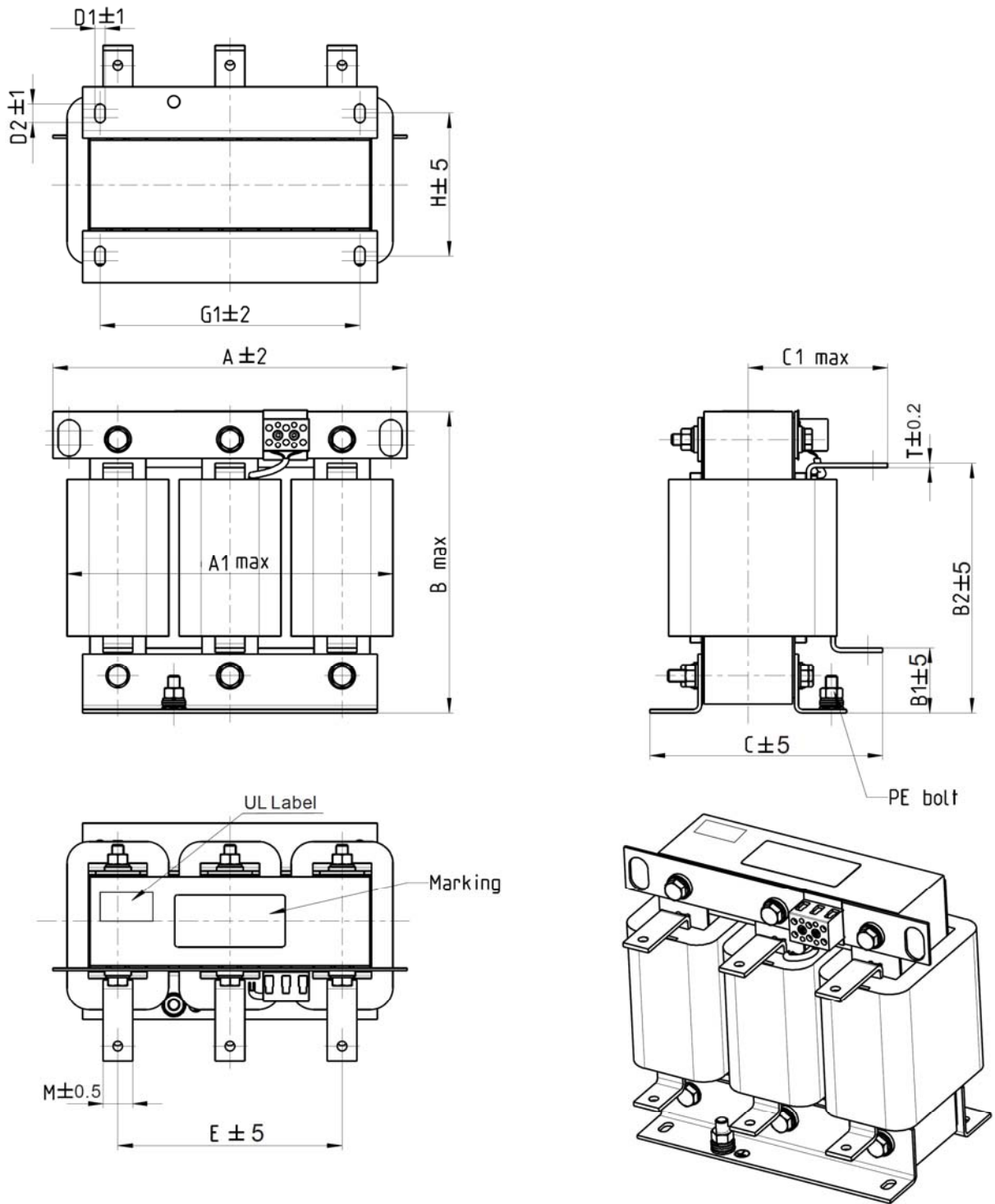


Terminal gauge: 16 mm²
Tightening torque: 1.2-1.4 Nm



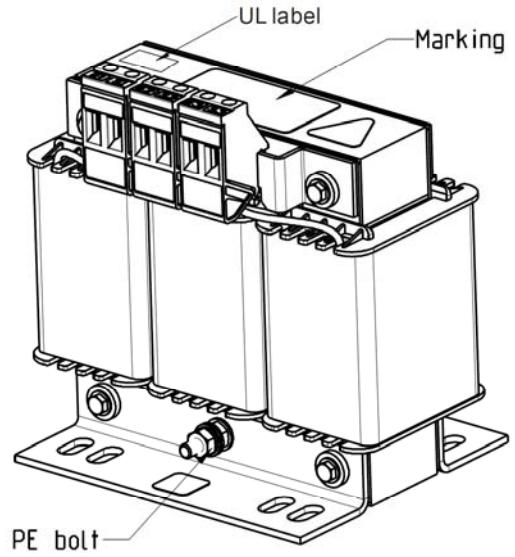
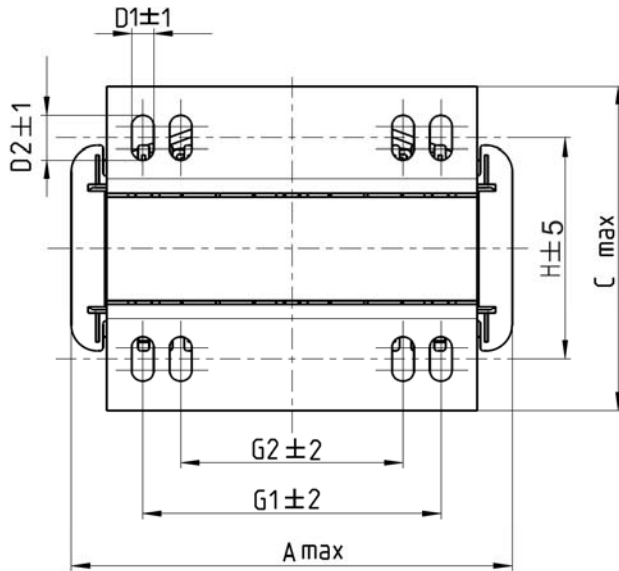
Unit: mm

Output Reactors Delta Part #	A	B	C	D1*D2	H	G	G1	Q	M	PE D
DR049LP215	180	205	175	6*12	115	85	122	16	1.2-1.4	M4
DR065LP162	180	215	185	6*12	115	85	122	35	2.5-3.0	M4



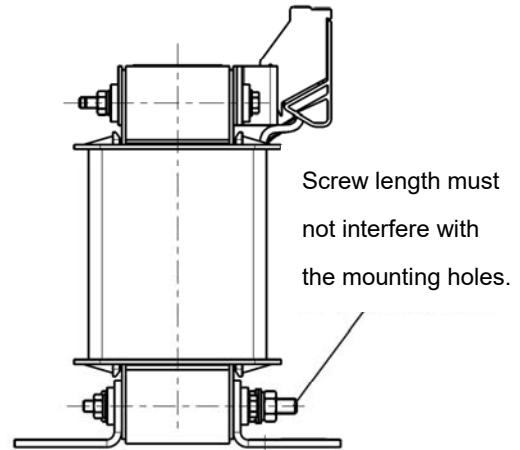
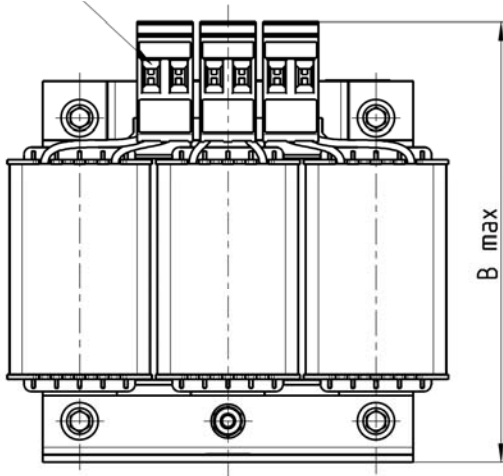
Unit: mm

Output Reactors Delta Part #	A	A1	B	B1	B2	C	C1	D1*D2	E	G1	H	M*T
DR075LP170	240	228	215	44	170	151	100	7*13	152	176	85	20*3
DR090LP141	240	228	215	44	170	151	100	7*13	152	176	85	20*3
DR105LP106	240	228	215	44	170	165	110	7*13	152	176	97	20*3
DR146LP087	240	228	240	45	202	165	110	7*13	152	176	97	30*3
DR180LP070	250	240	250	46	205	175	110	11*18	160	190	124	30*5



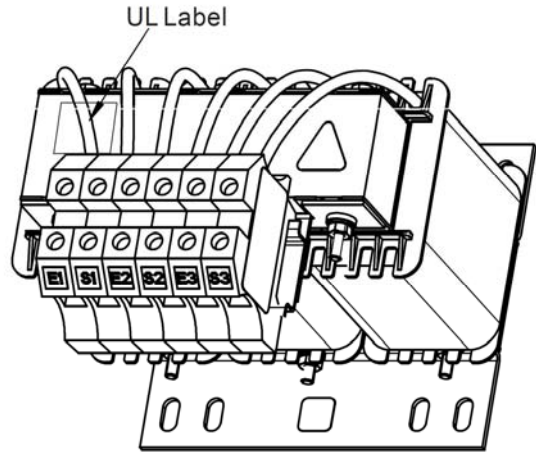
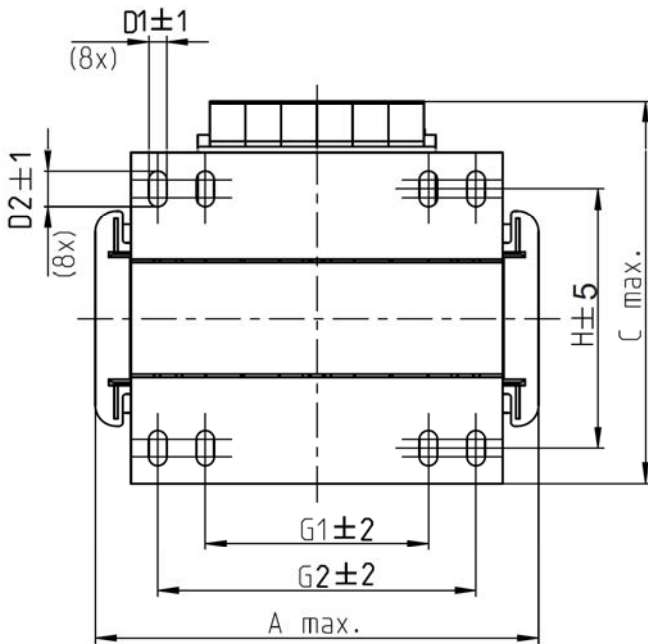
Tightening torque: 0.6–0.8 Nm

Tightening torque: 1.0–1.2 Nm

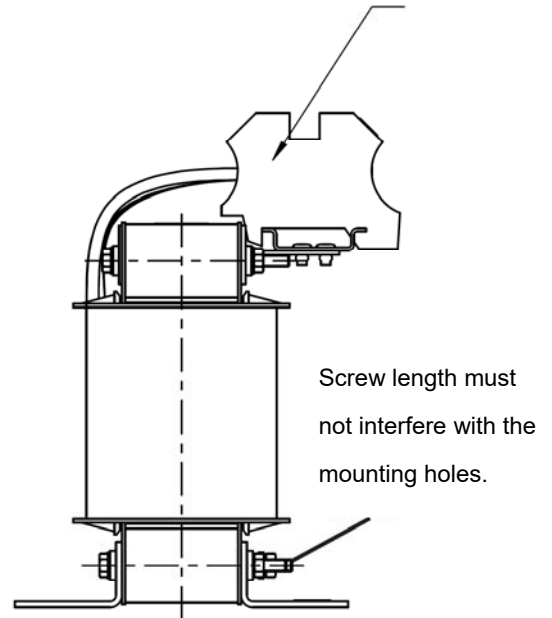
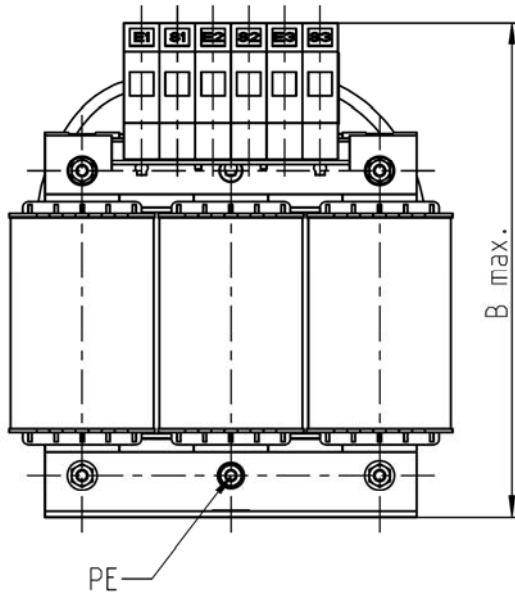


Unit: mm

Output Reactors Delta Part #	A	B	C	D1*D2	H	G1	G2	PE D
DR003L0810	96	115	65	6*9	42	60	40	M4
DR004L0607	120	135	95	6*12	60	80.5	60	M4
DR006L0405	120	135	95	6*12	60	80.5	60	M4
DR009L0270	150	160	100	6*12	74	107	75	M4
DR010L0231	150	160	115	6*12	88	107	75	M4
DR012L0202	150	160	115	6*12	88	107	75	M4
DR018L0117	150	160	115	6*12	88	107	75	M4
DR024LP881	150	160	115	6*12	88	107	75	M4
DR032LP660	180	190	145	6*12	114	122	85	M6

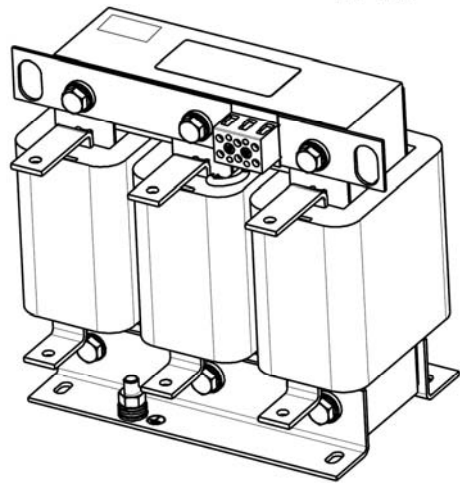
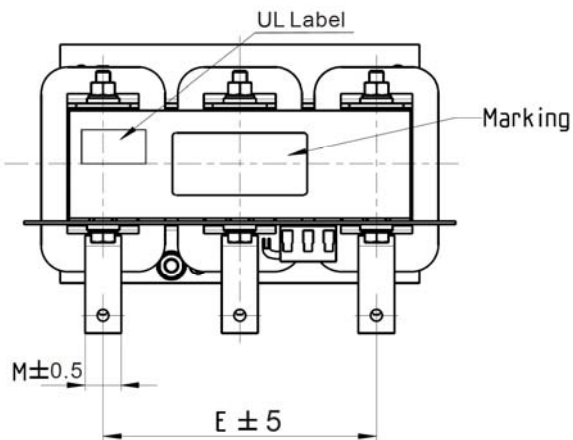
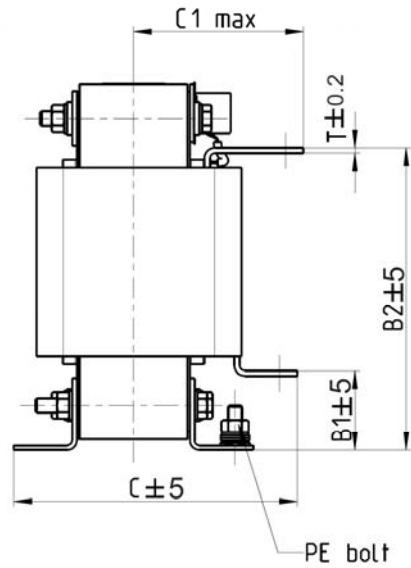
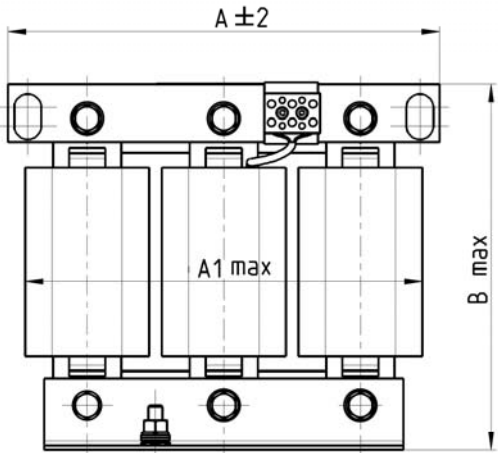
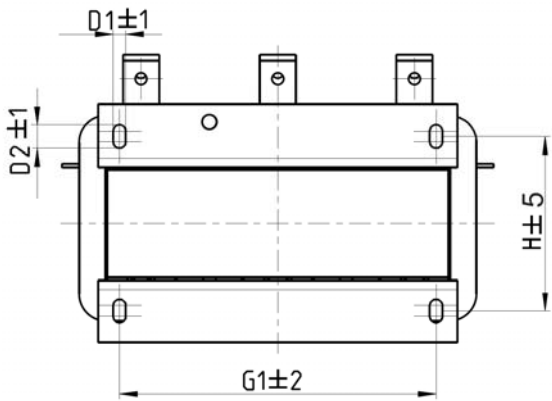


Terminal gauge: 16 mm²
Tightening torque: 1.2–1.4 Nm



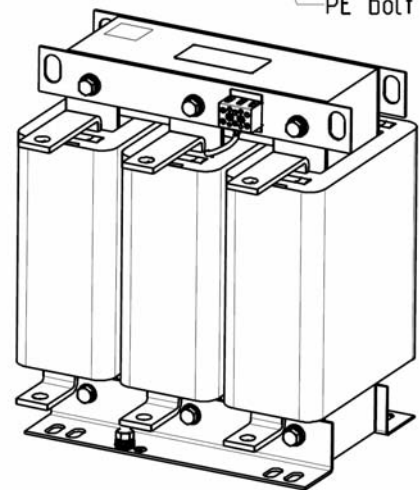
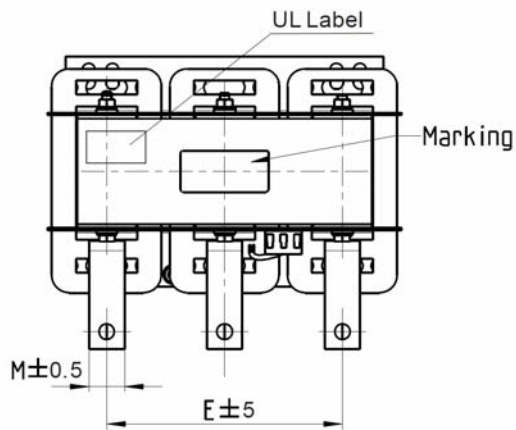
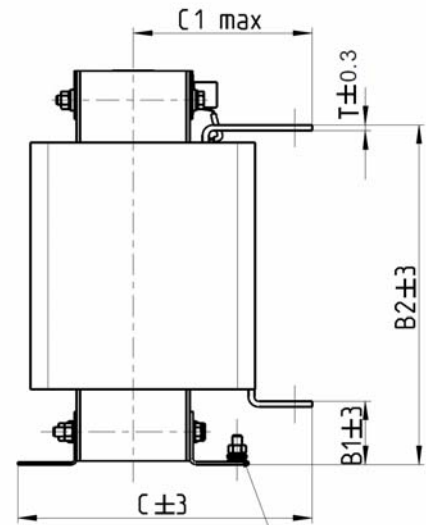
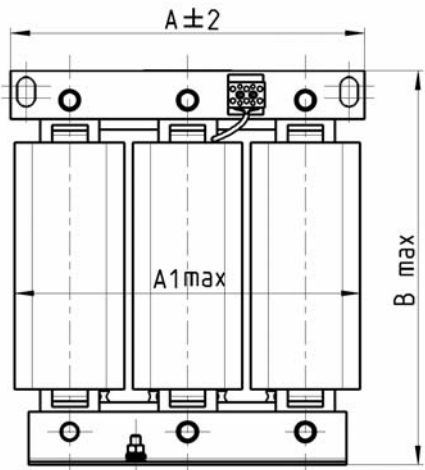
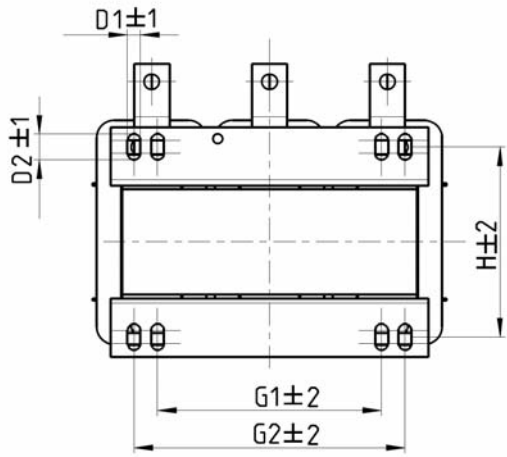
Unit: mm

Output Reactors Delta Part #	A	B	C	D1*D2	H	G1	G2	PE D
DR038LP639	180	205	170	6*12	115	85	122	M4
DR045LP541	235	245	155	7*13	85	/	176	M6



Unit: mm

Output Reactors Delta Part #	A	A1	B	B1	B2	C	C1	D1*D2	E	G1	H	M*T
DR060LP405	240	228	215	44	170	163	110	7*13	152	176	97	20*3
DR073LP334	250	235	235	44	186	174	115	11*18	160	190	124	20*3
DR091LP267	250	240	235	44	186	174	115	11*18	160	190	124	20*3
DR110LP221	270	260	245	50	192	175	115	10*18	176	200	106	20*3



Unit: mm

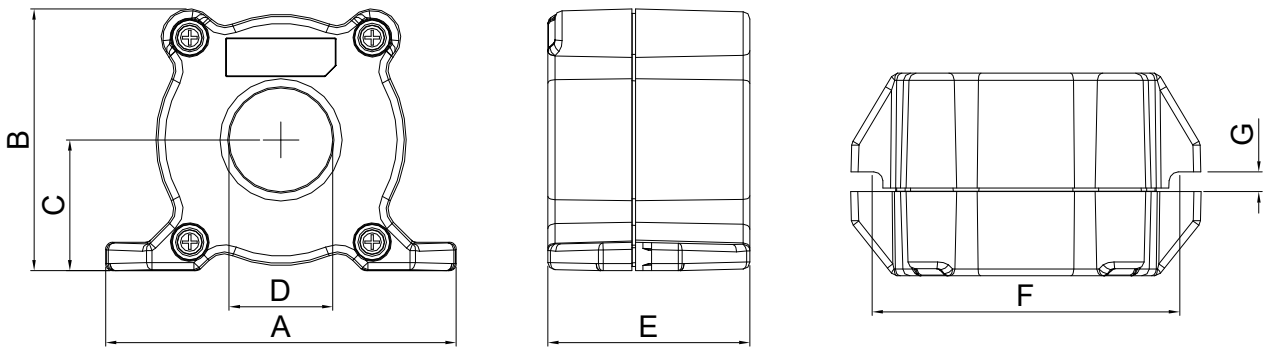
Output Reactors Delta Part #	A	A1	B	B1	B2	C	C1	D1*D2	E	G1	G2	H	M*T
DR150LP162	270	264	265	51	208	192	125	10*18	176	200	/	118	30*3
DR180LP135	300	295	310	55	246	195	125	11*22	200	230	190	142	30*3

6-5 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. Delta provides two types of zero phase reactors to solve interference problems.

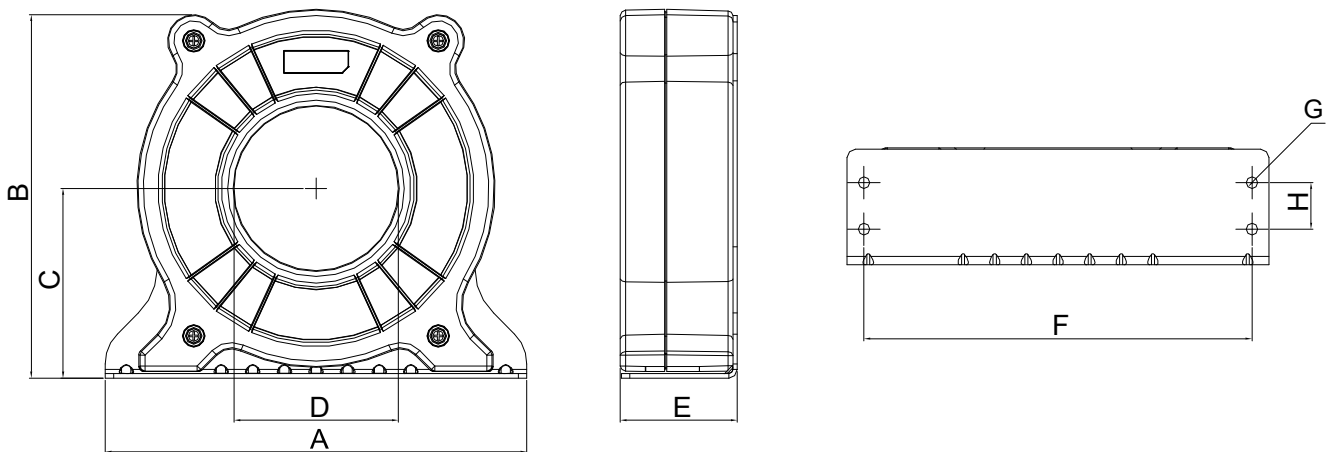
A. Casing with mechanical fixed part

The ideal material for withstanding large current loaded for the zero phase reactor at the main input/motor output is composite core. Core has strong saturation, and its strong resistance are many times of simple metal magnetic materials. Thus it can be used for high frequencies and you can get higher impedance by increasing the number of turns.



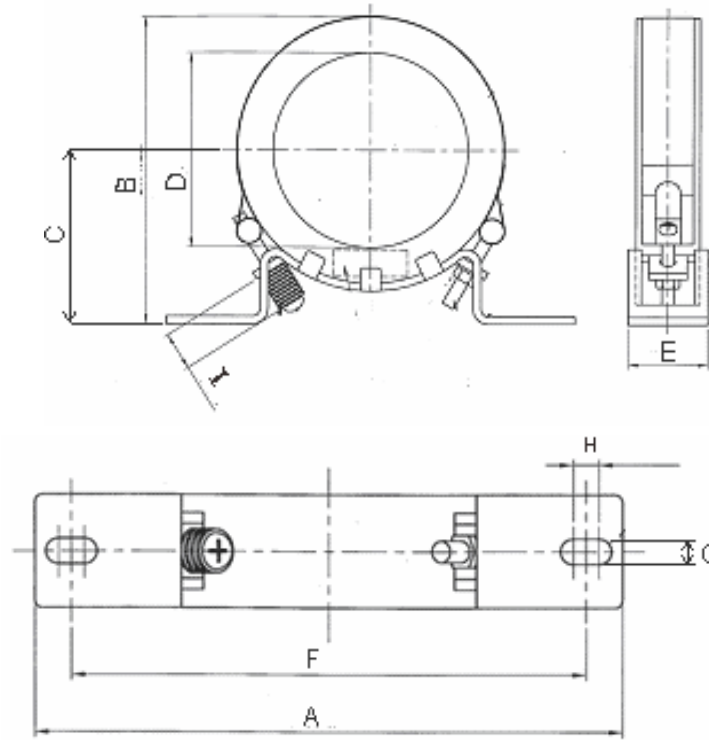
Unit: mm [inch]

Model	A	B	C	D	E	F	G(Ø)	Torque
RF008X00A	98 [3.858]	73 [2.874]	36.5 [1.437]	29 [1.142]	56.5 [2.224]	86 [3.386]	5.5 [0.217]	8–10 kgf/cm
RF004X00A	110 [4.331]	87.5 [3.445]	43.5 [1.713]	36 [1.417]	53 [2.087]	96 [3.780]	5.5 [0.217]	8–10 kgf/cm



Unit: mm [inch]

Model	A	B	C	D	E	F	G(Ø)	H	Torque
RF002X00A	200 [7.874]	172.5 [6.791]	90 [3.543]	78 [3.071]	55.5 [2.185]	184 [7.244]	5.5 [0.217]	22 [0.866]	40–45 kgf/cm



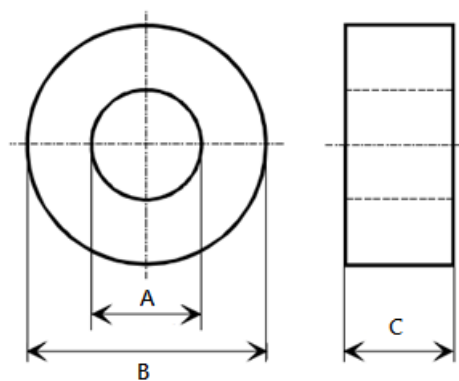
Unit: mm [inch]

Model	A	B	C	D	E	F	G(Ø)	H	I
RF300X00A	241 [9.488]	217 [8.543]	114 [4.488]	155 [6.102]	42 [1.654]	220 [8.661]	6.5 [0.256]	7.0 [0.276]	20 [0.787]

Torque:
40–45 kgf/cm

B. Casing without mechanical fixed part

Adopts nanocrystalline core developed by VAC[®], 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.



Unit: mm

Model	A	B	C	Function
T60006L2040W453	22.5	43.1	18.5	Motor wire
T60006L2050W565	36.3	53.5	23.4	Motor wire
T60006L2160V066	166.9	123.9	30.5	Motor wire
T60004L2016W620	10.7	17.8	8.0	Signal line
T60004L2025W622	17.5	27.3	12.3	Signal line

Reactor Model (See Note)	Recommended Wire Size		Wiring Method	Qty	Applicable Motor Drives
RF008X00A T60006L2040W453	≤ 8 AWG	≤ 8.37 mm ²	Diagram A Diagram B	1	VFD022ED21S VFD037ED21S VFD040ED23S VFD040ED43S
RF004X00A T60006L2050W565	≤ 4 AWG	≤ 21.15 mm ²	Diagram A Diagram B	1	VFD055ED23S VFD075ED23S VFD110ED23S VFD055ED43S VFD075ED43S VFD110ED43S VFD150ED43S VFD185ED43S
RF002X00A T60006L2160V066	≤ 2 AWG	≤ 33.62 mm ²	Diagram A Diagram B	1	VFD150ED23S VFD185ED23S VFD220ED23S VFD220ED43S VFD300ED43S
RF300X00A T60006L2160V066	≤ 300 MCM	≤ 152 mm ²	Diagram A Diagram B	1	VFD300ED23S VFD370ED23S VFD370ED43S VFD450ED43S VFD550ED43S VFD750ED43S

Note: 600 V insulated cable wire

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.

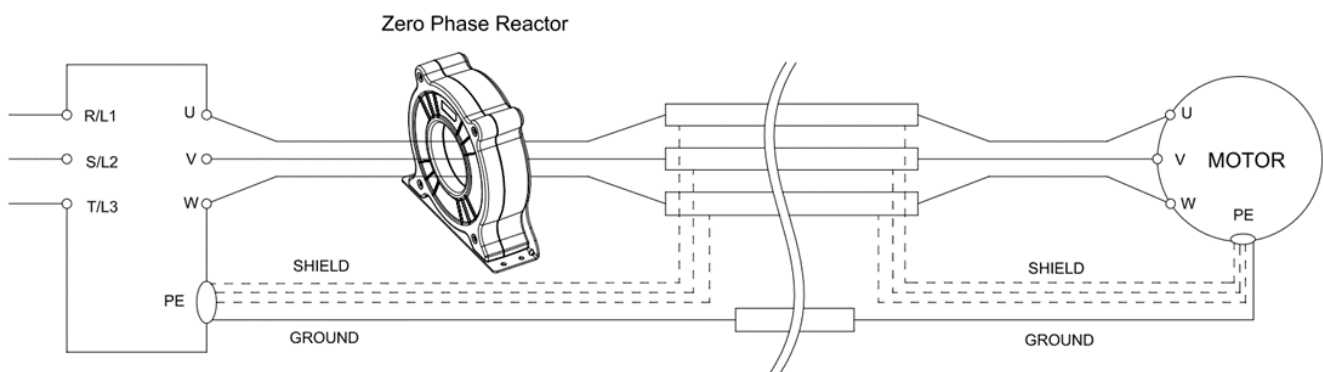


Diagram A. Single turn wiring diagram for shielding wire with a zero phase reactor

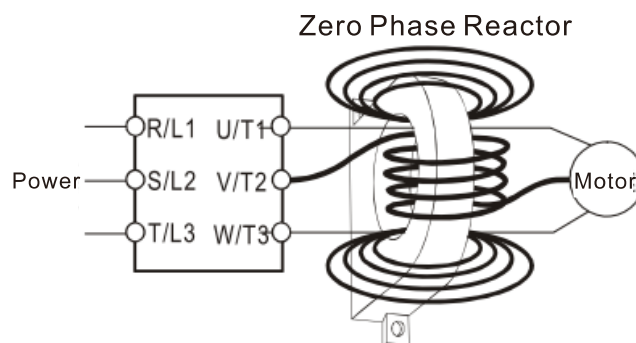


Diagram B. Multi-turn zero phase reactor

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 No.	Max. Wire Gauge or LUG width	Max. Wire Gauge AWG (1 C*3)		Max. Wire Gauge AWG (4 C*1)	
		75 C	90 C	75 C	90 C
RF008X00A	13 MM	3 AWG	1 AWG	3 AWG	1 AWG
RF004X00A	16 MM	1 AWG	2/0 AWG	1 AWG	1/0 AWG
RF002X00A	36 MM	600 MCM	600 MCM	1 AWG	1/0 AWG
RF300X00A	73 MM	650 MCM	650 MCM	300 MCM	300 MCM
T60006L2040W453	11 MM	9 AWG	4 AWG	6 AWG	6 AWG
T60006L2050W565	16 MM	1 AWG	2/0 AWG	1 AWG	1/0 AWG
T60006L2160V066	57 MM	600 MCM	600 MCM	300 MCM	300 MCM

6-6 EMC Filter

The table below shows external EMC filter models for each ED-S series motor drive.

Choose corresponding zero phase reactors and applicable shielding cables according to the required noise emission and electromagnetic interference rating for the best configuration and anti-interference performance. If radiation emission (RE) is not a concern on site and you only need conducted emission (CE) to reach EN55011 Class A, you do not need to install a zero phase reactor on the input side to reach the EMC standard.

220V Models

VFD-ED			EMC Filter Model #	Zero Phase Reactor	Carrier Frequency	EN12015	
Frame	Motor Drive Model #	Rated Input Current (A)		Input Side (R/S/T)		Conducted Emission	Radiation Emission
						Length of Output Shielded Cable 50 m	
B	VFD022ED21S	24	B84142A0042R122	RF008X00A or T60006L2040W453	Carrier frequency by default	CLASS A	CLASS A
	VFD037ED21S	34	B84142A0042R122	RF008X00A or T60006L2040W453		CLASS A	CLASS A
	VFD040ED23S	20	EMF035A23A	RF008X00A or T60006L2040W453		CLASS A	CLASS A
C	VFD055ED23S	23	EMF056A23A	RF004X00A or T60006L2050W565		CLASS A	CLASS A
	VFD075ED23S	30	EMF056A23A	RF004X00A or T60006L2050W565		CLASS A	CLASS A
	VFD110ED23S	47	EMF056A23A	RF004X00A or T60006L2050W565		CLASS A	CLASS A
D	VFD150ED23S	56	B84143D0150R127	RF002X00A or T60006L2160V066		CLASS A	CLASS A
	VFD185ED23S	73	B84143D0150R127	RF002X00A or T60006L2160V066		CLASS A	CLASS A
	VFD220ED23S	90	B84143D0150R127	RF002X00A or T60006L2160V066		CLASS A	CLASS A
E	VFD300ED23S	132	B84143D0150R127	RF002X00A or T60006L2160V066		CLASS A	CLASS A
	VFD370ED23S	161	B84143D0200R127	RF300X00A or T60006L2160V066	CLASS A	CLASS A	

460V Models

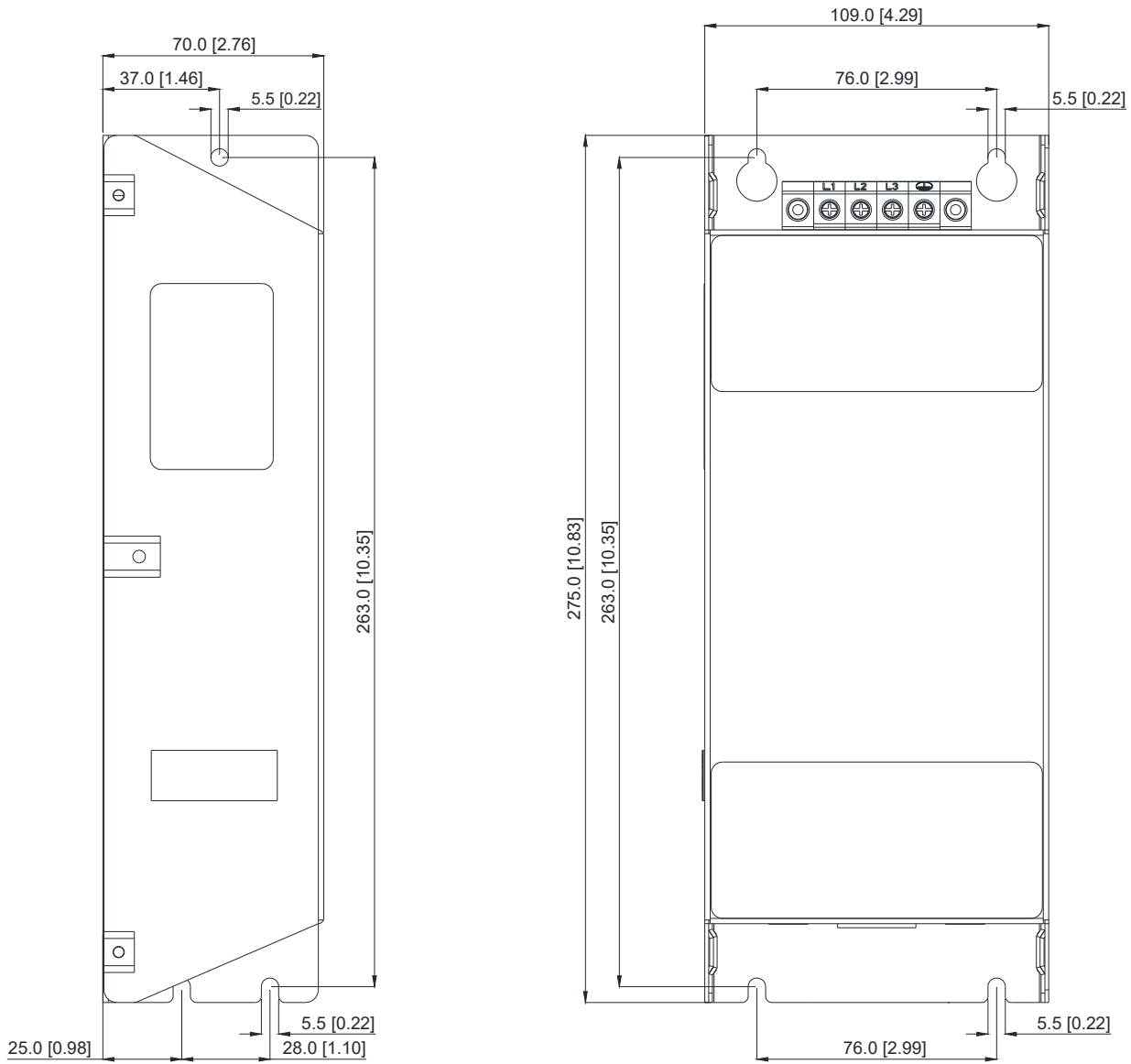
VFD-ED			EMC Filter Model #	Zero Phase Reactor	Carrier Frequency	EN12015	
Frame	Motor Drive Model #	Rated Input Current (A)		Input Side (R/S/T)		Conducted Emission	Radiation Emission
						Length of Output Shielded Cable 50 m	
B	VFD040ED43S	11.5	EMF018A43A	RF008X00A or T60006L2040W453	Carrier frequency by default	CLASS A	CLASS A
C	VFD055ED43S	14	EMF033A43A	RF004X00A or T60006L2050W565		CLASS A	CLASS A
	VFD075ED43S	17	EMF033A43A	RF004X00A or T60006L2050W565		CLASS A	CLASS A
	VFD110ED43S	24	EMF033A43A	RF004X00A or T60006L2050W565		CLASS A	CLASS A
	VFD150ED43S	30	B84143D0075R127	RF004X00A or T60006L2050W565		CLASS A	CLASS A
	VFD185ED43S	37	B84143D0075R127	RF004X00A or T60006L2050W565		CLASS A	CLASS A
D	VFD220ED43S	47	B84143D0090R127	RF002X00A or T60006L2160V066		CLASS A	CLASS A

	VFD300ED43S	58	B84143D0090R127	RF002X00A or T60006L2160V066		CLASS A	CLASS A
E	VFD370ED43S	80	B84143D0200R127	RF300X00A or T60006L2160V066		CLASS A	CLASS A
	VFD450ED43S	100	B84143D0200R127	RF300X00A or T60006L2160V066		CLASS A	CLASS A
	VFD550ED43S	128	B84143D0200R127	RF300X00A or T60006L2160V066		CLASS A	CLASS A
	VFD750ED43S	165	B84143D0200R127	RF300X00A or T60006L2160V066		CLASS A	CLASS A

EMC Filter Dimension

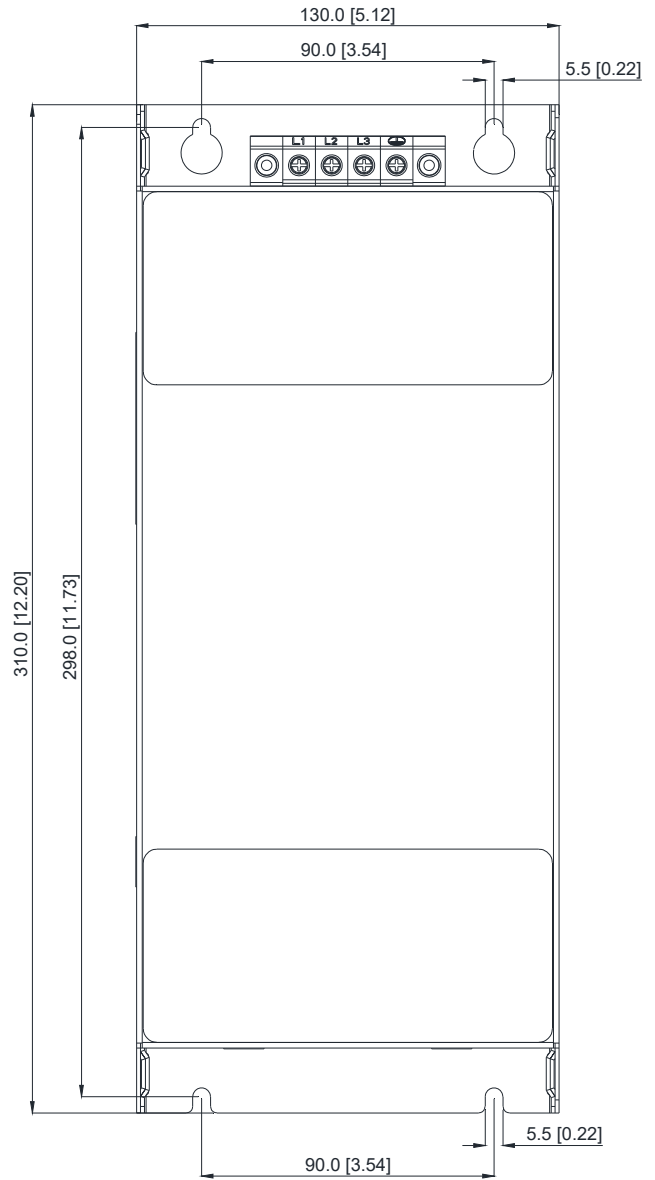
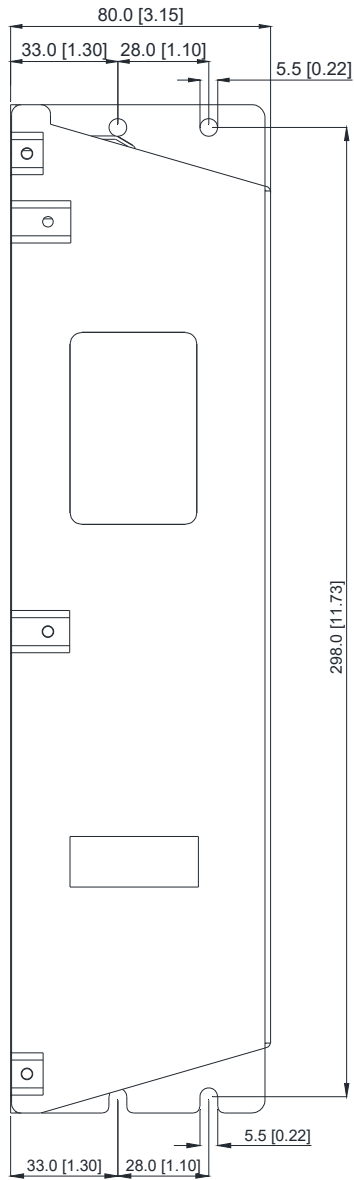
EMC Filter Model #: EMF018A43A

Unit: mm [inch]



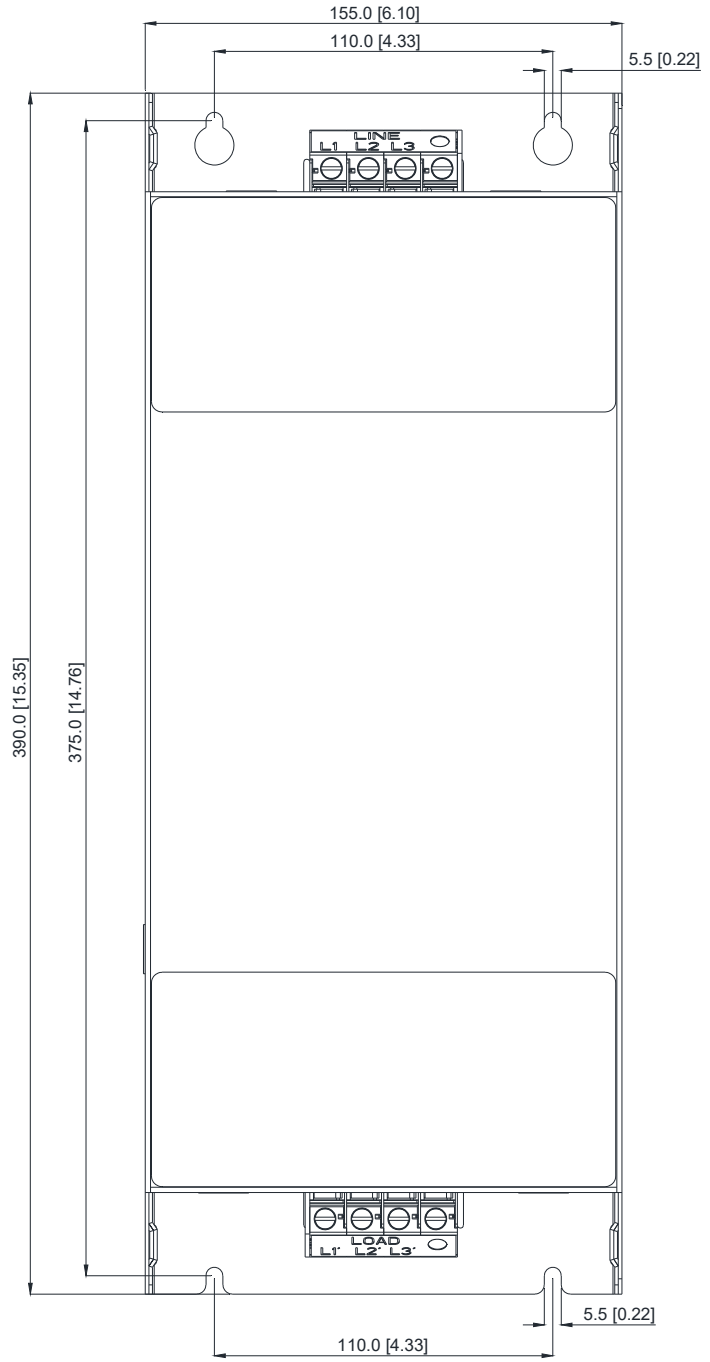
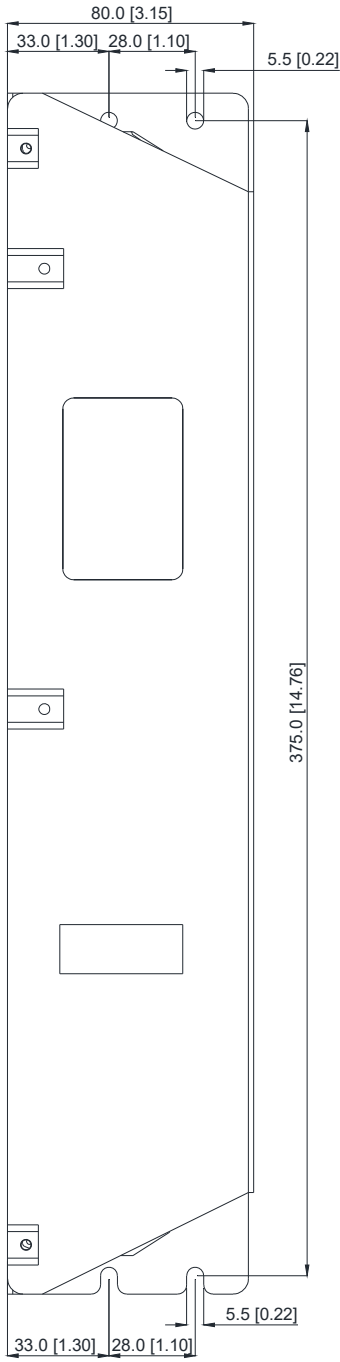
EMC Filter Model #: EMF035A23A, EMF033A43A

Unit: mm [inch]



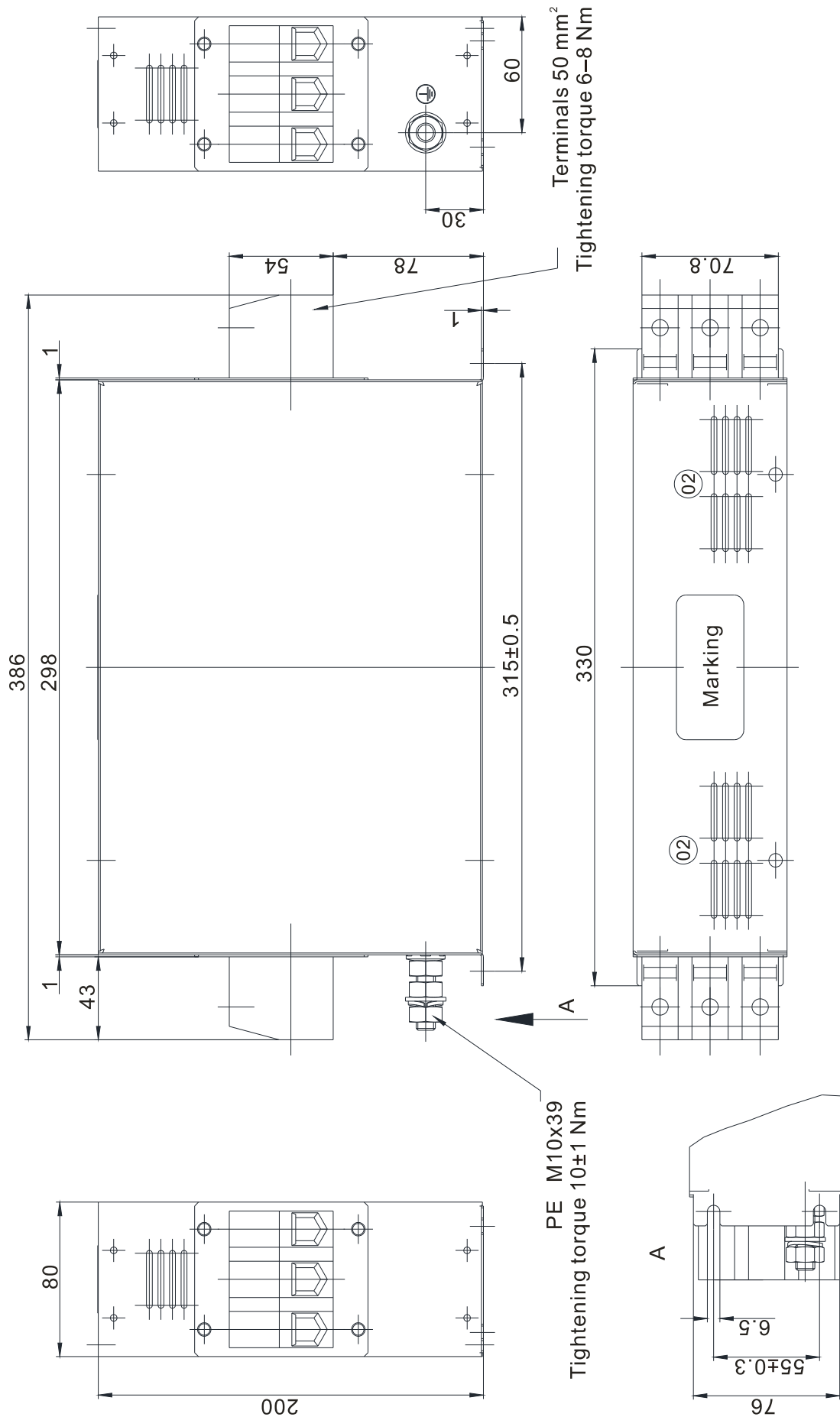
EMC Filter Model #: EMF056A23A

Unit: mm [inch]



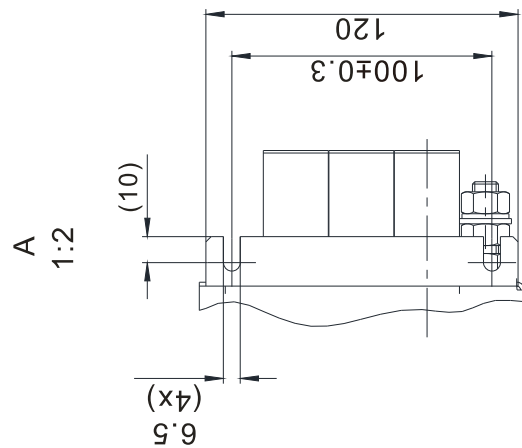
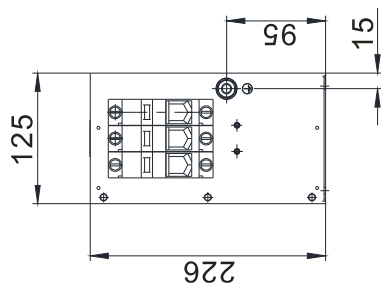
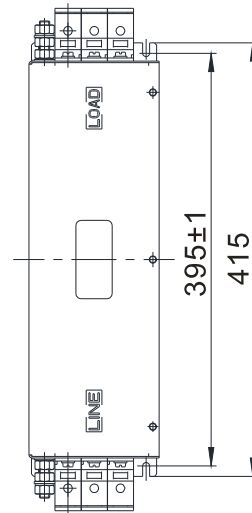
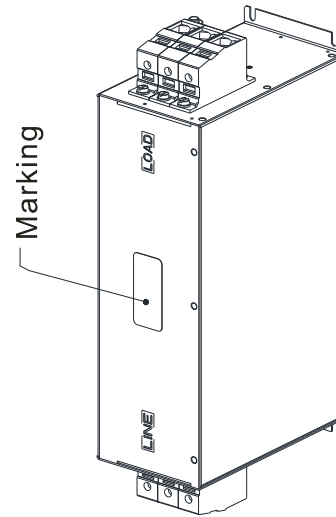
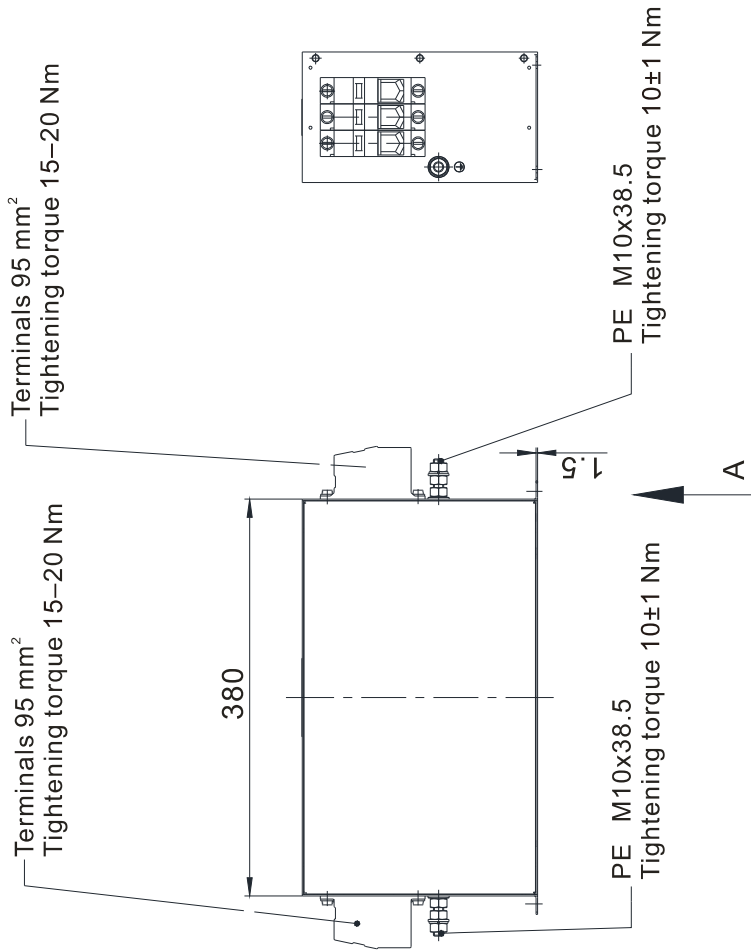
EMC Filter Model #: B84143D0075R127, B84143D0090R127

Unit: mm [inch]



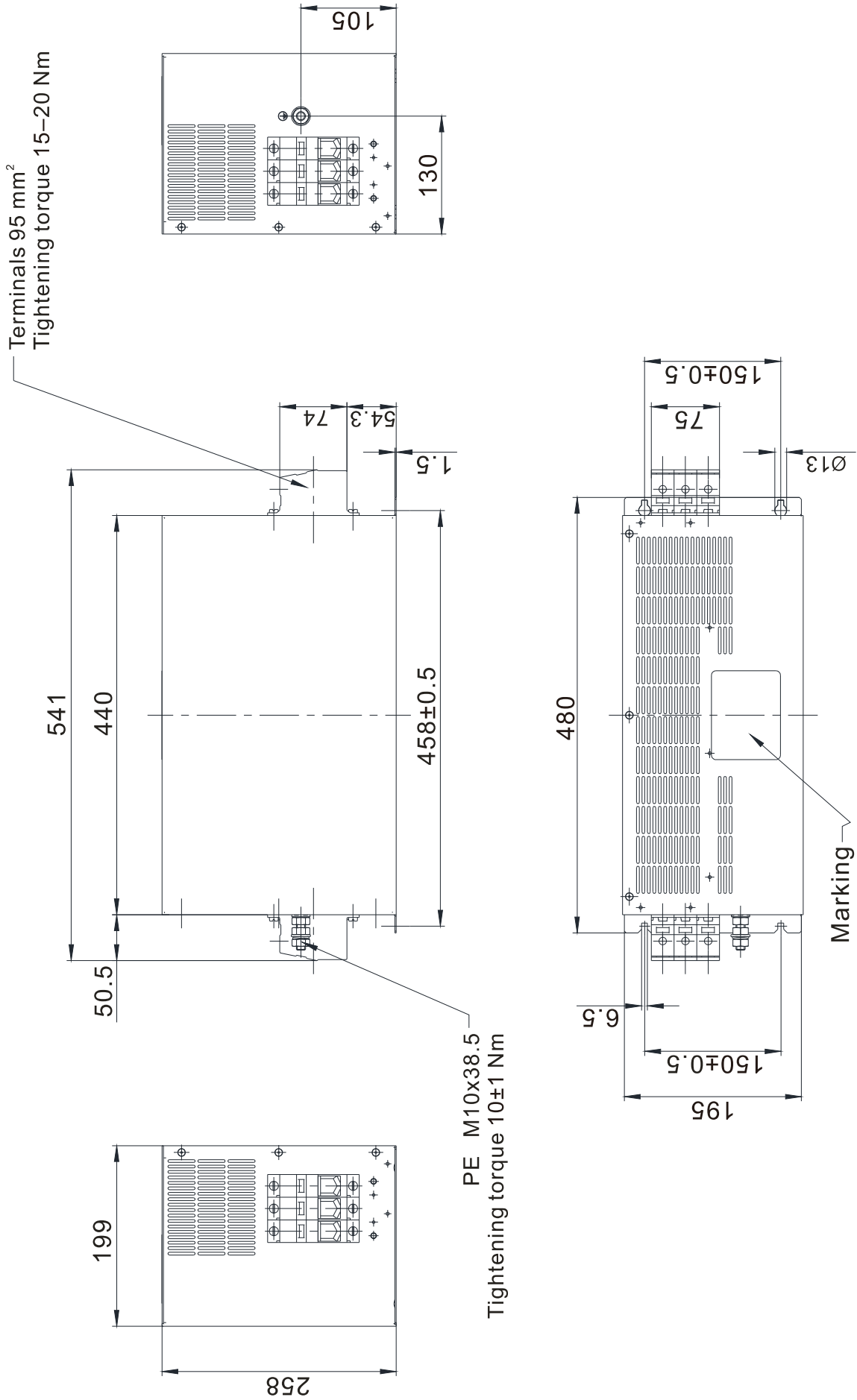
EMC Filter Model #: B84143D0150R127

Unit: mm [inch]



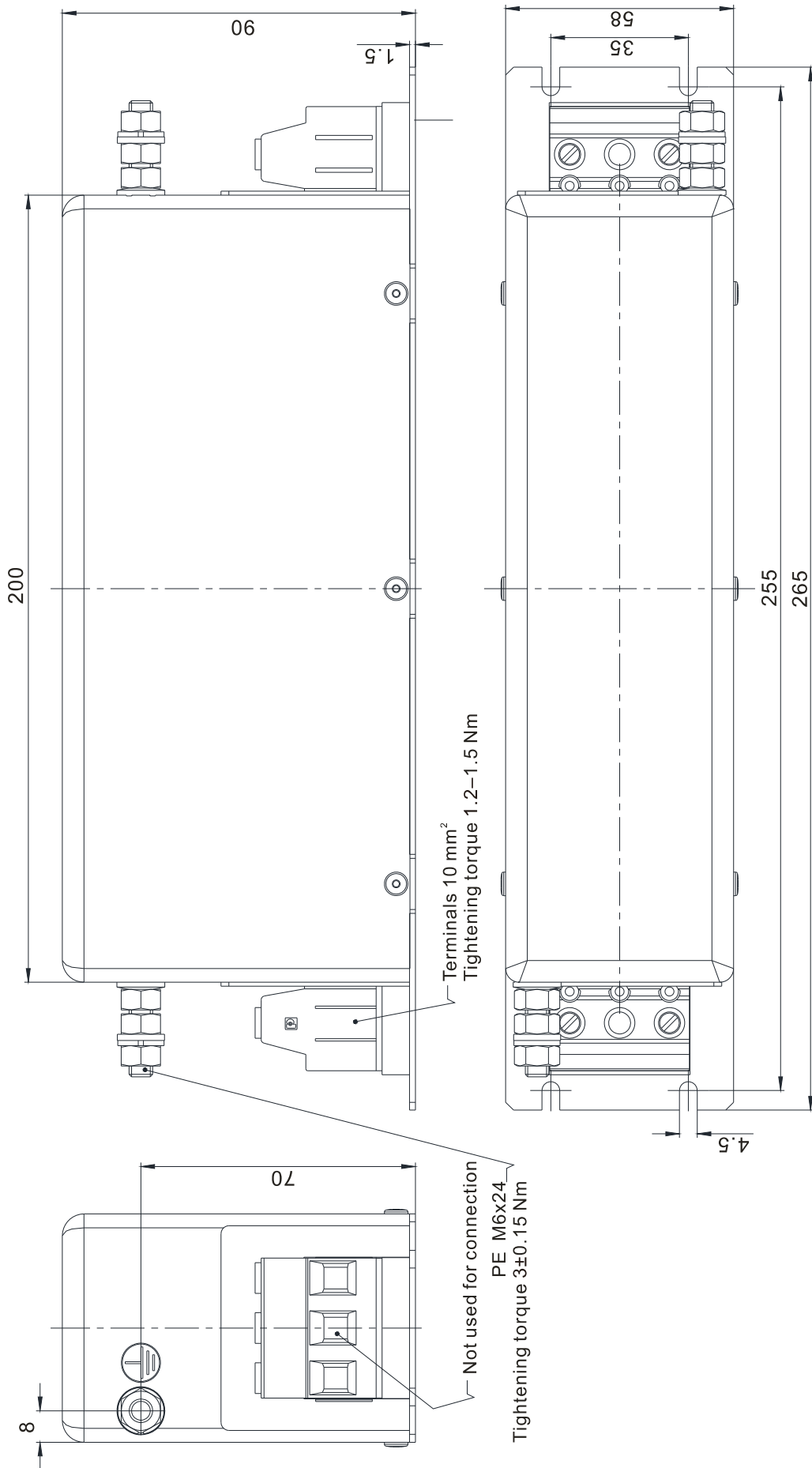
EMC Filter Model #: B84143D0200R127

Unit: mm [inch]



EMC Filter Model #: B84142A0042R122

Unit: mm [inch]



EMC Filter Installation

All electrical equipment in operation, including AC motor drives, generates high-frequency and low-frequency noise that interfere with peripheral equipment by radiation or conduction. By correctly installing an EMC filter, you can eliminate much of the interference. Use DELTA EMC filters for the best interference elimination.

The following standards are met when the AC motor drive and EMC filter are installed and wired according to the user manual:

1. EN61000-6-4
2. EN61800-3: 1996
3. EN55011: (1991) Class A Group 1 (1st Environment, restricted distribution)
4. European Standards: EN12015 & EN12016

General precaution

To ensure the best anti-interference performance for EMC filter, observe the following precautions in addition to the installation and wiring in the user manual:

- ☑ Install the EMC filter and AC motor drive on the same metal plate. Install the AC motor drive on the EMC filter footprint or install the EMC filter as close as possible to the AC motor drive.
- ☑ Use the shortest wire possible. Ground the metal plate. Fix the EMC filter cover and AC motor drive or grounding to the metal plate and make the contact area as large as possible.

Choose suitable motor cable and precautions

Improper installation and choice of motor cable affect the performance of EMC filters. Be sure to observe the following precautions when selecting motor cable.

- ☑ Use shielded cable (double shielding is best). Ground the shielding on both ends of the motor cable with the minimum length and maximum contact area.
- ☑ Remove any paint on the metal saddle for good ground contact with the plate and shielding (see Figure 1).
- ☑ The connections between the motor's shielded cable and metal plate must be correct. Use a U-shape metal saddle to fix both ends of the motor cable. See Figure 2 for correct connections.

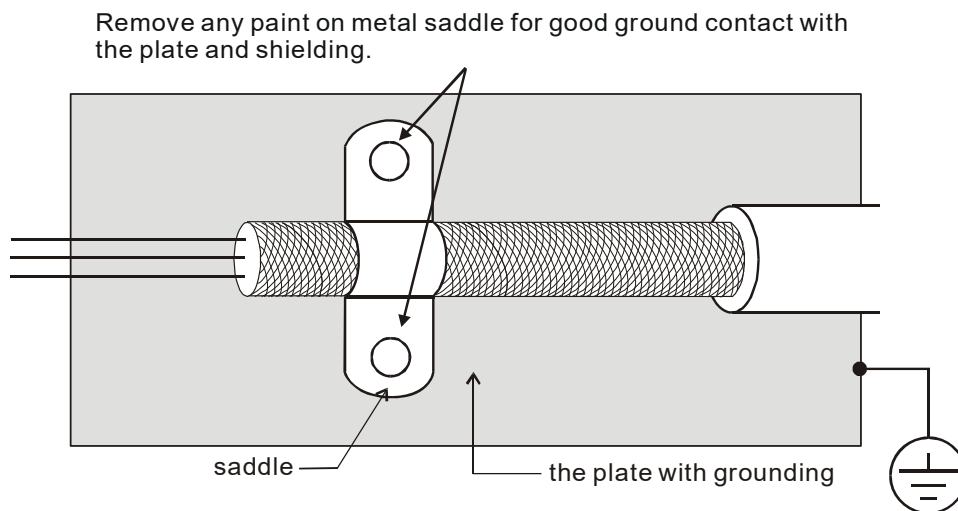


Figure 1

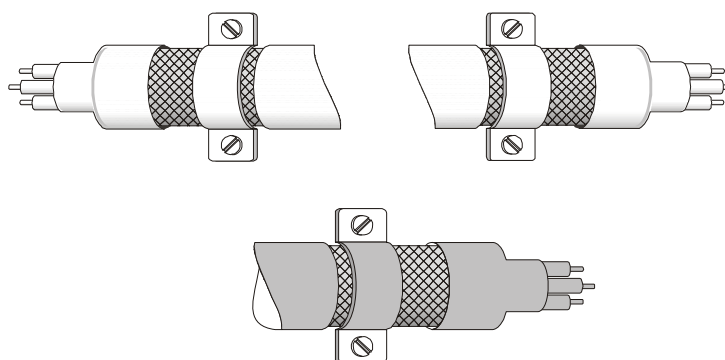


Figure 2

The motor cable length

1. Required cable length when the motor drive is at full load.
 - a. Non-shielded cable: For 5.5 kW (7.5 HP) and below models, the maximum cable length is 100 m (328 ft). For 7.5 kW (10 HP) and above models, the maximum cable length is 200 m (656 ft)
 - b. Shielded cable: For 5.5 kW (7.5 HP) and below models, the maximum cable length is 50 m (165 ft). For 7.5 kW (10 HP) models, the maximum cable length is 100 m (328 ft).
 - c. To be compatible with the European Standards EN12015 & EN12016, follow one of the following in addition to the precautions on page 6-44:
 - Use shielded cables
 - The motor cable must be shorter than 2 m (6 ft).

If the cable length is longer than the recommended lengths above, install an output reactor.

NOTE

- If the cable length is too long, the stray capacitance between cables increases and may cause leakage current. In this case, It activates the over-current protection, increases leakage current, or may affect the current display. The worst case is that it may damage the AC motor drive.
- If more than one motor is connected to the AC motor drive, the total wiring length is the sum of the wiring length from AC motor drive to each motor.
- For the 460V series AC motor drive, when you install an overload thermal relay between the drive and the motor to protect the motor from overheating, the connecting cable must be shorter than 50 m; however, an overload thermal relay malfunction may still occur. To prevent the malfunction, install an output reactor (optional) to the drive or lower the carrier frequency setting (Pr.00-12).

2. Consequence of the surge voltages on the motor

When a motor is driven by a PWM-type AC motor drive, the motor terminals experience surge voltages due to component conversion of AC motor drive and cable capacitance. When the motor cable is very long (especially for the 460V series), surge voltages may damage the insulation. To prevent this, follow these rules:

- a. Use a motor with enhanced insulation (refer to the tables below).
- b. Reduce the cable length between the AC motor drive and motor to suggested values.
- c. Connect an output reactor (optional) to the output terminals of the AC motor drive.

For 7.5 kW (10 HP) and higher models:

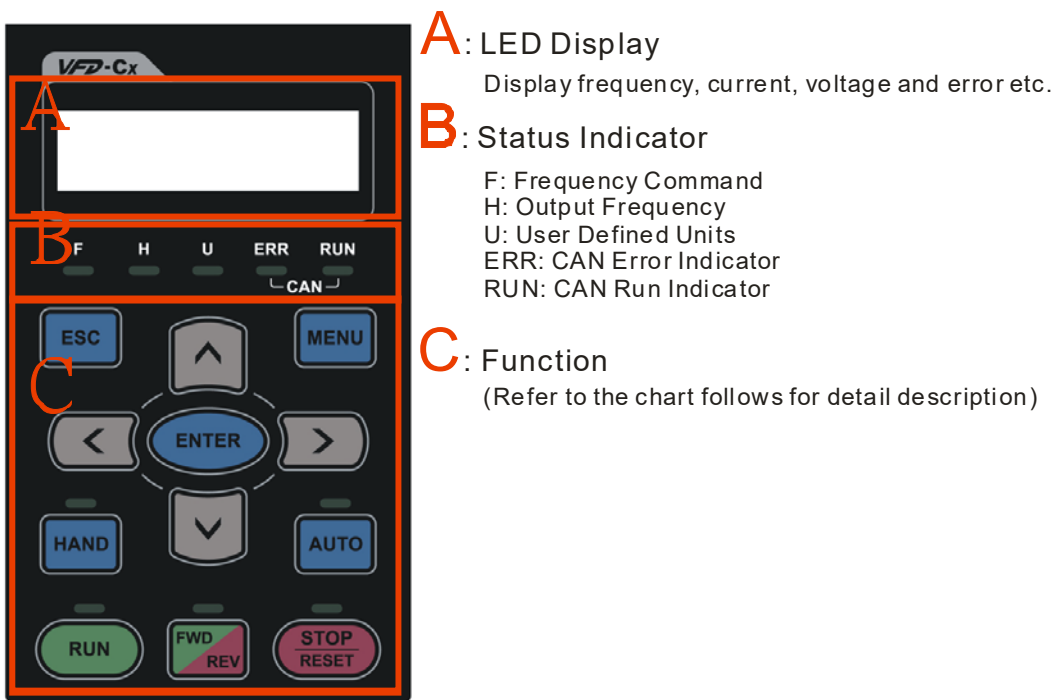
Insulation level of motor	1000 V	1300 V	1600 V
460 V _{AC} input voltage	20 m (66 ft)	100 m (328 ft)	400 m (1312 ft)
230 V _{AC} input voltage	400 m (1312 ft)	400 m (1312 ft)	400 m (1312 ft)

For 5.5 kW (7.5 HP) and lower models:

Insulation level of motor	1000 V	1300 V	1600 V
460 V _{AC} input voltage	20 m (66 ft)	50 m (165 ft)	50 m (165 ft)
230 V _{AC} input voltage	100 m (328 ft)	100 m (328 ft)	100 m (328 ft)

6-7 Digital Keypad




KPC-CC01



Keypad Functions

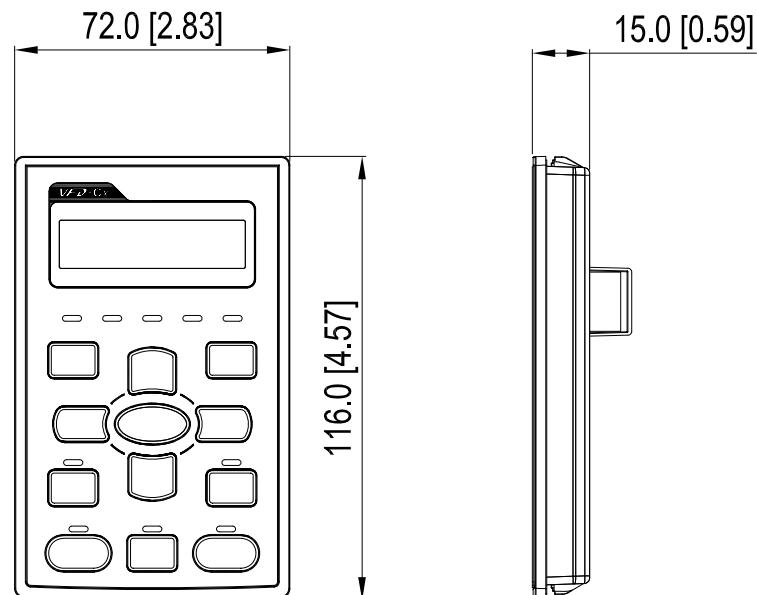
Key	Description																
ESC	ESC Key Press the ESC key to return to the previous page, or return to the last category in the sub-menu.																
MENU	Menu Key Press the MENU key to the main menu. Menu items: <table border="0" style="width: 100%;"> <tr> <td>1. Parameter Setup</td> <td>5. Copy PLC</td> <td>9. Time Setup</td> <td>13. PLC Link</td> </tr> <tr> <td>2. Copy Parameter</td> <td>6. Fault Record</td> <td>10. Language Setup</td> <td></td> </tr> <tr> <td>3. Keypad Locked</td> <td>7. Quick Start</td> <td>11. Start-up</td> <td></td> </tr> <tr> <td>4. PLC Function</td> <td>8. Display Setup</td> <td>12. Main Page</td> <td></td> </tr> </table> VFD-ED does not support menu item 4 and 5 (PLC functions) and menu item 7 (Quick Start).	1. Parameter Setup	5. Copy PLC	9. Time Setup	13. PLC Link	2. Copy Parameter	6. Fault Record	10. Language Setup		3. Keypad Locked	7. Quick Start	11. Start-up		4. PLC Function	8. Display Setup	12. Main Page	
1. Parameter Setup	5. Copy PLC	9. Time Setup	13. PLC Link														
2. Copy Parameter	6. Fault Record	10. Language Setup															
3. Keypad Locked	7. Quick Start	11. Start-up															
4. PLC Function	8. Display Setup	12. Main Page															
ENTER	ENTER Key Press the ENTER key to go to the next menu level. If you are at the last level, then press ENTER to execute the command.																
HAND	No function																
AUTO	No function																
FWD/REV	Operation Direction Key <input checked="" type="checkbox"/> The FWD/REV key controls the operation direction but does NOT activate the drive. FWD: forward, REV: reverse. <input checked="" type="checkbox"/> The drive operates in the direction as shown by the LED.																
RUN	Start Key <input checked="" type="checkbox"/> This button is functional only when the keypad is the source of the command. <input checked="" type="checkbox"/> This button causes the motor drive to run according to its settings. See “Description of LED Functions” for LED status. <input checked="" type="checkbox"/> Pressing the RUN button repeatedly is allowed while the motor drive is stopping. <input checked="" type="checkbox"/> If HAND mode is ON, the RUN key is valid only when the HAND mode operation source is digital keypad for parameter settings.																
STOP	Stop Key <input checked="" type="checkbox"/> The STOP key has the highest priority in command. <input checked="" type="checkbox"/> Press the STOP key to stop the drive under any conditions. <input checked="" type="checkbox"/> 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.																

LED Function Description

LED	Description
	<p>Steady ON: AC motor drive operation indicator, including DC brake, zero speed, standby, restart after fault and speed tracking.</p> <p>Blinking: motor drive is decelerating to stop or in Base Block status.</p> <p>Steady OFF: motor drive does not execute the operation command.</p>
	<p>Steady ON: AC motor drive stop indicator.</p> <p>Blinking: motor drive is in standby status.</p> <p>Steady OFF: motor drive does not execute the STOP command.</p>
	<p>Operation Direction LED</p> <ol style="list-style-type: none"> 1. Green light is on, the drive is running forward. 2. Red light is on, the drive is running in reverse. 3. Blinking light: the drive is changing direction.

Dimension

Unit: mm [inch]



RJ45 Extension Cables for the Digital Keypad

Part #	Description
CBC-K3FT	3 feet RJ45 extension lead (approximately 0.9 m)
CBC-K5FT	5 feet RJ45 extension lead (approximately 1.5 m)
CBC-K7FT	7 feet RJ45 extension lead (approximately 2.1 m)
CBC-K10FT	10 feet RJ45 extension lead (approximately 3 m)
CBC-K16FT	16 feet RJ45 extension lead (approximately 4.9 m)

6-8 USB/RS-485 Communication Interface IFD6530

Warning

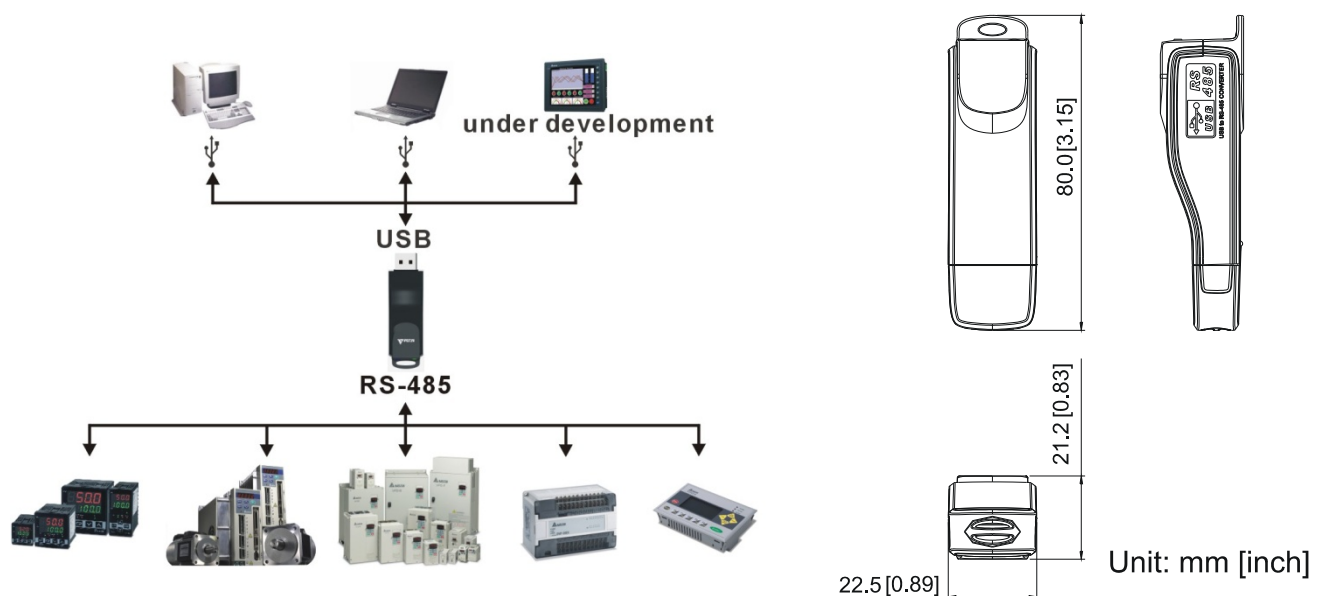
- ✓ Read this section thoroughly before installing and using the interface.
- ✓ This section and the driver file may be revised without prior notice. Consult our distributors or download the most updated instruction/driver version at http://www.delta.com.tw/product/em/control/cm/control_cm_main.asp.

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.

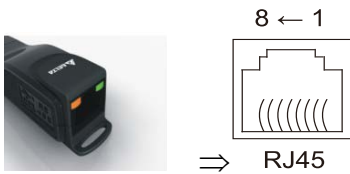
■ Application & Dimension:



Specifications

Power supply	No external power is needed.
Power consumption	1.5 W
Isolated voltage	2,500 V _{DC}
Baud rate	75, 150, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 bps
RS-485 connector	RJ45
USB connector	A type (plug)
Compatibility	Full compliance with USB V2.0 specification
Maximum cable length	RS-485 communication port: 100 m
Supports RS-485 half-duplex transmission	

RJ45



PIN	Description
1	Reserved
2	Reserved
3	GND
4	SG-

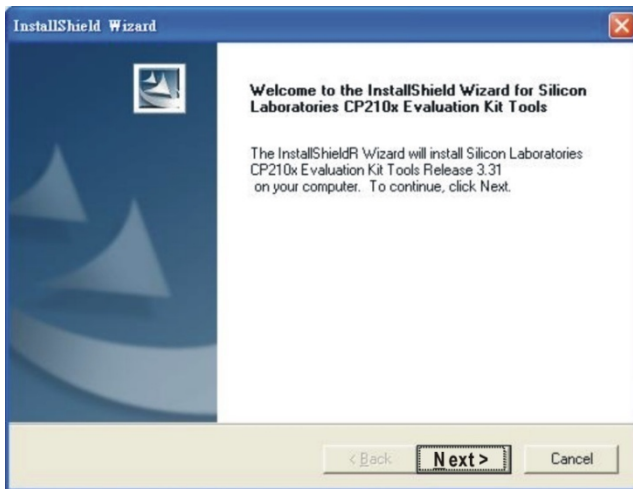
PIN	Description
5	SG+
6	GND
7	Reserved
8	+9V

Preparation before Installing Driver

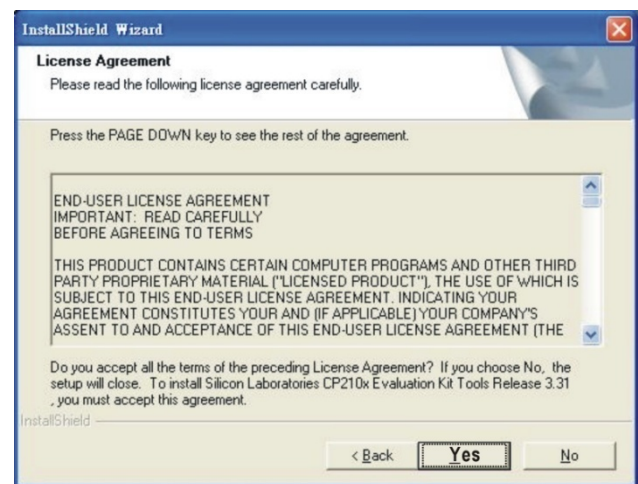
Extract the driver file (IFD6530_Drivers.exe) by following steps. Download the driver file (IFD6530_Drivers.exe) at www.deltaww.com/iadownload_acmotordrive/IFD6530_Drivers.

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

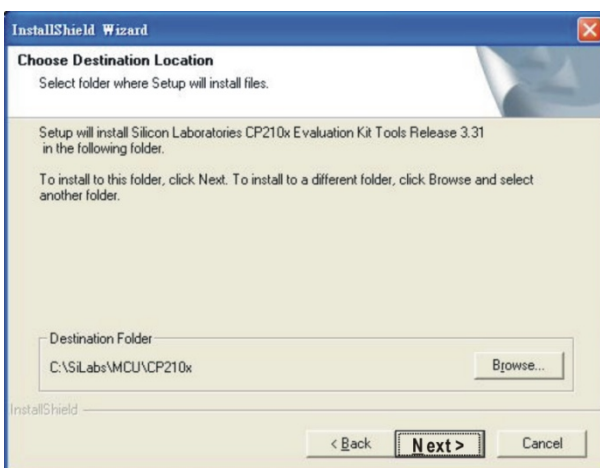
STEP 1



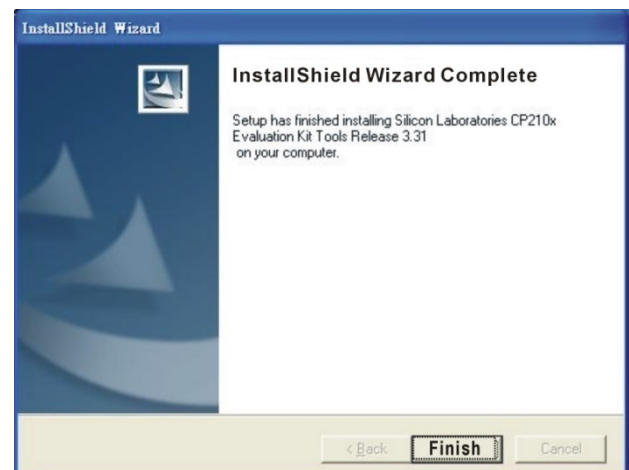
STEP 2



STEP 3



STEP 4



STEP 5

At the end of this process, you should have a folder named SiLabs under drive c:\ SiLabs.

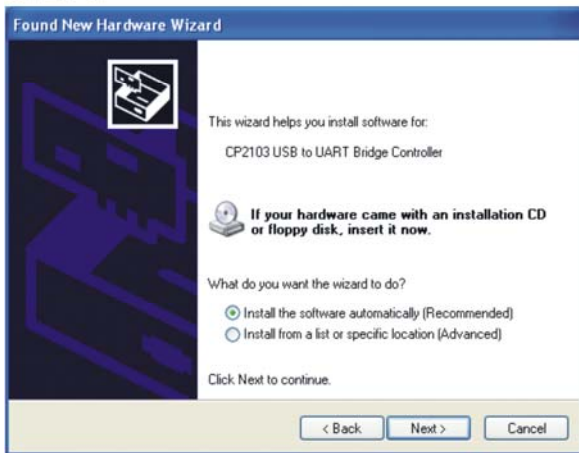
Installing the Driver

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

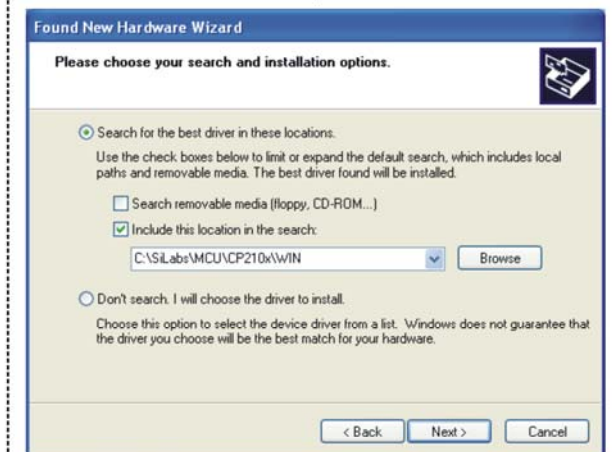
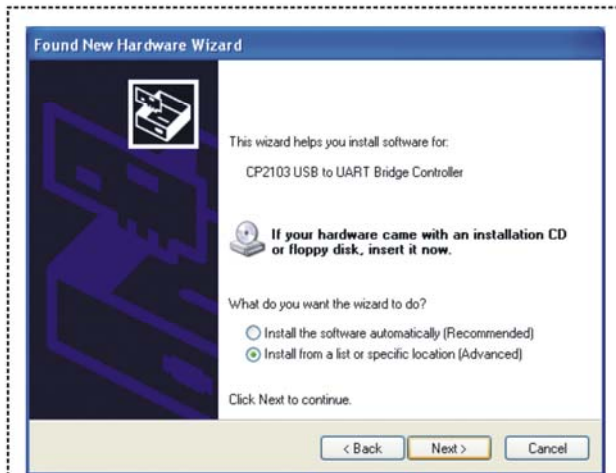
STEP 1



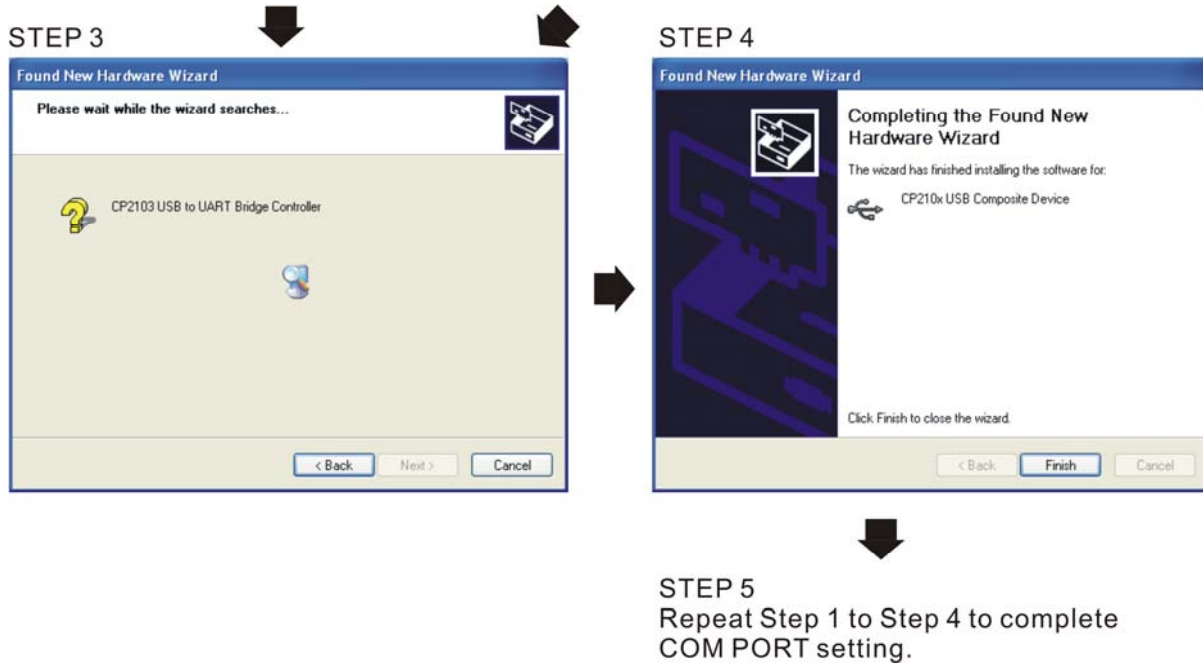
STEP 2



OR



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



LED Display

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

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Chapter 7 Option Cards

7-1 EMED-PGABD-1

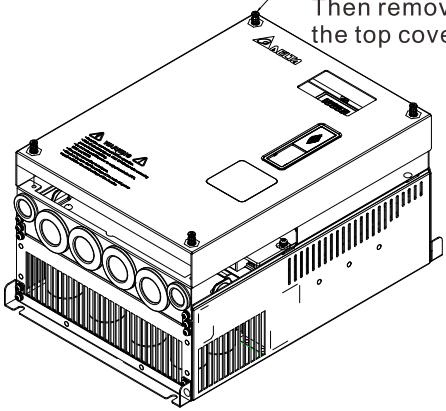
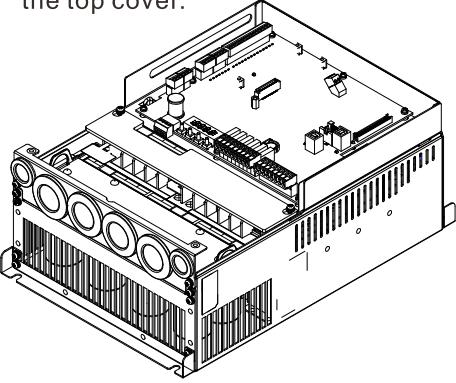
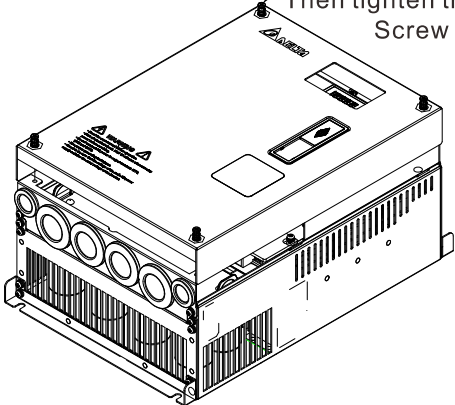
7-2 EMED-PGHSD-1

7-3 EMED-PGHSD-2

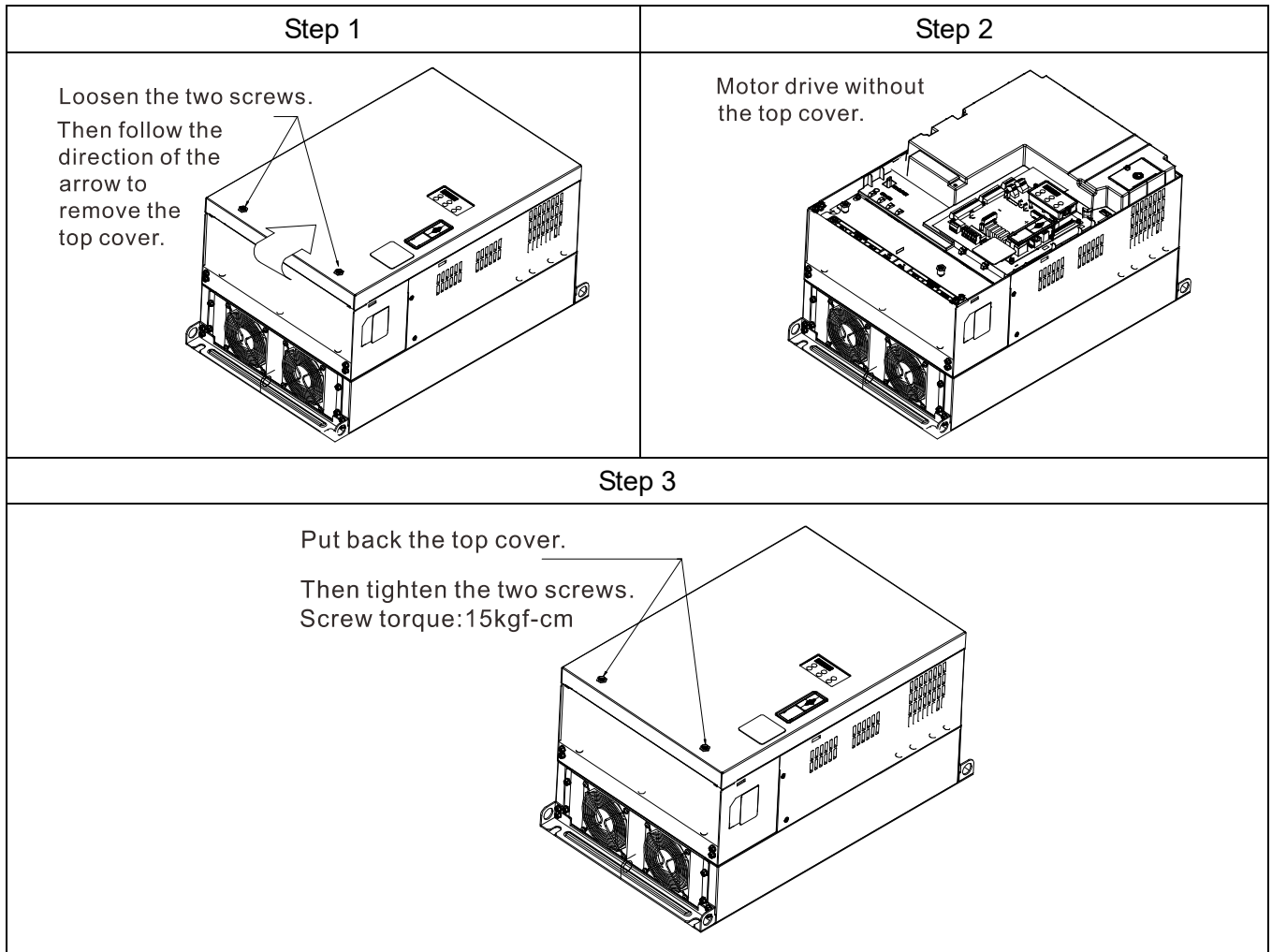
Select the applicable option cards for your drive or contact your local distributor for suggestions. To prevent damage to the motor drive during installation, remove the digital keypad and the cover before wiring. Refer to the following instructions.

Removing the Top Cover

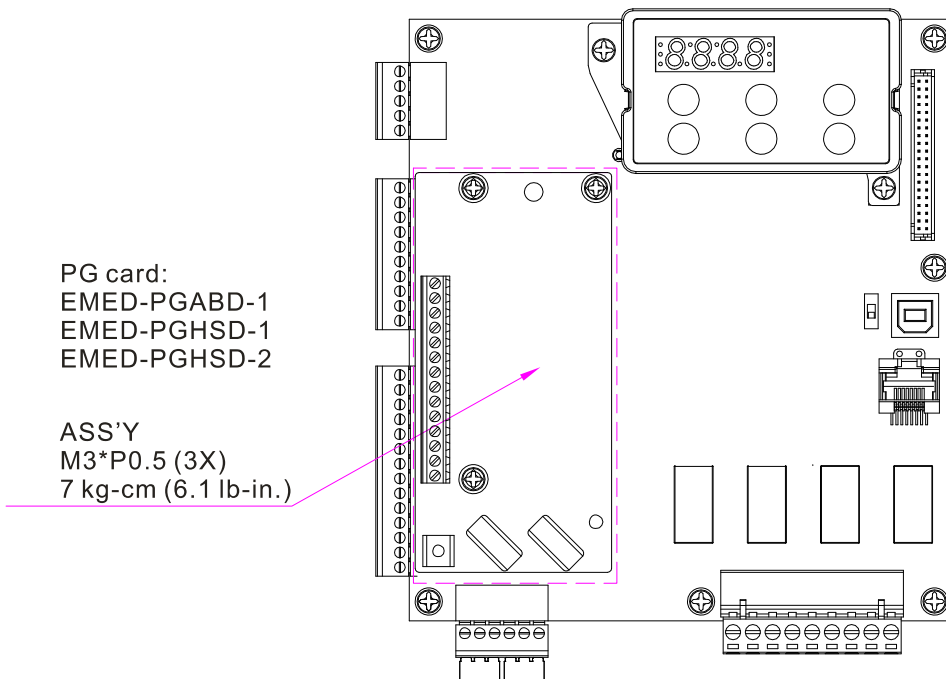
Frames B, C & D Screw Torque: kg-cm [[lb-in.]

Step 1	Step 2
<p data-bbox="395 465 678 555">Loosen the four screws. Then remove the top cover.</p> 	<p data-bbox="912 481 1157 537">Motor drive without the top cover.</p> 
Step 3	
<p data-bbox="730 992 1114 1093">Put back the top cover. Then tighten the four screws. Screw torque: 15kgf-cm</p> 	

Frame E Screw Torque: kg-cm [lb-in.]

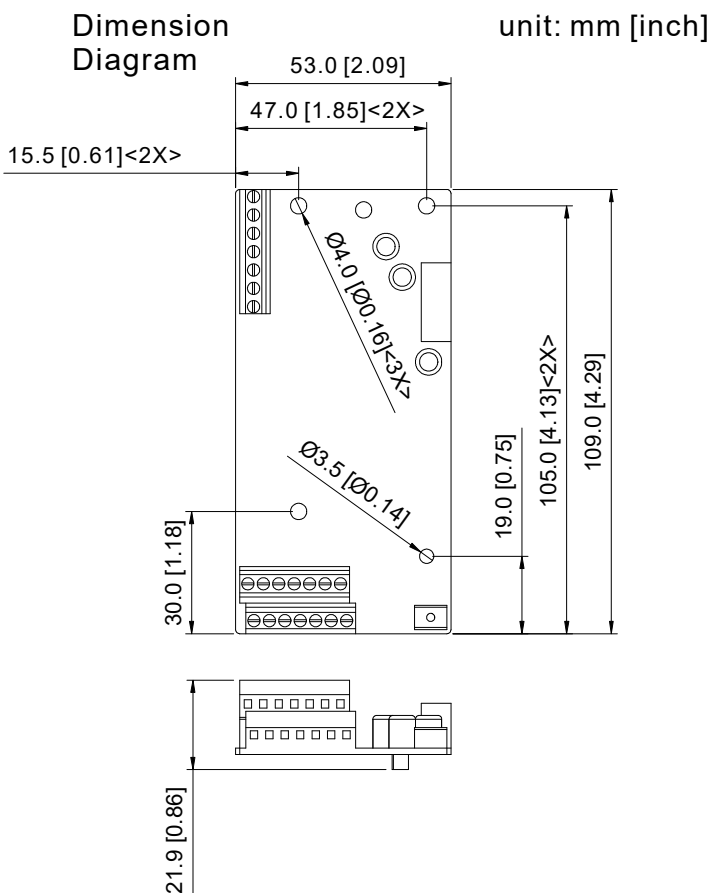
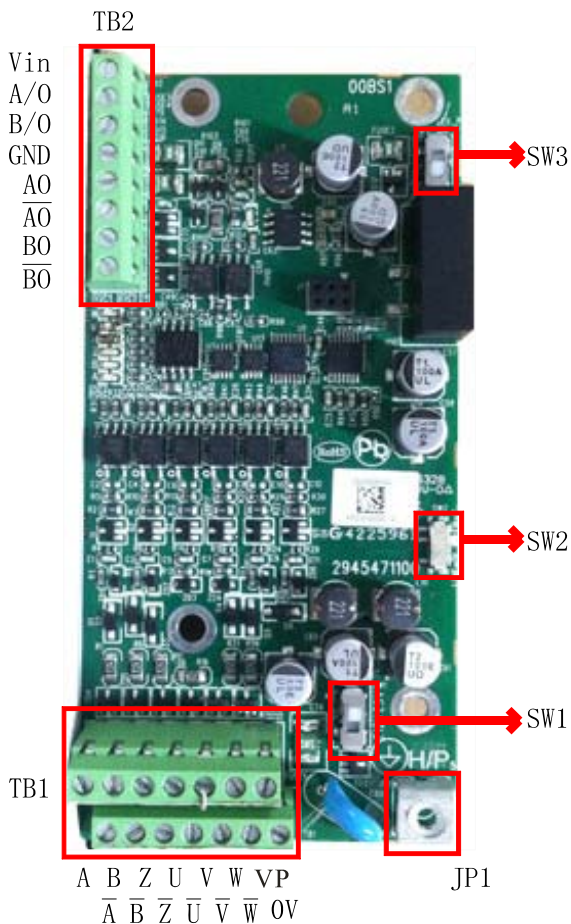


Vertical View of the Motor Drive & Screw Specifications



7-1 EMED-PGABD-1


Applicable encoder: A/B/Z & U/V/W Absolute Encoders



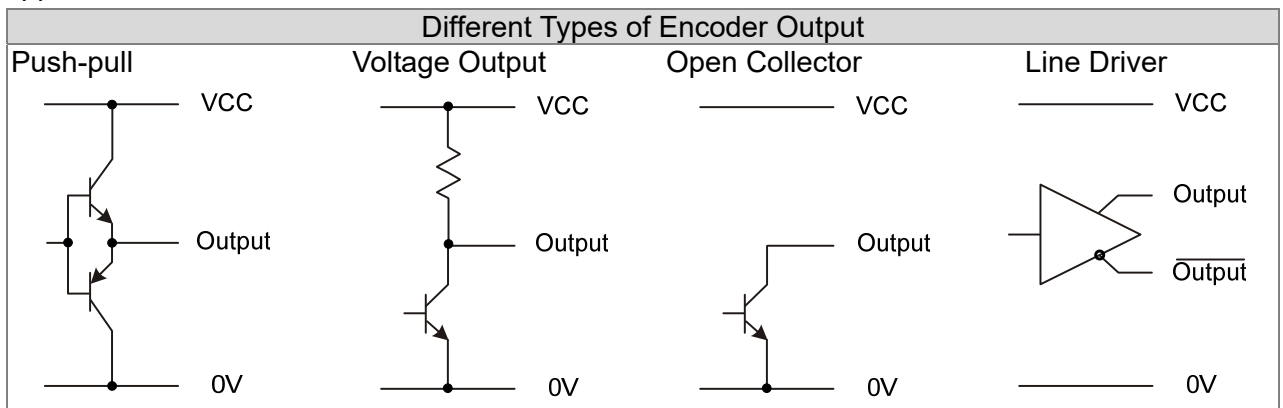
Wire Gauge	Torque
30–16 AWG	1.6 kg-cm [1.4 lb-in.]

The following table lists the terminal specifications.

Terminals	Descriptions
TB2	<p>Vin</p> <p>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, Max: 24 V.</p>
	<p>A/O, B/O</p> <p>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, Max: 24 V. Push-Pull Voltage Output Max. output frequency: 100 kHz Supports frequency division output, the frequency division range: 1–31.</p>
	<p>GND</p> <p>Common ground terminal connecting to the host controller and the motor drive.</p>
	<p>AO, /AO, BO, /BO</p> <p>Output signal for the line driver frequency division. Line Driver RS422 Max. output frequency: 150 kHz Supports frequency division output, the frequency division range: 1–31.</p>

TB1	VP	Power output for encoder Note: Use SW1 to set output voltage amplitude Voltage: $+5 \pm 0.5 \text{ V}$ or $+12 \pm 1 \text{ V}$ Current: 200 mA max.
	0 V	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 signals need different wiring methods. See the user manual for wiring diagrams. Max. 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 signals need different wiring methods. See the user manual for wiring diagrams. Max. input frequency: 150 kHz
JP1		Ground Terminal Connect the motor drive power supply to ground. Supports PG shielding.
	SW1	Switch between power for the encoder (5 V / 12 V).
	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.
	SW3	Power supply switch for frequency division. Switch to INP side to provide 24 V power for internal use. Switch to EXP side to provide 24 V power for external use (client).

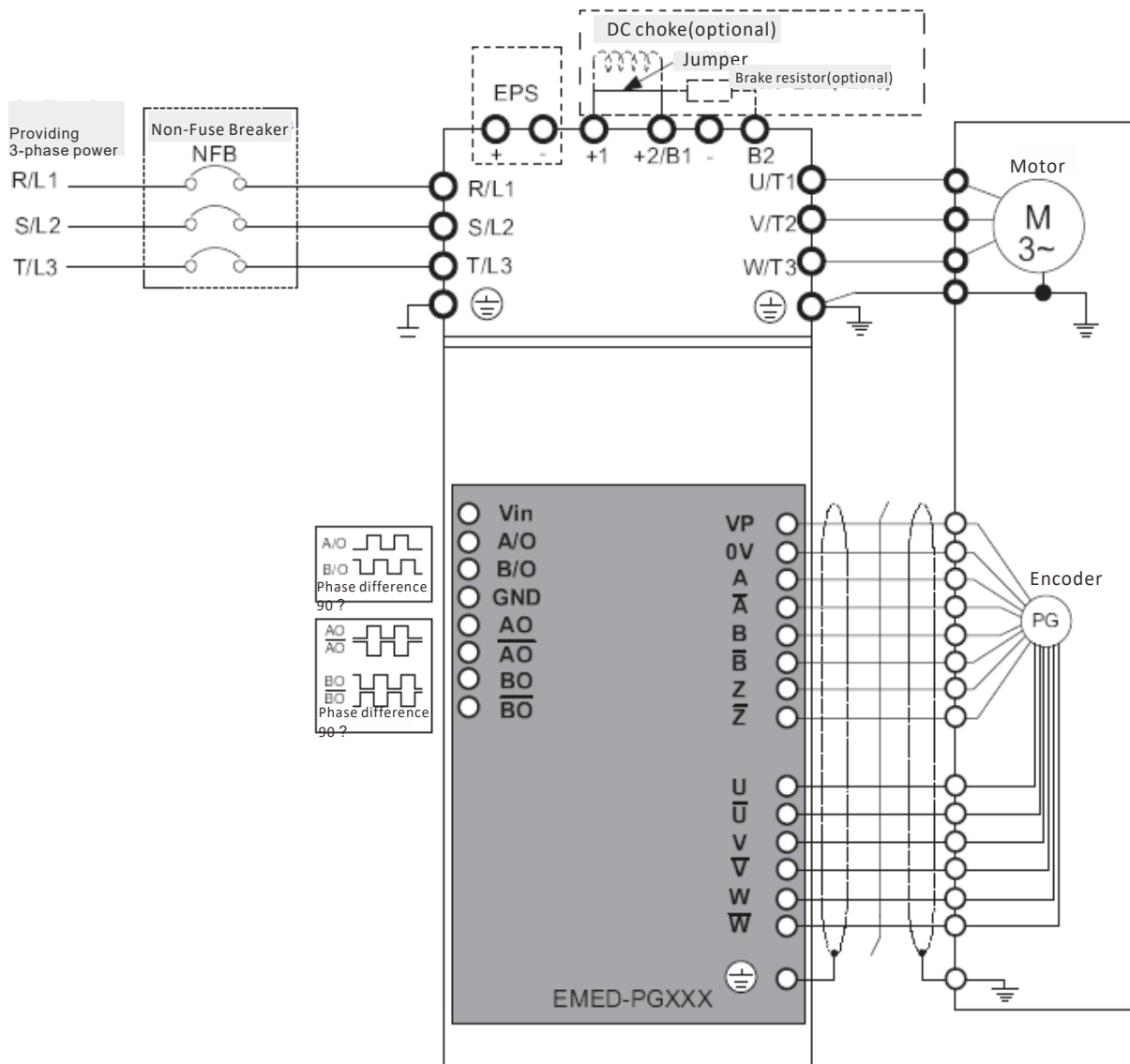
Applicable encoders:



 **NOTE**

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

Wiring Diagram



Set up the Frequency Division Signal

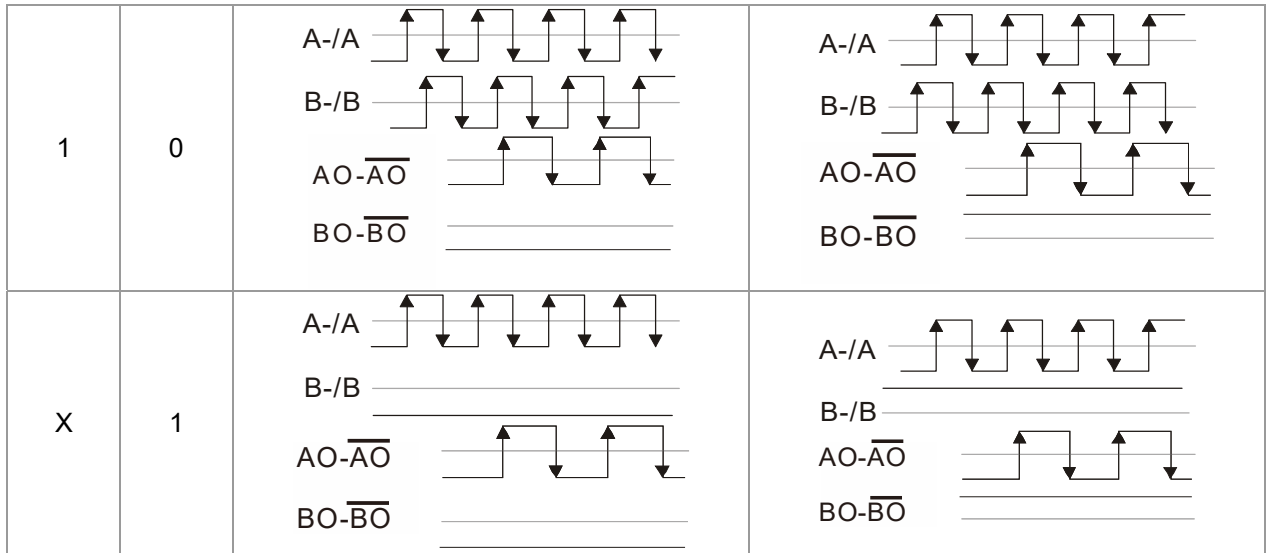
- ① After the encoder inputs a PULSE signal, there is an output signal by the division factor “n” Set the value in Pr.10-29 (PG card’s frequency division output).
- ② Set Pr.10-29 (PG card’s frequency division output):
The decimal frequency division output setting; range of the division factor “n”: 1–31.
- ③ Pr.10-30 (PG card’s frequency division output mode)

Bit3	Bit2	Bit1	Bit0
X	X	OUT/M	IN/M

OUT/M: Pulse output mode for frequency division;
IN/M: Pulse input mode for frequency division;
 “X” is for backup while “0” is a value to write.

The following table lists the Input Mode (IN/M) & Output Mode (OUT/M) setting and description:

OUT/M	IN/M	Division Factor	
		A is ahead of B	B is ahead of A
0	0		



NOTE

- In the waveform, A-/A, B-/B are the PG card input signals; AO- \overline{AO} , BO- \overline{BO} are the differential output frequency division signals. Use a differential probe to measure.
- Division factor “n”: Set 15 to divide the input signal by 15.
- When **OUT/M**, **IN/M** set to 0 and 0, the PG card input signal A-/A, B-/B are square waves while AO- \overline{AO} , BO- \overline{BO} are frequency division output.
- When **OUT/M**, **IN/M** are set to 1 and 0, the PG card input signal A-/A, B-/B are square waves while the BO- \overline{BO} is the A and B phase indicator (for example, when BO- \overline{BO} is LOW, it means A is ahead of B: when BO- \overline{BO} is HIGH, it means B is ahead of A). AO- \overline{AO} is frequency division output.
- When **OUT/M**, **IN/M** are set to X and 1, B-/B phase has to be the direction indication input signal (for example, when B-/B is LOW, it means A is ahead of B; when B-/B is HIGH, it means B is ahead of A). A-/A is a square wave input, BO- \overline{BO} and B-/B phase are input into synchronous action; AO- \overline{AO} is frequency division output.
- Take Pr.10-29 and Pr.10-30 as examples: When the frequency division value is 15, **OUT/M** =1, **IN/M** = 0. Set Pr.10-29 = 15 and Pr.10-30 = 0002h.

Set Pr.10-29 =15

Set Pr.10-30 =0002h

Bit3	Bit2	Bit1	Bit0
X	X	1	0

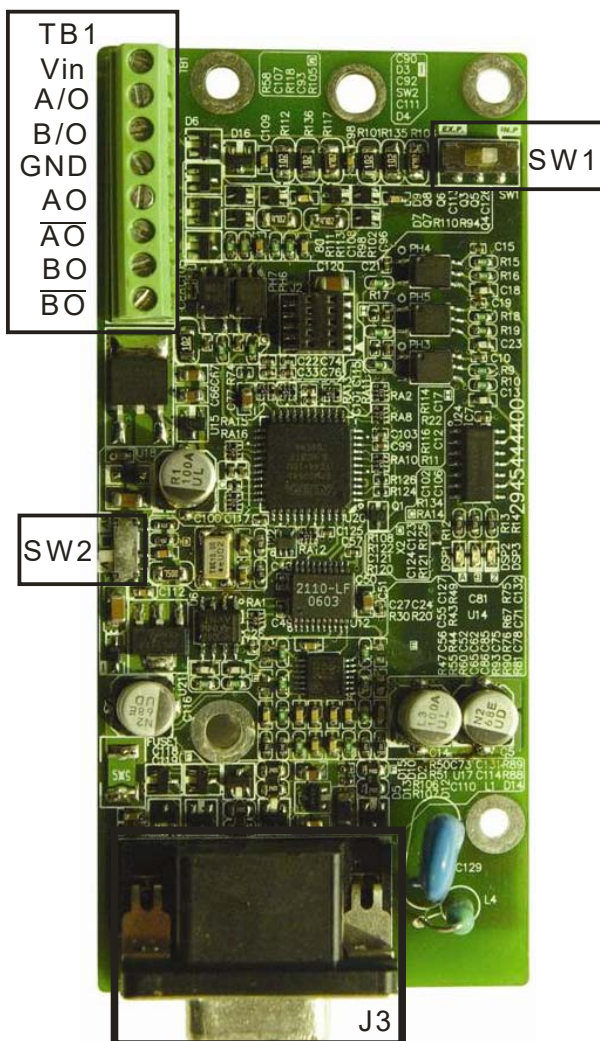
7-2 EMED-PGHSD-1

Applicable encoder:

SIN/COS: Heidenhain ERN1387

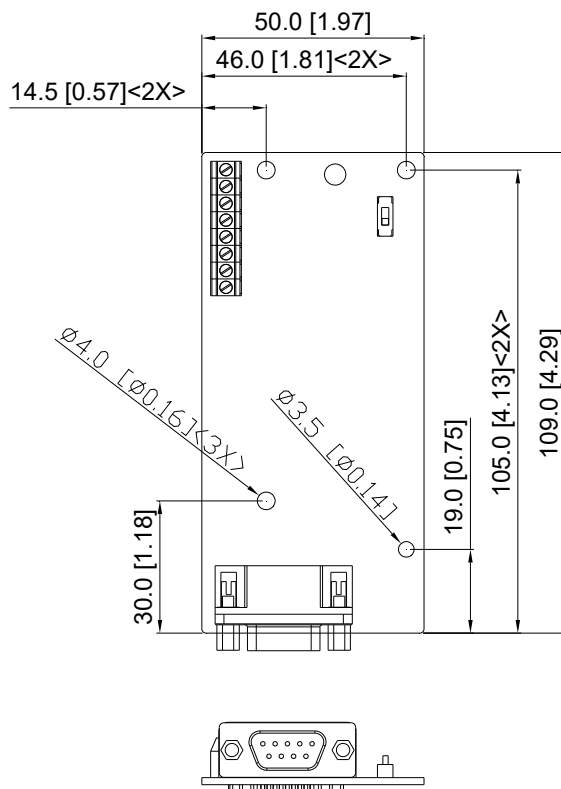
EnDat2.1/01: Heidenhain ECN413, ECN1313

SICK HIPERFACE: SRS50/60



Dimension

Unit: mm [inch]

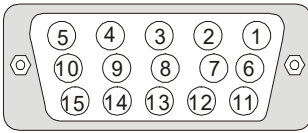


Wire Gauge	Torque
30-16 AWG	1.6 kg-cm [1.4 lb-in.]

※ Supports Heidenhain ERN1387, EnDat2.1, HIPERFACE.

Terminals	Descriptions
TB1	Vin Voltage input: (to adjust the output voltage amplitude of the push-pull pulse) Max. input voltage: 24 V _{DC} Max. input current: 30 mA
	A/O, B/O Push-pull pulse output signal Max. output frequency: 50 kHz
	GND Common power input/signal output terminal
	AO, /AO, BO, /BO Line driver RS422 Max. input frequency: 100 kHz
J3 (D-SUB female connector)	Encoder signal input terminal
SW1	Frequency division output power terminal selection INP: Power supplied by PG card EXP: Power from an external source
SW2	Encoder's voltage output terminal (Up) Note: Modify the terminal output voltage by switching the direction of the SW2 DIP switch on the PG card. 5 V: 5 V _{DC} 8 V: 8 V _{DC}

EMED-PGHSD-1 (Terminal J3) pin definitions depend on the encoder type



Terminal#	Heidenhain ERN1387	Heidenhain ECN1313	HIPERFACE®
1	B-	B-	REFSIN
2	-	-	-
3	R+	DATA	DATA+
4	R-	/DATA	DATA-
5	A+	A+	+COS
6	A-	A-	REFCOS
7	0V	0V	GND
8	B+	B+	+SIN
9	Up	Up	Up
10	C-	-	-
11	C+	-	-
12	D+	-	-
13	D-	-	-
14	-	/CLOCK	-
15	-	CLOCK	-

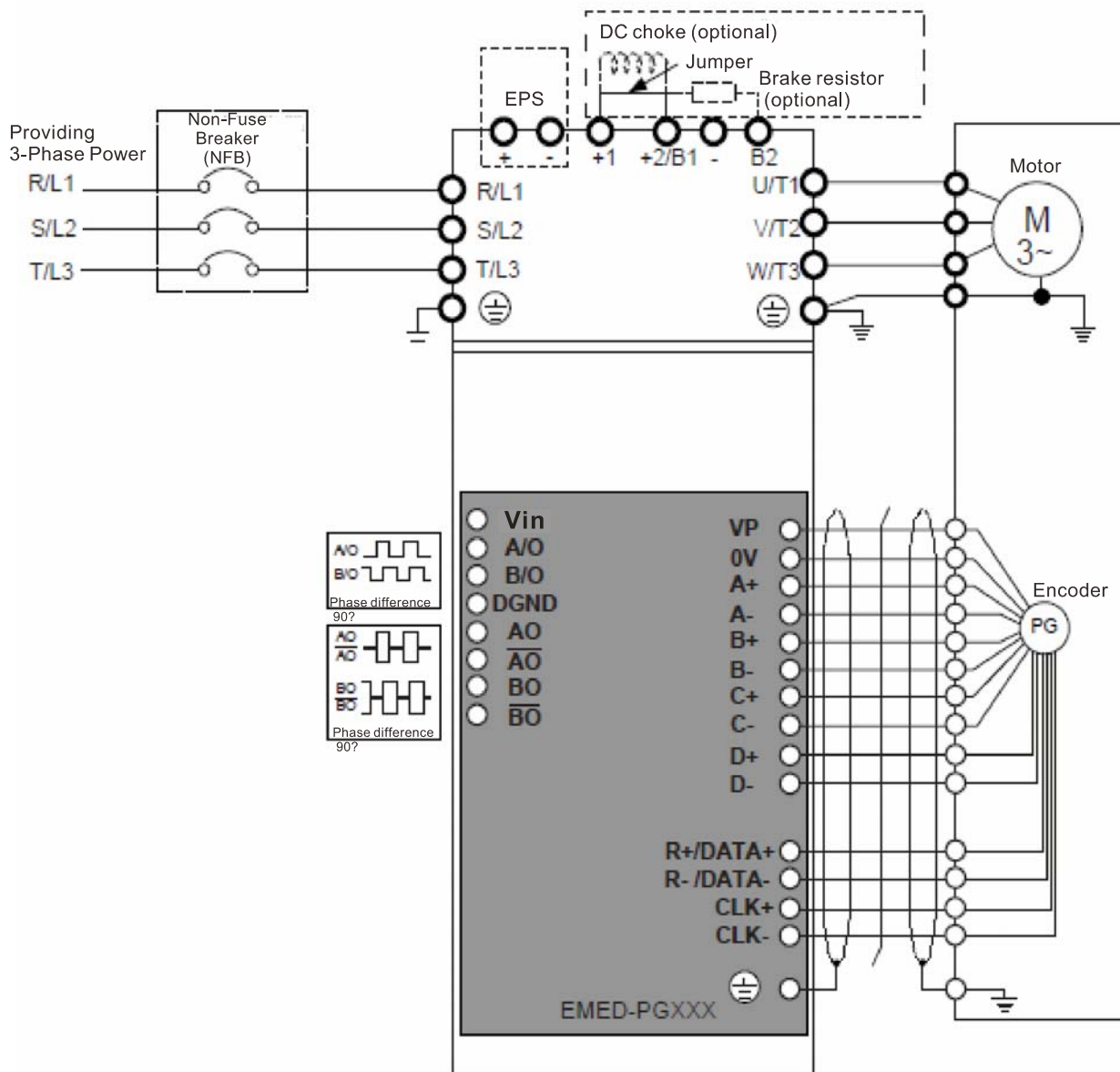
The following table lists the terminal functions.

Terminals	Descriptions	Specifications	
J3	Up (VP)	The output voltage for the encoder. Use the SW2 DIP switch to change the output voltage to +5 V or +8 V. Voltage: +5.1 V _{DC} ± 0.3 V; +8.4 V _{DC} ± 1.5 V Current: 200 mA max.	
	0 V	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: 40 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 130 Ω	
CLOCK+, CLOCK-	CLOCK differential output for ENDAT. Line Driver RS422 level output		

NOTE

- Verify that the SW2 switch is set to the correct output voltage before powering on.
- Keep the motor drive wiring away from any high voltage lines to avoid interference.

Wiring Diagram



Set the Frequency Division Signal

- ① After the encoder inputs a PULSE signal, there is an output signal by the division factor “n.” Set the value in Pr.10-29 (PG card’s frequency division output).
- ② Set Pr.10-29 (PG card’s frequency division output):
The decimal frequency division output setting; range of the division factor “n”: 1–31.
- ③ Pr.10-30 (PG card’s frequency division output mode)

Bit3	Bit2	Bit1	Bit0
X	X	OUT/M	IN/M

OUT/M: Pulse output mode for frequency division;
IN/M: Pulse input mode for frequency division;
 “X” is for backup while “0” is a value to write.

The following table lists the Input Mode (IN/M) & Output Mode (OUT/M) setting and description:

OUT/M	IN/M	Division Factor	
		A is ahead of B	B is ahead of A
0	0		
1	0		
X	1		

NOTE

- In the waveform, A-/A, B-/B are the PG card input signals; AO- \overline{AO} , BO- \overline{BO} are the differential output frequency division signals. Use a differential probe to measure.
- Division factor “n”: Set 15 to divide the input signal by 15.
- When **OUT/M**, **IN/M** set to 0 and 0, the PG card input signal A-/A, B-/B are square waves while AO- \overline{AO} , BO- \overline{BO} are frequency division output.
- When **OUT/M**, **IN/M** are set to 1 and 0, the PG card input signal A-/A, B-/B are square waves while the BO- \overline{BO} is the A and B phase indicator (for example, when BO- \overline{BO} is LOW, it means A is ahead of B: when BO- \overline{BO} is HIGH, it means B is ahead of A). AO- \overline{AO} is frequency division output.
- When **OUT/M**, **IN/M** are set to X and 1, B-/B phase has to be the direction indication input signal (for example, when B-/B is LOW, it means A is ahead of B; when B-/B is HIGH, it means B is ahead of A). A-/A is a square wave input, BO- \overline{BO} and B-/B phase are input into synchronous action; AO- \overline{AO} is frequency division output.
- Take Pr.10-29 and Pr.10-30 as examples: When the frequency division value is 15, **OUT/M** =1, **IN/M** = 0. Set Pr.10-29 = 15 and Pr.10-30 = 0002h.
Set Pr.10-29 =15
Set Pr.10-30 =0002h

Bit3	Bit2	Bit1	Bit0
X	X	1	0

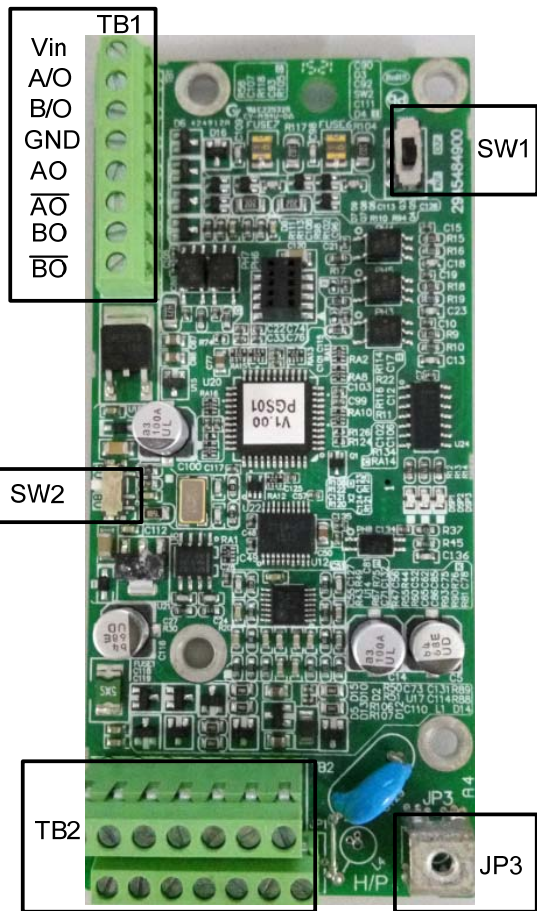
7-3 EMED-PGHSD-2

Applicable encoder:

SIN/COS: Heidenhain ERN1387

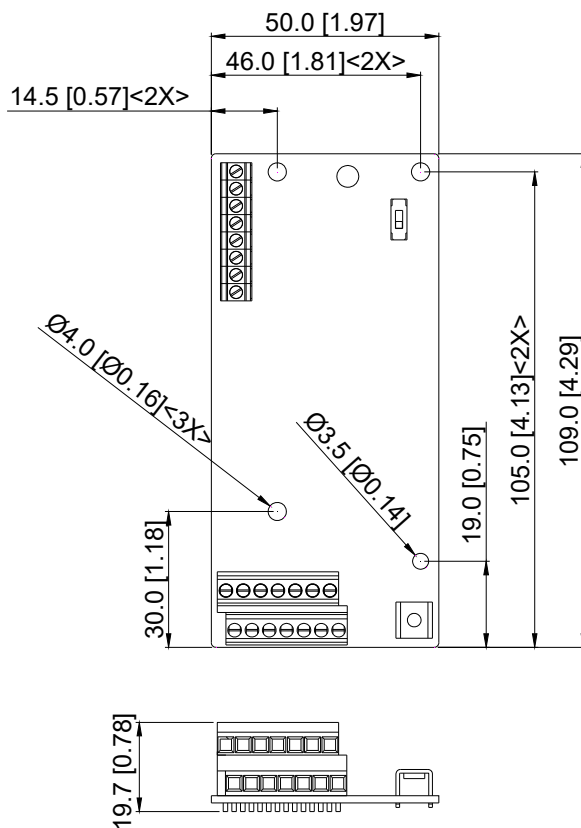
EnDat2.1/01: Heidenhain ECN413, ECN1313

SICK HIPERFACE: SRS50/60



Dimension

Unit: mm [inch]

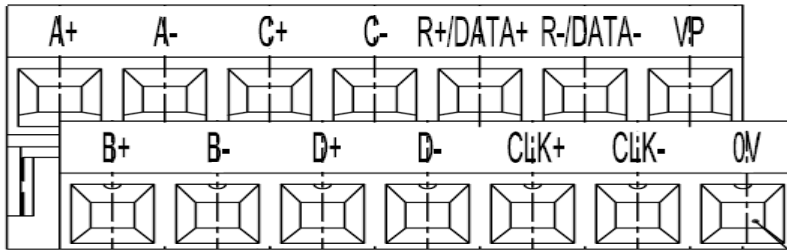


Wire Gauge	Torque
30–16 AWG	1.6 kg-cm [1.4 lb-in.]

※ Supports Heidenhain ERN1387, EnDat2.1, HIPERFACE.

Terminals		Descriptions
TB1	Vin	Voltage input: (to adjust the output voltage amplitude of the push-pull pulse) Max. input voltage: 24 V _{DC} Max. input current: 30 mA
	A/O, B/O	Push-pull pulse output signal Max. output frequency: 50 kHz
	GND	Common power input/signal output terminal
	AO, /AO, BO, /BO	Line driver RS422 Max. input frequency: 100 kHz
TB2		Encoder signal input terminal
JP3		Ground Terminal Connect the motor drive power supply to ground. Supports PG shielding.
SW1		Frequency division output power terminal selection INP: Power supplied by PG card EXP: Power from an external source
SW2		Encoder's voltage output terminal (Up) Note: Modify the terminal output voltage by switching the direction of the SW2 DIP switch on the PG card. 5 V: 5 V _{DC} 8 V: 8 V _{DC}

EMED-PGHSD-2 (Terminal TB2) pin definitions depend on the encoder type



Terminals	Heidenhain ERN1387	Heidenhain ECN1313	HIPERFACE®
A+	A+	A+	+COS
A-	A-	A-	REFCOS
C+	C+	Must set Pr.10-31=1	-
C-	C-		-
R+/DATA+	R+	DATA	DATA+
R-/DATA-	R-	/DATA	DATA-
VP	Up	Up	Up
B+	B+	B+	+SIN
B-	B-	B-	REFSIN
D+	D+	-	-
D-	D-	-	-
CLK+	-	CLOCK	-
CLK-	-	/CLOCK	-
0V	0V	0V	GND

The following table lists the terminal functions.

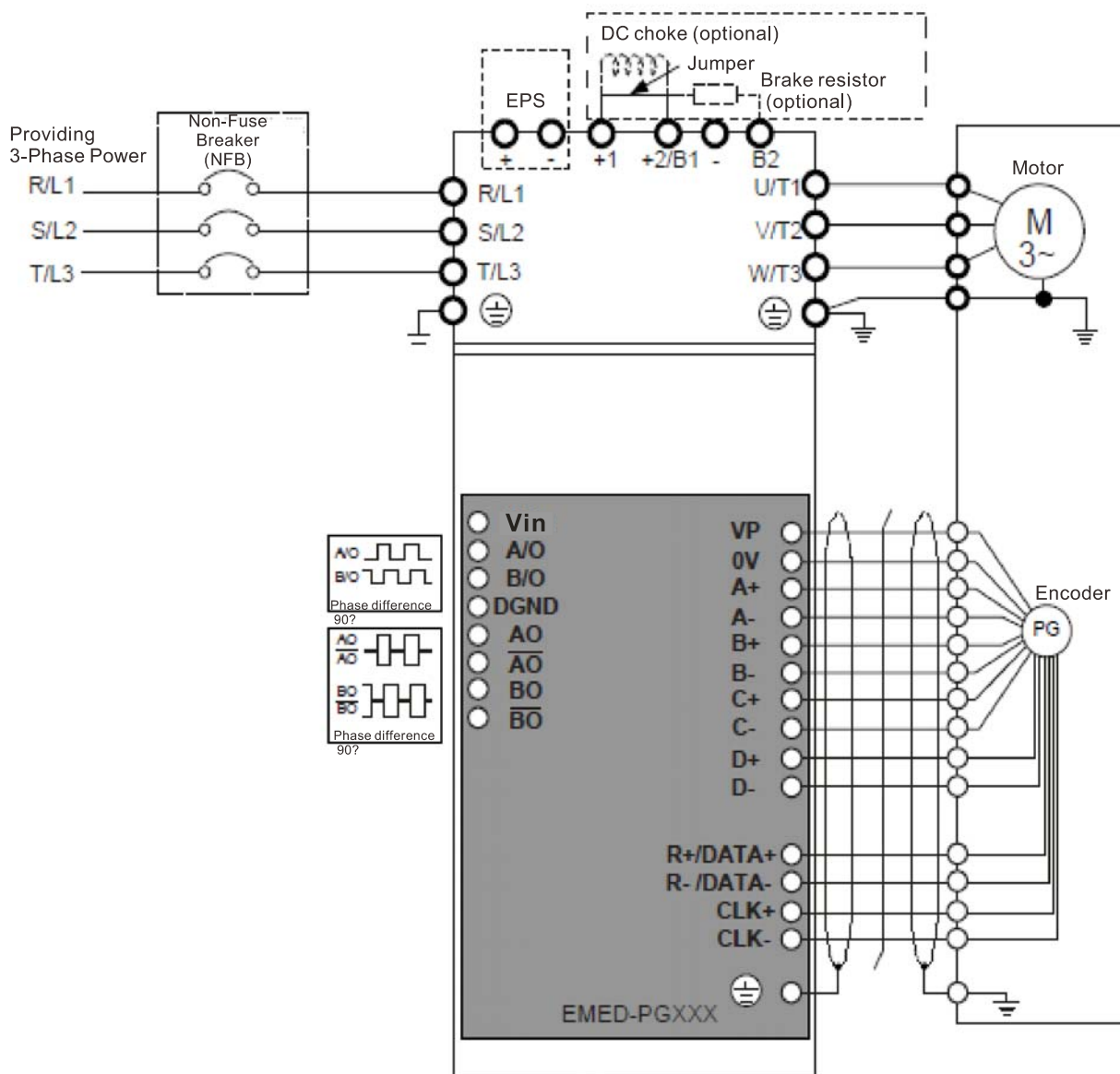
Terminals	Descriptions	Specifications	
TB2	Up (VP)	The output voltage for the encoder. Use the SW2 DIP switch to change the output voltage to +5 V or +8 V.	Voltage: +5.1 V _{DC} ± 0.3 V; +8.4 V _{DC} ± 1.5 V Current: 200 mA max.
	0 V	Encoder common power terminal	Reference level for the encoder's power.
	A+, A-, B+, B-, R+, R-	Encoder sine wave differential signal input (incremental signal)	Input frequency: 40 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 130 Ω.
CLOCK+, CLOCK-	CLOCK differential output for ENDAT	Line driver RS422 level output

NOTE

- Verify that the SW2 switch is set to the correct output voltage before powering on.
- Keep the motor drive wiring away from any high voltage lines to avoid interference.

Wiring Diagram



Set the Frequency Division Signal

- ① After the encoder inputs a PULSE signal, there is an output signal by the division factor “n.” Set the value in Pr.10-29 (PG card’s frequency division output).
- ② Set Pr.10-29 (PG card’s frequency division output):
The decimal frequency division output setting; range of the division factor “n”: 1–31.
- ③ Pr.10-30 (PG card’s frequency division output mode)

Bit3	Bit2	Bit1	Bit0
X	X	OUT/M	IN/M

OUT/M: Pulse output mode for frequency division;
IN/M: Pulse input mode for frequency division;
 “X” is for backup while “0” is a value to write.

The following table lists the Input Mode (IN/M) & Output Mode (OUT/M) setting and description:

OUT/M	IN/M	Division Factor	
		A is ahead of B	B is ahead of A
0	0		
1	0		
X	1		

NOTE

- In the waveform, A-/A, B-/B are the PG card input signals; AO- \overline{AO} , BO- \overline{BO} are the differential output frequency division signals. Use a differential probe to measure.
- Division factor “n”: Set 15 to divide the input signal by 15.
- When **OUT/M**, **IN/M** set to 0 and 0, the PG card input signal A-/A, B-/B are square waves while AO- \overline{AO} , BO- \overline{BO} are frequency division output.
- When **OUT/M**, **IN/M** are set to 1 and 0, the PG card input signal A-/A, B-/B are square waves while the BO- \overline{BO} is the A and B phase indicator (for example, when BO- \overline{BO} is LOW, it means A is ahead of B: when BO- \overline{BO} is HIGH, it means B is ahead of A). AO- \overline{AO} is frequency division output.
- When **OUT/M**, **IN/M** are set to X and 1, B-/B phase has to be the direction indication input signal (for example, when B-/B is LOW, it means A is ahead of B; when B-/B is HIGH, it means B is ahead of A). A-/A is a square wave input, BO- \overline{BO} and B-/B phase are input into synchronous action; AO- \overline{AO} is frequency division output.
- Take Pr.10-29 and Pr.10-30 as examples: When the frequency division value is 15, **OUT/M** =1, **IN/M** = 0. Set Pr.10-29 = 15 and Pr.10-30 = 0002h.
Set Pr.10-29 =15
Set Pr.10-30 =0002h

Bit3	Bit2	Bit1	Bit0
X	X	1	0

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Chapter 8 Specifications

8-1 230V Series

8-2 460V Series

8-3 Operation, Storage and Transportation Environments

8-1 230V Series

Frame Size		B			C			D			E	
Model VFD-__ _ED23/21S		022*	037*	040	055	075	110	150	185	220	300	370
Applicable Motor Output (kW)		2.2	3.7	4.0	5.5	7.5	11	15	18.5	22	30	37
Applicable Motor Output (HP)		3	5	5	7.5	10	15	20	25	30	40	50
Output Rating	Rated Output Capacity (kVA)	4.8	6.8	7.9	9.5	12.5	19	25	29	34	46	55
	Rated Output Current (A)	12.0	17	20.0	24.0	30.0	45.0	58.0	77.0	87.0	132.0	161.0
	Maximum Output Voltage (V)	Three-phase proportional to input voltage										
	Output Frequency Range	0.00–400 Hz										
	Carrier Frequency Range	2–15 kHz									2–9 kHz	
	Rated Output Maximum Carrier Frequency	8 kHz			10 kHz			8 kHz			6 kHz	
Input Rating	Input Current (A)	24	34	20	23	30	47	56	73	90	132	161
	Rated Voltage / Frequency	One-phase		Three-phase								
		200–240 V, 50/60 Hz										
	Voltage Tolerance	±10% (180–264 V)										
Frequency Tolerance	±5% (47–63 Hz)											
Cooling Method		Fan cooling										
Weight (kg)		6	6	6	8	10	10	13	13	13	36	36



*VFD022ED21S & VFD037ED21S are one-phase input models.

8-2 460V Series

Frame Size		B	C				D		E				
Model VFD-__ _ED43S		040	055	075	110	150	185	220	300	370	450	550	750
Applicable Motor Output (kW)		4.0	5.5	7.5	11	15	18.5	22	30	37	45	55	75
Applicable Motor Output (HP)		5	7.5	10	15	20	25	30	40	50	60	75	100
Output Rating	Rated Output Capacity (kVA)	9.2	10.4	13.5	18.3	24	30.3	36	46.2	63.7	80	96.4	116.3
	Rated Output Current (A)	11.5	13	17	23	30	38	45	58	80	100	128	165
	Maximum Output Voltage (V)	Three-phase proportional to input voltage											
	Output Frequency Range	0.00–400 Hz											
	Carrier Frequency Range	2–15 kHz							2–9 kHz		2–6 kHz		
	Rated Output Maximum Carrier Frequency	8 kHz	10 kHz			8 kHz			6 kHz				
Input Rating	Input Current (A)	11.5	14	17	24	30	37	47	58	80	100	128	165
	Rated Voltage / Frequency	Three-phase 380–480 V, 50/60 Hz											
	Voltage Tolerance	±10% (342–528 V)											
	Frequency Tolerance	±5% (47–63 Hz)											
Cooling Method		Fan cooling											
Weight (kg)		6	8	10	10	10	10	13	14.5	36	36	50	50

*Assumes operation at the rated output current. Input current rating varies depending on the input reactor, transformer, wiring connections and power supply impedance.

General Specifications

Control Characteristics	Control Method	1: V/F, 2: VF+PG, 3: SVC, 4: FOC+PG, 5: TQC+PG, 6: FOC+PM
	Starting Torque	In V/F mode: 150% at 0.5 Hz. In FOC+PG or FOC+PM mode: 150% at 0 Hz.
	Speed Control Range	1:100 (up to 1:1000 when using PG card)
	Speed Control Accuracy	±0.5% (up to ±0.02% when using PG card)
	Speed Response Ability	5 Hz (Up to 30 Hz for vector control)
	Max. Output Frequency	0.00–400.00 Hz
	Output Frequency 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.
	Torque Limit	Max. is 200% of the torque current
	Torque Accuracy	±5%
	Accel. / Decel. Time	0.00–600.00 seconds
	V/F Curve	Adjustable V/F curve using four independent points.
	Frequency Setting Signal	±10 V
Brake Torque	About 20% (while using optional braking resistor, about 125%, 30% ED)	
Protection Characteristics	Motor Protection	Electronic thermal relay protection
	Over-current Protection	The current is limited by 190% of the drive's rated current and the limit for over-current protection is 250% of the drive's rated current.
	Ground Leakage Current Protection	More than 50% of the drive's rated current
	Overload Ability	Constant torque: 150% for 60 seconds; variable torque: 180% for 10 seconds.
	Voltage Protection	Over-voltage level: $V_{DC} > 400/800$ V; low-voltage level: $V_{DC} < 200/400$ V
	Over-voltage Protection for the Input Power	Varistor (MOV)
	Overheating Protection	Built-in temperature sensor
Certifications	  EN81-1+A3, EN81-20: 2014	

8-3 Operation, Storage and Transportation Environments

DO NOT expose the AC motor drive to a poor environment, such as one with dust, direct sunlight, corrosive or inflammable gasses, humidity, liquids or excessive vibration. The salt in the air must be less than 0.01 mg/cm ² every year.				
Environment	Installation Location	IEC60364-1/IEC60664-1 pollution degree 2. Indoor use only.		
	Surrounding Temperature	Operation	Between -10–40°C, up to 50°C with derating for the operation temperature.	
			Between 40–50°C with Derating	2.2–4 kW: for every 1°C increase in temperature, decrease the drive's rated current by 2.2%
				5.5–30 kW: for every 1°C increase in temperature, decrease the drive's rated current by 2.5%
		Storage/ Transportation	-20–60°C	
	Non-condensing, non-freezing.			
	Rated Humidity	Operation	Max. 90%	
		Storage/ Transportation	Max. 90%	
		No water condensation		
	Altitude	Operation	If the AC motor drive is installed at an altitude of 0–1000 m, follow normal operation restrictions. For altitudes of 1000–3000 m, decrease the drive's rated current by 1% or lower the temperature by 0.5°C for every 100 m increase in altitude. The maximum altitude for corner grounding is 3000 m. If installing at an altitude higher than 3000 m is required, contact Delta for more information.	
Power System	TN system ^{*1*2}			
Package Drop	Storage	ISTA procedure 1A (according to weight) IEC60068-2-31		
	Transportation			
Vibration	<ul style="list-style-type: none"> ● 1.0 mm, peak to peak value range from 2–13.2 Hz; ● 0.7–1.0 G range from 13.2–55 Hz; ● 1.0 G range from 55–512 Hz. Compliance with IEC 60068-2-27.			
Impact	Compliance with IEC/EN 60068-2-27			
Protection Level	NEMA 1/IP20			
EMC Level	IEC 61800-3 and IEC 61000-4			

*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: One-phase models use a one-phase three-wire power system.

Chapter 9 Digital Keypad

9-1 Description of Keyboard Panel

9-2 Keypad Operation Process

9-3 Description of the Digital Keypad KPC-CC01

9-4 Digital Keypad KPC-CC01 Functions

9-5 Digital Keypad KPC-CC01 Fault Codes and Descriptions






9-6 TPEditor Installation

9-1 Description of Keyboard Panel



Keyboard Panel KPED-LE01



Keypad Functions

Keys	Description
	Shift key Moves the cursor so you can adjust the selected value.
	Reset key Resets the motor drive after a fault.
	Mode key Changes among the different display modes.
	ENTER key Allows you to read or modify the current parameter settings.
	Up and Down keys These buttons have two functions: 1. Press the Up or Down button to increase or decrease the selected value. 2. Press the Up or Down button to select items in a menu and languages.

LED Function Description

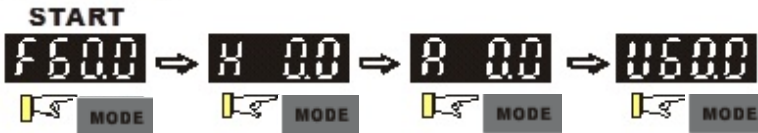
LED	Description
	Status Display UP: Moving up. DN: Moving down D1: MI1 status D2: MI2 status D3: MI3 status D4: MI4 status
	Main Display Area Displays frequency, current, voltage, rotation direction, user-defined units, errors and warnings.

Description of the Displayed Functions

Displayed Function	Description
<p>UP D1 D3, DN D2 D4</p>	Displays the VFD-ED frequency setting.
<p>UP D1 D3, DN D2 D4</p>	Displays the actual frequency output from the VFD-ED to the motor.
<p>UP D1 D3, DN D2 D4</p>	Displays the user-defined value in Pr.00-04.
<p>UP D1 D3, DN D2 D4</p>	Displays the current (amperes).
<p>UP D1 D3, DN D2 D4</p>	Displays the selected parameter.
<p>UP D1 D3, DN D2 D4</p>	Displays the value in a parameter.
<p>UP D1 D3, DN D2 D4</p>	Displays the external fault.
<p>UP D1 D3, DN D2 D4</p>	Displays "End" for approximately one second (as shown in the left figure) if the data has been accepted and automatically stored in the register.
<p>UP D1 D3, DN D2 D4</p>	Displays if the setting data is not accepted or data value exceeds the allowed range.

9-2 Keypad Operation Process

Setting Mode



NOTE: In the selected mode, press **ENTER** to set the parameters.

Setting parameters



NOTE :In the parameter setting mode, you can press **MODE** to the selected mode.

To change data



9-3 Description of the Digital Keypad KPC-CC01

KPC-CC01



Communication Interface
RJ45 (socket), RS-485 interface




Installation methods

- Place the keypad flat on the surface of the control box. The front cover is water proof.
- Use a model MKC-KPPK for wall mounting or embedded mounting. Its protection level is IP66.
- The maximum RJ45 extension cable is 5 m (16 ft).
- This keypad can also be used on Delta’s motor drives C2000, CH2000 and CP2000.

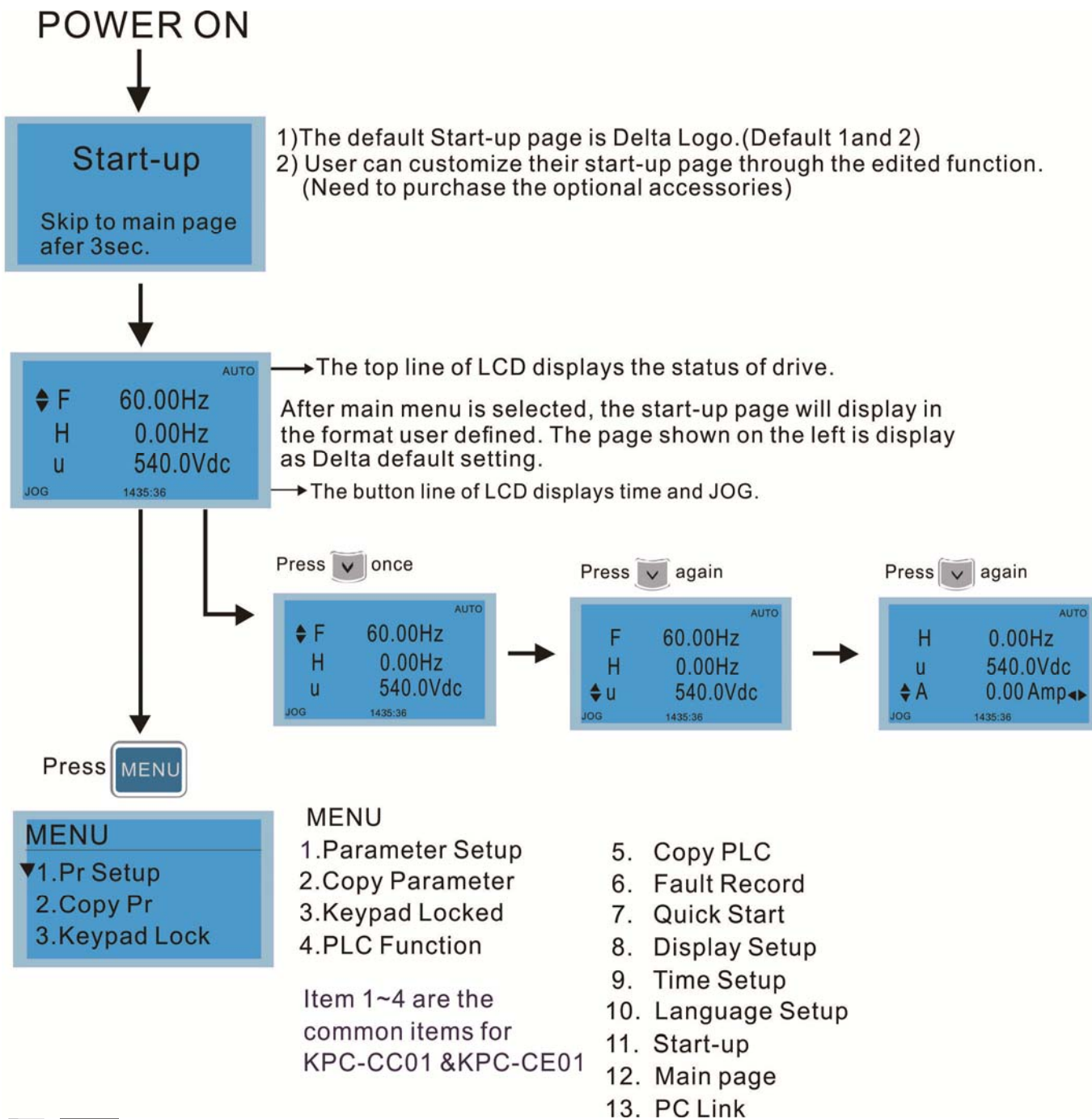
Keypad Functions

Key	Description																
	<p>Start Key</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> This button is functional only when the keypad is the source of the command. <input checked="" type="checkbox"/> This button causes the motor drive to run according to its settings. See “LED Function Description” for LED status. <input checked="" type="checkbox"/> Pressing the RUN button repeatedly is allowed while the motor drive is stopping. 																
	<p>Stop Key</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> The STOP key has the highest priority in command. <input checked="" type="checkbox"/> Press the STOP key to stop the drive under any conditions. <input checked="" type="checkbox"/> 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. 																
	<p>Operation Direction Key</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> The FWD/REV key controls the operation direction but does NOT activate the drive. FWD: forward, REV: reverse. <input checked="" type="checkbox"/> The drive operates in the direction as shown by the LED. 																
	<p>ENTER Key</p> <p>Press the ENTER key to go to the next menu level. If you are at the last level, then press ENTER to execute the command.</p>																
	<p>ESC Key</p> <p>Press the ESC key to return to the previous page, or return to the last category in the sub-menu.</p>																
	<p>MENU Key</p> <p>Press the MENU key to return to the main menu.</p> <p>Menu items:</p> <table border="0"> <tr> <td>1. Parameter Setup</td> <td>5. Copy PLC</td> <td>9. Time Setup</td> <td>13. PLC Link</td> </tr> <tr> <td>2. Copy Parameter</td> <td>6. Fault Record</td> <td>10. Language Setup</td> <td></td> </tr> <tr> <td>3. Keypad Locked</td> <td>7. Quick Start</td> <td>11. Start-up</td> <td></td> </tr> <tr> <td>4. PLC Function</td> <td>8. Display Setup</td> <td>12. Main Page</td> <td></td> </tr> </table> <p>VFD-ED does not support menu item 4 and 5 (PLC functions) and menu item 7 (Quick Start).</p>	1. Parameter Setup	5. Copy PLC	9. Time Setup	13. PLC Link	2. Copy Parameter	6. Fault Record	10. Language Setup		3. Keypad Locked	7. Quick Start	11. Start-up		4. PLC Function	8. Display Setup	12. Main Page	
1. Parameter Setup	5. Copy PLC	9. Time Setup	13. PLC Link														
2. Copy Parameter	6. Fault Record	10. Language Setup															
3. Keypad Locked	7. Quick Start	11. Start-up															
4. PLC Function	8. Display Setup	12. Main Page															
	<p>Direction: Left/Right/Up/Down cursor keys</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> In the numeric value setting mode, press Left and Right to move the cursor; press Up and Down to change the selected value. <input checked="" type="checkbox"/> In the menu/text selection mode, use the cursor keys to select an item. 																

LED Function Descriptions

LED	Description
	<p>Steady ON: AC motor drive operation indicator, including DC brake, zero speed, standby, restart after fault and speed tracking.</p> <p>Blinking: motor drive is decelerating to stop or in Base Block status.</p> <p>Steady OFF: motor drive does not execute the operation command.</p>
	<p>Steady ON: AC motor drive stop indicator.</p> <p>Blinking: motor drive is in standby status.</p> <p>Steady OFF: motor drive does not execute the STOP command.</p>
	<p>Operation Direction LED</p> <ol style="list-style-type: none"> 1. Green light is on, the drive is running forward. 2. Red light is on, the drive is running in reverse. 3. Blinking light: the drive is changing direction.

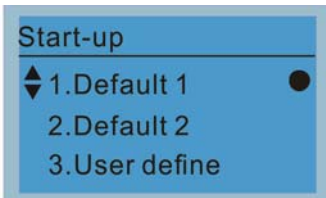
9-4 Digital Keypad KPC-CC01 Functions



NOTE

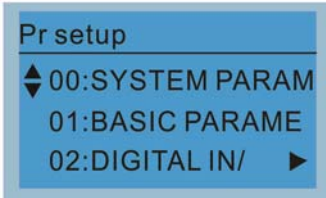
1. Start-up page can only display pictures, no flash.
2. When power is ON, it displays the start-up page and then the main page. The main page displays Delta's default setting F/H/A/U. Set the displayed order with Pr.00-03 (Start-up Display). When the selected item is U page, use left key and right key to switch between the items. Set the displayed order of U page with Pr.00-04 (Content of Multi-function Display).
3. VFD-ED does not support menu item 4 and 5 (PLC functions) and menu item 7 (Quick Start).



Display Icon



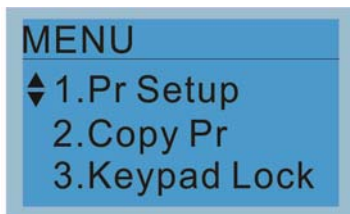
- : present setting
- ▲▼ : roll down the page for more options

Press  for more options.



- ▶ : show complete sentence
- Press   for complete information

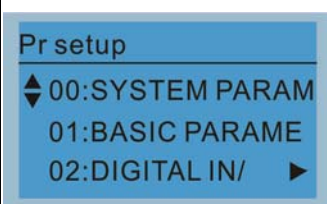



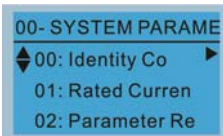
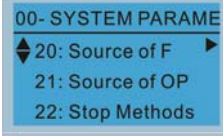
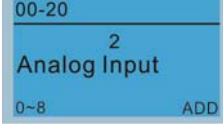
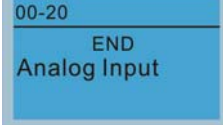
Display Item



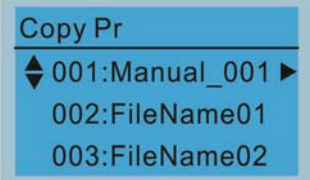
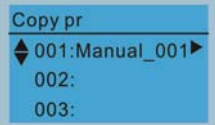
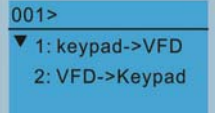
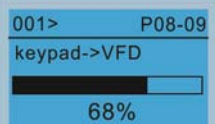
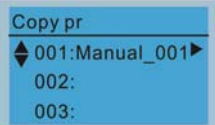
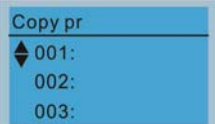
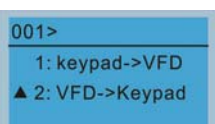
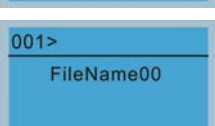
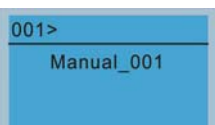
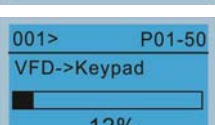
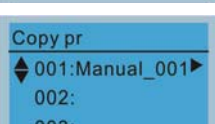
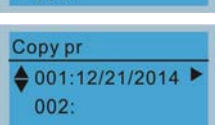
Item 1~4 are the common items for KPC-CC01 &KPC-CE01


- MENU
- 1.Parameter Setup
 - 2.Copy Parameter
 - 3.Keypad Locked
 - 4.PLC Function
 - 5. Copy PLC
 - 6. Fault Record
 - 7. Quick Start
 - 8. Display Setup
 - 9. Time Setup
 - 10. Language Setup
 - 11. Start-up
 - 12. Main page
 - 13. PC Link

1. Parameter Setup

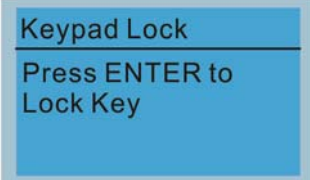


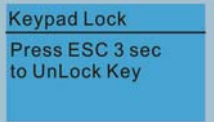

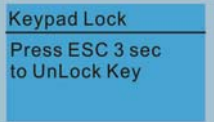

 <p>Press  to select.</p> <p>Press  to select a parameter group.</p> <p>Once a parameter group is selected, press  to go into that group.</p>	<p>For example: Set the master frequency command source.</p>  <p>Display the Group 00 Motor Drive Parameter. Use Up and Down to select parameter 20: Auto Frequency Command.</p>  <p>Press ENTER to display the parameter's setting menu.</p>  <p>Use Up and Down to choose a setting. For example, choose 2 Analogue Input, and then press ENTER.</p>  <p>After you press ENTER, the screen displays "END", indicating that the new parameter value is set.</p>
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2. Copy Parameter

 <p>Press ENTER to go to 001–004: content storage</p>	<p>Four groups of parameters are available to copy. The steps are shown in the example below. Example: Save parameters in the motor drive.</p>  <ol style="list-style-type: none"> 1. Go to Copy Parameter. 2. Select the parameter group to copy, and then press ENTER.  <ol style="list-style-type: none"> 1. Select 1: keypad->VFD. 2. Press ENTER to go to the “Save in the motor drive” screen.  <p>Copy parameters until it is done.</p>  <p>Once copying parameters is done, the keypad automatically returns to this screen.</p> <p>Example: Save parameters in the keypad.</p>  <ol style="list-style-type: none"> 1. Go to Copy Parameter. 2. Select the parameter group to copy, and then press ENTER.  <ol style="list-style-type: none"> 1. Select 2: VFD->Keypad. 2. Press ENTER to go to the “Save in the keypad drive” screen.  <p>Press Up or Down to select a symbol. Press Left or Right to move the cursor to select a filename.</p> <p>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 { } ~</p>  <p>After you confirm the filename, press ENTER.</p>  <p>Copy parameters until it is done.</p>  <p>After copying parameters, the keypad automatically returns to this screen.</p>  <p>Press Right to see the date the parameters were copied.</p>
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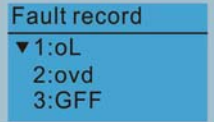
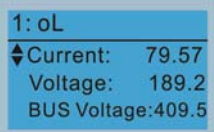
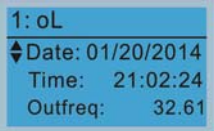
	 <p>Press Right again to see the time the parameters were copied.</p>
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3. Keypad Locked

 <p>Press  to lock</p>	<p>Lock the Keypad</p> <p>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 any key is pressed.</p>
	<p>When the keypad is locked, the main screen does not display the locked status.</p> 
	<p>Press any key on the keypad; a message displays as shown on the left.</p> 
	<p>If you do not press ESC, the keypad automatically returns to this screen.</p> 
	<p>The keypad is still locked. When you press any key, the screen shows the message on the left.</p> 
	<p>Press ESC for 3 seconds to unlock the keypad and the keypad returns to this screen. All keys on the keypad are functional.</p> 
	<p>Once the keypad is unlocked, turning the power off and then back on does not lock the keypad.</p>

4.
4.

4. Fault Record

 <p>Press  to select.</p> <p>KPC-CE01 does not support this function.</p>	<p>Able to store 6 error codes (Keypad V1.02 and previous versions) Able to store 20 error codes (Keypad V1.03 and later versions) The most recent error record shows as the first record. Choose an error record to see details such as date, time, frequency, current, voltage, and DC BUS voltage.</p>
	<p>Press Up or Down to select a fault record. After selecting a fault code, press ENTER to see that fault record’s details.</p> 
	<p>Press Up or Down to see the fault record’s details such as date, time, frequency, current, voltage, and DC BUS voltage.</p> 
	<p>Press ESC to return to the Fault Record screen.</p> 

		<p>Press Up or Down to select the next fault record. After selecting a fault record, press ENTER to see that fault record's details.</p> <p>Press Up or Down to see the fault record's details such as date, time, frequency, current, voltage, and DC BUS voltage.</p>
<p> NOTE</p> <p>The AC motor drive fault 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.</p>		

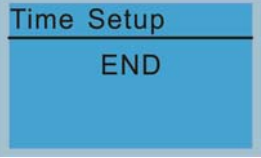

5. Display Setup

<p>Press ENTER to display the Display Setup screen.</p>	<p>1. Contrast</p>	<p>Press Up or Down to adjust the setting value.</p> <p>For example, increase the contrast to +10.</p> <p>After you set the value, press ENTER to see the screen display after increasing the contrast.</p> <p>Then press ENTER and decrease the contrast to -10.</p> <p>Press ENTER to see the screen display after adjusting the contrast to -10.</p>
<p>2. Back-Light</p>		


	<p>Displ Setup 1: Contrast 2: Back-Light 3: Text Color</p> <p>3. Text Color</p> <p>Displ Setup 1: Contrast 2: Back-Light 3: Text Color</p> <p>Text Color 0 White Text 0~1</p> <p>Text Color 1 Blue Text 0~1</p> <p>Displ Setup 1: Contrast 2: Back-Light 3: Text Color</p>	<p>When the setting value is 10 Min, the backlight turns off in 10 minutes.</p> <p>Press ENTER to go to the Text Color setting screen.</p> <p>The default value is White Text.</p> <p>Press Up or Down to adjust the setting value, and then press ENTER.</p> <p>The setting value changes to Blue Text.</p>
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6. Time Setup





<p>Time setup 2009/01/01 --:--:--</p> <p>Press Left or Right to select Year, Month, Day, Hour, Minute or Second to change.</p>	<p>Time Setup 2014/01/01 00:00:00</p> <p>Time Setup 2014/01/01 00:00:00</p> <p>Time Setup 2014/01/01 00:00:00</p> <p>Time Setup 2014/01/01 21:00:00</p> <p>Time Setup 2014/01/01 21:12:00</p> <p>Time Setup 2014/01/01 21:12:14</p>	<p>Press Up or Down to set the Year.</p> <p>Press Up or Down to set the Month.</p> <p>Press Up or Down to set the Day.</p> <p>Press Up or Down to set the Hour.</p> <p>Press Up or Down to set the Minute.</p> <p>Press Up or Down to set the Seconds.</p>
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		<p>Press ENTER to confirm the new date and time setting.</p> <p> NOTE</p> <p>Limitation: The charging process for the keypad super capacitor finishes in about 6 minutes. When you remove the digital keypad from the motor drive, the drive stores the time setting for seven days. After seven days, you must reset the time.</p>
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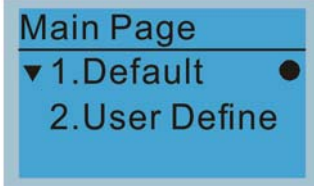
7. Language Setup

 <p>Press Up or Down to select the language, and then press ENTER.</p>	<p>The Language setting option is displayed in the language of your choice. Language setting options:</p> <ol style="list-style-type: none"> 1. English 2. 繁體中文 3. 简体中文 <p>NOTE: VFD-ED only supports these three languages currently.</p>
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8. Start-up

	<ol style="list-style-type: none"> 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 page. If the editor accessory is not installed, the User Define option displays a blank screen.  <p><u>USB/RS-485 Communication Interface-IFD6530</u> Refer to Chapter 06 Optional Accessories for more details.</p> <p><u>TPEditor</u> Go to Delta's website to download the TPEditor V1.30.6 or later versions. http://www.delta.com.tw/ch/product/em/download/download_main.asp?act=3&pid=1&cid=1&tpid=3</p> <p>Refer to Section 9-6 TPEditor Installation for operation description.</p>
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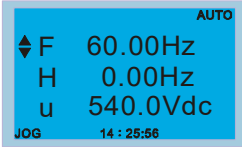
9. Main Page



You can choose the Default picture or the User-defined picture.

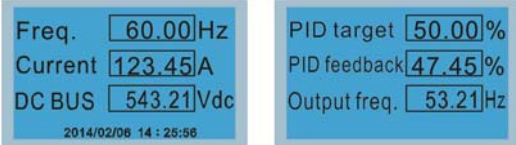
Press  to select.

1. Default page



F 600.00 Hz >>> H >>> A >>> U (options rotate)

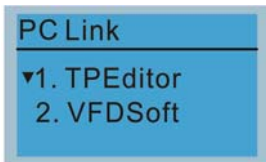
2. User-defined: an optional accessory is required (TPEditor & USB/RS-485 Communication Interface-IFD6530) to design your own start-up page. If the editor accessory is not installed, the User Define option displays a blank screen.



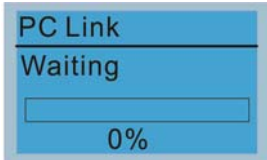
USB/RS-485 Communication Interface-IFD6530
Refer to Chapter 06 Optional Accessories for more details.

TPEditor
Go to Delta's website to download the TPEditor V1.30.6 or later versions.
http://www.delta.com.tw/ch/product/em/download/download_main.asp?act=3&pid=1&cid=1&tpid=3
Refer to Section 9-6 TPEditor Installation for operation description.

10. PC Link

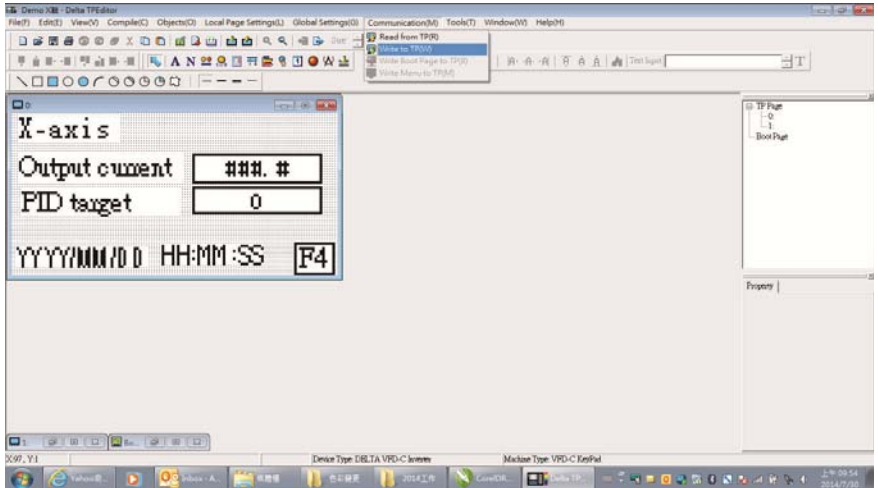


1. TPEditor: This function allows you to connect the keypad to a computer, and then download and edit user-defined pages.

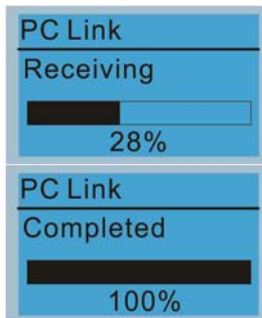
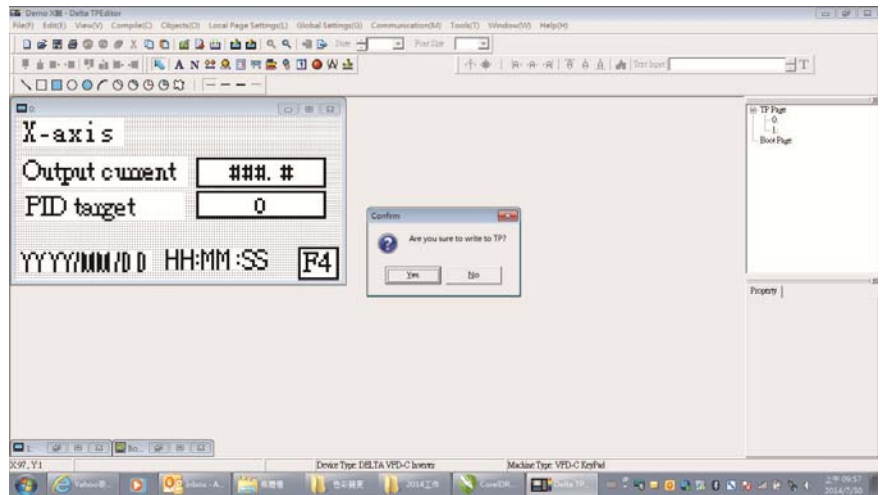


Press ENTER to go to the PC Link Waiting to connect to PC screen.

In TPEditor, from the **Communication** menu, choose **Write to TP**.



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

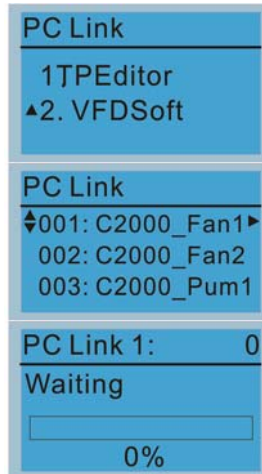


The software starts downloading screens to the KPC-CC01.

Download completed.

2. VFDSOft: This function links to the software VFDSOft, and then you can upload data that you copied one or more parameter (1–4) from the drive to the KPC-CC01.

Connect KPC-CC01 to your computer.

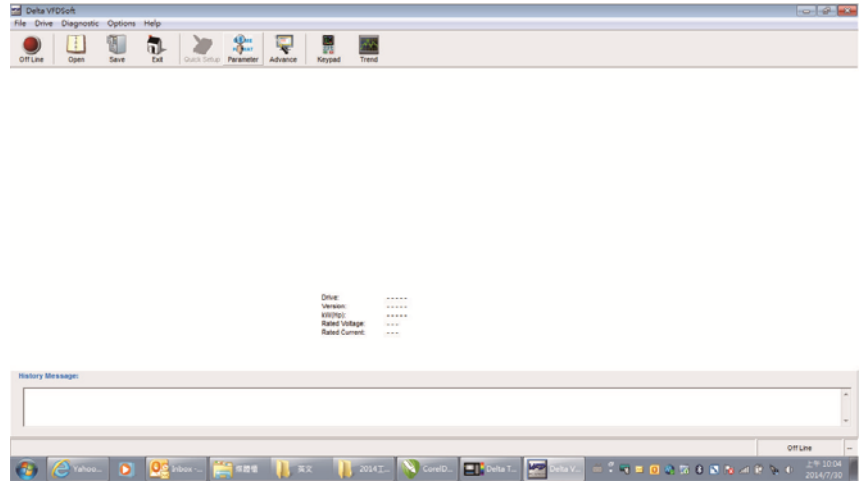


Choose 2. VFDSOft

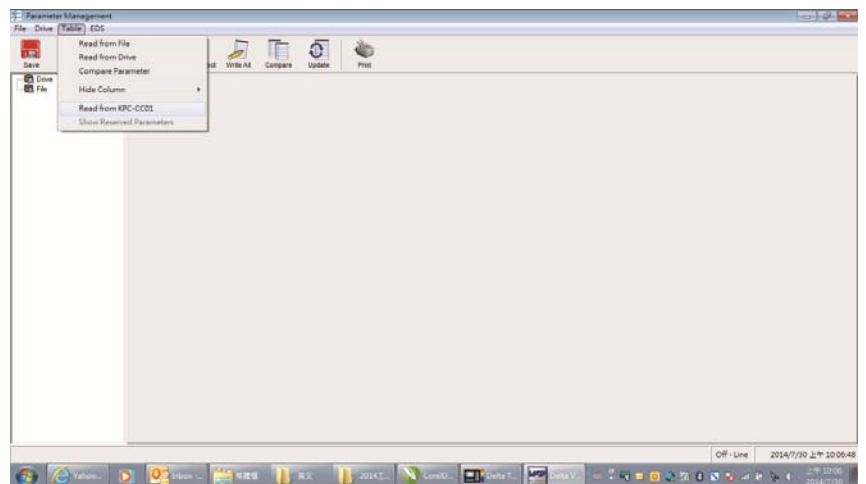
Press Up or Down to select a parameter group to upload to VFDSOft.

Press ENTER to display the PC Link Waiting to connect to PC screen.

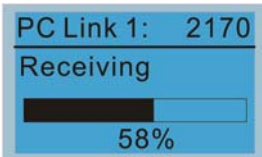
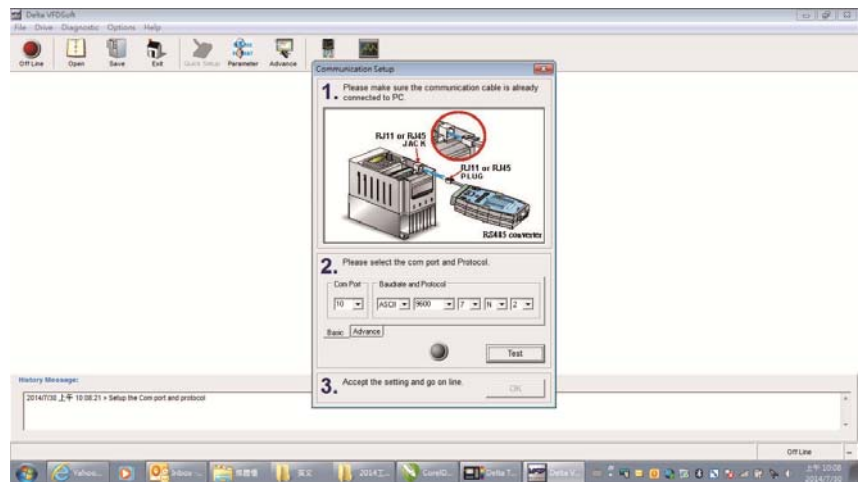
On your computer, open VFDSOft, and click **Parameter** on the toolbar.



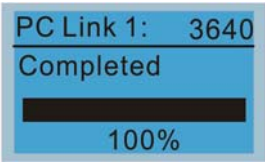
In the Parameter Management, from the **Table** menu, click **Read from KPC-CC01**.



Choose the correct communication port, and then click **OK**.

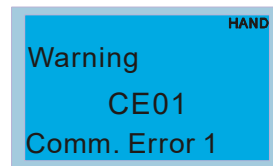
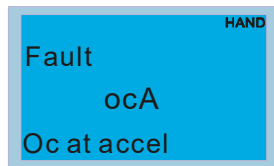


Start to upload parameters to VFDSOft.

	 <p>Uploading parameter is completed.</p> <p>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 screens to the KPC-CC01, the Start-up screen and the Main screen are blank.</p>
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Other Displays

When a fault or warning occurs, the menu displays the following screens.


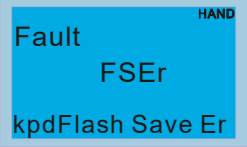
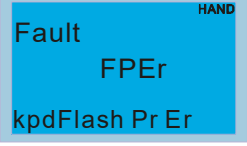
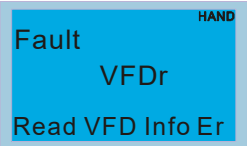
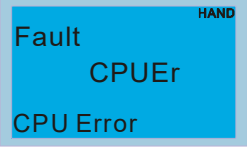


1. Press ENTER to RESET. If there is no response, contact your local distributor for instructions to return the equipment to the factory. To view the DC BUS fault voltage value, output current and output voltage, press MENU and then choose Fault Record for details (refer to the descriptions in the above #4 Fault Record).
2. Press ENTER again. If the screen returns to Main page, the fault is cleared.

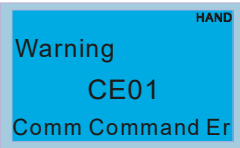
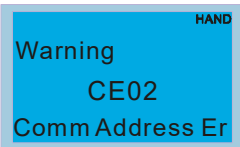
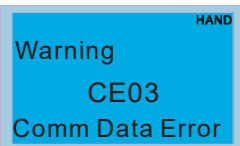
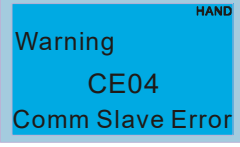
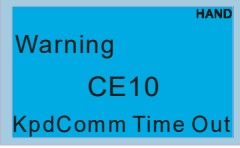
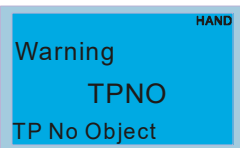
When a fault or warning message appears, the screen backlight blinks until the fault or warning is cleared.

9-5 Digital Keypad KPC-CC01 Fault Codes and Descriptions

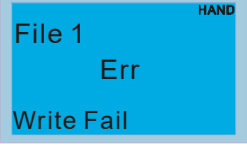
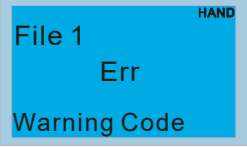
Fault Codes

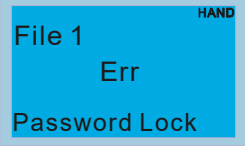
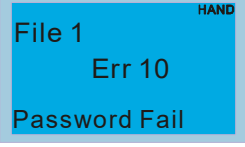
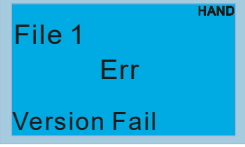
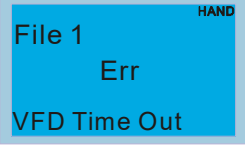
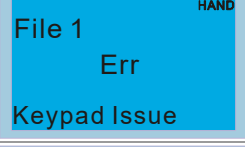
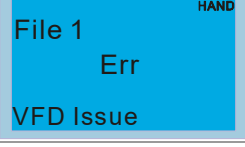
LCM Display *	Description	Corrective Actions
	Keypad flash memory read error	Error in the keypad's flash memory. 1. Press RESET to clear the errors. 2. Check for any problem on Flash IC. 3. Shut down the system, wait for ten minutes, and then restart the system. If none of the above solutions works, contact your authorized local dealer for assistance.
	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.
	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 local authorized dealer for assistance.
	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 local authorized dealer for assistance.
	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 local authorized dealer for assistance.

Warning Codes

LCM Display *	Description	Corrective Actions
 <p>Warning CE01 Comm Command Er</p>	<p>Modbus function code error</p>	<p>Motor drive does not accept the communication command sent from the keypad.</p> <ol style="list-style-type: none"> 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. <p>If none of the above solutions works, contact your local authorized dealer for assistance.</p>
 <p>Warning CE02 Comm Address Er</p>	<p>Modbus data address error</p>	<p>Motor drive does not accept the keypad's communication address.</p> <ol style="list-style-type: none"> 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. <p>If none of the above solutions works, contact your local authorized dealer for assistance.</p>
 <p>Warning CE03 Comm Data Error</p>	<p>Modbus data value error</p>	<p>Motor drive does not accept the communication data sent from the keypad.</p> <ol style="list-style-type: none"> 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. <p>If none of the above solution works, contact your local authorized dealer for assistance.</p>
 <p>Warning CE04 Comm Slave Error</p>	<p>Modbus slave drive error</p>	<p>Motor drive cannot process the communication command sent from the keypad.</p> <ol style="list-style-type: none"> 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. <p>If none of the above solutions works, contact your local authorized dealer for assistance.</p>
 <p>Warning CE10 KpdComm Time Out</p>	<p>Modbus transmission time-out</p>	<p>Motor drive does not respond to the communication command sent from the keypad.</p> <ol style="list-style-type: none"> 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. <p>If none of the above solutions works, contact your local authorized dealer for assistance.</p>
 <p>Warning TPNO TP No Object</p>	<p>Object not supported by TPEditor</p>	<p>Keypad's TPEditor uses an unsupported object.</p> <ol style="list-style-type: none"> 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. <p>If none of the above solutions works, contact your local authorized dealer for assistance.</p>

File Copy Setting Fault Description

LCM Display *	Description	Corrective Actions
	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.
	Fail to write parameter and file	An error occurred while writing to a parameter/file. 1. Check for any problem on Flash IC. 2. Shut down the system, wait for ten minutes, and then restart the system. If this solution does not work, contact your local authorized dealer for assistance.
	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.
	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.
	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.
	Fault code is not cleared	A setting cannot be changed because an error has occurred in the motor drive. 1. Check if an 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.
	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.
	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 authorized dealer for assistance.

LCM Display *	Description	Corrective Actions
	File is locked with password	<p>A setting cannot be changed because some data are locked.</p> <ol style="list-style-type: none"> 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. <p>If none of the above solutions works, contact your authorized dealer for assistance.</p>
	File password mismatch	<p>A setting cannot be changed because the password is incorrect.</p> <ol style="list-style-type: none"> 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. <p>If none of the above solutions works, contact your authorized dealer for assistance.</p>
	File version mismatch	<p>A setting cannot be changed because the version of the data is incorrect.</p> <ol style="list-style-type: none"> 1. Check if the version of the data matches the motor drive. If it matches, try to change the setting again. <p>If this solution does not work, contact your authorized dealer for assistance.</p>
	AC motor drive copy function time-out	<p>A setting cannot be changed because the data copying time-out expired.</p> <ol style="list-style-type: none"> 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. <p>If none of the above solutions works, contact your authorized dealer for assistance.</p>
	Other keypad error	<p>This setting cannot be changed due to other keypad issues (Reserved functions). Contact your authorized dealer for assistance.</p>
	Other AC motor drive error	<p>This setting cannot be changed due to other motor drive issues (Reserved functions). Contact your authorized dealer for assistance.</p>

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

9-6 TPEditor Installation

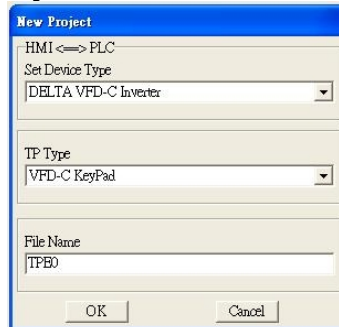
The TPEditor can edit up to 256 HMI (Human-Machine Interface) pages with a total storage capacity of 256 KB. Each page can include 50 normal objects and 10 communication objects.

1) TPEditor: Setup & Basic Functions

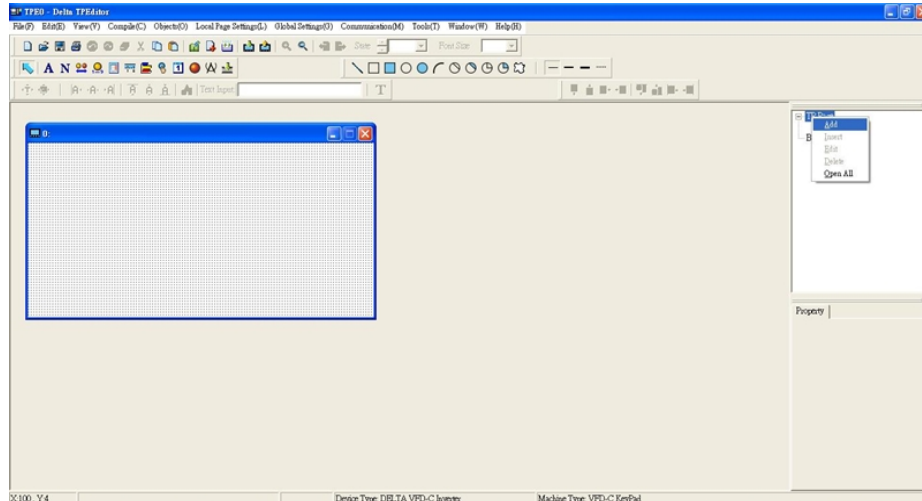
1. Run TPEditor (version 1.60 or later) by double-clicking the program icon.




2. On the **File** menu, click **New**. In the **New Project** window, for **Set Device Type**, select **DELTA VFD-C Inverter**. For **TP Type**, select **VFD-C KeyPad**. For **File Name**, enter TPE0 and then click **OK**.

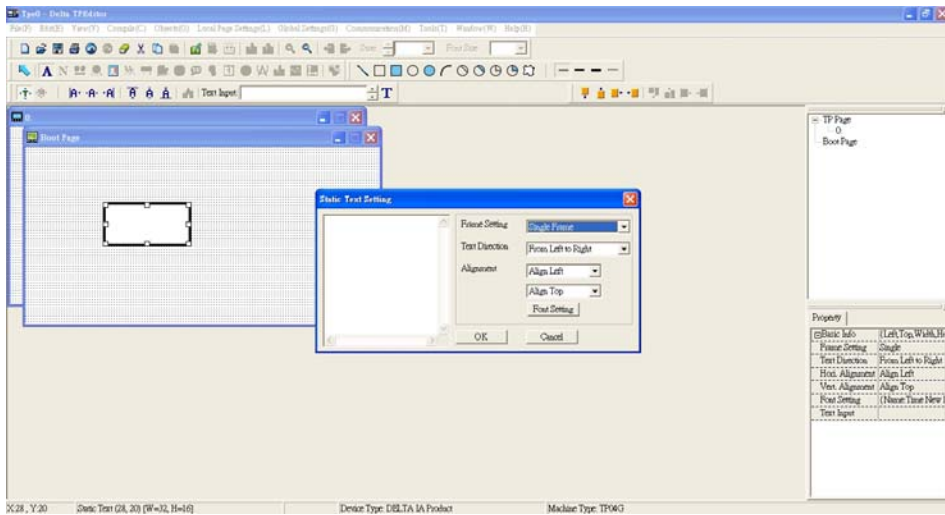



3. The editor displays the Design window. On the **Edit** menu, click **Add a New Page**. You can also right-click on the TP page in the upper right corner of the Design window and click **Add** to add one more pages to edit.

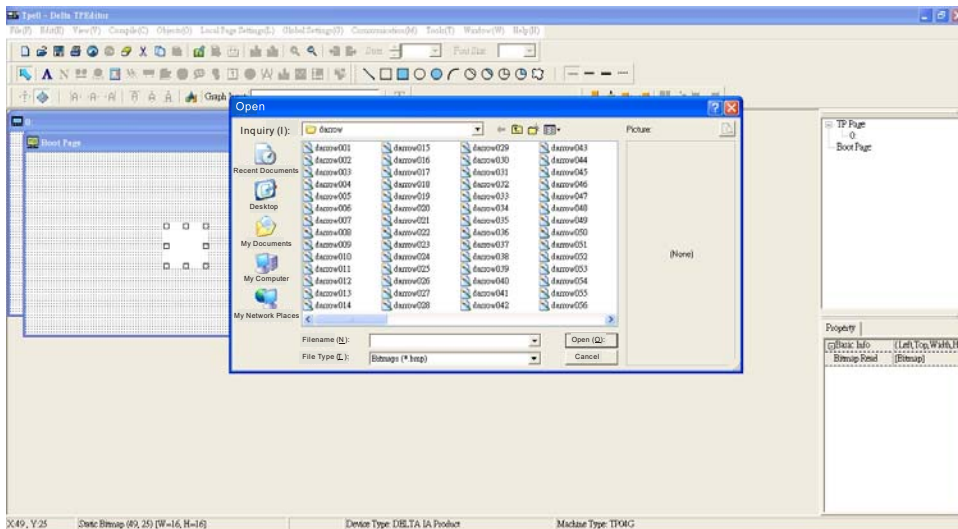


4. Edit the Start-up screen.

5. Add static text. Open a blank page (step 3), then on the toolbar click . Double-click the blank page to display the **Static Text Setting** dialog box, and then enter the static text.



6. Add a static bitmap. Open a blank page (step 3), then on the toolbar, click . Double-click the blank page to display the **Static Bitmap Setting** dialog box where you can choose the bitmap.



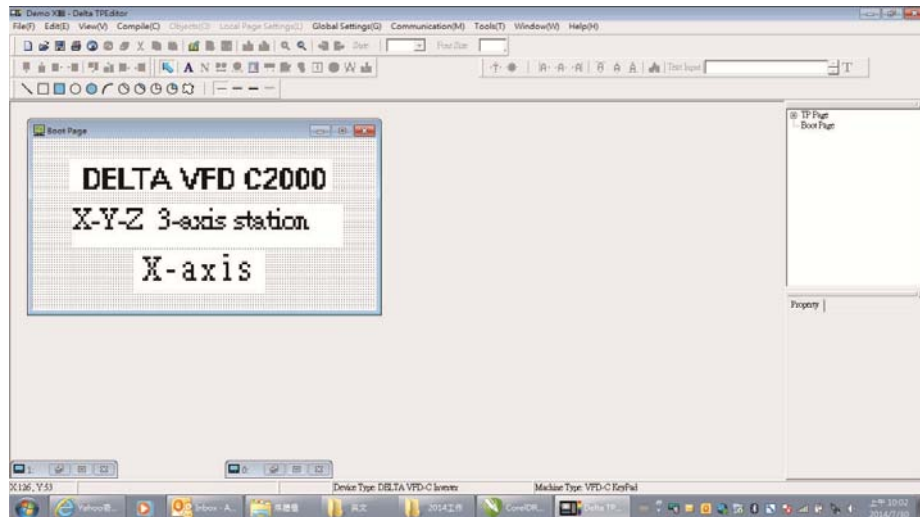
You can only use images in the BMP format. Click the image and then click **Open** to show the image in the page.

7. Add a geometric bitmap. There are 11 kinds of geometric bitmaps to choose. Open a new blank page (step 3), then on the toolbar click the geometric bitmap icon that you need



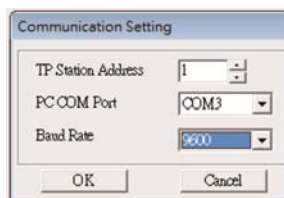
In the page, drag the geometric bitmap and enlarge it to the size that you need.

- When you finish editing the start-up screen, on the **Communication** menu, click **Input User Defined Keypad Starting Screen**.

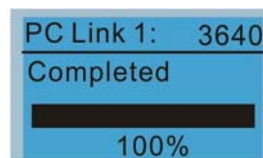
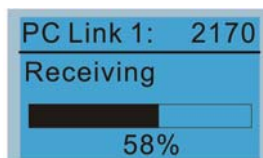
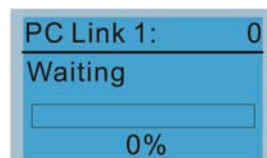
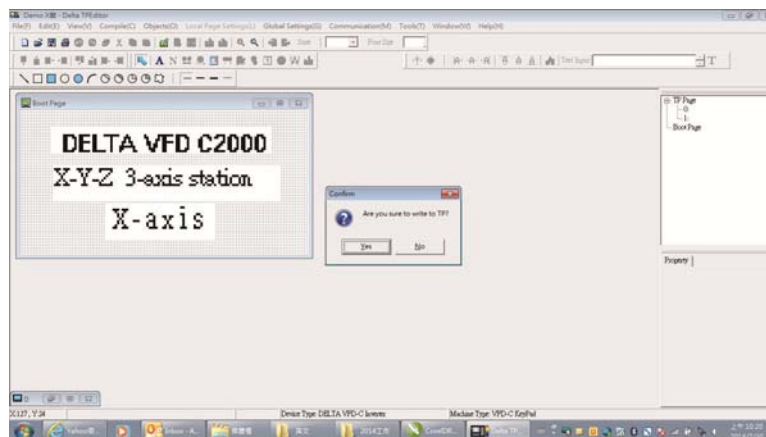


- Download the new setting: On the **Tool** menu, click **Communication**. Set up the communication port and speed for the IFD6530. There are three speeds available: 9600 bps, 19200 bps, and 38400 bps.

- On the **Communication** menu, click **Input User Defined Keypad Starting Screen**.

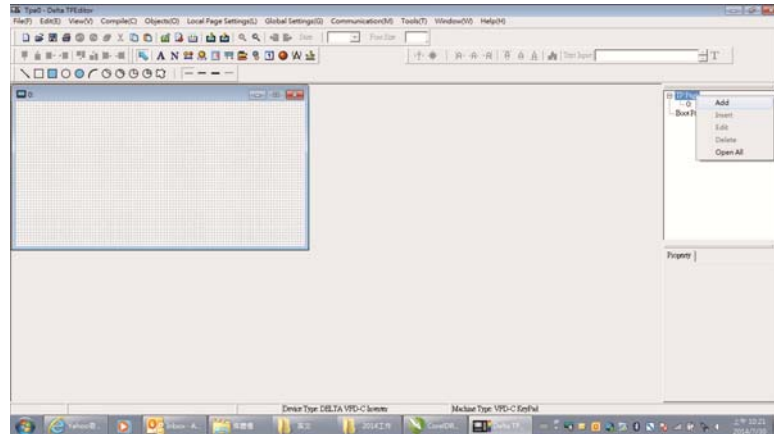


- The Editor displays a message asking you to confirm the new setting. Before you click **OK**, on the keypad, go to MENU, select PC LINK, press ENTER and then wait for few seconds. Then click **YES** in the confirmation dialog box in the TPEditor to start downloading.



2) Edit Main Page and Download to the Keypad

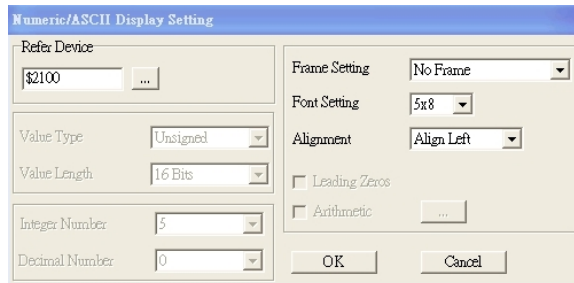
1. In the Editor, add a page to edit. On the **Edit** menu, click **Add a New Page**. You can also right-click on the TP page in the upper right corner of the Design window and click **Add** to add one more pages to edit. This keypad currently support up to 256 pages.



2. In the bottom right-hand corner of the Editor, click the page number to edit, or on the **View** menu, click **HMI Page** to start editing the main page. As shown in the picture above, the following objects are available. From left to right they are: Static Text, ASCII Display, Static Bitmap, Scale, Bar Graph, Button, Clock Display, Multi-state bit map, Units, Numeric Input, the 11 geometric bitmaps, and lines of different widths. Use the same steps to add Static Text, Static Bitmap, and geometric bitmaps as for the start-up page.



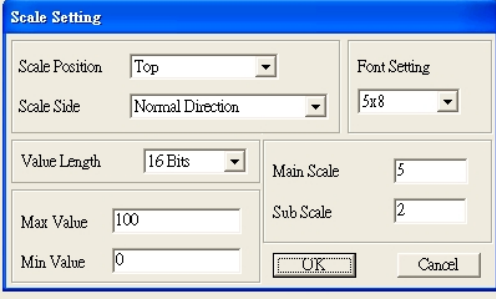
3. Add a numeric/ASCII display. On the toolbar, click the **Numeric/ASCII** button. In the page, double-click the object to specify the **Refer Device**, **Frame Setting**, **Font Setting** and **Alignment**.



Click [...]. In the **Refer Device** dialog box, choose the VFD communication port that you need. If you want to read the output frequency (H), set the **Absolute Addr.** to 2202. For other values, refer to the ACMD Modbus Comm Address List in Pr.09-04 in Chapter 12.



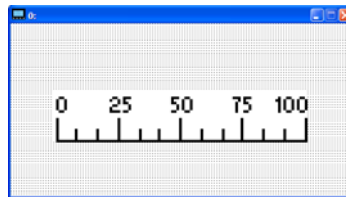
4. Scale Setting : On the toolbar, double-click  to add a scale. You can also edit the Scale Setting in the Property Window on the right-hand side of your computer screen.



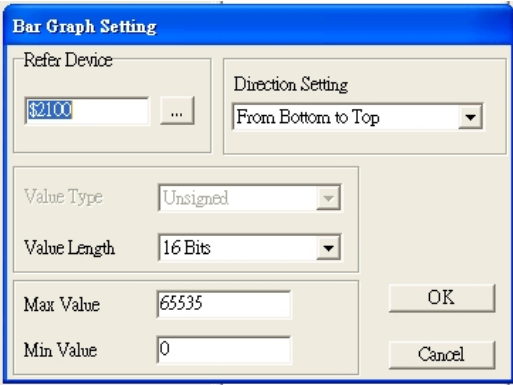
The Scale Setting dialog box contains the following fields:

- Scale Position: Top
- Scale Side: Normal Direction
- Font Setting: 5x8
- Value Length: 16 Bits
- Main Scale: 5
- Sub Scale: 2
- Max Value: 100
- Min Value: 0
- Buttons: OK, Cancel

- Scale Position:** specifies where to place the scale.
- Scale Side:** specifies whether the scale is numbered from smaller numbers to larger numbers or from larger to smaller.
- Font Setting:** specifies the font.
- Value Length:** specifies 16 bits or 32 bits.
- Main Scale & Sub-scale:** divides the whole scale into equal parts; enter the numbers for the main scale and sub-scale.
- Max Value & Min Value:** specifies the numbers on the two ends of the scale. They can be negative numbers, but the maximum and minimum values are limited by the **Value Length** setting. For example, when **Value Length** is **hexadecimal (16 bits)**, the maximum and the minimum value cannot be entered as -400000. Clicking **OK** creates a scale as in the picture below.





5. Bar Graph setting. On the toolbar, click  to add a bar graph.

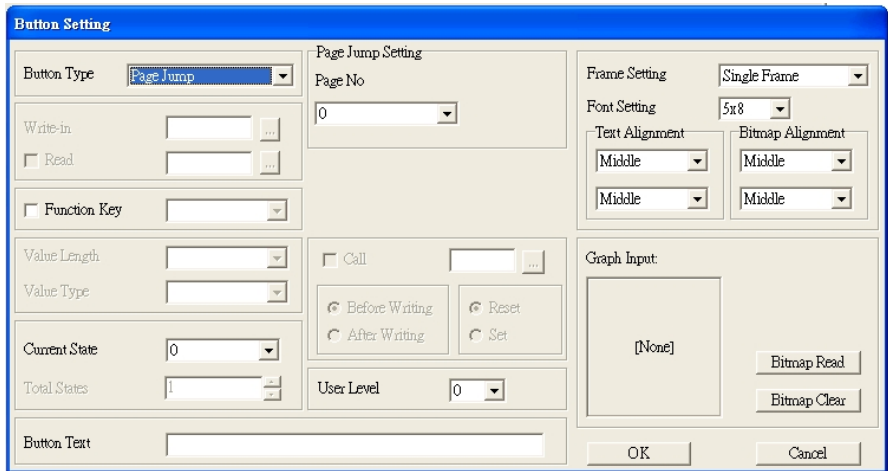


The Bar Graph Setting dialog box contains the following fields:

- Refer Device: \$2100
- Direction Setting: From Bottom to Top
- Value Type: Unsigned
- Value Length: 16 Bits
- Max Value: 65535
- Min Value: 0
- Buttons: OK, Cancel

- Refer Device:** specifies the VFD communication port.
- Direction Setting:** specifies the direction: **From Bottom to Top**, **From Top to Bottom**, **From Left to Right** or **From Right to Left**.
- Value Length:** determines the range of the maximum value and minimum value.
- Max Value and Min Value:** specifies the maximum value and minimum value. A value smaller than or equal to the minimum value causes the bar graph to be blank (0). A value is bigger or equal to the maximum value causes the bar graph is full (100%). A value between the minimum and maximum values causes the bar graph to be filled proportionally.

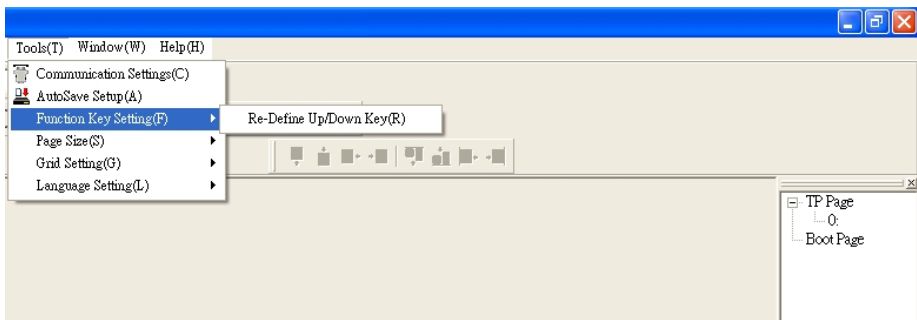
- Button setting. On the toolbar, click . Currently this function only allows the keypad to switch pages; other functions are not yet available (including text input and insert image). In the blank page, double-click  to open the **Button Setting** window.



Button Type: specifies the button's functions. **Page Jump** and **Constant Setting** are the only functions currently supported.

a. Page Jump Setting

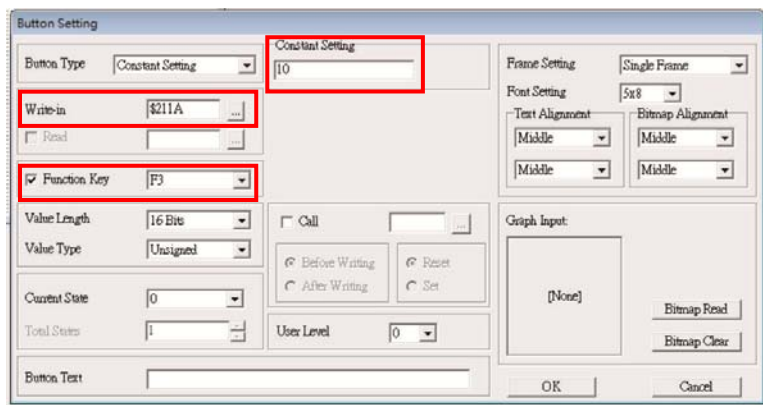
- Page Jump Setting:** in the **Button Type** drop-down list, choose **Page Jump** to show the **Page Jump Setting**.
- Function Key:** specifies the functions for the following keys on the KPC-CC01 keypad: F1, F2, F3, F4, Up, Down, Left and Right. Note that the Up and Down keys are locked by TPEditor. You cannot program these two keys. If you want to program Up and Down keys, on the **Tool** menu, click **Function Key Settings**, and then click **Re-Define Up/Down Key**.




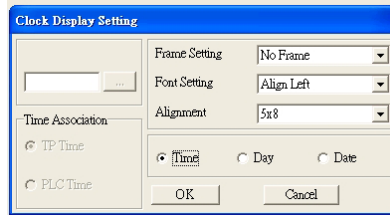
- Button Text:** specifies the text that appears on a button. For example, when you enter Next Page for the button text, that text appears on the button.


b. Constant Setting

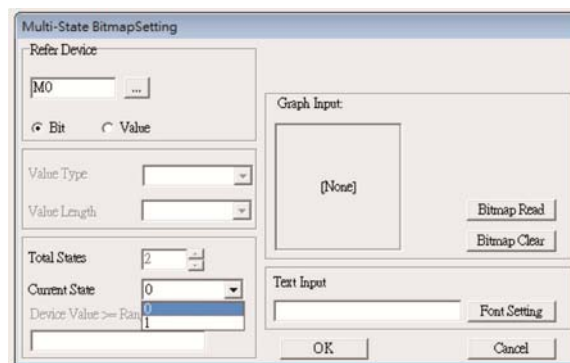
This function specifies the memory address' values for the VFD or PLC. When you press the **Function key**, it writes a value to the memory address specified by the value for **Constant Setting**. You can use this function to initialize a variable.




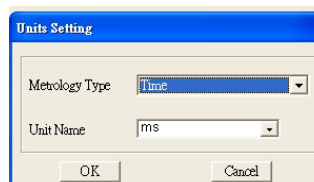
7. Clock Display Setting: on the toolbar, click . You can display the time, day, or date on the keypad. Open a new page and click once in that window to add a clock display. Choose to display **Time**, **Day**, or **Date** on the keypad. To adjust time, go to Time Setup on the keypad's menu. You can also specify the **Frame Setting**, **Font Setting**, and **Alignment**.




8. Multi-state bitmap: on the toolbar, click . Open a new page and click once in that window to add a Multi-state bitmap. This object reads a bit's property value from the PLC. It defines the image or text that appears when this bit is 0 or 1. Set the initial status (**Current State**) to be 0 or 1 to define the displayed image or text.

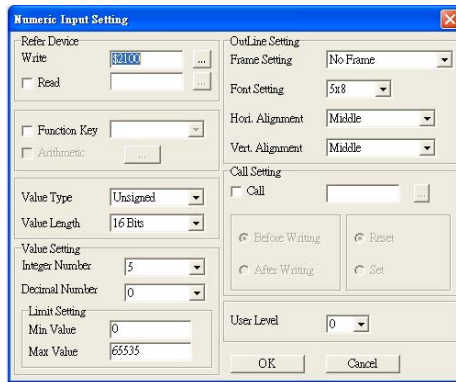


9. Unit Measurement: on the toolbar, click . Open a new blank page, and double-click on that window to display the **Units Setting** dialog box.



Choose the **Metrology Type** and the **Unit Name**. For **Metrology**, the choices are Length, Square Measure, Volume/Solid Measure, Weight, Speed, Time, and Temperature. The unit name changes automatically when you change metrology type.

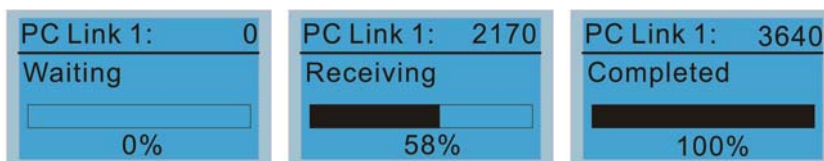
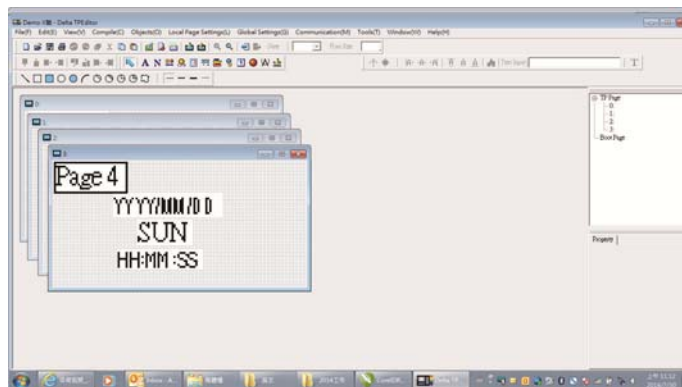
10. Numeric Input Setting: on the toolbar, click . This object allows you to provide parameters or communication ports and to input numbers. Open a new file and double-click on that window to display the **Numeric Input Setting** dialog box.



- a. **Refer Device**: specifies the **Write** and the **Read** values. Enter the numbers to display and the corresponding parameter and communication port numbers. For example, enter 012C to Read and Write Parameter Pr.01-44.
- b. **OutLine Setting**: specifies the **Frame Setting**, **Font Setting**, **Hori. Alignment**, and **Vert. Alignment** for the outline.
- c. **Function Key**: specifies the function key to program on the keypad in the **Function Key** box. The corresponding key on the keypad starts to blink. Press ENTER to confirm the setting.
- d. **Value Type** and **Value Length**: specify the range of the **Min Value** and **Max Value** for the **Limit Setting**. Note that the corresponding supporting values for VFD-ED must be 16 bits. 32 bit values are not supported.
- e. **Value Setting**: automatically set by the keypad itself.
- f. **Limit Setting**: specifies the range for the numeric input here.

For example, if you set **Function Key** to **F1**, **Min Value** to 0 and **Max Value** to 4, when you press F1 on the keypad, then you can press Up/Down on the keypad to increase or decrease the value. Press ENTER on the keypad to confirm your setting. You can also view the parameter table for Pr.01-44 to verify if you correctly entered the value.

11. Download the TP Page
 Press Up or Down on the keypad to select “PC Link” in the Menu. Then press ENTER on the keypad. The screen displays “Waiting”. In TPEditor, choose a page that you have created, and then on the **Communication** menu click **Write to TP** to start downloading the page to the keypad. Then, the keypad displays “Receiving”. When you see “Completed” on the keypad screen, the download is finished. You can then press ESC on the keypad to go back to the menu screen.



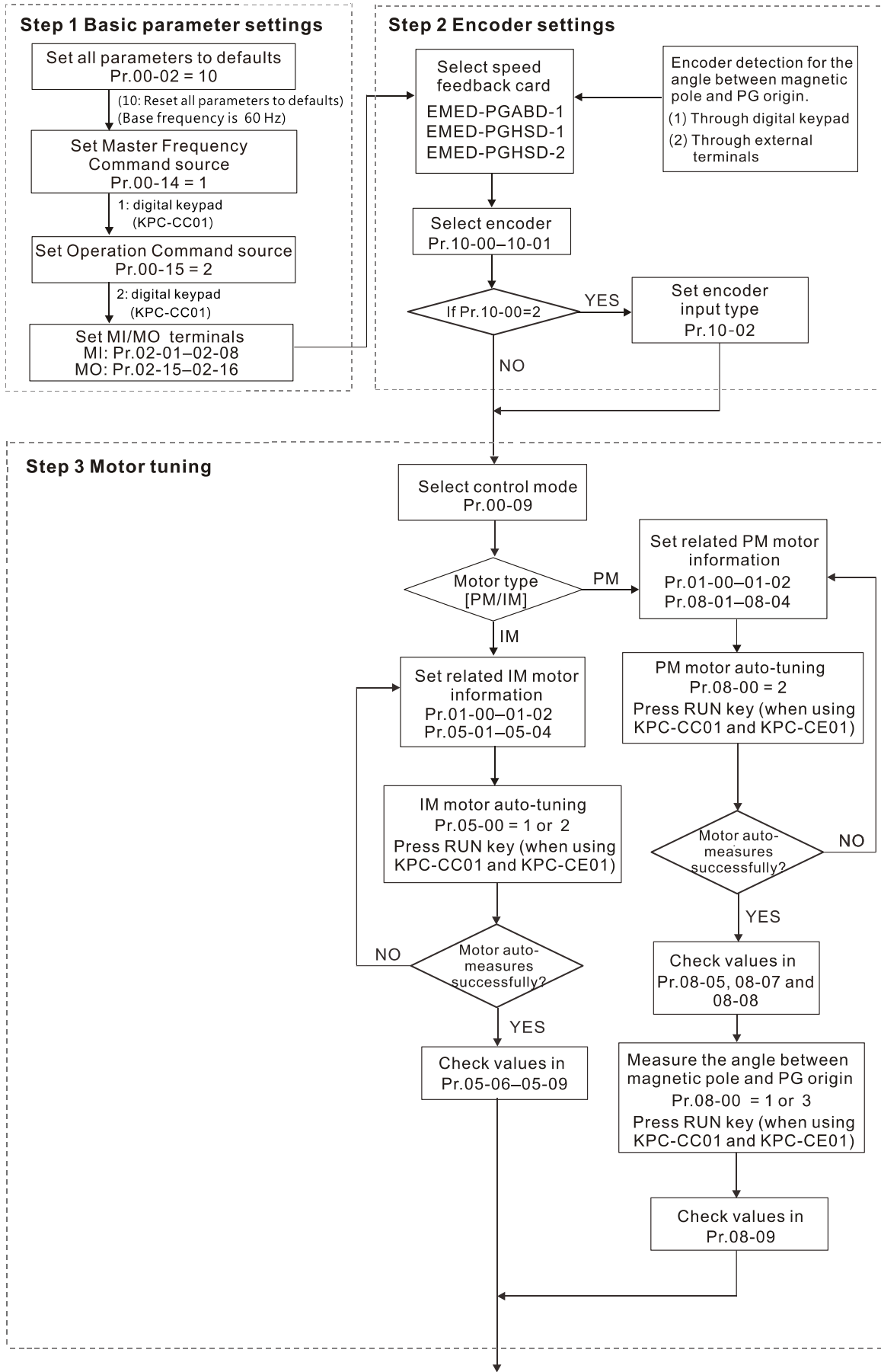
Chapter 10 Auto-tuning Process

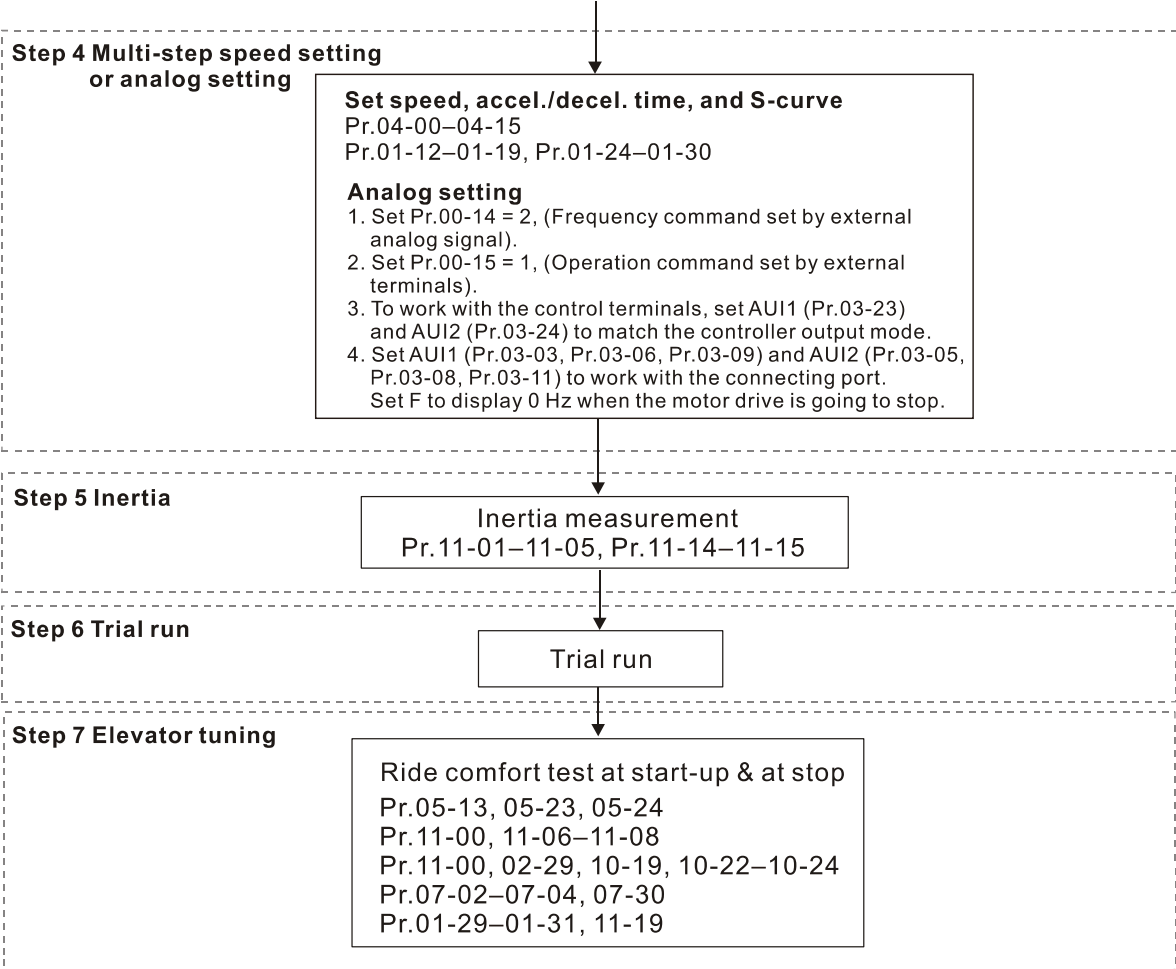
10-1 Auto-tuning Flow Chart

10-2 Explanations for the Auto-tuning Steps

10-3 Elevator Performance Fine-tuning

10-1 Auto-tuning Flow Chart





10-2 Explanations for the Auto-tuning Steps

Step 1

Basic Parameter Settings

- Make sure that Pr.00-00 (AC motor drive identity code) matches with the nameplate on the AC motor drive.
- Reset all parameters to default (set Pr.00-02 to 9 or 10).

Pr.00-02	0: No function
Parameter	1: Read only
Reset	5: Direct docking mode only, contact Delta for more information. ◆
	8: Keypad locked
	9: Reset all parameters to defaults (base frequency = 50 Hz)
	10: Reset all parameters to defaults (base frequency = 60 Hz)

- Master Frequency Command Source: User-defined. (Pr.00-14)

Pr.00-14	1: RS-485 serial communication or digital keypad (KPC-CC01)
Master	2: External analog input (Pr.03-00)
Frequency	3: Digital terminal inputs (Pr.04-00–Pr.04-15)
Command	4: Direct docking mode only, contact Delta for more information. ◆
Source	

- Operation Command Source: User-defined. (Pr.00-15)

Pr.00-15	1: External terminals
Operation	
Command	2: RS-485 serial communication or digital keypad (KPC-CC01)
Source	

- MI/MO External Terminal Settings

Refer to Pr.02-01–Pr.02-08 for the external input terminals MI1–MI8 settings.

NOTE: The default for Pr.02-08 is 40 (Enable drive function).

Disable this function if you do not need to use it.

Pr.02-01–	0: No function
Pr.02-08	1: Multi-step speed command 1
Settings	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 and second acceleration/deceleration time
	9: Third and fourth acceleration/deceleration time
	10: EF input (Pr.07-28)
	11: Reserved
	12: Stop output
	13–14: Reserved
	15: AUI1 operation speed command
	16: Reserved
	17: AUI2 operation speed command
	18: Emergency stop (Pr.07-28)
	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.07-21)
 32: Middle torque bias (according to Pr.07-22)
 33: Low torque bias (according to Pr.07-23)
 34–37: Reserved
 38: Disable writing to EEPROM function
 39: Torque command direction
 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, contact Delta for more information. ◆
 53: Terminal signal for direct docking
 54: Power failure signal
 55: Manual emergency deceleration
 56: Automatic emergency deceleration

Refer to Pr.02-15 and Pr.02-16 for the settings for MO1–MO2

Pr.02-15– Pr.02-16 Settings	0: No function 1: Operation indication 2: Operation speed reached 3: Desired frequency 1 reached (Pr.02-25, Pr.02-26) 4: Desired frequency 2 reached (Pr.02-27, Pr.02-28) 5: Zero speed (Frequency command) 6: Zero speed with stop (Frequency command) 7: Over-torque (OT1) (Pr.06-05–06-07) 8: Over-torque (OT2) (Pr.06-08–06-10) 9: Drive ready 10: User-defined low-voltage detection (LV) 11: Malfunction indication 12: Mechanical brake release (Pr.02-29, Pr.02-30, Pr.02-37) 13: Overheat (Pr.06-14) 14: Brake chopper signal 15: Motor-controlled magnetic contactor output 16: Slip error (oSL) 17: Malfunction indication 1 18: Reserved 19: Brake chopper output error 20: Warning output 21: Over-voltage warning 22: Over-current stall prevention warning 23: Over-voltage stall prevention warning 24: Operation mode indication (Pr.00-15=1) 25: Forward command 26: Reverse command 27: Output when current \geq Pr.02-33 28: Output when current $<$ Pr.02-33 29: Output when frequency \geq Pr.02-34 30: Output when frequency $<$ Pr.02-34 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 selection 1 (Pr.06-22) 36: Fault output selection 2 (Pr.06-23) 37: Fault output selection 3 (Pr.06-24) 38: Fault output selection 4 (Pr.06-25) 39: Reserved 40: Speed reached (including zero speed)
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	<p>41: Reserved 42: STO output error 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 star-delta contactor 49: Emergency power mode action</p>
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Step 2

Encoder Settings

■ Speed feedback card selections

Refer to CH07 Speed Feedback Card Selection. Delta provides three kinds of PG cards including EMED-PGABD-1, EMED-PGHSD-1, EMED-PGHSD-2.

Pr.10-00	0: Disable
Selection of Encoder	1: ABZ
	2: ABZ+Hall
	3: SIN/COS + Sinusoidal
	4: SIN/COS + Endat
	5: SIN/COS
	6: SIN/COS + Hiperface

■ Encoder input type settings: Pr.10-01–Pr.10-02

Detection of the motor magnetic pole position

The detection method is different according to the setting for Pr.10-00 (Selection of Encoder).

The detection methods: (refer to detailed parameter descriptions for Pr.10-00)

- (1) 1 or 5: The AC motor 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 AC motor drive detects the position of the magnetic pole with the UVW encoder signal.
- (3) 3: The AC motor drive detects the position of the magnetic pole with the sine encoder signal.
- (4) 4 or 6: The AC motor drive detects the position of the magnetic pole with the communication encoder signal.

Encoder defines the number of pulses per revolution.

Pr.10-01	1–25000
Encoder Pulse	

Encoder Input Type Setting. This parameter is normally set to 1. If the motor does not run with the parameter set to 1, change it to 2.

Pr.10-02	0: Disable
Encoder Input Type Setting	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
	3: Phase A is a pulse input and phase B is a direction input (low input = reverse direction, high input = forward direction).
	4: Phase A is a pulse input and phase B is a direction input (low input = forward direction, high input = reverse direction).
	5: Single-phase input

Step 3

Motor Tuning

- Set the parameters according to the motor type (PM or IM).
1. Motor auto-tuning: Set the Operation Command source to the digital keypad (Pr.00-15 = 2, refer to step 1 above)

- Control method selections: Set Pr.00-09 to 8 when using PM motors.

Pr.00-09	0: V/F control (V/F)
Control Method	1: V/F control + Encoder (VFPG)
	2: Sensorless Vector Control (SVC)
	3: FOC vector control + Encoder (FOCPG)
	8: FOC Permanent Motor control (FOCPM)

NOTE: Set the parameter according to the motor type (PM or IM).

2. Enter the motor nameplate information into Pr.01-00–Pr.01-02

Pr.01-00	10.00–400.00 Hz
Maximum Output Frequency	

Pr.01-01	0.00–400.00 Hz
First Output Frequency Setting (base frequency/ motor's rated frequency)	

Pr.01-02	230V series: 0.1–255.0 V
First Output Voltage Setting (base voltage/ motor's rated voltage)	460V series: 0.1–510.0 V

【IM (Induction Motor)】

3. Motor auto-tuning: If the Operation Command source is set to the digital keypad (Pr.00-15 = 2, refer to step 1 above), set Pr.05-00 = 2.

Pr.05-00	0: No function
Motor Auto-tuning	1: Dynamic test (Rs, Rr, Lm, Lx, no-load current) (Motor runs)
	2: Static test (Motor does not run)

NOTE 1: You do not need to release the brake in this auto-tuning operation. Make sure that the electromagnetic valve is ON when it is installed between the AC motor drive and the motor. When Pr.05-00 is set to 2, you must enter the motor no-load current in Pr.05-05. The digital keypad displays the warning message “Auto tuning” during auto-tuning until it is finished. Finally, it saves the measured results in Pr.05-06–Pr.05-09.

NOTE 2: Dynamic test can also apply for IM auto-tuning.

Pr.05-01	(40–120%)*Pr.00-01 Amps
Motor Full-load Current	

Pr.05-02 Motor Rated Power	0.00–655.35 kW
Pr.05-03 Motor Rated Speed (rpm)	0–65535
Pr.05-04 Number of Motor Poles	2–48

【PM (Permanent Magnet Motor)】





4. Motor Auto-tuning: If the Operation Command source is set to the digital keypad (Pr.00-15 = 2, refer to step 1 above), set Pr.08-00 = 2.

Pr.08-00 Motor Auto-tuning	<p>0: No function</p> <p>1: Only for an unloaded motor, auto-measures the angle between magnetic pole and PG origin (Pr.08-09)</p> <p>2: For PM parameters (suggested to lock the brake)</p> <p>3: Auto-measures the angle between the magnetic pole and the PG origin (Pr.08-09)</p>
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NOTE 1: You do not need to release the brake in this auto-tuning operation. Make sure that the electromagnetic valve is ON when it is installed between the AC motor drive and the motor. The digital keypad displays the warning message “Auto tuning” during auto-tuning until it is finished. Finally, it saves the measured results in Pr.08-05, Pr.08-07 and Pr.08-08. Pr.08-05 is Motor Rs, Pr.08-07 is Motor Lq and Pr.08-08 is Back Electromotive Force.


NOTE 2: It is recommended that you set Pr.08-00 to 1 (unloaded motor) for the most accurate calculation. If you must run auto-tuning with a loaded motor, balance the carriage before execution.

When Pr.08-00 = 1, note the following:

-  When executing auto-measurement of the angle between the magnetic pole and the PG origin, stop the carriage at the middle level.
-  Make sure that the electromagnetic valve and mechanical brake are OFF before executing this function.
-  When Pr.08-00 = 1, execute this function with the motor unloaded for the most accurate result. If you must run auto-tuning with a loaded motor, balance the carriage before execution.
-  Ensure the balance by releasing the brake manually before running. This balance affects the accuracy that influences the power efficiency in driving the motor.

NOTE 3: If you are unable to balance the carriage in the measuring environment, set Pr.08-00 to 3 when you execute this function. This setting does not require an unloaded motor. However, it has a difference of 15–30° for the different encoder types.

-  When you set Pr.08-00 to 3, the motor drive executes the function according to the Pr.10-00 setting. The difference between Pr.08-00 = 3 and Pr.08-00 = 1 is that it does not need to balance the carriage when Pr.08-00 = 3. In addition, the motor operation status is shown in the above table (When Pr.10-00=1, 2, 3 and 5, the motor runs. When Pr.10-00=4 and 6, the motor does not run).

 When Pr.08-00=3, make sure that Pr.10-02 Encoder Input Type is set correctly. The incorrect setting results in the wrong magnetic pole position and makes the wrong angle between magnetic pole and PG origin (Pr.08-09).

NOTE 4: The digital keypad displays the warning message “Auto tuning” during auto-tuning until it is finished. Finally, it saves the measured result in Pr.08-09.

NOTE 5: If the digital keypad displays the warning message “Auto Tuning Err” during auto-tuning due to an abnormal drive or human error, check if the wiring is correct. When the digital keypad displays the warning message “PG Fbk Error”, change the setting in Pr.10-02 (for example: if it was set to 1, change it to 2). When the digital keypad displays the warning message “PG Fbk Loss”, check if the Z-phase pulse feedback is normal.

Pr.08-01 Motor Full-load Current	(40–120%) * Pr.00-01 Amps
Pr.08-02 Motor Rated Power	0.00–655.35 kW
Pr.08-03 Motor Rated Speed (rpm)	0–65535 rpm
Pr.08-04 Number of Motor Poles	2–96

■ Measure the angle between the magnetic pole and the PG origin

To execute “RUN” from the digital keypad or external terminals:

1. Using the digital keypad:
Set Pr.08-00 = 1 and press RUN key to execute “auto-measure the angle between magnetic pole and PG origin”. Note that you must manually release the electromagnetic valve and brake if they are not controlled by the AC motor drive.
2. Using external terminals:
Set Pr.00-14 = 3 (Frequency command source)
Set Pr.00-15 = 1 (Operation command source)
Use the “Inspection” function to execute “auto-measure the angle between magnetic pole and PG origin”.

An IM motor does not need the position of the magnetic pole so you do not need to execute this function (auto-measure the angle between the magnetic pole and the PG origin).

Measure the angle between the magnetic pole and the PG origin: Pr.08-00 = 1 or 3

Pr.08-00 Motor Auto-tuning	0: No function
	1: Only for an unloaded motor, auto-measures the angle between the magnetic pole and the PG origin (Pr.08-09)
	2: For PM parameters (suggested to lock the brake)
	3: Auto-measures the angle between the magnetic pole and the PG origin (Pr.08-09)

NOTE 1: You must finish motor auto-tuning before you can execute the “auto-measure the angle between the magnetic pole and the PG origin” function.

NOTE 2: Measure twice, and the angle tolerance between two times must be $\pm 5^\circ$.

Step 4

Multi-step Speed Setting or Analog Setting (Do not wire the two settings at the same time)

A. Multi-step speed settings

- Confirm the total number of speed steps (high speed, middle speed, low speed, creep, inspection and level auto-learning)
- Make sure that the step speed settings and the corresponding terminal actions for the multi-function input commands (MI1–MI4) are correct.
- Set the multi-step speeds in Pr.04-00–Pr.04-15

Pr.04-00–Pr.04-15 settings	Zero Step Speed Frequency	0.00–400.00 Hz
	1st Step Speed Frequency	0.00–400.00 Hz
	2nd Step Speed Frequency	0.00–400.00 Hz
	3rd Step Speed Frequency	0.00–400.00 Hz
	4th Step Speed Frequency	0.00–400.00 Hz
	5th Step Speed Frequency	0.00–400.00 Hz
	6th Step Speed Frequency	0.00–400.00 Hz
	7th Step Speed Frequency	0.00–400.00 Hz
	8th Step Speed Frequency	0.00–400.00 Hz
	9th Step Speed Frequency	0.00–400.00 Hz
	10th Step Speed Frequency	0.00–400.00 Hz
	11th Step Speed Frequency	0.00–400.00 Hz
	12th Step Speed Frequency	0.00–400.00 Hz
	13th Step Speed Frequency	0.00–400.00 Hz
	14th Step Speed Frequency	0.00–400.00 Hz
15th Step Speed Frequency	0.00–400.00 Hz	

NOTE: It is recommended that you set the high speed frequency to the half of the maximum operating frequency before confirming each step speed setting and the corresponding terminal actions for the multi-function input commands.

- Ensure the speed steps, and use with Pr.01-23 and the multi-function input commands (Pr.02-01–Pr.02-08) setting #8 (first and second acceleration/deceleration time) and setting #9 (third and fourth acceleration/deceleration time).
- Set the acceleration/deceleration time: Pr.01-12–Pr.01-19.

Pr.01-12–Pr.01-19 settings	Acceleration Time 1	0.00–600.00 sec.
	Deceleration Time 1	0.00–600.00 sec.
	Acceleration Time 2	0.00–600.00 sec.
	Deceleration Time 2	0.00–600.00 sec.
	Acceleration Time 3	0.00–600.00 sec.
	Deceleration Time 3	0.00–600.00 sec.
	Acceleration Time 4	0.00–600.00 sec.
	Deceleration Time 4	0.00–600.00 sec.

NOTE: It is recommended that you set Pr.01-31 (Deceleration Time when Operating without RUN Command) to the smallest value for the trial run to ensure that all the actions are correct, and then increase it for the ride comfort test.

■ S-curve setting: Pr.01-24–Pr.01-30

Pr.01-24–Pr.01-30 settings	S-curve for Acceleration Begin Time S1	0.00–25.00 sec.
	S-curve for Acceleration Arrival Time S2	0.00–25.00 sec.
	S-curve for Deceleration Begin Time S3	0.00–25.00 sec.
	S-curve for Deceleration Arrival Time S4	0.00–25.00 sec.
	Mode Selection when Frequency < Fmin	0: Output waiting 1: Zero-speed operation 2: Fmin (fourth output frequency setting)
	Switch Frequency for S3/S4 Changes to S5	0.00–400.00 Hz
	S-curve for Deceleration Arrival Time S5	0.00–25.00 sec.

NOTE: It is recommended that you set the S-curve time to 0 for the trial run to ensure that all the actions are correct, and then increase it for the ride comfort test.

B. Analog setting

1. Set Pr.00-14 = 2, (Frequency command set by external analog signal).
2. Set Pr.00-15 = 1, (Operation command set by external terminals).
3. To work with the control terminals, set AUI1 (Pr.03-23) and AUI2 (Pr.03-24) to match the controller output mode.
4. Set AUI1 (Pr.03-03, Pr.03-06, Pr.03-09) and AUI2 (Pr.03-05, Pr.03-08, Pr.03-11) to work with the connecting port. Set F to display 0 Hz when the motor drive is going to stop.

Step 5

Inertia

For a synchronous motor, set Pr.11-05 = 40%; for an asynchronous motor, set Pr.11-05 = 80%.

Pr.11-05	1–300%
Inertial Ratio	

Inertia reference value (%)

Load/Motor		IM	PM
No-load		40	10
With load		80–120	40

Step 6

Trial Run

Use the trial run after you complete Step 1 to Step 5 above to check if the motor runs normally after executing the inspection with a loaded motor. At the same time, check if the multi-function output terminal operations are correct (such as whether the action of the brake release and electromagnetic valve match the host controller).

Also check the speed, current value, and check for noise in the carriage and other noise sources when switching between each step.

Step 7**Elevator Tuning**

(1) Enable slip compensation (VF, SVC)

0: Disable; > 0: Enable.

Set Pr.05-13, Pr.05-23, Pr.05-24

Pr.05-13	0.00–10.00
Slip Compensation Gain	

Pr.05-23	0.0–100.0%
Slip Compensation Gain % (Power Generation Mode)	

Pr.05-24	0.0–100.0%
Slip Compensation Gain % (Electricity Mode)	

NOTE 1: In V/F mode, you do not need to set Pr.05-13. Set Pr.05-23 and Pr.05-24 directly according to the compensation requirements for power generation mode and electricity mode.

NOTE 2: In SVC mode, you must set Pr.05-13 first, and then set Pr.05-23 and Pr.05-24 according to the compensation requirements for power generation mode and electricity mode.

(2) Comfort adjustment for normal operation (FOCPG, FOCPM)

■ PDFF enabled

Set Pr.11-00, Pr.11-06, Pr.11-07, Pr.11-08

Pr.11-00	Bit 0 = 0: No function Bit 0 = 1: ASR auto-tuning, enable PDFF
System	Bit 7 = 0: No function Bit 7 = 1: Zero speed position control is enabled
Control	Bit 9 = 0: Dynamic PG origin auto-tuning with load (support by PGHSD-1) Bit 9 = 1: Static PG origin auto-tuning with load by enabling PGHSD-1 Bit 15 = 0: Detect the position of magnetic pole again when power is applied Bit 15 = 1: Start from the magnetic pole position of the previous power failure when power is applied

Fine-tune Pr.11-06, Pr.11-07, and Pr.11-08 to make a comfortable ride (jerk free and smooth)

Pr.11-06–	Zero speed Bandwidth	1–40 Hz
Pr.11-08	Low speed Bandwidth	1–40 Hz
Settings	High speed Bandwidth	1–40 Hz

(3) Start-up adjustment (FOCPM)

■ Control by the zero speed position

Set Pr.11-00, Pr.10-19, Pr.10-22, Pr.10-23, Pr.02-29 and Pr.10-24

Pr.11-00	Bit 0 = 0: No function Bit 0 = 1: ASR auto-tuning, enable PDFF.
System	Bit 7 = 0: No function Bit 7 = 1: Zero speed position control is enabled
control	Bit 9 = 0: Dynamic PG origin auto-tuning with load (support by PGHSD-1) Bit 9 = 1: Static PG origin auto-tuning with load by enabling PGHSD-1 Bit 15 = 0: Detect the position of magnetic pole again when power is applied

Bit 15 = 1: Start from the magnetic pole position of the previous power failure when power is applied

Pr.10-19	0.00–655.00%
Zero Speed Position Control Gain (P)	

NOTE: Refer to detailed parameter descriptions for Pr.02-32.

Pr.10-22	0.001–65.535 sec.
Zero Speed Position Control Holding Time	

Pr.10-23	0.001–65.535 sec.
Zero Speed Position Control Low Pass Filter Time	

Pr.10-24	0: After the brake release set in Pr.02-29
Zero Speed Position Control Activation Mode Selection	
	1: After the brake signal input (Pr.02-01–Pr.02-08 is set to 42)

Pr.02-29	0.000–65.000 sec.
Brake Release Delay Time when Elevator Starts	

NOTE: When Pr.10-24 = 0, you must use the zero speed position control with Pr.02-29 (refer to detailed parameter descriptions for Pr.02-32),

- Preload input function (This function is not for normal usage. Refer to the following settings if needed.)

Connect the preload signal to the AC motor drive external terminal (AUI1).

Set Pr.03-00 = 3, Pr.07-19 = 1, Pr.03-03, Pr.03-06 and Pr.03-09.

Pr.03-00	0: No function
Analog Input 1 (AUI1)	
	1: Frequency command (speed limit under torque control mode)
	2: Torque command (torque limit under speed mode)
	3: Preload input
	4–5: Reserved
	6: P.T.C. thermistor input value
	7: Positive torque limit
	8: Negative torque limit
	9: Regenerative torque limit
	10: Positive/negative torque limit

Pr.07-19 Torque Offset Source	0: Disable 1: Analog input (Pr.03-00) 2: Torque offset setting (Pr.07-20) 3: Control through external terminals (by Pr.07-21–Pr.07-23)
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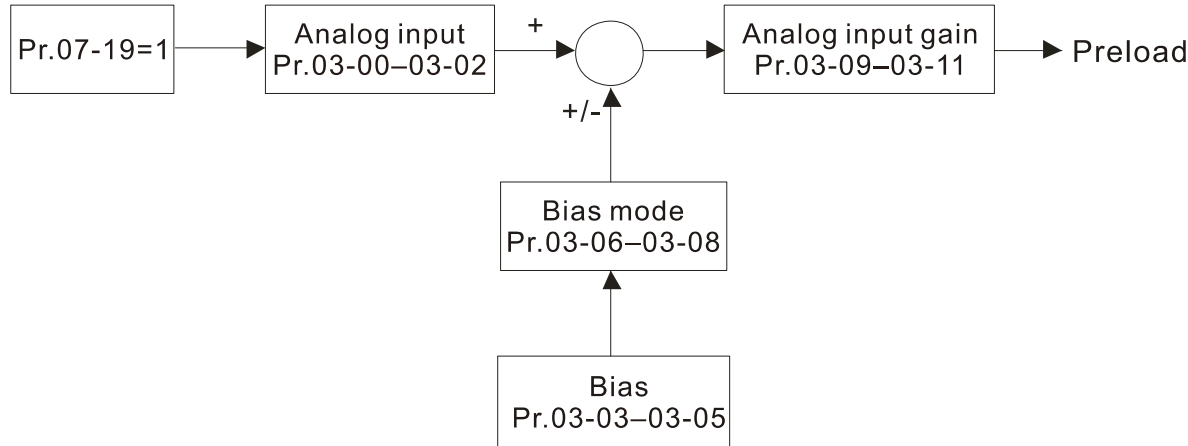
Pr.03-03 Analog Input Bias 1 (AUI1)	-100.0–100.0%
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Pr.03-06 Positive/negative Bias Mode (AUI1)	0: Zero bias 1: Lower than or equal to bias 2: Higher than or equal to bias 3: Using bias as the base to get the absolute value of bias voltage (unipolar) 4: Using bias as the base (unipolar)
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Pr.03-09 Analog Input Gain 1 (AUI1)	0.0–500.0%
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NOTE: Use Pr.03-03, Pr.03-06 and Pr.03-09 to adjust the analog input signal.

Pr.07-19: Torque Offset Source
 Pr.03-00–03-02: Analog input selections (AUI1/AUI2)
 Pr.03-03–03-05: Analog input bias (AUI1/AUI2)
 Pr.03-06–03-08: AUI1/AUI2 bias mode



(4) DC brake adjustment

Set Pr.07-02, Pr.07-03, Pr.07-04, Pr.07-30

Pr.07-02	0–100% (motor drive rated current)
DC Brake Current Level at Start-up (VF, VFPG, SVC)	

Pr.07-03	0.0–60.00 sec.
DC Brake Activation Time	

Pr.07-30	0–100% (motor drive rated current)
DC Brake Current Level at Stop (VF, VFPG, SVC)	

Pr.07-04	0.0–60.00 sec.
DC Brake Stopping Time	

(5) Set drive stop

Set Pr.01-29, Pr.01-30, Pr.01-31 and Pr.11-19

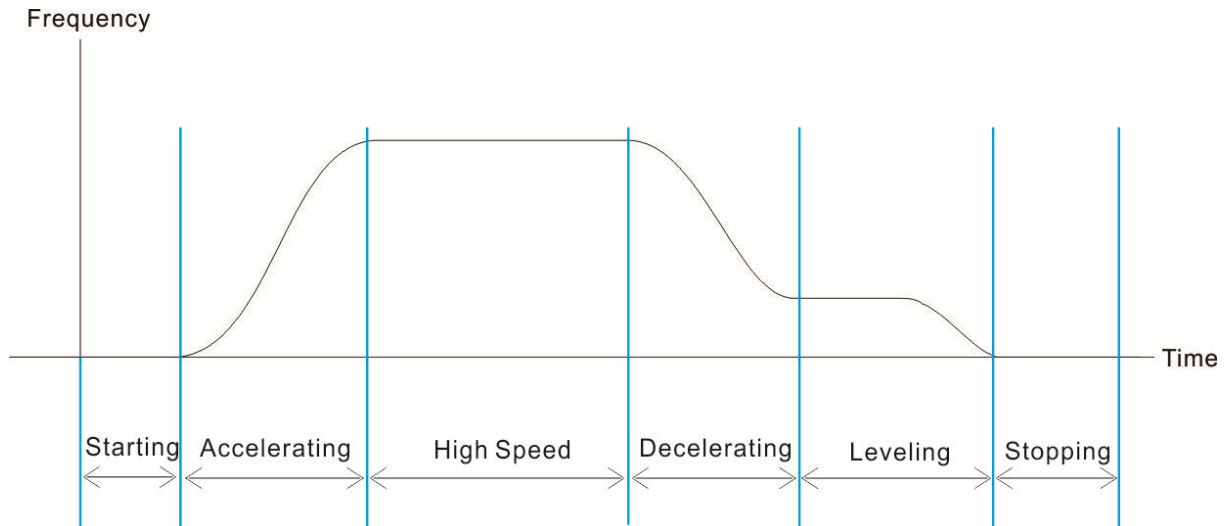
Pr.01-29	0.00–400.00 Hz
Switch Frequency for S3/S4 Changes to S5	

Pr.01-30	0.00–25.00 sec.
S-curve for Deceleration Arrival Time S5	

Pr.11-19	1–40 Hz
Zero Speed Parking Bandwidth	

Pr.01-31	0.00–600.00 sec.
Deceleration Time when Operating without RUN Command	

10-3 Elevator Performance Fine-tuning



Stage	Function	Pr.	Explanation	Settings	Default
Starting	Delay Time	02-31	Magnetic Contactor Contracting Delay Time between Drive and Motor	0.010–65.000 sec.	0.200
		02-29	Brake Release Delay Time when Elevator Starts	0.000–65.000 sec.	0.250
	Start-up Adjustment	01-04	Second Output Voltage Setting (VF)	230V series: 0.1–255.0 V 460V series: 0.1–510.0 V	5.0 10.0
		01-06	Third Output Voltage Setting (VF)	230V series: 0.1–255.0 V 460V series: 0.1–510.0 V	5.0 10.0
		01-08	Fourth Output Voltage Setting (VF, SVC)	230V series: 0.1–255.0 V 460V series: 0.1–510.0 V	5.0 10.0
		11-00	System Control (FOCPM)	Bit 7 = 1: Zero speed position control is enabled	0000h
		10-19	Zero Speed Position Control Gain (P) (FOCPM)	0.00–655.00%	80.00
		10-22	Zero Speed Position Control Holding Time (FOCPM)	0.001–65.535 sec.	0.250
		10-23	Zero Speed Position Control Low Pass Filter Time (FOCPM)	0.001–65.535 sec.	0.004
		10-24	Zero Speed Position Control Activation Mode Selection (FOCPM)	0: After the brake release set in Pr.02-29 1: After the brake signal input (Pr.02-01–Pr.02-08 is set to 42)	0
		Torque Check	02-33	External Terminal Output Current Level	0–100% (motor drive rated current)

Stage	Function	Pr.	Explanation	Settings	Default
	DC Brake	02-37	Torque Check	0: Disable 1: Enable	0
		07-02	DC Brake Current Level at Start-up	0–100% (motor drive rated current)	0
		07-03	DC Brake Activation Time	0.0–60.0 sec.	0.7
Accelerating	Multi-step Speed	01-12	Accel. Time 1	0.00–600.00 sec.	3.00
		01-24	S-curve for Acceleration Begin Time S1	0.00–25.00 sec.	1.00
		01-25	S-curve for Acceleration Arrival Time S2	0.00–25.00 sec.	1.00
Decelerating	Multi-step Speed	01-13	Decel. Time 1	0.00–600.00 sec.	2.00
		01-26	S-curve for Deceleration Begin Time S3	0.00–25.00 sec.	1.00
		01-27	S-curve for Deceleration Arrival Time S4	0.00–25.00 sec.	1.00
Leveling	Elevator Parking	01-29	Switch Frequency for S3/S4 Changes to S5	0.00–400.00Hz	0.00
		01-30	S-curve for Deceleration Arrival Time S5	0.00–25.00 sec.	1.00
		11-19	Zero Speed Parking Bandwidth (FOCPG, FOCPM)	1–40Hz	10
		01-31	Deceleration Time when Operating without RUN Command	0.00–600.00 sec.	2.00
Stopping	Delay Time	02-30	Brake Engage Delay Time when Elevator Stops	0.000–65.000 sec.	0.250
		02-32	Magnetic Contactor Release Delay Time between Drive and Motor	0.010–65.000 sec.	0.200
	Torque Check	02-33	External Terminal Output Current Level	0–100% (motor drive rated current)	0
		02-37	Torque Check	0: Disable 1: Enable	0
	DC Brake	07-30	DC Brake Current Level at Stop	0–100% (motor drive rated current)	0
		07-04	DC Brake Stopping Time	0.0–60.0 sec.	0.7

Chapter 11 Summary of Parameter Settings


This chapter provides a summary of parameter settings including the ranges, defaults, and sets parameters. You can set, change, and reset the parameters with the digital keypad.

NOTE

- 1) \swarrow : Indicates a parameter that you can set during operation.
- 2) For more details on parameters, refer to Chapter 12 Descriptions of Parameter Settings.
- 3) \blacklozenge indicates that the parameters or the setting values only apply on the Direct Docking Mode. The actual functions of each elevator controller vary from one to another. For more information, contact Delta.
- 4) The parameters described in this user manual are designed for multi-speed mode. The defaults for direct docking mode are different from the defaults described in this user manual. If you need to use the direct docking mode, contact Delta for more information.

00 Drive Parameters

\swarrow : You can set this parameter during operation.

 NOTE IM: Induction Motor; PM: Permanent Magnet Motor

Pr.	Explanation	Setting Range	Default	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM
				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
00-00	AC Motor Drive Identity Code	108: 220 V, 3 HP (single-phase) 110: 220 V, 5 HP (single-phase) 8: 230V, 3 HP 10: 230V, 5 HP 11: 460V, 5 HP (4.0 kW) 12: 230V, 7.5 HP 13: 460V, 7.5 HP 14: 230V, 10 HP 15: 460V, 10 HP 16: 230V, 15 HP 17: 460V, 15 HP 18: 230V, 20 HP 19: 460V, 20 HP 20: 230V, 25 HP 21: 460V, 25 HP 22: 230V, 30 HP 23: 460V, 30 HP 24: 230V, 40 HP 25: 460V, 40 HP 26: 230V, 50 HP 27: 460V, 50 HP 29: 460V, 60 HP 31: 460V, 75 HP 33: 460V, 100 HP	Read Only	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
00-01	AC Motor Drive Rated Current Display	Display by model	Read only	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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	00-02	Parameter Reset	<p>0: No function 1: Read only 5: Direct docking mode only ◆ 8: Keypad locked 9: Reset all parameters to defaults (base frequency is 50 Hz) 10: Reset all parameters to defaults (base frequency is 60 Hz)</p>	0	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
✓	00-03	Start-up Display	<p>0: Frequency command value 1: The actual output frequency 2: DC BUS voltage 3: Output current 4: Output voltage 5: User-defined (Pr.00-04)</p>	0	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
✓	00-04	Content of Multi-function Display	<p>0: Display output current (A) (Unit: Amps) 1: Reserved 2: Display the actual output frequency (H.) (Unit: Hz) 3: Display DC BUS voltage (v) (Unit: V_{DC}) 4: Display output voltage (E) (Unit: V_{AC}) 5: Display output power angle (n) (Unit: degree) 6: Display output power in kW (P) (Unit: kW) 7: Display the actual motor speed in rpm (r) (Unit: rpm) 8: Display estimated output torque in % (t) (Unit: %) 9: Display the PG feedback (G) (see Pr.10-00, Pr.10-01) (Unit: PLS) 10: Display the electrical angle of drive output (b) (Unit: %) 11: Display AUI1 in % (1.) (Unit: %) 12: Reserved 13: Display AUI2 in % (2.) (Unit: %) 14: Display the heat sink temperature in °C (c.) (Unit: °C). 15: Display the IGBT temperature in °C (c.) (Unit: °C). 16: Display digital input status (ON/OFF) (i) 17: Display digital output status (ON/OFF) (o) 18: Display multi-step speed (S) 19: The corresponding CPU digital input pin status (i.)</p>	0	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	

		20: The corresponding CPU digital output pin status (o.) 21–23: Reserved 24: Output AC voltage when malfunction occurred 25: Output DC voltage when malfunction occurred 26: Motor frequency when malfunction occurred 27: Output current when malfunction occurred 28: Output frequency when malfunction occurred 29: Frequency command when malfunction occurred 30: Output power when malfunction occurred 31: Output torque when malfunction occurred 32: Input terminal status when malfunction occurred 33: Output terminal status when malfunction occurred 34: Drive status when malfunction occurred 35: Display MI and MO status on digital keypad 36: CAN communication interference index 37: Multi-function display selection									
✓	00-05	User-Defined Coefficient K	Digit 4: number of decimal points (0–3) Digit 3–0: 40–9999	0	○	○	○	○	○	○	○
	00-06	Software Version	READ ONLY	#. #	○	○	○	○	○	○	○
✓	00-07	Password Input	1–9998, 10000–65535 0–2: number of wrong password attempts	0	○	○	○	○	○	○	○
✓	00-08	Password Set	1–9998, 10000–65535 0: No password set or successful input in Pr.00-07 1: Password has been set	0	○	○	○	○	○	○	○
	00-09	Control Method	0: V/F control (V/F) 1: V/F control + Encoder (VFPG) 2: Sensorless Vector Control (SVC) 3: FOC vector control + Encoder (FOCPG) 8: FOC Permanent Motor control (FOCPM)	0	○	○	○	○	○	○	○
✓	00-10	Speed Unit	0: Hz 1: m/s 2: ft/s 3: Direct docking mode only ◆	0	○	○	○	○	○	○	○
	00-11	Output Direction Selection	0: FWD: counterclockwise, REV: clockwise 1: FWD: clockwise, REV: counterclockwise	0	○	○	○	○	○	○	○
✓	00-12	Carrier Frequency	2–15 kHz	12	○	○	○	○	○	○	○
✓	00-13	Automatic Voltage	0: Enable AVR	0	○	○	○	○	○	○	○

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	Regulation (AVR) Function	1: Disable AVR 2: Disable AVR when deceleration stop							
↗	00-14 Master Frequency Command Source	1: RS-485 serial communication or digital keypad (KPC-CC01) 2: External analog input (Pr.03-00) 3: Digital terminal inputs (Pr.04-00–Pr.04-15) 4: Direct docking mode only ◆	1	○	○	○	○		○
↗	00-15 Operation Command Source	1: External terminals 2: RS-485 serial communication or digital keypad (KPC-CC01)	1	○	○	○	○	○	○

01 Basic Parameters

↗: You can set this parameter during operation.

Pr.	Explanation	Setting Range	Default	VF	VFP	SVC	FOCPG	TQCPG	FOCPM
01-00	Maximum Output Frequency	10.00–400.00 Hz	60.00/ 50.00	○	○	○	○	○	○
01-01	First Output Frequency Setting (base frequency / motor's rated frequency)	0.00–400.00 Hz	60.00/ 50.00	○	○	○	○	○	○
01-02	First Output Voltage Setting (base voltage/ motor's rated voltage)	230V series: 0.1–255.0 V 460V series: 0.1–510.0 V	220.0 440.0	○	○	○	○	○	○
01-03	Second Output Frequency Setting	0.00–400.00 Hz	0.50	○	○				
↗ 01-04	Second Output Voltage Setting	230V series: 0.1–255.0 V 460V series: 0.1–510.0 V	5.0 10.0	○	○				
01-05	Third Output Frequency Setting	0.00–400.00 Hz	0.50	○	○				
↗ 01-06	Third Output Voltage Setting	230V series: 0.1–255.0 V 460V series: 0.1–510.0 V	5.0 10.0	○	○				
01-07	Fourth Output Frequency Setting	0.00–400.00 Hz	0.00	○	○	○	○	○	
↗ 01-08	Fourth Output Voltage Setting	230V series: 0.1–255.0 V 460V series: 0.1–510.0 V	5.0 10.0	○	○				
01-09	Starting Frequency	0.00–400.00 Hz	0.50	○	○	○	○		
↗ 01-10	Output Frequency Upper Limit	0.00–400.00 Hz	120.00	○	○	○	○		○
↗ 01-11	Output Frequency Lower Limit	0.00–400.00 Hz	0.00	○	○	○	○		○
↗ 01-12	Accel. Time 1	0.00–600.00 sec.	3.00	○	○	○	○		○
↗ 01-13	Decel. Time 1	0.00–600.00 sec.	2.00	○	○	○	○		○
↗ 01-14	Accel. Time 2	0.00–600.00 sec.	3.00	○	○	○	○		○
↗ 01-15	Decel. Time 2	0.00–600.00 sec.	2.00	○	○	○	○		○
↗ 01-16	Accel. Time 3	0.00–600.00 sec.	3.00	○	○	○	○		○
↗ 01-17	Decel. Time 3	0.00–600.00 sec.	2.00	○	○	○	○		○
↗ 01-18	Accel. Time 4	0.00–600.00 sec.	3.00	○	○	○	○		○
↗ 01-19	Decel. Time 4	0.00–600.00 sec.	2.00	○	○	○	○		○
↗ 01-20	JOG Acceleration Time	0.00–600.00 sec.	1.00	○	○	○	○		○
↗ 01-21	JOG Deceleration Time	0.00–600.00 sec.	1.00	○	○	○	○		○
↗ 01-22	JOG Frequency	0.00–400.00 Hz	6.00	○	○	○	○	○	○
↗ 01-23	Switch Frequency between First and Fourth Accel./ Decel.	0.00–400.00 Hz	0.00	○	○	○	○		○
↗ 01-24	S-curve for Acceleration Begin Time S1	0.00–25.00 sec.	1.00	○	○	○	○		○
↗ 01-25	S-curve for Acceleration Arrival Time S2	0.00–25.00 sec.	1.00	○	○	○	○		○
↗ 01-26	S-curve for Deceleration Begin Time S3	0.00–25.00 sec.	1.00	○	○	○	○		○
↗ 01-27	S-curve for Deceleration Arrival Time S4	0.00–25.00 sec.	1.00	○	○	○	○		○
01-28	Mode Selection when Frequency < Fmin	0: Output waiting 1: Zero-speed operation 2: Fmin (fourth output frequency setting)	1	○	○	○			
↗ 01-29	Switch Frequency for S3/S4 Changes to S5	0.00–400.00 Hz	0.00	○	○	○	○		○
↗ 01-30	S-curve for Deceleration Arrival Time S5	0.00–25.00 sec.	1.00	○	○	○	○		○

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↗	01-31	Deceleration Time when Operating without RUN Command	0.00–600.00 sec.	2.00	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	01-32	Direct docking mode only ◆			<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	01-33	High Speed Time for Short Floor	0.00–60.00 sec.	3.00	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	01-34	Leveling Time for Short Floor	0.00–60.00 sec.	3.00	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	01-35	Limit for Direct Docking Terminal	0.00–10.00	2.00	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	01-36	Deceleration Distance for Direct Docking Terminal	0.00–100.00 cm	30.00	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	01-37	Deceleration Distance Reference for Short Floor	0.00–655.35 m	Read only	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	01-38	Short Floor/Direct Docking Terminal Enabled	0000h: Disabled 0001h: Short floor enabled 0002h: Direct docking terminal enabled 0003h: Short floor + direct docking terminal enabled	0000h	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	01-39	Automatic Emergency Deceleration Level	5.00–400.00 Hz	60.00	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
↗	01-40	Deceleration Time for Emergency Deceleration	0.00–600.00 sec.	2.00	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

02 Digital Input / Output Parameters

↗: You can set this parameter during operation.

Pr.	Explanation	Setting Range	Default	VF	VFG	SVC	FOCPG	TQCPG	FOCPM
02-00	Two-wire/three-wire Operation Control	0: FWD/STOP, REV/STOP 1: FWD/STOP, REV/STOP (Line Start Lockout) 2: RUN/STOP, REV/FWD 3: RUN/STOP, REV/FWD (Line Start Lockout) 4: Three-wire 5: Three-wire (Line Start Lockout)	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
02-01	Multi-Function Input Command 1 (MI1) (The Stop terminal for three-wire operation)	0: no function	1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		1: multi-step speed command 1		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
02-02	Multi-Function Input Command 2 (MI2)	2: multi-step speed command 2	2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
02-03	Multi-Function Input Command 3 (MI3)	3: multi-step speed command 3	3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
02-04	Multi-Function Input Command 4 (MI4)	4: multi-step speed command 4	4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
02-05	Multi-Function Input Command 5 (MI5)	5: Reset	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
02-06	Multi-Function Input Command 6 (MI6)	6: JOG command	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
02-07	Multi-Function Input Command 7 (MI7)	7: Acceleration/ deceleration speed inhibit	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
02-08	Multi-Function Input Command 8 (MI8) (Enable Drive terminal)	8: First, second acceleration/deceleration time	40	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		9: Third, fourth acceleration/deceleration time		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		10: EF input (Pr.07-28)		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		11: Reserved							
		12: Stop output		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		13-14: Reserved							
		15: AUI1 operation speed command		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		16: Reserved							
		17: AUI2 operation speed command		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		18: Emergency Stop (Pr.07-28)		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		19-23: Reserved							
		24: FWD JOG command		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		25: REV JOG command		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		26: Reserved							
		27: ASR1/ASR2 selection		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		28: Emergency stop (EF1) (Motor coasts to stop)		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		29-30: Reserved							
		31: High torque bias (according to Pr.07-21)		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		32: Middle torque bias (according to Pr.07-22)		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		33: Low torque bias (according to Pr.07-23)		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
34-37: Reserved									
38: Disable writing to EEPROM function	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
39: Torque command direction						<input type="checkbox"/>			
40: Enable drive function	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			

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		41: Magnetic contactor detection		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
		42: Mechanical brake 1		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
		43: EPS function (Emergency Power System)		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
		44: Mechanical brake 2								
		45–51: Direct docking mode only ◆								
		53: Terminal leveling signal for direct docking		<input type="checkbox"/>		<input type="checkbox"/>			<input type="checkbox"/>	
		54: Power failure signal		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
		55: Manual emergency deceleration			<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>	
		56: Automatic emergency deceleration			<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>	
↗	02-09	Digital Input Response Time	0.001–30.000 sec.	0.005	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
↗	02-10	Digital Input Operation Direction	0–65535	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
↗	02-11	Multi-function Output 1: RA, RB, RC (Relay1)	0: No function 1: Operation indication	11	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
↗	02-12	Multi-function Output 2: MRA, MRB, MRC (Relay2)	2: Operation speed reached 3: Desired frequency reached 1 (Pr.02-25, Pr.02-26)	1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
↗	02-13	Multi-function Output 3: R1A, R12C (Relay3)	4: Desired frequency reached 2 (Pr.02-27, Pr.02-28)	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
↗	02-14	Multi-function Output 4: R2A, R12C (Relay4)	5: Zero speed (Frequency command)	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
↗	02-15	Multi-function Output 5: (MO1)	6: Zero speed with stop (Frequency command)	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
↗	02-16	Multi-function Output 6: (MO2)	7: Over-torque (OT1) (Pr.06-05–06-07)	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
			8: Over-torque (OT2) (Pr.06-08–06-10)	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			9: Drive ready	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			10: User-defined low-voltage detection (LV)	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			11: Malfunction indication	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			12: Mechanical brake release (Pr.02-29, Pr.02-30, Pr.02-37)	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			13: Overheat (Pr.06-14)	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			14: Brake chopper signal		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			15: Motor-controlled magnetic contactor output		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			16: Slip error (oSL)		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>
			17: Malfunction indication 1		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			18: Reserved							
			19: Brake chopper output error		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			20: Warning output		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			21: Over-voltage warning		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			22: Over-current stall prevention warning		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
			23: Over-voltage stall prevention warning		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	24: Operation mode indication (Pr.00-15=1)		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	25: Forward command		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	26: Reverse command		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	27: Output when current ≥ Pr.02-33		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	28: Output when current < Pr.02-33		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	29: Output when frequency ≥ Pr.02-34		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	30: Output when frequency < Pr.02-34		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	31: Power generation direction and status verification		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	32: Power generation direction		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	33: Zero speed (actual output frequency)		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>		
	34: Zero speed with Stop (actual output frequency)		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>		

		35: Fault output option 1 (Pr.06-22)		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		36: Fault output option 2 (Pr.06-23)		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		37: Fault output option 3 (Pr.06-24)		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		38: Fault output option 4 (Pr.06-25)		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		39: Reserved							
		40: Speed reached (including zero speed)		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>
		41: Reserved							
		42: STO output error		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		43–44: Direct docking mode only ◆							
		45: Reserved							
		46: Retrying after a fault has occurred indication		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		47: Direct docking mode only ◆							
		48: Control output of star-delta contactor		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		49: Emergency power mode action		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	02-17–02-22	Reserved							
↗	02-23	Multi-output Direction	0–65535	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	02-24	Serial Start Signal Selection	0: According to FWD/REV signal 1: According to Enable drive function signal	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
↗	02-25	Desired Frequency Reached 1	0.00–400.00 Hz	60.00/ 50.00	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
↗	02-26	Desired Frequency Reached Width 1	0.00–400.00 Hz	2.00	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
↗	02-27	Desired Frequency Reached 2	0.00–400.00 Hz	60.00/ 50.00	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
↗	02-28	Desired Frequency Reached Width 2	0.00–400.00 Hz	2.00	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	02-29	Brake Release Delay Time when Elevator Starts	0.000–65.000 sec.	0.250	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	02-30	Brake Engage Delay Time when Elevator Stops	0.000–65.000 sec.	0.250	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
↗	02-31	Magnetic Contactor Contracting Delay Time between Drive and Motor	0.010–65.000 sec.	0.200	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
↗	02-32	Magnetic Contactor Release Delay Time between Drive and Motor	0.010–65.000 sec.	0.200	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
↗	02-33	External Terminal Output Current Level	0–100% (motor drive rated current)	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
↗	02-34	External Terminal Output Speed Limit	0.00–±400.00 Hz (this is motor speed when using with PG)	0.00	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
↗	02-35	Mechanical Brake Detection Time	0.00–10.00 sec.	0.00	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
↗	02-36	Magnetic Contactor Detection Time	0.00–10.00 sec.	0.00	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	02-37	Torque Check	0: Disable 1: Enable	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
↗	02-38	Star-delta Contactor Release Delay Time between Drive and Motor	0.0010~65.000 sec.	0.200	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
↗	02-39	Star-delta Contactor Contracting Delay Time between Drive and Motor	0.0010~65.000 sec.	0.200	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

03 Analog Input / Output Parameters

↗: You can set this parameter during operation.

Pr.	Explanation	Setting Range	Default	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM
↗ 03-00	Analog Input 1 (AUI1)	0: No function	1	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
03-01	Reserved	1: Frequency command (speed limit under torque control mode)							
↗ 03-02	Analog Input 2 (AUI2)	2: Torque command (torque limit under speed mode)	0					<input type="radio"/>	
		3: Preload Input		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
		4-5: Reserved							
		6: P.T.C. thermistor input value		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
		7: Positive torque limit					<input type="radio"/>		<input type="radio"/>
		8: Negative torque limit					<input type="radio"/>		<input type="radio"/>
		9: Regenerative torque limit					<input type="radio"/>		<input type="radio"/>
		10: Positive/negative torque limit					<input type="radio"/>		<input type="radio"/>
↗ 03-03	Analog Input Bias 1 (AUI1)	-100.0-100.0%	0.0	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
03-04	Reserved								
↗ 03-05	Analog Input Bias 1 (AUI2)	-100.0-100.0%	0.0	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
↗ 03-06	AUI1 Positive/negative Bias Mode	0: Zero bias	0	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
03-07		Reserved		1: Lower than or equal to bias					
↗ 03-08	AUI2 Positive/negative Bias Mode	2: Higher than or equal to bias	0	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
		3: Using bias as the base to get the absolute value of bias voltage (unipolar)							
		4: Using bias as the base (unipolar)							
↗ 03-09	Analog Input Gain 1 (AUI1)	0.0-500.0%	100.0	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
03-10	Reserved								
↗ 03-11	Analog Input Gain 1 (AUI2)	0.0-500.0%	100.0	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
↗ 03-12	Analog Input Filter Time (AUI1)	0.00-2.00 sec.	0.01	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
03-13	Reserved								
↗ 03-14	Analog Input Filter Time (AUI2)	0.00-2.00 sec.	0.01	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
03-15	Reserved								
03-16	Reserved								
↗ 03-17	Analog Output Selection 1	0: Output frequency (Hz)	0	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
		1: Frequency command (Hz)		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
		2: Motor speed (RPM)		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
		3: Output current (rms)		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
		4: Output voltage		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
		5: DC BUS voltage		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
		6: Power factor angle		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
		7: Power factor		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
		8: Output torque		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
		9: AUI1		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
		10: Reserved							
		11: AUI2		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
		12: q-axis current		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
		13: q-axis feedback value		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
		14: d-axis current		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
		15: d-axis feedback value		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
		16: q-axis voltage		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
		17: d-axis voltage		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	18: Torque command	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		

		19–20: Reserved									
		21: Power Output									
↘	03-18	Analog Output Gain 1	0–200.0%	100.0							
↘	03-19	Analog Output Value in REV Direction 1	0: Absolute value in output voltage 1: Output 0 V in REV direction 2: Enable output voltage in REV direction	0							
↘	03-20	Analog Output Selection 2	0: Output frequency (Hz)	0							
			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								
↘	03-21	Analog Output Gain 2	0–200.0%	100.0							
↘	03-22	Analog Output Value in REV Direction 2	0: Absolute value in output voltage 1: Output 0 V in REV direction 2: Enable output voltage in REV direction	0							
	03-23	Analog Input Type (AUI1)	0: Bipolar (±10 V) 1: Unipolar (0–10 V)	0							
	03-24	Analog Input Type (AUI2)	0: Bipolar (±10 V) 1: Unipolar (0–10 V)	0							

04 Multi-step Speed Parameters ↗: You can set this parameter during operation.

Pr.	Explanation	Setting Range	Default	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM
↗ 04-00	Zero Step Speed Frequency	0.00–400.00 Hz	0.00	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
↗ 04-01	1st Step Speed Frequency	0.00–400.00 Hz	0.00	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
↗ 04-02	2nd Step Speed Frequency	0.00–400.00 Hz	0.00	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
↗ 04-03	3rd Step Speed Frequency	0.00–400.00 Hz	0.00	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
↗ 04-04	4th Step Speed Frequency	0.00–400.00 Hz	0.00	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
↗ 04-05	5th Step Speed Frequency	0.00–400.00 Hz	0.00	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
↗ 04-06	6th Step Speed Frequency	0.00–400.00 Hz	0.00	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
↗ 04-07	7th Step Speed Frequency	0.00–400.00 Hz	0.00	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
↗ 04-08	8th Step Speed Frequency	0.00–400.00 Hz	0.00	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
↗ 04-09	9th Step Speed Frequency	0.00–400.00 Hz	0.00	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
↗ 04-10	10th Step Speed Frequency	0.00–400.00 Hz	0.00	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
↗ 04-11	11th Step Speed Frequency	0.00–400.00 Hz	0.00	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
↗ 04-12	12th Step Speed Frequency	0.00–400.00 Hz	0.00	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
↗ 04-13	13th Step Speed Frequency	0.00–400.00 Hz	0.00	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
↗ 04-14	14th Step Speed Frequency	0.00–400.00 Hz	0.00	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
↗ 04-15	15th Step Speed Frequency	0.00–400.00 Hz	0.00	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
04-16 – 04-99	Direct docking mode only ◆								

05 IM Parameters

↗: You can set this parameter during operation.

Pr.	Explanation	Setting Range	Default	VF	VFP	SVC	FOCPG	TQCPG	FOCPM
05-00	Motor Auto-tuning	0: No function 1: Dynamic test (Rs, Rr, Lm, Lx, no-load current) (Motor runs) 2: Static test (Motor does not run)	0	<input type="radio"/>					
05-01	Motor Full-load Current	(40–120%) * Pr.00-01 Amps	###	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
05-02	Motor Rated Power	0.00–655.35 kW	###			<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
05-03	Motor Rated Speed (rpm)	0–65535	1710		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
05-04	Number of Motor Poles	2–48	4	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
05-05	Motor No-load Current	0–Pr.05-01 <default>	###		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
05-06	Motor Rs	0.000–65.535 Ω	0.000			<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
05-07	Motor Rr	0.000–65.535 Ω	0.000			<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
05-08	Motor Lm	0.0–6553.5 mH	0.0			<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
05-09	Motor Lx	0.0–6553.5 mH	0.0			<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
↗ 05-10	Torque Compensation Time Constant	0.001–10.000 sec.	0.020			<input type="radio"/>			
↗ 05-11	Slip Compensation Time Constant	0.001–10.000 sec.	0.100			<input type="radio"/>			
↗ 05-12	Torque Compensation Gain	0–10	0	<input type="radio"/>	<input type="radio"/>				
↗ 05-13	Slip Compensation Gain	0.00–10.00	1.00	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>			
↗ 05-14	Slip Deviation Level	0–1000% (0: disable)	0		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		
↗ 05-15	Slip Deviation Detection Time	0.0–10.0 sec.	1.0		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		
↗ 05-16	Over-slip Action	0: Warn and keep operation 1: Fault and ramp to stop 2: Fault and coast to stop	0		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		
↗ 05-17	Hunting Gain	0–10000 (0: disable)	2000	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>			
05-18	Accumulated Motor Operation Time (Min.)	0–1439	0	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
05-19	Accumulated Motor Operation Time (day)	0–65535	0	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
↗ 05-20	Core Loss Compensation	0–250%	10			<input type="radio"/>			
05-21	Accumulated Motor Power-on Time (Min.)	0–1439	0	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
05-22	Accumulated Motor Power-on Time (day)	0–65535	0	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
↗ 05-23	Slip Compensation Gain % (Power Generation Mode)	0.0–100.0%	0.0	<input type="radio"/>		<input type="radio"/>			
↗ 05-24	Slip Compensation Gain % (Electricity Mode)	0.0–100.0%	0.0	<input type="radio"/>		<input type="radio"/>			

06 Protection Parameters

↗: You can set this parameter during operation.

Pr.	Explanation	Setting Range	Default	VF	VFP	SVC	FOCPG	TQCPG	FOCPM
↗ 06-00	Low Voltage Level	230V series: 160.0–220.0 V 460V series: 320.0–440.0 V	180.0 360.0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
↗ 06-01	Phase-loss Protection	0: Warn and keep operation 1: Fault and ramp to stop 2: Fault and coast to stop	2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
↗ 06-02	Over-current Stall Prevention during Acceleration	0: Disable 0–250% (rated current of the motor drive)	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
↗ 06-03	Over-current Stall Prevention during Operation	0: Disable 0–250% (rated current of the motor drive)	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
↗ 06-04	Acceleration/Deceleration Time for Stall Prevention at Constant Speed	0: Use the current acceleration/deceleration time 1: Use the first acceleration/deceleration time 2: Use the second acceleration/deceleration time 3: Use the third acceleration/deceleration time 4: Use the fourth acceleration/deceleration time 5: Use the auto-acceleration/ auto-deceleration time	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
↗ 06-05	Over-torque Detection (OT1)	0: Disable 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	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
↗ 06-06	Over-torque Detection Level (OT1)	10–250% (rated current of the motor drive)	150	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
↗ 06-07	Over-torque Detection Time (OT1)	0.1–60.0 sec.	0.1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
↗ 06-08	Over-torque Detection (OT2)	0: Disable 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	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
↗ 06-09	Over-torque Detection Level (OT2)	10–250% (rated current of the motor drive)	150	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
↗ 06-10	Over-torque Detection Time (OT2)	0.1–60.0 sec.	0.1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

✓	06-11	Current Limit	0–250% (rated current of the motor drive)	200					○	○	○	
	06-12	Electronic Thermal Relay	0: Standard motor 1: Inverter motor 2: Disabled	2	○	○	○	○	○	○	○	
✓	06-13	Electronic Thermal Characteristic	30.0–600.0 sec.	60.0	○	○	○	○	○	○	○	
✓	06-14	Heat Sink Overheat (OH) Warning	0.0–110.0°C	90.0	○	○	○	○	○	○	○	
✓	06-15	Stall Prevention Limit Level	0–100% (refer to Pr.06-02, Pr.06-03)	50	○	○	○					
	06-16	Present Fault Record	0: No fault	0	○	○	○	○	○	○	○	
	06-17	Second Most Recent Fault Record	1: Over-current during acceleration (ocA)	0	○	○	○	○	○	○	○	
	06-18	Third Most Recent Fault Record	2: Over-current during deceleration (ocd)	0	○	○	○	○	○	○	○	
	06-19	Fourth Most Recent Fault Record	3: Over-current during constant speed (ocn)	0	○	○	○	○	○	○	○	
	06-20	Fifth Most Recent Fault Record	4: Ground fault (GFF)	0	○	○	○	○	○	○	○	
	06-21	Sixth Most Recent Fault Record	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: Input phase loss (PHL) 16: IGBT overheat (oH1) 17: Bulk capacitors overheat (oH2) 18: Abnormal IGBT temperature detected (tH1o) 19: Abnormal bulk capacitor temperature detected (tH2o) 20: Unusal cooling fan operation (FAn) 21: Overload (oL) (150%; 1 minute, motor drive overloaded) 22: Motor overloaded (EoL1) 23: Reserved 24: Motor PTC overheat (oH3) 25: Reserved 26: Over-torque 1 (ot1) 27: Over-torque 2 (ot2) 28: Reserved 29: Reserved 30: Memory writing error (cF1) 31: Memory reading error (cF2) 32: Isum current detection error (cd0) 33: U-phase current detection error (cd1) 34: V-phase current detection error (cd2) 35: W-phase current detection error (cd3) 36: CC current clamp hardware error (Hd0) 37: OC (over-current) hardware error (Hd1) 38: ov (over-voltage hardware error (Hd2) 39: GFF(ground fault) hardware error (Hd3) 40: Auto-tuning error on motor's parameter (AUE) 41: Reserved	0	○	○	○	○	○	○	○	○

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		42: PG feedback error (PGF1) 43: PG feedback loss (PGF2) 44: PG feedback stall (PGF3) 45: PG slip error (PGF4) 46: Reserved 47: Reserved 48: Reserved 49: External fault input (EF) 50: Emergency stop from external terminals (EF1) 51: Reserved 52: Password error after three attempts (Pcod) 53: Reserved 54: Illegal communication command (cE01) 55: Illegal communication address (cE02) 56: Communication data length error (cE03) 57: Communication attempts to write to a read-only address (cE04) 58: Modbus transmission time-out (cE10) 59: Keypad transmission time-out (cP10) 60: Brake chopper error (BF) 61–63: Reserved 64: Mechanical brake feedback error (MBF) 65: PGF5 hardware error 66: Magnetic contactor error (MCF) 67: Output phase loss (MPHL) 68: CAN BUS disconnected 69–71: Reserved 72: Safe torque loss (STL1) 73: PGcd hardware error 74: PG absolute signal error (PGHL) 75: PG Z phase signal loss (PGAF) 76: Safe torque output stops (STO) 77: Safe torque loss 2 (STL2) 78: Safe torque loss 3 (STL3) *The definition of codes #69–#71 has been modified in v1.04. See Chapter 14 for more information.								
✓	06-22	Fault Output Option 1	0–65535 (refer to bit table for fault code)	0	○	○	○	○	○	○
✓	06-23	Fault Output Option 2	0–65535 (refer to bit table for fault code)	0	○	○	○	○	○	○
✓	06-24	Fault Output Option 3	0–65535 (refer to bit table for fault code)	0	○	○	○	○	○	○
✓	06-25	Fault Output Option 4	0–65535 (refer to bit table for fault code)	0	○	○	○	○	○	○
✓	06-26	PTC (Positive Temperature Coefficient) Detection Action	0: Warn and keep operation 1: Fault and ramp to stop	0	○	○	○	○	○	○
✓	06-27	PTC Level	0.0–100.0%	50.0	○	○	○	○	○	○
✓	06-28	PTC Detection Filter Time	0.00–10.00 sec.	0.20	○	○	○	○	○	○
	06-29	Voltage of Emergency Power	24.0–375.0 V _{DC} 48.0–750.0 V _{DC}	24.0 48.0	○	○	○	○	○	○
✓	06-30	Fault Output Setting Method	0: According to Pr.06-22–Pr.06-25 1: According to the binary setting	0	○	○	○	○	○	○
	06-31	Phase Loss Detection of Drive Output at Start-up (MPHL)	0: Disable 1: Enable	0	○	○	○	○	○	○
	06-32	Accumulated Drive Power-on Time at the	0–65535	Read only	○	○	○	○	○	

	First Fault (min.)									
06-33	Accumulated Drive Power-on Time at the First Fault (day)	0-65535	Read only	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
06-34	Accumulated Drive Power-on Time at the Second Fault (min.)	0-65535	Read only	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
06-35	Accumulated Drive Power-on Time at the Second Fault (day)	0-65535	Read only	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
06-36	Accumulated Drive Power-on Time at the Third Fault (min.)	0-65535	Read only	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
06-37	Accumulated Drive Power-on Time at the Third Fault (day)	0-65535	Read only	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
06-38	Accumulated Drive Power-on Time at the Fourth Fault (min.)	0-65535	Read only	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
06-39	Accumulated Drive Power-on Time at the Fourth Fault (day)	0-65535	Read only	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
06-40	Accumulated Drive Power-on Time at the Fifth Fault (min.)	0-65535	Read only	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
06-41	Accumulated Drive Power-on Time at the Fifth Fault (day)	0-65535	Read only	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
06-42	Accumulated Drive Power-on Time at the Sixth Fault (min.)	0-65535	Read only	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
06-43	Accumulated Drive Power-on Time at the Sixth Fault (day)	0-65535	Read only	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
06-44	(EPS) Emergency Power Mode Operation Speed	0.00-400.00 Hz	0.00	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
↗ 06-45	Fault and Warning Actions	Bit0 = 0: Display Lv fault and coast to stop Bit0 = 1: Display Lv warn and coast to stop Bit1 = 0: Fan lock, fault and coast to stop Bit1 = 1: Fan lock, warn and coast to stop Bit2 = 0: software GFF protection enabled Bit2 = 1: software GFF protection disabled	0	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
↗ 06-46	(EPS) Emergency Power ON Operation Direction	0: Run according to the 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	0	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

		<p>and the direction of power generation mode does not remain.) Execute the power generation direction detection every time.</p> <p>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.</p> <p>4. Run according to the operation direction of power generation mode, and execute the power generation direction detection when in normal mode.</p>								
✓	06-47	Power Generation Direction Search Time	0.0–5.0 sec.	1.0	○	○	○	○	○	○
	06-48	Power Capacity of Emergency Power (EPS)	0.0–100.0 kVA	0.0	○	○	○	○	○	○
✓	06-49	STO Latch Selection	<p>0: STO alarm latch</p> <p>1: STO alarm no latch</p> <p>2: STO latch (warn and record running commands when stop)</p> <p>3: STO no latch (warn and record running commands when stop)</p>	0	○	○	○	○	○	○
✓	06-50	MO's Action when Retrying after Fault	<p>0: Output</p> <p>1: No output</p>	0	○	○	○	○	○	○
✓	06-51	Number of Times to Retry after Fault	0–10	0	○	○	○	○	○	○
✓	06-52	Time Interval between Retries	0.5–600.0 sec.	10.0	○	○	○	○	○	○
	06-53	Frequency Command when the Most Recent Fault Occurred	0.00–655.35 Hz	Read only	○	○	○	○	○	○
	06-54	Output Frequency when the Most Recent Fault Occurred	0.00–655.35 Hz	Read only	○	○	○	○	○	○
	06-55	Output Current when the Most Recent Fault Occurred	0.00–655.35 Amps	Read only	○	○	○	○	○	○
	06-56	Motor Frequency when the Most Recent Fault Occurred	0.00–655.35 Hz	Read only	○	○	○	○	○	○
	06-57	Output Voltage when the Most Recent Fault Occurred	0.0–6553.5 V	Read only	○	○	○	○	○	○
	06-58	DC BUS Voltage when the Most Recent Fault Occurred	0.0–6553.5 V	Read only	○	○	○	○	○	○

	06-59	Output Power when the Most Recent Fault Occurred	0.0–6553.5 kW	Read only	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	06-60	Output Torque when the Most Recent Fault Occurred	0.00–655.35%	Read only	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	06-61	IGBT Temperature when the Most Recent Fault Occurred	-3276.8–3276.7°C	Read only	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	06-62	Multi-input Terminals Status when the Most Recent Fault Occurred	0000h–FFFFh	Read only	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	06-63	Multi-output Terminals status when the Most Recent Fault Occurred	0000h–FFFFh	Read only	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	06-64	Motor Drive Status when the Most Recent Fault Occurred	0000h–FFFFh	Read only	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
↙	06-68	Power Factor Angle Level for Power Generation Direction	0.0–150.0 °	70.0	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	06-69	Reference Level for Power Factor Angle during Operation	-200.0–200.0 °	Read only	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	06-70	Power Generation Direction	0: FWD 1: REV	Read only	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
↙	06-71	UPS Output Delay Time	0.0–10.0 sec.	1.0	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	06-72	UPS Stops Output Delay Time	0.0–60.0 sec.	3.0	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	06-73	Permanent Operation Direction Count (H)	0–60000	Read only	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	06-74	Permanent Operation Direction Count (L)	0–9999	Read only	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	06-75	Single Operation Direction Count (H)	0–20	Read only	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	06-76	Single Operation Direction Count (L)	0–9999	Read only	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	06-77	Number of Times for Single Operation Reset	0–100	Read only	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	06-78	Number of Times for Operation Direction	0.00–200.00 k	2.00	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	06-79	Function Selection for Operation Times	0–2	0	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	06-80	Output Frequency when Fault 2 Occurred	0.00–655.35 Hz	Read only	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	06-81	DC BUS Voltage when Fault 2 Occurred	0.0–6553.5 V	Read only	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	06-82	Output Current when Fault 2 Occurred	0.00–655.35 Amps	Read only	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	06-83	IGBT Temperature when Fault 2 Occurred	-3276.8–3276.7 °C	Read only	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	06-84	Output Frequency when Fault 3 Occurred	0.00–655.35 Hz	Read only	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	06-85	DC BUS Voltage when Fault 3 Occurred	0.0–6553.5 V	Read only	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	06-86	Output Current when Fault 3 Occurred	0.00–655.35 Amps	Read only	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	06-87	IGBT Temperature when Fault 3 Occurred	-3276.8–3276.7 °C	Read only	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	06-88	Output Frequency when Fault 4 Occurred	0.00–655.35 Hz	Read only	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	06-89	DC BUS Voltage when	0.0–6553.5 V	Read only	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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	Fault 4 Occurred									
06-90	Output Current when Fault 4 Occurred	0.00–655.35 Amps	Read only	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
06-91	IGBT Temperature when Fault 4 Occurred	-3276.8–3276.7 °C	Read only	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
06-92	Output Frequency when Fault 5 Occurred	0.00–655.35 Hz	Read only	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
06-93	DC BUS Voltage when Fault 5 Occurred	0.0–6553.5 V	Read only	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
06-94	Output Current when Fault 5 Occurred	0.00–655.35 Amps	Read only	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
06-95	IGBT Temperature when Fault 5 Occurred	-3276.8–3276.7 °C	Read only	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
06-96	Output Frequency when Fault 6 Occurred	0.00–655.35 Hz	Read only	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
06-97	DC BUS Voltage when Fault 6 Occurred	0.0–6553.5 V	Read only	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
06-98	Output Current when Fault 6 Occurred	0.00–655.35 Amps	Read only	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
06-99	IGBT Temperature when Fault 6 Occurred	-3276.8–3276.7 °C	Read only	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

07 Special Parameters

↗: You can set this parameter during operation.

Pr.	Explanation	Setting Range	Default	VF	VFP	SVC	FOCPG	TQCPG	FOCPM
↗ 07-00	Brake Chopper Level	230V series: 350.0–450.0 V _{DC} 460V series: 700.0–900.0 V _{DC}	380.0 760.0	○	○	○	○	○	○
07-01	Reserved								
↗ 07-02	DC Brake Current Level at Start-up	0–100% (motor drive rated current)	0	○	○	○			
↗ 07-03	DC Brake Activation Time	0.0–60.0 sec.	0.7	○	○	○	○		○
↗ 07-04	DC Brake Stopping Time	0.0–60.0 sec.	0.7	○	○	○	○		○
↗ 07-05	Start-point for DC Brake	0.00–400.00 Hz	0.00	○	○	○	○		
↗ 07-06	DC Brake Proportional Gain	1–500	50	○	○	○			
↗ 07-07	Dwell Time at Acceleration	0.00–600.00 sec.	0.00	○	○	○	○		○
↗ 07-08	Dwell Frequency at Acceleration.	0.00–400.00 Hz	0.00	○	○	○	○		○
↗ 07-09	Dwell Time at Deceleration.	0.00–600.00 sec.	0.00	○	○	○	○		○
↗ 07-10	Dwell Frequency at Deceleration.	0.00–400.00 Hz	0.00	○	○	○	○		○
↗ 07-11	Cooling Fan Control	0: Cooling fan 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	○	○	○	○	○	○
↗ 07-12	Torque command	-150.0–150.0% (Pr.07-14 setting = 100%)	0.0					○	
↗ 07-13	Torque Command Source	0: Digital keypad (KPC-CC01) 1: RS-485 serial communication 2: Analog signal (Pr.03-00)	2					○	
↗ 07-14	Maximum Torque Command	0–300% (motor drive rated torque)	100	○	○	○	○	○	○
↗ 07-15	Torque Command Filter Time	0.000–1.000 sec.	0.000					○	
07-16	Speed Limit	0: Settings in Pr.07-17 and Pr.07-18 1: Frequency command source (Pr.00-14)	0					○	
↗ 07-17	Torque Mode +Speed Limit	0–120%	10					○	
↗ 07-18	Torque Mode-Speed Limit	0–120%	10					○	

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✎	07-19	Torque Offset Source	0: Disable 1: Analog input (Pr.03-00) 2: Torque offset setting (Pr.07-20) 3: Control through external terminals (by Pr.07-21–Pr.07-23)	0				○	○	○	○
✎	07-20	Torque Offset Setting	0.0–100.0% (motor drive rated torque)	0.0				○	○	○	○
✎	07-21	High Torque Offset	0.0–100.0% (motor drive rated torque)	30.0				○	○	○	○
✎	07-22	Middle Torque Offset	0.0–100.0% (motor drive rated torque)	20.0				○	○	○	○
✎	07-23	Low Torque Offset	0.0–100.0% (motor drive rated torque)	10.0				○	○	○	○
✎	07-24	Forward Motor Torque Limit	0–300% (motor drive rated torque)	200					○	○	○
✎	07-25	Forward Regenerative Torque Limit	0–300% (motor drive rated torque)	200					○	○	○
✎	07-26	Reverse Motor Torque Limit	0–300% (motor drive rated torque)	200					○	○	○
✎	07-27	Reverse Regenerative Torque Limit	0–300% (motor drive rated torque)	200					○	○	○
✎	07-28	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.01-31	0	○	○	○	○	○	○	○
✎	07-29	Time for Decreasing Torque at Stop	0.000–5.000 sec.	0.000					○	○	○
✎	07-30	DC Brake Current Level at Stop	0–100% (motor drive rated current)	0	○	○	○				

08 PM Parameters

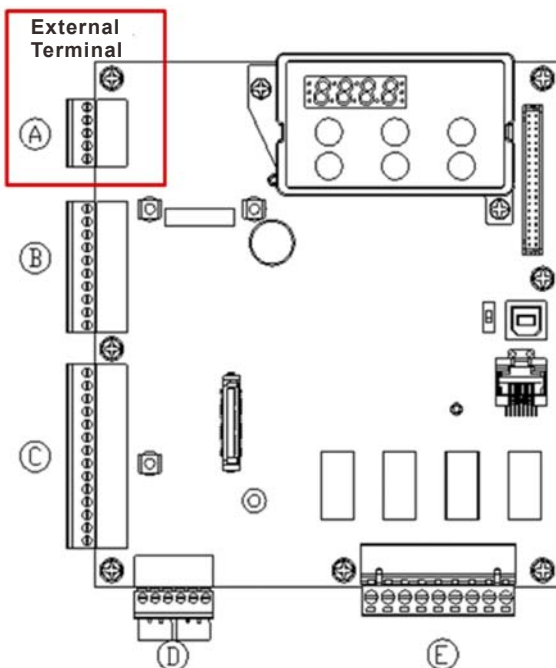
✎: You can set this parameter during operation.

Pr.	Explanation	Setting Range	Default	VF	VFP	SVC	FOCPG	TQCPG	FOCPM
08-00	Motor Auto-tuning	0: No function 1: Only for an unloaded motor, auto-measures the angle between magnetic pole and PG origin (Pr.08-09) 2: For PM parameters (suggested to lock the brake) 3: Auto-measures the angle between magnetic pole and PG origin (Pr.08-09)	0						○
08-01	Motor Full-load Current	(40–120%) * Pr.00-01 Amps	#.##						○
08-02	Motor Rated Power	0.00–655.35 kW	#.##						○
08-03	Motor Rated Speed (rpm)	0–65535 rpm	1710						○
08-04	Number of Motor Poles	2–96	4						○
08-05	Motor Rs	0.000–65.535 Ω	0.000						○
08-06	Motor Ld	0.0–6553.5 mH	0.0						○
08-07	Motor Lq	0.0–6553.5 mH	0.0						○
08-08	Back Electromotive Force	0.0–6553.5 V rms	0.0						○
08-09	Angle between Magnetic Pole and PG Origin	0.0–360.0°	360.0						○
08-10	Magnetic Pole Reorientation	0: Disable 1: Enable	0						○

09 Communication Parameters

↗: You can set this parameter during operation.

Pr.	Explanation	Setting Range	Default	VF	VFP	SVC	FOCPG	TQCPG	FOCPM
↗ 09-00	Communication Address	1–254	1						
↗ 09-01	Transmission Speed	4.8–115.2 kbps	19.2	○	○	○	○	○	○
↗ 09-02	Transmission Fault Treatment	0: Warn and keep operation 1: Warn and ramp to stop 2: Reserved 3: No action and no display	3	○	○	○	○	○	○
↗ 09-03	Time-out Detection	0.0–100.0 sec. 0.0: Disable	0.0	○	○	○	○	○	○
↗ 09-04	Communication Protocol	0: 7N1 (ASCII) 1: 7N2 (ASCII) 2: 7E1 (ASCII) 3: 7O1 (ASCII) 4: 7E2 (ASCII) 5: 7O2 (ASCII) 6: 8N1 (ASCII) 7: 8N2 (ASCII) 8: 8E1 (ASCII) 9: 8O1 (ASCII) 10: 8E2 (ASCII) 11: 8O2 (ASCII) 12: 8N1 (RTU) 13: 8N2 (RTU) 14: 8E1 (RTU) 15: 8O1 (RTU) 16: 8E2 (RTU) 17: 8O2 (RTU)	13	○	○	○	○	○	○
↗ 09-05	Response Delay Time	0.0–200.0 ms	2.0	○	○	○	○	○	○
09-06 – 09-13	Direct docking mode only ◆		-						
09-14	PDO Transmission Interval	0–65535 ms	0	○	○	○	○	○	○



10 Feedback Control Parameters

✎: You can set this parameter during operation.

Pr.	Explanation	Setting Range	Default	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM
10-00	Selection of Encoder	0: Disable 1: ABZ 2: ABZ+Hall 3: SIN/COS+Sinusoidal 4: SIN/COS+Endat 5: SIN/COS 6: SIN/COS+Hiperface	0		○		○	○	○
10-01	Encoder Pulse	1–25000	2048		○		○	○	○
10-02	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 3: Phase A is a pulse input and phase B is a direction input (low input = reverse direction, high input = forward direction) 4: Phase A is a pulse input and phase B is a direction input (low input = forward direction, high input = reverse direction) 5: Single-phase input	0		○		○	○	○
✎ 10-03	Encoder Feedback Signal Fault Action (PGF1, PGF2)	0: Warn and keep operation 1: Fault and ramp to stop 2: Fault and stop operation	2		○		○	○	○
✎ 10-04	Encoder Feedback Signal Fault Detection Time	0.0–10.0 sec.	1.0		○		○	○	○
✎ 10-05	Encoder Stall Level (PGF3)	0–120% (0: Disable)	115		○	○	○		○
✎ 10-06	Encoder Stall Detection Time	0.0–2.0 sec.	0.1		○	○	○		○
✎ 10-07	Encoder Slip Range (PGF4)	0–50% (0: Disable)	50		○	○	○		○
✎ 10-08	Encoder Slip Detection Time	0.0–10.0 sec.	0.5		○	○	○		○
✎ 10-09	Encoder Stall and Slip Error Action	0: Warn and keep operation 1: Fault and ramp to stop 2: Fault and stop operation	2		○	○	○		○
10-10	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		○		○	○	○
✎ 10-11	ASR (Auto Speed Regulation) Control (P) of Zero Speed	0.0–1000.0%	100.0	○	○	○	○		○
✎ 10-12	ASR (Auto Speed Regulation) Control (I) of Zero Speed	0.000–10.000 sec.	0.100	○	○	○	○		○
✎ 10-13	ASR (Auto Speed Regulation) Control (P) 1	0.0–1000.0%	100.0	○	○	○	○		○
✎ 10-14	ASR (Auto Speed Regulation) Control (I) 1	0.000–10.000 sec.	0.100	○	○	○	○		○
✎ 10-15	ASR (Auto Speed	0.0–1000.0%	100.0	○	○	○	○		○

Ch11 Summary of Parameter Settings | VFD-ED

	Regulation) Control (P) 2								
✓	10-16 ASR (Auto Speed Regulation) Control (I) 2	0.000–10.000 sec.	0.100	○	○	○	○		○
✓	10-17 ASR 1/ ASR2 Switch Frequency	0.00–400.00 Hz (0: Disable)	7.00	○	○	○	○		○
✓	10-18 ASR Primary Low Pass Filter Gain	0.001–0.350 sec.	0.008	○	○	○	○		○
✓	10-19 Zero Speed Position Control Gain (P)	0.00–655.00%	80.00						○
✓	10-20 Low Speed ASR Width Adjustment	0.00–400.00 Hz	5.00		○		○		○
✓	10-21 High Speed ASR Width Adjustment	0.00–400.00 Hz	5.00		○		○		○
✓	10-22 Zero Speed Position Control Holding Time	0.001–65.535 sec.	0.250						○
✓	10-23 Zero Speed Position Control Low Pass Filter Time	0.001–65.535 sec.	0.004						○
✓	10-24 Zero Speed Position Control Activation Mode Selection	0: After the brake release set in Pr.02-29 1: After the brake signal input (Pr.02-01–Pr.02-08 is set to 42)	0						○
✓	10-25 Elevator Leveling (Zero Speed Gain P)	0.0–1000.0%	100.0	○	○	○	○		○
✓	10-26 Elevator Leveling (Zero Speed Integral I)	0.000–10.000 sec.	0.100	○	○	○	○		○
✓	10-27 Elevator Starting (Zero Speed Gain P)	0.0–1000.0%	100.0	○	○	○	○		○
✓	10-28 Elevator Starting (Zero Speed Integral I)	0.000–10.000 sec.	0.100	○	○	○	○		○
✓	10-29 PG Card Frequency Division Output	0–31	0		○		○	○	○
✓	10-30 PG Card Frequency Division Output Type	0000h–0008h	0000h		○		○	○	○
	10-31 PG Card C+/C-	0000h–0001h	0000h						
✓	10-32 Over-acceleration Level	0.0–20.0 m/s ²	0.0	○	○	○	○		○
	10-33 Over-acceleration Detection Time	0.01–5.00 sec.	0.05	○	○	○	○		○
	10-34 Over-acceleration Detection Selection	0: Always detect 1: Detect during operation	0	○	○	○	○		○

11 Advanced Parameters

↗: You can set this parameter during operation.

Pr.	Explanation	Setting Range	Default	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM
11-00	System Control	Bit 0 = 0: No function Bit 0 = 1: ASR auto-tuning, enable PDFF Bit 7 = 0: No function Bit 7 = 1: Zero speed position control is enabled Bit 9 = 0: Dynamic PG origin auto-tuning with load (support by PGHSD-1) Bit 9 = 1: Static PG origin auto-tuning with load by enabling PGHSD-1 Bit 15 = 0: Detect the position of magnetic pole again when power is applied Bit 15 = 1: Start from the magnetic pole position of the previous power failure when power is applied	0				○		○
↗ 11-01	Elevator Speed	0.10–4.00 m/s	1.00				○		○
↗ 11-02	Sheave Diameter	100–2000 mm	400				○		○
↗ 11-03	Mechanical Gear Ratio	1.00–100.00	1.00				○		○
↗ 11-04	Suspension Ratio	0 = 1:1 1 = 2:1 2 = 4:1 3 = 8:1	1				○		○
↗ 11-05	Inertial Ratio	1–300%	40				○		○
↗ 11-06	Zero speed Bandwidth	1–40 Hz	10				○		○
↗ 11-07	Low speed Bandwidth	1–40 Hz	10				○		○
↗ 11-08	High speed Bandwidth	1–40 Hz	10				○		○
↗ 11-09	PDFF Gain Value	0–200%	30				○		○
↗ 11-10	Speed Feed Forward Gain	0–500	0				○		○
↗ 11-11	Notch Filter Depth	0–20 db	0				○		○
↗ 11-12	Notch Filter Frequency	0.00–200.00 Hz	0.00				○		○
↗ 11-13	Keypad Display for Low Pass Filter Time	0.001–65.535 sec.	0.500	○	○	○	○	○	○
↗ 11-14	Motor Current at Acceleration	50–200%	150						○
↗ 11-15	Carriage Acceleration	0.20–2.00 m/s ²	0.75						○
11-16	Reserved								
11-17	Reserved								
11-18	Reserved								
↗ 11-19	Zero Speed Parking Bandwidth	1–40 Hz	10				○		○
↗ 11-20	PWM Mode	0: DPWM mode (Digital Pulse-Width Modulation Mode) 1: SVPWM mode (Space-Vector Pulse Width Modulation Mode)	0						

12 User-defined Parameters

↗: You can set this parameter during operation.

User-defined Parameters include parameters from Group 00–11.

Pr.	Explanation	Setting Range	Default	VF	VFP	SVC	FOCPG	TQCPG	FOCPM
↗ 12-00	User-defined Parameter 1	0–9999	0616	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
↗ 12-01	User-defined Parameter 2	0–9999	0632	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
↗ 12-02	User-defined Parameter 3	0–9999	0633	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
↗ 12-03	User-defined Parameter 4	0–9999	0653	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
↗ 12-04	User-defined Parameter 5	0–9999	0654	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
↗ 12-05	User-defined Parameter 6	0–9999	0655	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
↗ 12-06	User-defined Parameter 7	0–9999	0656	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
↗ 12-07	User-defined Parameter 8	0–9999	0657	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
↗ 12-08	User-defined Parameter 9	0–9999	0658	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
↗ 12-09	User-defined Parameter 10	0–9999	0659	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
↗ 12-10	User-defined Parameter 11	0–9999	0660	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
↗ 12-11	User-defined Parameter 12	0–9999	0661	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
↗ 12-12	User-defined Parameter 13	0–9999	0662	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
↗ 12-13	User-defined Parameter 14	0–9999	0663	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
↗ 12-14	User-defined Parameter 15	0–9999	0664	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
↗ 12-15	User-defined Parameter 16	0–9999	0617	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
↗ 12-16	User-defined Parameter 17	0–9999	0634	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
↗ 12-17	User-defined Parameter 18	0–9999	0635	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
↗ 12-18	User-defined Parameter 19	0–9999	0618	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
↗ 12-19	User-defined Parameter 20	0–9999	0636	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
↗ 12-20	User-defined Parameter 21	0–9999	0637	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
↗ 12-21	User-defined Parameter 22	0–9999	0619	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
↗ 12-22	User-defined Parameter 23	0–9999	0638	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
↗ 12-23	User-defined Parameter 24	0–9999	0639	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
↗ 12-24	User-defined Parameter 25	0–9999	0620	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
↗ 12-25	User-defined Parameter 26	0–9999	0640	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
↗ 12-26	User-defined Parameter 27	0–9999	0641	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
↗ 12-27	User-defined Parameter 28	0–9999	0621	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
↗ 12-28	User-defined Parameter 29	0–9999	0642	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
↗ 12-29	User-defined Parameter 30	0–9999	0643	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
↗ 12-30	User-defined Parameter 31	0–9999	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
↗ 12-31	User-defined Parameter 32	0–9999	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

13 View User-defined Parameters

ℳ: You can set this parameter during operation.

Pr.	Explanation Parameter Group 12 Setting Values	Display Address Pr.00-00–Pr.11-20	Default						
				VF	VFPG	SVC	FOCPG	TQCPG	FOCPM
13-00	Present Fault Record	0616	-	○	○	○	○	○	○
13-01	Motor Operation at Present Fault Time (min.)	0632	-	○	○	○	○	○	○
13-02	Motor Operation at Present Fault Time (day)	0633	-	○	○	○	○	○	○
13-03	Frequency Command at Present Fault	0653	-	○	○	○	○	○	○
13-04	Output Frequency at Preset Fault	0654	-	○	○	○	○	○	○
13-05	Output Current at Present Fault	0655	-	○	○	○	○	○	○
13-06	Motor Frequency at Present Fault	0656	-	○	○	○	○	○	○
13-07	Output Voltage at Present Fault	0657	-	○	○	○	○	○	○
13-08	DC BUS Voltage at Present Fault	0658	-	○	○	○	○	○	○
13-09	Output Power at Present Fault	0659	-	○	○	○	○	○	○
13-10	Output Torque at Present Fault	0660	-	○	○	○	○	○	○
13-11	Power Module IGBT Temperature at Present Fault	0661	-	○	○	○	○	○	○
13-12	Multi-function Terminal Input Status at Present Fault	0662	-	○	○	○	○	○	○
13-13	Multi-function Terminal Output Status at Present Fault	0663	-	○	○	○	○	○	○
13-14	Drive Status at Present Fault	0664	-	○	○	○	○	○	○
13-15	Second Most Recent Fault Record	0617	-	○	○	○	○	○	○
13-16	Motor Operation at Second Most Recent Fault Time (min.)	0634	-	○	○	○	○	○	○
13-17	Motor Operation at Second Most Recent Fault Time (day)	0635	-	○	○	○	○	○	○
13-18	Third Most Recent Fault Record	0618	-	○	○	○	○	○	○
13-19	Motor Operation at Third Most Recent Fault Time (min.)	0636	-	○	○	○	○	○	○
13-20	Motor Operation at Third Most Recent Fault Time (day)	0637	-	○	○	○	○	○	○
13-21	Fourth Most Recent Fault Record	0619	-	○	○	○	○	○	○
13-22	Motor Operation at Fourth Most Recent Fault Time (min.)	0638	-	○	○	○	○	○	○
13-23	Motor Operation at Fourth Most Recent Fault Time (day)	0639	-	○	○	○	○	○	○
13-24	Fifth Most Recent Fault Record	0620	-	○	○	○	○	○	○
13-25	Motor Operation at Fifth Most Recent Fault Time (min.)	0640	-	○	○	○	○	○	○
13-26	Motor Operation at Fifth Most Recent Fault Time (day)	0641	-	○	○	○	○	○	○
13-27	Sixth Most Recent Fault Record	0621	-	○	○	○	○	○	○
13-28	Motor Operation at Sixth Most Recent Fault Time (min.)	0642	-	○	○	○	○	○	○
13-29	Motor Operation at Sixth Most Recent Fault Time (day)	0643	-	○	○	○	○	○	○
13-30	No default								
13-31	No default								

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Chapter 12 Descriptions of Parameter Settings

00 Drive Parameters

↗: You can set this parameter during operation.

00-00 AC Motor Drive Identity Code

Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: ##
Settings Read Only

00-01 AC Motor Drive Rated Current Display

Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: ##
Settings Read Only (Display by model)

- 📖 Pr.00-00 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.00-01 displays the AC motor drive rated current. By reading this parameter, you can check if the AC motor drive is correct.




230V series												
Power (kW)	2.2*	3.7*	4.0	5.5	7.5	11	15	18.5	22	30	37	
Horsepower (HP)	3	5	5	7.5	10	15	20	25	30	40	50	
Motor Drive ID Code (Pr.00-00)	108	110	10	12	14	16	18	20	22	24	26	
Rated Output Current for General Purposes (A)	12.0	17.0	20	24	30	45	58	77	87	132	161	
Range of the Carrier Frequency	2–15 kHz								2–9 kHz			
Rated Max. Output Carrier Frequency	8 kHz			10 kHz			8 kHz			6 kHz		

*VFD022ED21S and VFD037ED21S are single-phase models.

460V series												
Power (kW)	4.0	5.5	7.5	11	15	18.5	22	30	37	45	55	75
Horsepower (HP)	5	7.5	10	15	20	25	30	40	50	60	75	100
Motor Drive ID Code (Pr.00-00)	11	13	15	17	19	21	23	25	27	29	31	33
Rated Output Current for General Purposes (A)	11.5	13	17	23	30	38	45	58	80	100	128	165
Range of the Carrier Frequency	2–15 kHz						2–9 kHz			2–6 kHz		
Rated Max. Output Carrier Frequency	8 kHz	10 kHz			8 kHz			6 kHz				


00-02 Parameter Reset

Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	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.00-00–Pr.00-07, 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.00-02 and Pr.00-07 can be changed.

00-03 Start-up Display


Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	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.00-04)						

-  Determines the start-up display page after power is applied to the drive.

00-04 Content of Multi-Function Display

Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: 0
Settings	0: Display the output current in A supplied to the motor 1: Reserved 2: Display the actual output frequency (H) 3: Display the actual DC BUS voltage for the AC motor drive in V_{DC} 4: Display the terminals U, V, and W output voltage to the motor in V_{AC} 5: Display the terminals U, V, W power factor angle to the motor in $^{\circ}$ 6: Display the terminals U, V, and W output power to the motor in kW 7: Display the actual motor speed in rpm (enabled when using with a PG card) 8: Display the estimated torque in % as it relates to current. 9: Display the PG feedback 10: Display the electrical angle of drive output 11: Display the AUI1 analog input terminal signal in %. Range -10–10 V corresponds to 0–100%. (1.) 12: Reserved 13: Display the AUI2 analog input terminal signal in %. Range -10–10 V corresponds to 0–100%. (2.)						

- 14: Display the heat sink temperature (°C)
- 15: Display the IGBT temperature in °C.
- 16: Display digital input status ON/OFF (i)
- 17: Display digital output status ON/OFF (o)
- 18: Display multi-step speed
- 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 (8)
- 25: Output DC voltage when malfunction occurred (8.)
- 26: Motor frequency when malfunction occurred (h)
- 27: Output current when malfunction occurred (4)
- 28: Output frequency when malfunction occurred (h.)
- 29: Frequency command when malfunction occurred
- 30: Output power when malfunction occurred
- 31: Output torque when malfunction occurred
- 32: Input terminal status when malfunction occurred
- 33: Output terminal status when malfunction occurred
- 34: Drive status when malfunction occurred
- 35: Display MI and MO status on digital keypad
- 36: CAN communication interference index
- 37: Multi-function display selection

 This parameter displays the content on the digital keypad KPC-CC01 on page U. Use this parameter to get the AC motor drive's status.

Example 01

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.02-01 to 1 (multi-step speed command 1).

MI8: Set Pr.02-08 to 8 (the 1st, 2nd acceleration/deceleration time selection).

If REV, MI1 and MI8 are ON, the value is 0000 0000 1000 01102 in binary and 0086H in HEX. Meanwhile, if you set Pr.00-04 to 16 or 19, the keypad KPC-CC01 displays “0086” and LED U is ON. Pr.00-04=16 is the status of the digital input and Pr.00-04=19 is the corresponding CPU digital input pin status. Set the parameter to 16 to monitor the digital input status and then set to 19 to check if the wire is normal.

Example 02

Terminal	MO8	MO7	MO6	MO5	MO4	MO3	MO2	MO1	R2A	R1A	MRA	RA
Status	0	0	0	0	1	0	0	0	0	1	1	0

RA: Set Pr.02-11 to 9 (Drive ready)

After applying the power to the AC motor drive, if there is no other error, the contact is ON. If you set Pr.00-04 to 17 or 20, the keypad displays 0001 and LED U is ON. Pr.00-04=17 is the status of digital output and Pr.00-04=20 is the corresponding CPU digital output pin status. Set the parameter to 17 to monitor the digital output status and then set to 20 to check if the wire is normal.

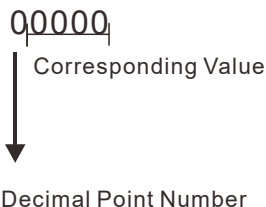
00-05 User-defined Coefficient K

Control Mode **VF VFPG SVC FOC PG TQCPG FOC PM** Default: 0
 Settings Digit 4: number of decimal points (0–3)
 Digit 0–3: 40–9999

Digital setting method

Digital 4: number of decimal points (0: no decimal points, 1: one decimal point and so on.)
 Digit 0–3: 40–9999 (the corresponding value for the maximum frequency).

Meaning of numerical order



For example, if you use rpm to display the motor speed, and the corresponding value for the four-pole motor, 60 Hz is 1800. You can set this parameter to 1800 to indicate that the corresponding value for 60 Hz is 1800 rpm. If the unit is rps, set to 10300 to indicate that the corresponding value for 60 Hz is 30.0 (one decimal point).

The frequency setting only displays as the rpm value. For example, 60 Hz is displayed as 1800 rpm.

After you set Pr.00-05, the keypad does not display the frequency unit “Hz” after returning to the Main menu.


00-06 Software Version

Control Mode **VF VFPG SVC FOC PG TQCPG FOC PM** Default: #.##
 Settings Read Only

00-07 Password Input

Control Mode **VF VFPG SVC FOC PG TQCPG FOC PM** Default: 0
 Settings 1–9998, 10000–65535
 Display 0–2 (number of wrong password attempts)

Inputs the password that is set in Pr.00-08. 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 and press the PROG/DATA button () twice. Note that this resets the settings to the default.

00-08 Password Set

Control Mode **VF VFPG SVC FOC PG TQCPG FOC PM** Default: 0
 Settings 1–9998, 10000–65535
 Display 0: No password set or successful input in Pr. 00-07
 1: Password has been set

Sets a password to protect your parameter settings.

If the display shows 0, no password is set or the password in Pr.00-07 is not correct.

When the display shows 0, you can change all parameters, including Pr.00-08.

The first time you can set a password directly. After you successfully set the password, the display shows 1.

Be sure to record the password for later use.

To cancel the parameter lock, set this parameter to 0 after setting correct password in Pr.00-07.
The password consists of 2–5 digits.

How to make the password valid again after decoding by Pr.00-07:

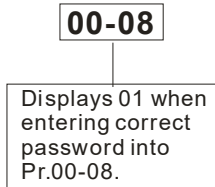
Method 1: Re-enter the original password into Pr.00-08 (or you can enter a new password if you want to use a changed or new one).

Method 2: After rebooting, the password function is restored.

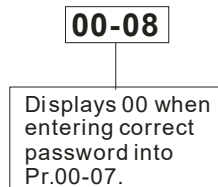
Method 3: Entering a non-password value into Pr.00-07.

Password Decode Flow Chart

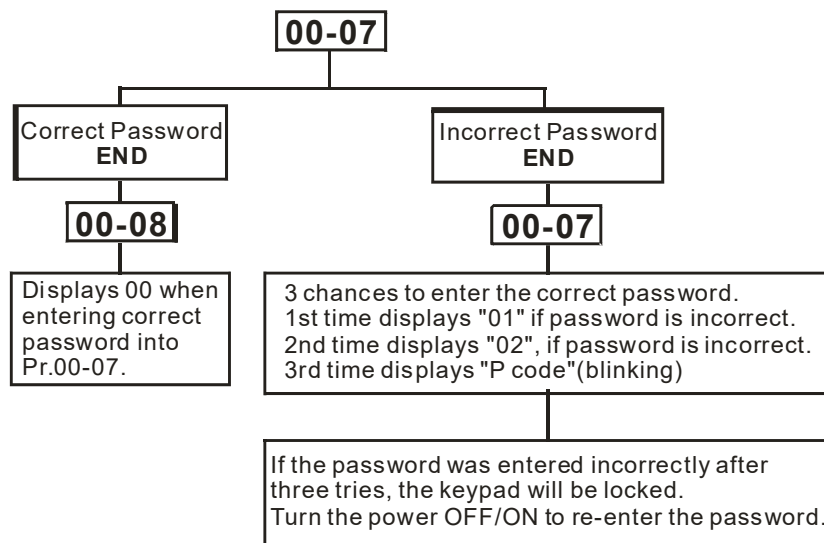
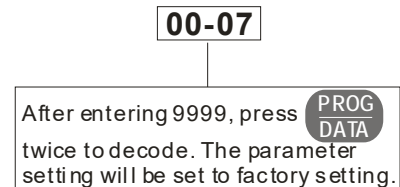
Password Setting



Decoding Flow Chart



Forgetting Password



00-09 Control Mode

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

- Settings
- 0: V/F control (V/F)
 - 1: V/F control + Encoder (VFPG)
 - 2: Sensorless Vector Control (SVC)
 - 3: FOC vector control + Encoder (FOCPG)
 - 8: 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 Learning	Basic Control	Speed Control
0	V/F	IM	X	Low	Low	Normal	1:50	X	V/F control	Voltage control
1	VFPG	IM	O	Medium	Medium	Normal	1:50	O	Frequency control	Frequency control
2	SVC	IM	X	Medium	Medium	Normal	1:50	O	Voltage control	Voltage control
3	FOCPG	IM	O	High	High	Good	1:1000	O	Vector control	Frequency control
8	FOCPM	PM	O	High	High	Good	1:1000	O	Vector control	Frequency control

Ch12 Descriptions of Parameter Settings | VFD-ED

Determines the AC motor drive control method.

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

Setting 1: You can use a PG card with an Encoder for close-loop speed control.

Setting 2: Use auto-tuning for optimal settings of the control parameters.

Setting 3: To increase torque and the accuracy of the speed control (1:1000).

Setting 8: 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.

00-10 Speed Unit

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

Settings 0: Hz

1: m/s

2: ft/s

3: Direct docking mode only, contact Delta for more information.

00-11 Output Direction Selection

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

Settings 0: FWD: counterclockwise, REV: clockwise

1: FWD: clockwise, REV: counterclockwise

00-12 Carrier Frequency

Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: 12

Settings 2–15 kHz

Determines the PWM carrier frequency for the AC motor drive.

Models	3–5 HP	7.5–15 HP	20–30 HP	40–60 HP	75–100 HP
Settings	2–15 kHz	2–15 kHz	2–15 kHz	2–9 kHz	2–6 kHz
Default	8 kHz	10 kHz	8 kHz	6 kHz	6 kHz

Carrier Frequency	Acoustic Noise	Electromagnetic Noise or Leakage Current	Heat Dissipation	Current Wave
2kHz	Significant ↑ ↓ Minimal	Minimal ↑ ↓ Significant	Minimal ↑ ↓ Significant	
8kHz				
15kHz				

From the table, you see that the PWM carrier frequency has a significant influence on the electromagnetic noise, the AC motor drive heat dissipation, and the motor acoustic noise.

If you set the carrier frequency higher than the defaults in the table above, the motor drive derates the capacity. See Carrier Frequency Derating Capacity (Fc) in Chapter 02.



00-13 Automatic Voltage Regulation (AVR) Function

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

Settings 0: Enable AVR

1: Disable AVR


2: Disable AVR when decelerating to stop

-  Selects the AVR mode. AVR regulates the output voltage to the motor. For example, if you set the V/F curve to 200 V_{AC} / 50 Hz and the input voltage is from 200 to 264 V_{AC}, the output voltage does not exceed 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 you set this parameter to 1 during ramp to stop using the auto-acceleration / auto-deceleration function, the deceleration is smoother and faster.

00-14 Master Frequency Command Source

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



- Settings 1: RS-485 serial communication or digital keypad (KPC-CC01)
 2: External analog input (Pr.03-00)
 3: Digital terminal inputs (Pr.04-00–04-15)
 4: Direct docking mode only, contact Delta for more information.

 Determines the drive's master frequency source.

00-15 Operation Command Source

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

- Settings 1: External terminals
 2: RS-485 serial communication or digital keypad (KPC-CC01)

-  The ED series motor drives are shipped without a digital keypad, but you can use the external terminals or RS-485 to control the operation command.
-  When the LED PU is ON, you can control the operation command with the optional digital keypad. (Refer to Chapter 09 for more information about the digital keypad KPC-CC01).

01 Basic Parameters

↗: You can set this parameter during operation.

01-00 Maximum Output Frequency

Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: 60.00/50.00
Settings 10.00–400.00 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.

01-01 1st Output Frequency Setting (base frequency/ motor's rated frequency)

Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: 60.00/50.00
Settings 0.00–400.00 Hz

📖 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.

01-02 1st Output Voltage Setting (base voltage/ motor's rated voltage)

Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: 220.0/440.0
Settings 230V series 0.1–255.0 V
460V series 0.1–510.0 V

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

01-03 Second Output Frequency Setting

Control Mode **VF** **VFPG** Default: 0.50
Settings 0.00–400.00 Hz

↗ 01-04 Second Output Voltage Setting

Control Mode **VF** **VFPG** Default: 5.0/10.0
Settings 230V series 0.1–255.0 V
460V series 0.1–510.0 V

01-05 Third Output Frequency Setting

Control Mode **VF** **VFPG** Default: 0.50
Settings 0.00–400.00 Hz

↗ 01-06 Third Output Voltage Setting

Control Mode **VF** **VFPG** Default: 5.0/10.0
Settings 230V series 0.1–255.0 V
460V series 0.1–510.0 V

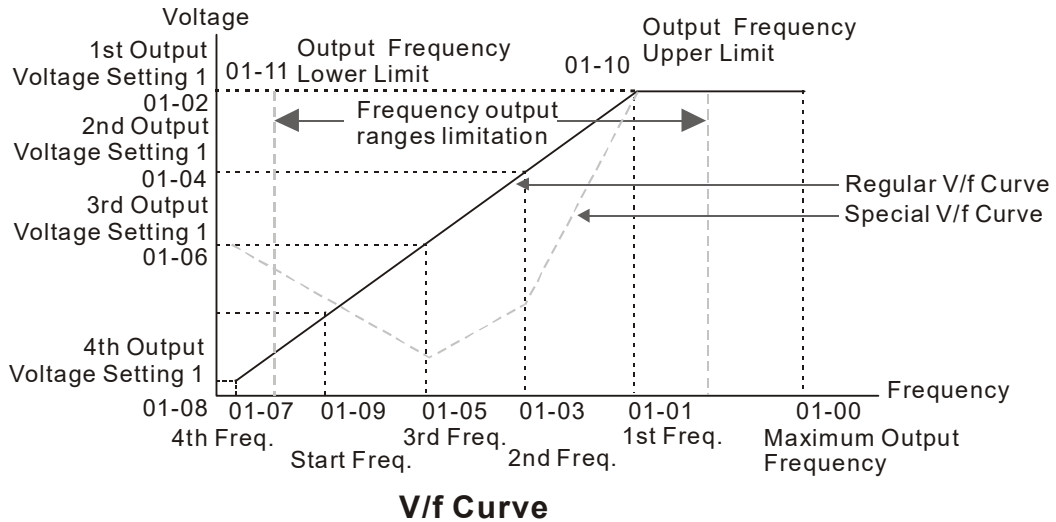
01-07 Fourth Output Frequency Setting

Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** Default: 0.00
Settings 0.00–400.00 Hz

01-08 Fourth Output Voltage Setting

Control Mode **VF** **VFPG** Default: 5.0/10.0
 Settings 230V series 0.1–255.0 V
 460V series 0.1–510.0 V

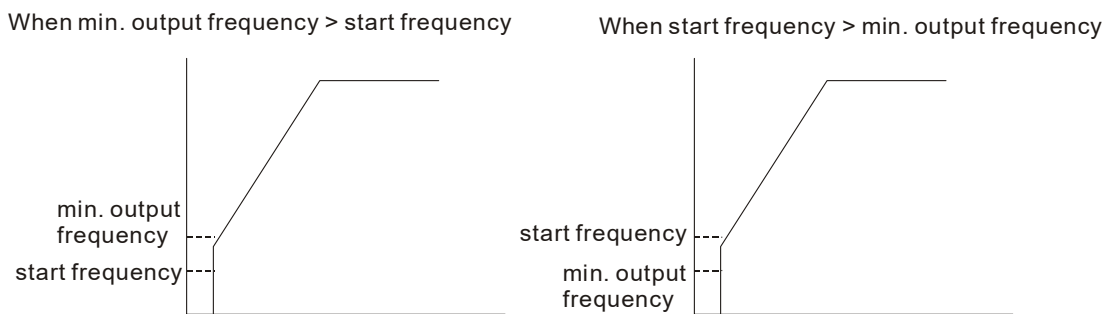
- You usually set the V/F curve according to the motor's allowable loading characteristics. Pay special attention to the motor's heat dissipation, dynamic balance, and bearing lubrication when the loading characteristics exceed the loading limit of the motor.
- For the V/F curve setting, use Pr.01-01 ≥ Pr.01-03 ≥ Pr.01-05 ≥ Pr.01-07. There is no limit for the voltage setting, but a high voltage at a low frequency may cause motor damage, overheating, and trigger the stall prevention or trigger the over-current protection; therefore, use low voltage at low frequency to prevent motor damage.



01-09 Starting Frequency

Control Mode **VF** **VFPG** **SVC** **FOCPG** Default: 0.50
 Settings 0.00–400.00 Hz

- Determines the starting frequency. When the starting frequency (Pr.01-09) is larger than the output frequency (Pr.01-11), the frequency output starts when the starting frequency (Pr.01-09) reaches the F command.



01-10 Output Frequency Upper Limit

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 120.00
 Settings 0.00–400.00 Hz




01-11 Output Frequency Lower Limit

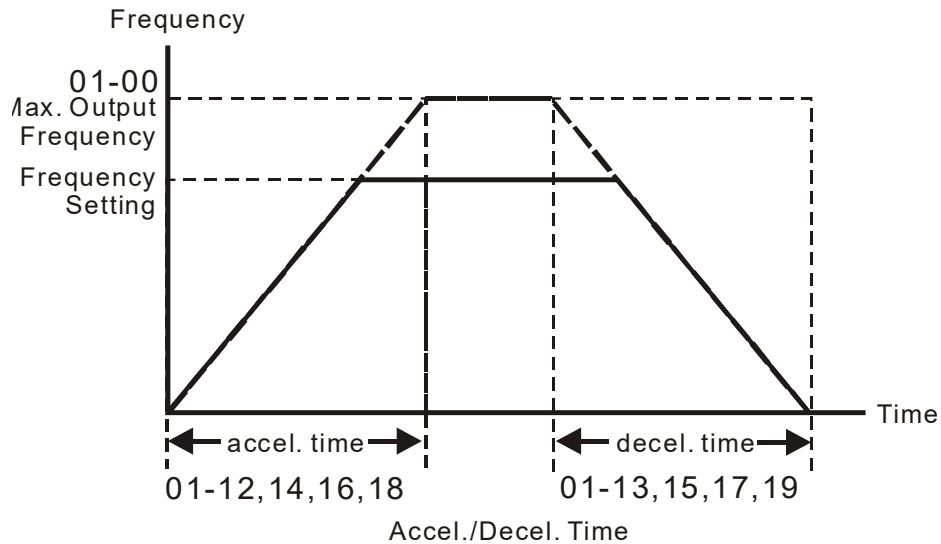
Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0.00
 Settings 0.00–400.00 Hz

- Use the upper/lower output frequency settings to limit the actual output frequency. If the frequency setting is lower than the start-up frequency, it runs with zero speed. If the frequency setting is higher than the upper limit, it runs with the upper limit frequency. If the output frequency lower limit > output frequency upper limit, this function is invalid.

Ch12 Descriptions of Parameter Settings | VFD-ED

↗	01-12	Accel. Time 1					
Control Mode	VF	VFP	SVC	FOCPG	FOCPM		Default: 3.00
Settings	0.00–600.00 sec.						
↗	01-13	Decel. Time 1					
Control Mode	VF	VFP	SVC	FOCPG	FOCPM		Default: 2.00
Settings	0.00–600.00 sec.						
↗	01-14	Accel. Time 2					
Control Mode	VF	VFP	SVC	FOCPG	FOCPM		Default: 3.00
Settings	0.00–600.00 sec.						
↗	01-15	Decel. Time 2					
Control Mode	VF	VFP	SVC	FOCPG	FOCPM		Default:2.00
Settings	0.00–600.00 sec.						
↗	01-16	Accel. Time 3					
Control Mode	VF	VFP	SVC	FOCPG	FOCPM		Default:3.00
Settings	0.00–600.00 sec.						
↗	01-17	Decel. Time 3					
Control Mode	VF	VFP	SVC	FOCPG	FOCPM		Default:2.00
Settings	0.00–600.00 sec.						
↗	01-18	Accel. Time 4					
Control Mode	VF	VFP	SVC	FOCPG	FOCPM		Default:3.00
Settings	0.00–600.00 sec.						
↗	01-19	Decel. Time 4					
Control Mode	VF	VFP	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 Hz to the Maximum Output Frequency (Pr.01-00). The Deceleration Time determines the time required for the AC motor drive to decelerate from the Maximum Output Frequency (Pr.01-00) down to 0 Hz.
-  Select the Acceleration/Deceleration Time 1, 2, 3, 4 with the multi-function input terminal settings. The defaults are Acceleration Time 1 and Deceleration Time 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.

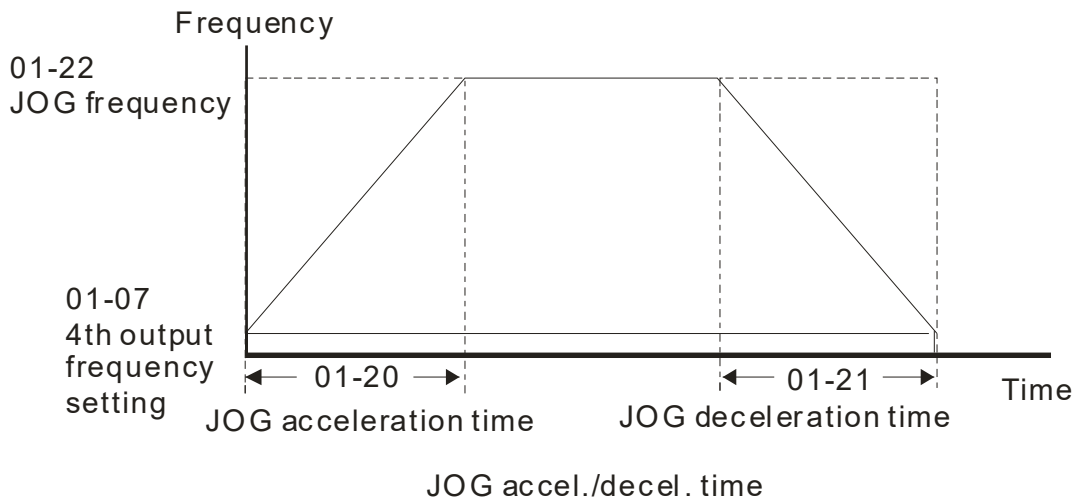


✎ **01-20** JOG Acceleration Time

✎ **01-21** JOG Deceleration Time

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 1.00
 Settings 0.00–600.00 sec.

- 📖 You can use both the external terminal JOG and the JOG key on the keypad. When the JOG command is ON, the AC motor drive accelerates from the fourth output voltage setting (Pr.01-07) to the JOG frequency (Pr.01-22). 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.01-20, Pr.01-21).
- 📖 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.



✎ **01-22** JOG Frequency

Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: 6.00
 Settings 0.00–400.00 Hz

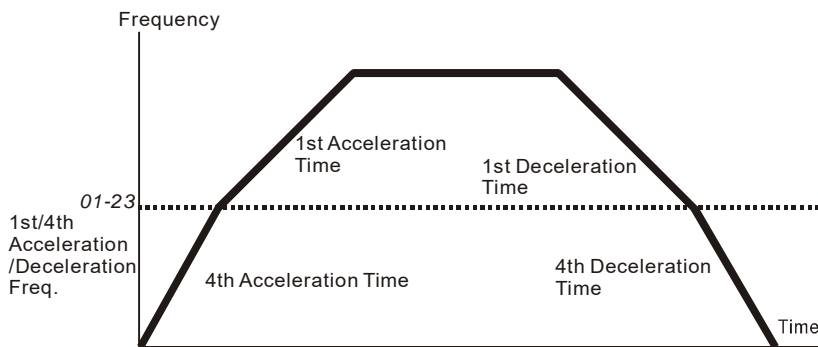
- 📖 You can use both the external terminal JOG and the JOG key on PU. When the JOG terminal is disabled, the AC motor drive accelerates from 0 Hz to the JOG frequency (Pr.01-22). When the JOG terminal is enabled, the AC motor drive decelerates from the JOG frequency to zero. The Acceleration and Deceleration time are set by these parameters (Pr.01-20, Pr.01-21). 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.

➤ **01-23** Switch Frequency between First and Fourth Accel./Decel.

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

Settings 0.00–400.00 Hz

📖 Determines the frequency for the transition from acceleration and deceleration time 1 to acceleration and deceleration time 4. You can also enable the transition from acceleration or deceleration time 1 to acceleration and deceleration time 4 with the external terminals (Pr.02-01–Pr.02-08). The external terminal has priority over Pr.01-23.



1st/4th Acceleration/Deceleration Switching

➤ **01-24** S-curve for Acceleration Begin Time S1

➤ **01-25** S-curve for Acceleration Arrival Time S2

➤ **01-26** S-curve for Deceleration Begin Time S3

➤ **01-27** S-curve for Deceleration Arrival Time S4

➤ **01-30** S-curve for Deceleration Arrival Time S5

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

Settings 0.00–25.00 sec.

➤ **01-29** Switch Frequency for S3/S4 Changes to S5

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

Settings 0.00–400.00 Hz

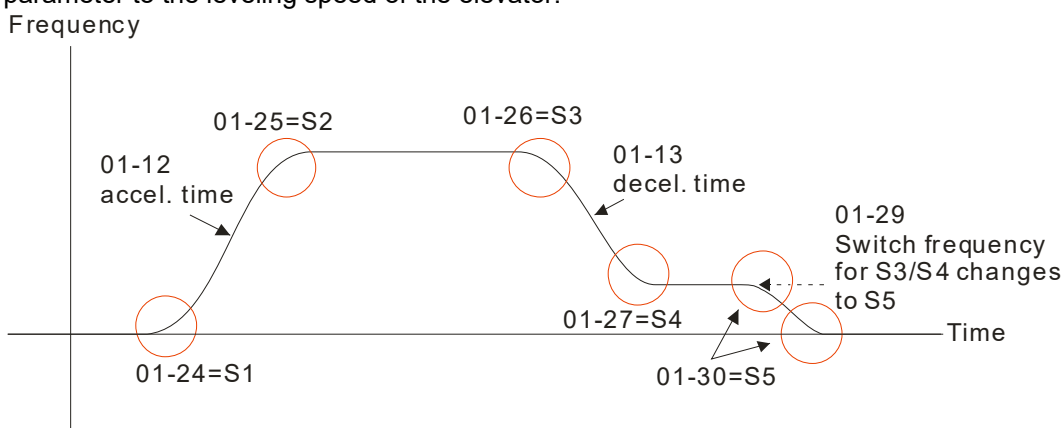
📖 Using an S-curve gives the smoothest transition between speed changes. The acceleration and deceleration curve adjusts the acceleration and deceleration S-curve. When enabled, the motor drive produces a different acceleration and deceleration curve according to the acceleration and deceleration time.

📖 The Actual Acceleration Time = selected acceleration Time + (Pr.01-24 + Pr.01-25) / 2.

The Actual Deceleration Time = selected deceleration Time + (Pr.01-26 + Pr.01-27 + Pr.01-30 * 2) / 2.

📖 Use Pr.01-29 to set the switch frequency between S4 and S5 for smooth stopping.

📖 Set this parameter to the leveling speed of the elevator.



01-28 Mode Selection when Frequency < Fmin

Control Mode	VF	VFPG	SVC			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.01-08).

01-31 Deceleration Time when Operating without RUN Command

Control Mode	VF	VFPG	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.01-29 for details.

01-32 Direct docking mode only

Control Mode						Default: -
Settings	Contact Delta for more information					

01-33 High Speed Time for Short Floor

Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: 3.00
Settings	0.00–60.00 sec.						

Sets the high speed duration during short floor operation.

01-34 Leveling Speed Time for Short Floor

Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: 3.00
Settings	0.00–60.00 sec.						

Sets the leveling speed duration during short floor operation.

01-35 Limit for Direct Docking Terminal

Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: 2.00
Settings	0.00–10.00						

Sets the limit for changing from leveling speed to acceleration when using terminals for direct docking.

01-36 Deceleration Distance for Direct Docking Terminal

Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: 30.00
Settings	0.00–10.00 cm						

Sets the distance between deceleration points.

01-37 Deceleration Distance Reference for Short Floor

Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: Read only
Settings	0.00–655.35 m						

Sets the distance between deceleration points according to short floors (write inhibit).

01-38 Short Floor/Direct Docking Terminal Enabled

Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: 0000h

- Settings
- 0000h: Disabled
 - 0001h: Short floor enabled
 - 0002h: Direct docking terminal enabled
 - 0003h: Short floor + direct docking terminal enabled

📖 Related parameters: Pr.02-01–02-08 multi-function input terminal (53: terminal leveling signal for direct docking).

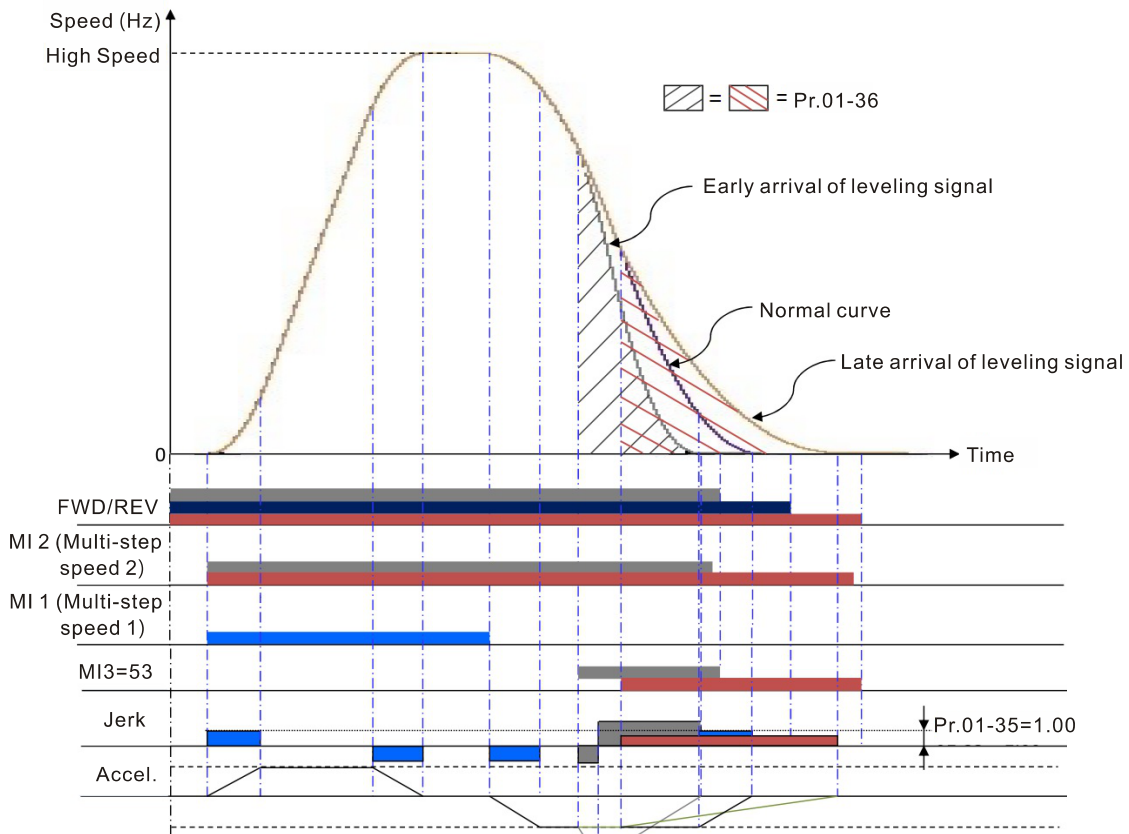
📖 Direct docking terminal function:

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.01-36), as shown in the figure below. If deceleration distance is too short, the drive adjusts the speed according to the limit for acceleration change (Pr.01-35).

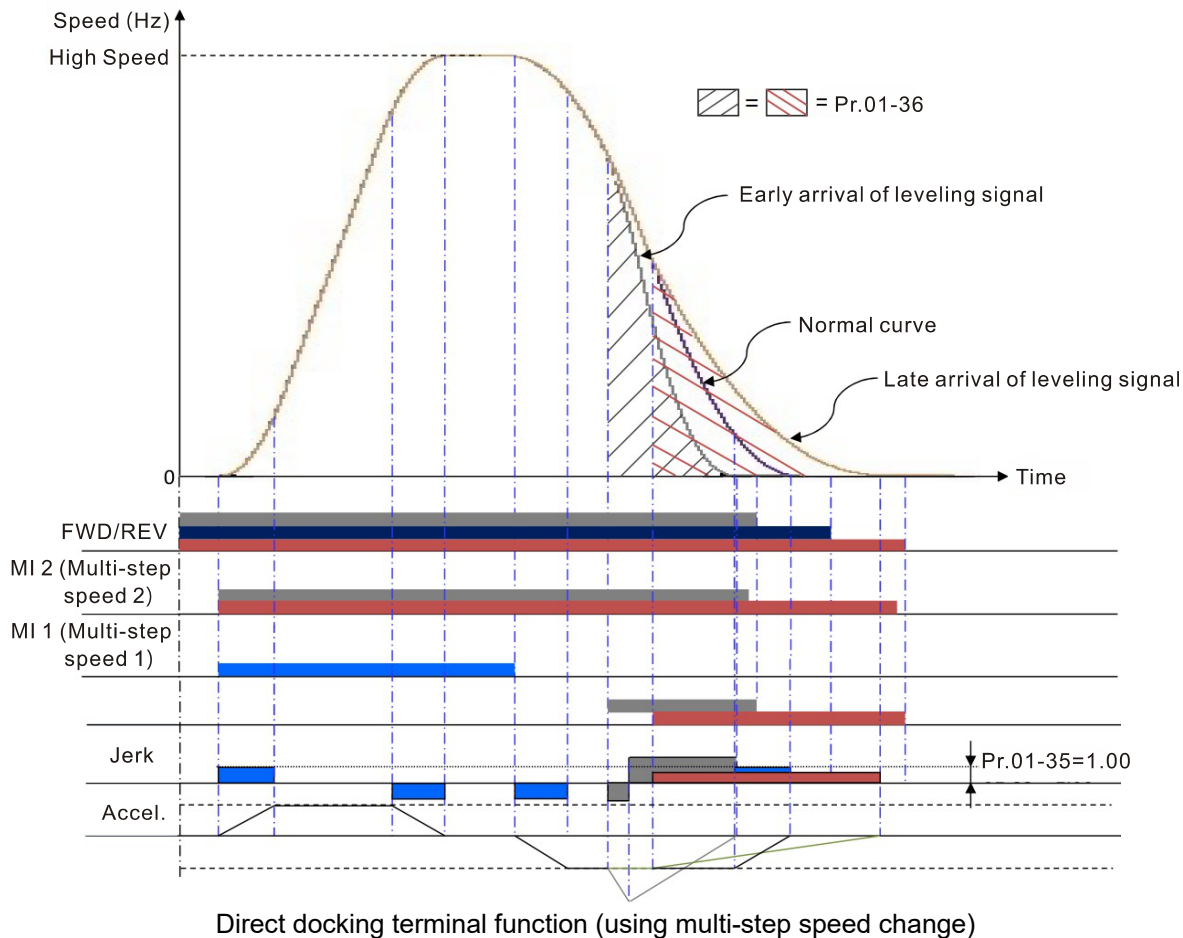
There are two methods for sending leveling signals:

1. Using multi-function input terminals
2. Do not use the low speed multi-step speed

When using the first method, set MI setting value to 53.



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



Definitions of deceleration distance for short floors:

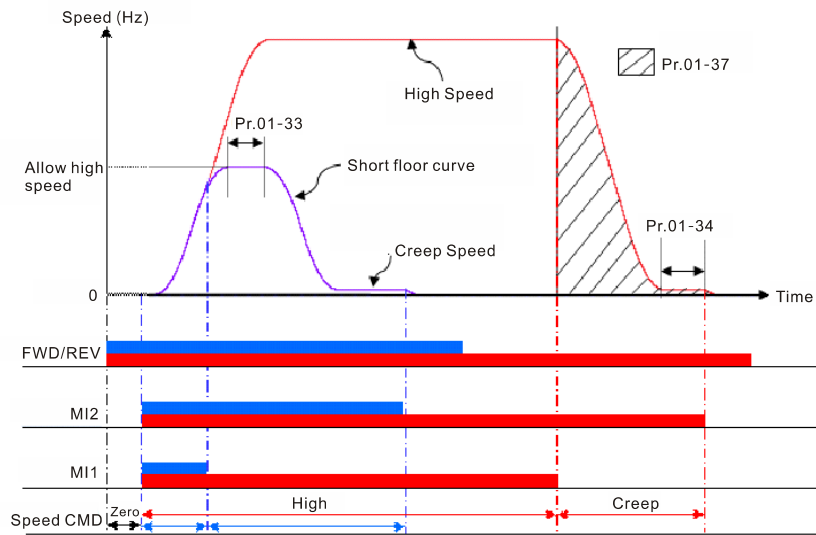
When the motor runs with the highest speed, the deceleration distance for short floors is calculated according to the first deceleration time (S3 curve time, equivalent deceleration time, S4 curve time) and leveling speed duration, as Pr.01-37 in Case 1_Short floor function diagram illustrated.

The following cases are illustrated by diagrams:

- Case 1. Deceleration point (instead of high speed) is given before allowed speed
- Case 2. Deceleration point (instead of high speed) is given before allowed speed and high speed time is not zero.
- Case 3. Deceleration point (instead of high speed) is given before allowed speed and high speed time is zero.

Case 1. Deceleration point (instead of high speed) is given before allowed speed

Regardless of the corresponding speed when the drive gives the deceleration points, the drive issues the speed allowance command to replace leveling speed, executes the corresponded S2 curve before allowed speed, maintains the high speed time set, and gives the leveling speed after high speed duration. Refer to Pr.01-12, 01-24, 01-25 for information on acceleration curves.

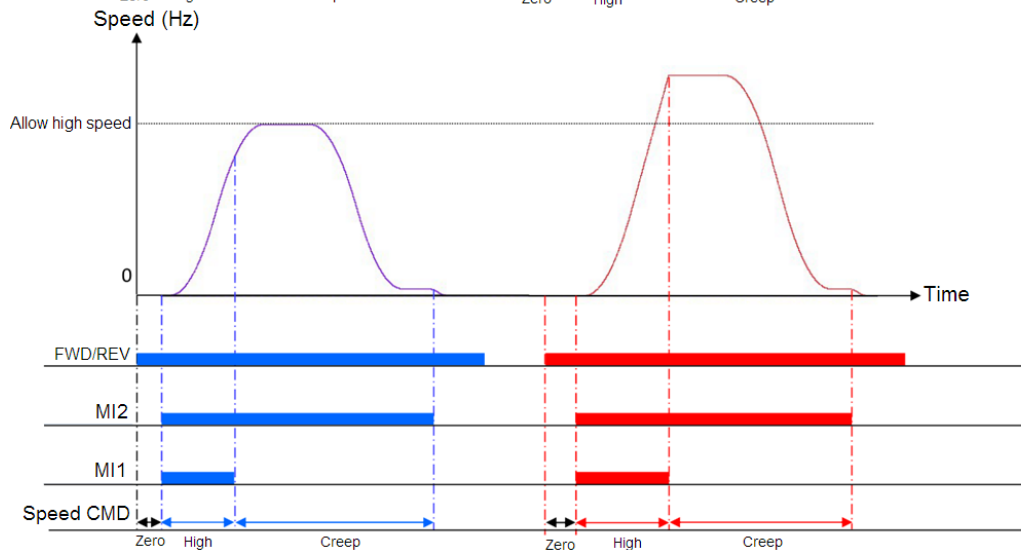
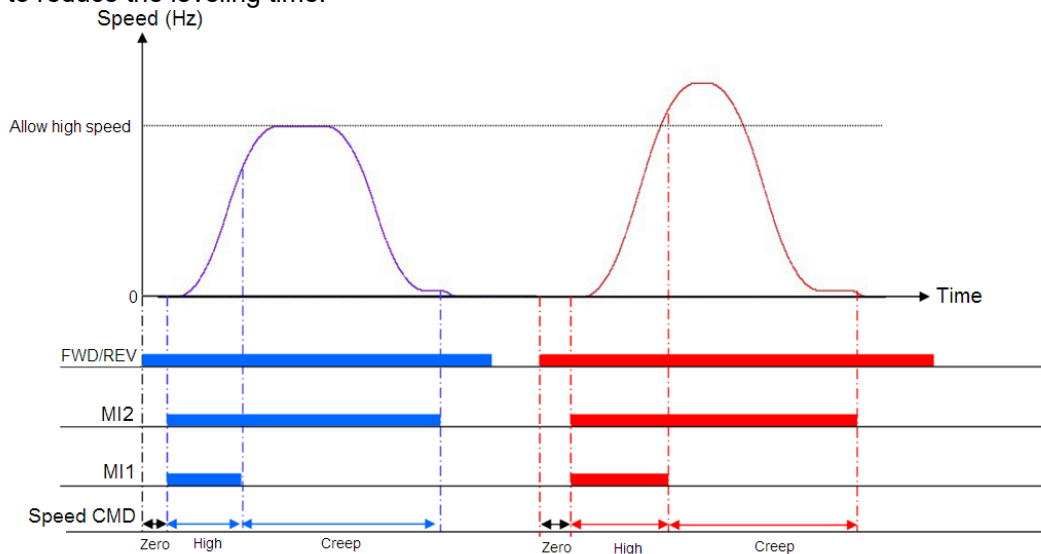


Short floor function diagram

Case 2. Deceleration point (instead of high speed) is given before allowed speed and high speed time is not zero.

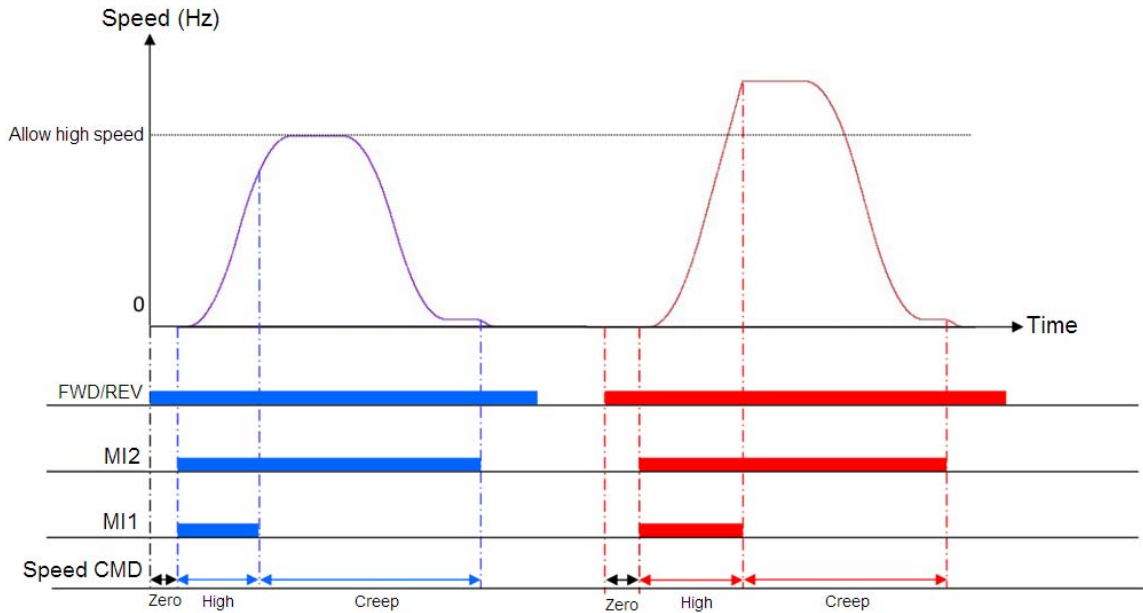
When high speed is higher than allowed speed, the drive automatically determines the remaining distances and reduces the high speed duration accordingly to increase the running speed.

Note that if the high speed duration is reduced to zero or below zero, the system executes the equivalent speed command according to the current speed instead of executing S2, and increases the high speed duration to reduce the leveling time.



Case 3. Deceleration point (instead of high speed) is given before allowed speed and high speed time is zero

When high speed is higher than allowed speed, because there is no duration, the drive levels the speed instead of executing S2, adds high speed duration accordingly to reduce the leveling time, which is the same as Case 2 when the high speed duration is reduced to zero or below zero.



01-39 Automatic Emergency Deceleration Level

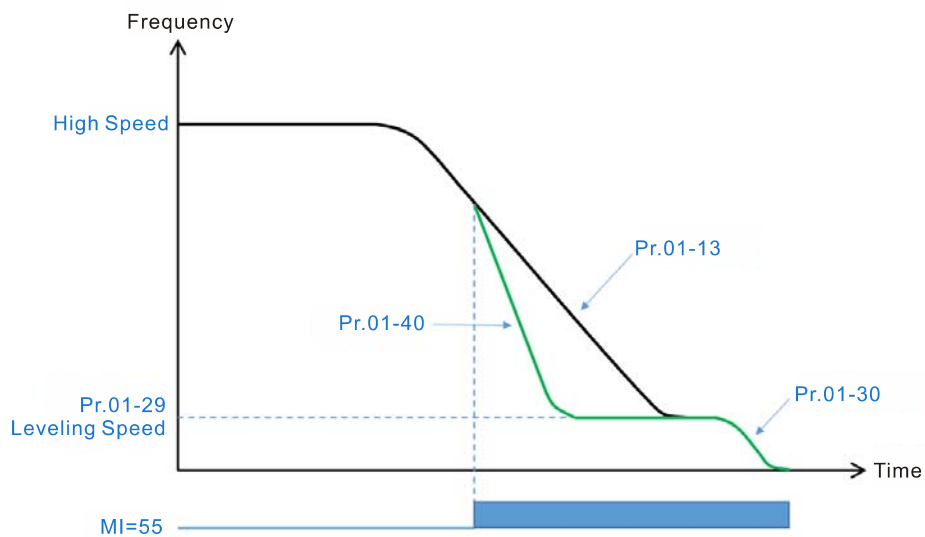
Control Mode **VFPG** **FOCPG** **FOCPM** Default: 60.00
 Settings 5.00–400.00 Hz

When MI is set to 56, the system monitors the current speed. If the speed is higher than Pr.01-39, the drive decelerates to Pr.01-29 speed according to Pr.01-40 deceleration time.

01-40 Deceleration Time for Emergency Deceleration

Control Mode **VFPG** **FOCPG** **FOCPM** Default: 2.00
 Settings 0.00–600.00 sec.

When MI=55 function is triggered, the drive decelerates to Pr.01-29 speed according to Pr.01-40 deceleration time, as shown in the figure below.



02 Digital Input / Output Parameters

↗: You can set this parameter during operation.

02-00 Two-wire//three-wire Operation Control

Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: 0
Settings	0: FWD/STOP, REV/STOP 1: FWD/STOP, REV/STOP (Line Start Lockout) 2: RUN/STOP, REV/FWD 3: RUN/STOP, REV/FWD (Line Start Lockout) 4: Three-wire 5: Three-wire (Line Start Lockout)						

📖 Three of the six modes include 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 malfunctioning switch.

This parameter controls operation from external terminals. There are three different control modes.

Pr.02-00	External Terminal Control Circuits
0, 1 Two-wire operation control (1) FWD/STOP REV/STOP	
2, 3 Two-wire operation control (2) RUN/STOP FWD/REV REV/FWD	
4, 5 Three-wire operation control	

02-01 Multi-Function Input Command 1 (MI1) (It is the Stop terminal for three-wire operation)

Default:1

02-02 Multi-Function Input Command 2 (MI2)

Default:2

02-03 Multi-Function Input Command 3 (MI3)

Default:3

02-04 Multi-Function Input Command 4 (MI4)

Default:4

02-05 Multi-Function Input Command 5 (MI5)

Default: 0

02-06 Multi-Function Input Command 6 (MI6)

Default: 0

02-07 Multi-Function Input Command 7 (MI7)

Default: 0


02-08 Multi-Function Input Command 8 (MI8) (Enable Drive terminal)


Default:40

Settings	Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM
0: no function		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
1: Multi-step speed command 1		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>
2: Multi-step speed command 2		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>
3: Multi-step speed command 3		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>
4: Multi-step speed command 4		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>
5: Reset		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6: JOG command		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>
7: Acceleration/deceleration speed inhibit		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>
8: First, second acceleration/deceleration time		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>
9: Third, fourth acceleration/deceleration time		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>
10: EF input (Pr.07-28)		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11: Reserved							
12: Stop output		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13–14: Reserved							
15: AUI1 operation speed command		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>
16: Reserved		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>
17: AUI2 operation speed command		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>
18: Emergency Stop (Pr.07-28)		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19–23: Reserved							
24: FWD JOG Command		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>
25: REV JOG Command		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>
26: Reserved							
27: ASR1/ASR2 selection		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>
28: Emergency stop (EF1) (motor coasts to stop)		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
29–30: Reserved							
31: High torque bias (according to Pr.07-21)		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
32: Middle torque bias (according to Pr.07-22)		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
33: Low torque bias (according to Pr.07-23)		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
34–37: Reserved							
38: Disable writing to EEPROM		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
39: Torque command direction						<input type="radio"/>	
40: Enable drive function		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
41: Magnetic contactor detection			<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
42: Mechanical brake 1		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
43: EPS function (Emergency Power System)		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Ch12 Descriptions of Parameter Settings | VFD-ED

44: Mechanical brake 2	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
45–51: Direct docking mode only						
53: Terminal leveling signal for direct docking		<input type="radio"/>		<input type="radio"/>		<input type="radio"/>
54: Power failure signal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
55: Manual emergency deceleration		<input type="radio"/>		<input type="radio"/>		<input type="radio"/>
56: Automatic emergency deceleration		<input type="radio"/>		<input type="radio"/>		<input type="radio"/>

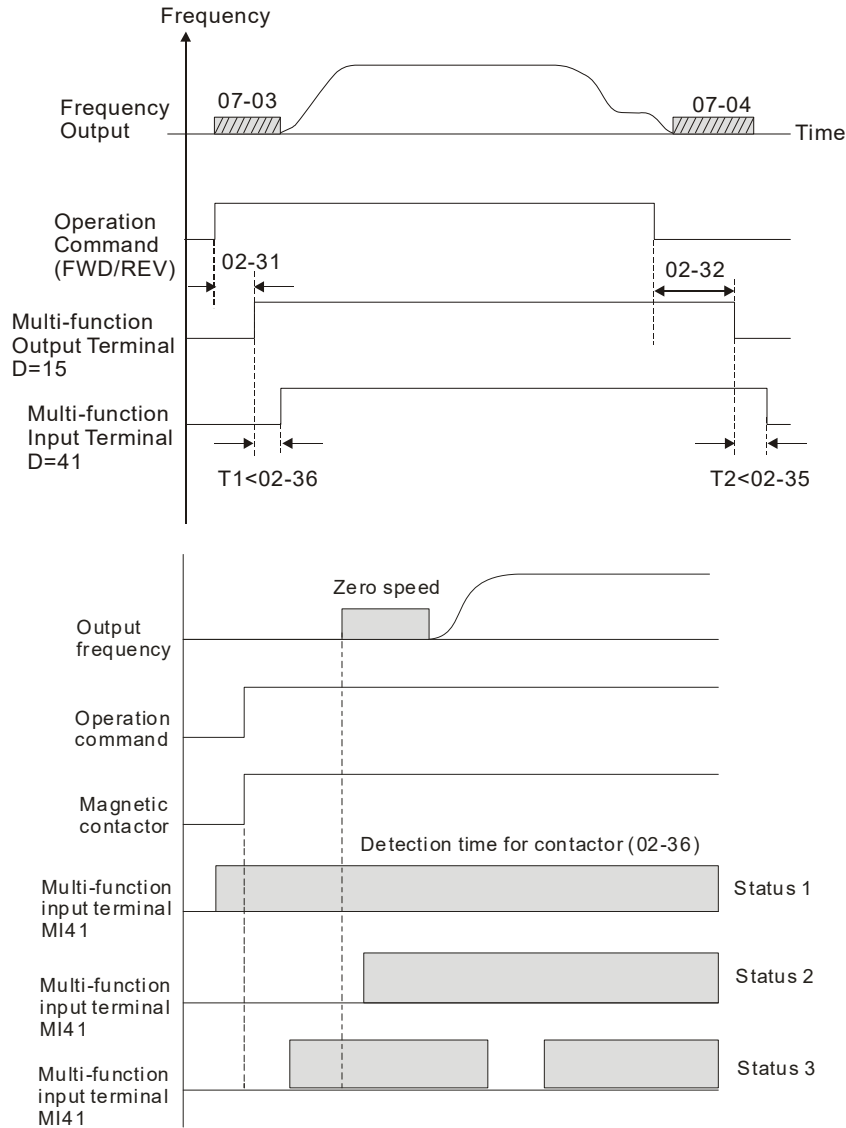
 Selects the functions for each multi-function terminal.

 If you set Pr.02-00 to three-wire operation control, terminal MI1 is for STOP terminal, and MI1 is not available for any other operation.

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. 04-00–Pr.04-14). 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.													
8	The first, second acceleration or deceleration time	You can select the motor drive's acceleration and deceleration time through the terminals; there are four acceleration and deceleration speeds in total.													
		<table border="1"> <thead> <tr> <th>Bit 0</th> <th>Bit 1</th> <th>Descriptions</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>First accel./decel. time When output frequency is less than Pr.01-23 (Switch Frequency between first/fourth Accel./decel.), it outputs the fourth accel./decel. time.</td> </tr> <tr> <td>0</td> <td>1</td> <td>Second accel./decel. time</td> </tr> <tr> <td>1</td> <td>0</td> <td>Third accel./decel. time</td> </tr> <tr> <td>1</td> <td>1</td> <td>Fourth accel./decel. time</td> </tr> </tbody> </table>	Bit 0	Bit 1	Descriptions	0	0	First accel./decel. time When output frequency is less than Pr.01-23 (Switch Frequency between first/fourth Accel./decel.), it outputs the fourth accel./decel. time.	0	1	Second accel./decel. time	1	0	Third accel./decel. time	1
Bit 0	Bit 1	Descriptions													
0	0	First accel./decel. time When output frequency is less than Pr.01-23 (Switch Frequency between first/fourth Accel./decel.), it outputs the fourth accel./decel. time.													
0	1	Second accel./decel. time													
1	0	Third accel./decel. time													
1	1	Fourth accel./decel. time													
9	The third, fourth acceleration or deceleration time	If the drive receives STOP command, it decelerates to stop with Pr.01-31.													
10	EF Input	External fault input terminal, and decelerates according to Pr.07-28 (records EF fault).													
11: Reserved															
12	Stop output	When enabled, the motor drive output stops immediately and the motor coasts. When disabled, the motor drive accelerates to the frequency setting.													
13–14: Reserved															
15	AUI1 operation speed command	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.													

16: Reserved																																						
17	AUI2 operation speed command	When enabled, it forces the frequency source to AUI2.																																				
18	Emergency Stop	When enabled, the motor drive ramps to stop according to Pr.07-28.																																				
19–23: Reserved																																						
24	FWD JOG command	When enabled, the motor drive executes the forward Jog command.																																				
25	REV JOG command	When enabled, the motor drive executes the reverse Jog command.																																				
26: Reserved																																						
27	ASR1/ASR2 selection	ON: Speed is adjusted according to ASR 2. OFF: Speed is adjusted according to ASR 1.																																				
28	Emergency stop (EF1) (Motor coasts to stop)	ON: The motor drive executes emergency stop and records the fault code.																																				
29–30: Reserved																																						
31	High torque bias	When Pr.07-19 is set to 3: Set the high torque bias in Pr.07-21.																																				
32	Middle torque bias	Set the middle torque bias in Pr.07-22.																																				
33	Low torque bias	Set the low torque bias in Pr.07-23.																																				
<table border="1"> <thead> <tr> <th>31</th> <th>32</th> <th>33</th> <th>Torque Bias</th> </tr> </thead> <tbody> <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.07-23</td> </tr> <tr> <td>OFF</td> <td>ON</td> <td>OFF</td> <td>Pr.07-22</td> </tr> <tr> <td>OFF</td> <td>ON</td> <td>ON</td> <td>Pr.07-23+ Pr.07-22</td> </tr> <tr> <td>ON</td> <td>OFF</td> <td>OFF</td> <td>Pr.07-21</td> </tr> <tr> <td>ON</td> <td>OFF</td> <td>ON</td> <td>Pr.07-21+ Pr.07-23</td> </tr> <tr> <td>ON</td> <td>ON</td> <td>OFF</td> <td>Pr.07-21+ Pr.07-22</td> </tr> <tr> <td>ON</td> <td>ON</td> <td>ON</td> <td>Pr.07-21+ Pr.07-22+ Pr.07-23</td> </tr> </tbody> </table>			31	32	33	Torque Bias	OFF	OFF	OFF	N/A	OFF	OFF	ON	Pr.07-23	OFF	ON	OFF	Pr.07-22	OFF	ON	ON	Pr.07-23+ Pr.07-22	ON	OFF	OFF	Pr.07-21	ON	OFF	ON	Pr.07-21+ Pr.07-23	ON	ON	OFF	Pr.07-21+ Pr.07-22	ON	ON	ON	Pr.07-21+ Pr.07-22+ Pr.07-23
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OFF	OFF	OFF	N/A																																			
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ON	ON	OFF	Pr.07-21+ Pr.07-22																																			
ON	ON	ON	Pr.07-21+ Pr.07-22+ Pr.07-23																																			
34–37: Reserved																																						
38	Disable writing to EEPROM	When enabled, you cannot write to EEPROM.																																				
39	Torque command direction	When the torque command is AUI, set this function to change the torque command direction. To work with Pr.07-13 = 2, set Pr.03-01 to 2.																																				
40	Enable drive function	When enabled, it executes the motor drive function. This function can be used with multi-function output (setting Pr.02-11–Pr.02-14 to 15) and (Pr.02-31 and Pr.02-32).																																				

41	Magnetic contactor detection	<p>This terminal is for the magnetic contactor feedback signal ON/OFF.</p> <p>When the motor drive receives a RUN command, it enables the corresponding output terminal (setting 15) after Pr.02-31 time. It checks if this function is enabled in the detection time (Pr.02-36). If NOT, the magnetic contactor error occurs and error code "MCF" displays.</p>
42	Mechanical brake 1	<p>When the motor drive receives a RUN command, it enables the corresponding output terminal (setting 12) after Pr.02-29 time. It checks if this function is enabled in the detection time (Pr.02-35). If NOT, the mechanical brake error occurs and error code "MBF" displays.</p>
43	EPS function (Emergency Power System)	<p>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.</p>
44	Mechanical brake 2	<p>When the motor drive receives a RUN command, it enables the corresponding output terminal (setting 12) after Pr.02-29 time. It checks if this function is enabled in the detection time (Pr.02-35). If NOT, the mechanical brake error occurs and error code "MBF" displays.</p>
45–51	Direct docking mode only	<p>Contact Delta for more information.</p>
53	Terminal leveling signal for direct docking	<p>When the elevator runs to the leveling area, controller sends a signal to the drive to make the drive stop within effective distance (Pr.01-36).</p>
54	Power failure signal	<p>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.06-71 time</p>
55	Manual emergency deceleration	<p>When the motor drive receives this signal, it decelerates to Pr.01-29 speed according to Pr.01-40 deceleration time.</p>
56	Automatic emergency deceleration	<p>After setting this MI function, the system monitors the current speed. If the speed is higher than Pr.01-39, the drive decelerates to Pr.01-29 speed according to Pr.01-40 deceleration time.</p>



02-09 Digital Input Response Time

Control Mode **VF VFPG SVC FOCPG TQCPG 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.

02-10 Digital Input Operation Direction

Control Mode **VF VFPG SVC FOCPG TQCPG FOCPM** Default: 0
 Settings 0–65535

- Sets the input signal level and it is not affected by the SINK/SOURCE status.
 - Bit 0 is for FWD terminal, bit 1 is for REV terminal and bits 2–9 are for MI1 to MI8.
 - You can change the terminal status through communications.
- For example, set MI1=1 (multi-step speed command 1) and MI2=2 (multi-step speed command 2). Then the forward + second step speed command = 1001 (binary) = 9 (Decimal). You only need to set Pr.02-10=9 through communications and it can move forward at the second step speed. In this case, you do not need to wire any multi-function terminals.

bit9	bit8	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
MI8	MI7	MI6	MI5	MI4	MI3	MI2	MI1	REV	FWD

- ↗ **02-11** Multi-function Output 1: RA, RB, RC (Relay 1) Default: 11
- ↗ **02-12** Multi-function Output 2: MRA, MRB, MRC (Relay 2) Default: 1
- ↗ **02-13** Multi-function Output 3: R1A, R12C (Relay 3)
- ↗ **02-14** Multi-function Output 4: R2A, R12C (Relay 4)
- ↗ **02-15** Multi-function Output 5: MO1
- ↗ **02-16** Multi-function Output 6: MO2
- 02-17** Reserved
- 02-18** Reserved
- 02-19** Reserved
- 02-20** Reserved
- 02-21** Reserved
- 02-22** Reserved

Default: 0

Settings	Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM
0: No function		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
1: Operation indication		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2: Operation speed reached		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3: Desired frequency 1 reached (Pr.02-25, Pr.02-26)		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>
4: Desired frequency 2 reached (Pr.02-27, Pr.02-28)		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>
5: Zero Speed (Frequency command)		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>
6: Zero speed with stop (Frequency command)		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>
7: Over-torque (OT1) (Pr.06-05–06-07)		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8: Over-torque (OT2) (Pr.06-08–06-10)		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9: Drive ready		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10: User-defined low-voltage detection (LV)		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11: Malfunction indication		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12: Mechanical brake release (Pr.02-29, Pr.02-30, Pr.02-37)		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13: Overheat (Pr.06-14)		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14: Brake chopper signal		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15: Motor-controlled magnetic contactor output		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16: Slip error (oSL)		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>
17: Malfunction indication 1		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18: Reserved							
19: Brake chopper output error		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
20: Warning output		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21: Over-voltage warning		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
22: Over-current stall prevention warning		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>			

23: Over-voltage stall prevention warning	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
24: Operation mode indication (Pr.00-15=1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
25: Forward command	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
26: Reverse command	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
27: Output when current \geq Pr.02-33	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
28: Output when current $<$ Pr.02-33	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
29: Output when frequency \geq Pr.02-34	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
30: Output when frequency $<$ Pr.02-34	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
31: Power generation direction and status verification	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
32: Power generation direction	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
33: Zero speed (actual output frequency)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
34: Zero speed with Stop (actual output frequency)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
35: Fault output option 1 (Pr.06-22)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
36: Fault output option 2 (Pr.06-23)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
37: Fault output option 3 (Pr.06-24)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
38: Fault output option 4 (Pr.06-25)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
39: Reserved						
40: Speed reached (including zero speed)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
41: Reserved						
42: STO Output Error	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
43–44: Direct Docking Mode only						
45: Reserved						
46: Retrying after a fault has occurred indication	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
47: Direct Docking Mode only						
48: Control output of star-delta contactor	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
49: Emergency power mode action	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Settings	Functions	Descriptions
0	No function	No function
1	Operation indication	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.02-25, 02-26)	Active when the desired frequency (Pr.02-25, 02-26) reached.
4	Desired frequency 2 reached (Pr.02-27, 02-28)	Active when the desired frequency (Pr.02-27, 02-28) 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)	Active when detecting over-torque. Refer to Pr.06-05 (over-torque

	(Pr.06-05–06-07)	detection-OT1), Pr.06-06 (over-torque detection level-OT1) and Pr.06-07 (over-torque detection time-OT1).
8	Over-torque (OT2) (Pr.06-08–06-10)	Active when detecting over-torque. Refer to Pr.06-08 (over-torque detection-OT2), Pr.06-09 (over-torque detection level-OT2) and Pr.06-10 (over-torque detection time-OT2).
9	Drive 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 (refer to Pr.06-00 Low voltage level).
11	Malfunction indication	Active when a fault occurs (except Lv stop).
12	Mechanical brake release (Pr.02-29, Pr.02-30, Pr.02-37)	<p>When the drive runs according to Pr.02-29, it is ON. Use this function with the DC brake. It is recommended to use contact “b” (N.C).</p>
13	Overheat (Pr.06-14)	Active when IGBT or heat sink overheats. To prevent OH, turn off the drive (refer to Pr.06-14).
14	Brake chopper signal	Activated when the drive needs help braking the load. This function helps achieve a smooth deceleration (refer to Pr.07-00).
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.05-14).
17	Malfunction indication 1	Activate after 10 ms when a fault occurs (except Lv stop).
18	Reserved	
19	Brake chopper output error	Active when a brake chopper error is detected
20	Warning output	Active when a warning is detected.
21	Over-voltage warning	Active when an over-voltage is detected.
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.00-15=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 \geq Pr.02-33	Active when current is \geq Pr.02-33.
28	Output when current $<$	Active when current is $<$ Pr.02-33.

	Pr.02-33															
29	Output when frequency ≥ Pr.02-34	Active when frequency is ≥ Pr.02-34.														
30	Output when frequency < Pr.02-34	Active when frequency is < Pr.02-34.														
31	Power generation direction and status verification	Activate when the power generation direction is verified.														
32	Power generation direction	Activate when the power generation direction runs forward.														
33	Zero speed (actual output frequency)	Active when the actual output frequency is 0. The drive should be in RUN mode.														
34	Zero speed with stop (actual output frequency)	Active when the actual output frequency is 0 or Stop. The drive should be in RUN mode.														
35	Fault output option 1 (Pr.06-22)	Active when Pr.06-22 is ON.														
36	Fault output option 2 (Pr.06-23)	Active when Pr.06-23 is ON.														
37	Fault output option 3 (Pr.06-24)	Active when Pr.06-24 is ON.														
38	Fault output option 4 (Pr.06-25)	Active when Pr.06-25 is ON.														
39	Reserved															
40	Speed reached (including zero speed)	Active when the output frequency reaches the frequency setting.														
41	Reserved															
42	STO Output Error	<table border="1"> <thead> <tr> <th rowspan="2">Status of drive</th> <th colspan="2">Status of safety output</th> </tr> <tr> <th colspan="2">Status A (MO=42)</th> </tr> </thead> <tbody> <tr> <td>Normal</td> <td colspan="2">Broken circuit (open)</td> </tr> <tr> <td>STO</td> <td colspan="2">Short circuit (closed)</td> </tr> <tr> <td>STL1–STL3</td> <td colspan="2">Short circuit (closed)</td> </tr> </tbody> </table> <p>*Setting of logic output B is on page 16-6.</p>	Status of drive	Status of safety output		Status A (MO=42)		Normal	Broken circuit (open)		STO	Short circuit (closed)		STL1–STL3	Short circuit (closed)	
Status of drive	Status of safety output															
	Status A (MO=42)															
Normal	Broken circuit (open)															
STO	Short circuit (closed)															
STL1–STL3	Short circuit (closed)															
43–44	Direct Docking Mode only	Contact Delta for more information														
45	Reserved															
46	Retrying after a fault has occurred indication	Retry multiple outputs after an error has occurred. When the retry period has finished, MO stops.														
47	Direct Docking Mode only	Contact Delta for more information														
48	Control output of star-delta contactor	Active when the drive receives a STOP command.														
49	Emergency power mode action	Active when the drive receives a signal from the host controller (Pr.02-01–02-08=54) after Pr.06-71 time.														

02-23 Multi-output Direction

Control Mode **VF VFPG SVC FOC PG TQCPG FOC PM** Default: 0
 Settings 0-65535

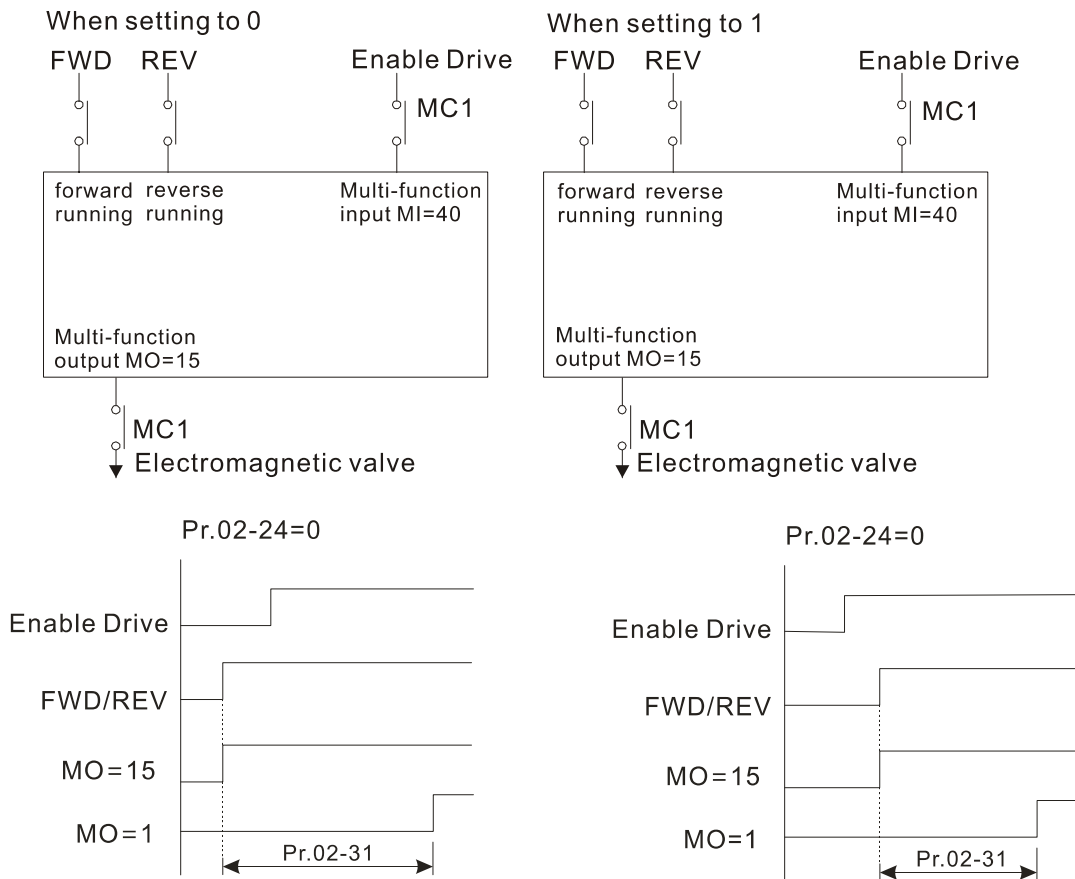
This parameter uses bit setting. If the bit is 1, the multi-function output terminal acts in the opposite direction. For example, if you set Pr.02-11 to 1 and the forward bit is 0, Relay 1 is ON when the drive is running and OFF when the drive is stopped.

Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
-	-	-	-	-	-	MO2	MO1	R2A	R1A	MRA	RA

02-24 Serial Start Signal Selection

Control Mode **VF VFPG SVC FOC PG FOC PM** Default: 0
 Settings 0: According to FWD/REV signal
 1: According to Enable drive function signal

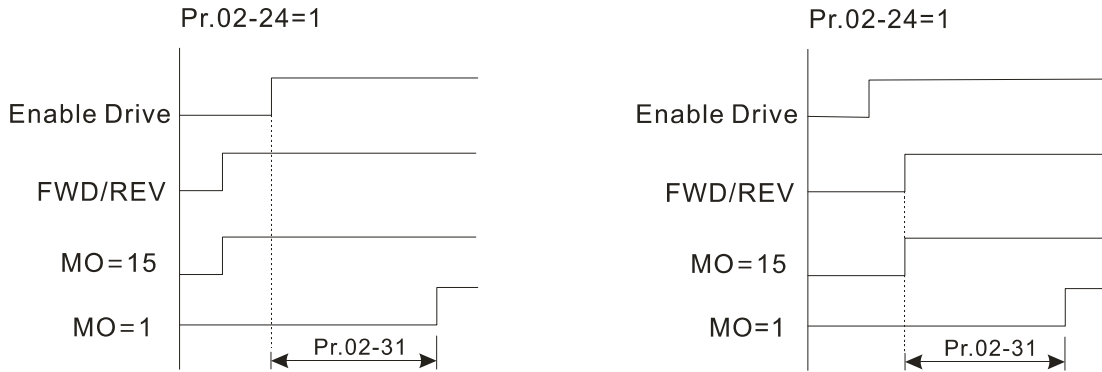
- Selects the electromagnetic valve serial start method.
- 0: According to FWD/REV signal, the motor starts to run after the Enable signal MI = 40 is ON.
- 1: According to Enable signal, the electromagnetic valve, mechanical brake and DC brake all follow parameters' setting to run after FWD/REV and Enable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



Pr.02-24=0	Enable Drive		
	0	1	
Multi-function output MO= 15	0	False	False
	1	True	True

No matter if the Enable Drive function signal outputs or not,

the drive starts to count Pr.02-31 after MO15 .outputs.



Pr.02-24=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.02-31.

➤ **02-25** Desired Frequency Reached 1

Control Mode **VF VFPG SVC FOCPG FOCPM** Default: 60.00/50.00
 Settings 0.00–400.00 Hz

➤ **02-26** Desired Frequency Reached Width 1

Control Mode **VF VFPG SVC FOCPG FOCPM** Default: 2.00
 Settings 0.00–400.00 Hz

➤ **02-27** Desired Frequency Reached 2

Control Mode **VF VFPG SVC FOCPG FOCPM** Default: 60.00/50.00
 Settings 0.00–400.00 Hz

➤ **02-28** Desired Frequency Reached Width 2

Control Mode **VF VFPG 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.02-11–Pr.02-22), this multi-function output terminal is ON.

02-29 Brake Release Delay Time when Elevator Starts

Control Mode **VF VFPG SVC FOCPG TQCPG FOCPM** Default: 0.250
 Settings 0.000–65.000 sec.

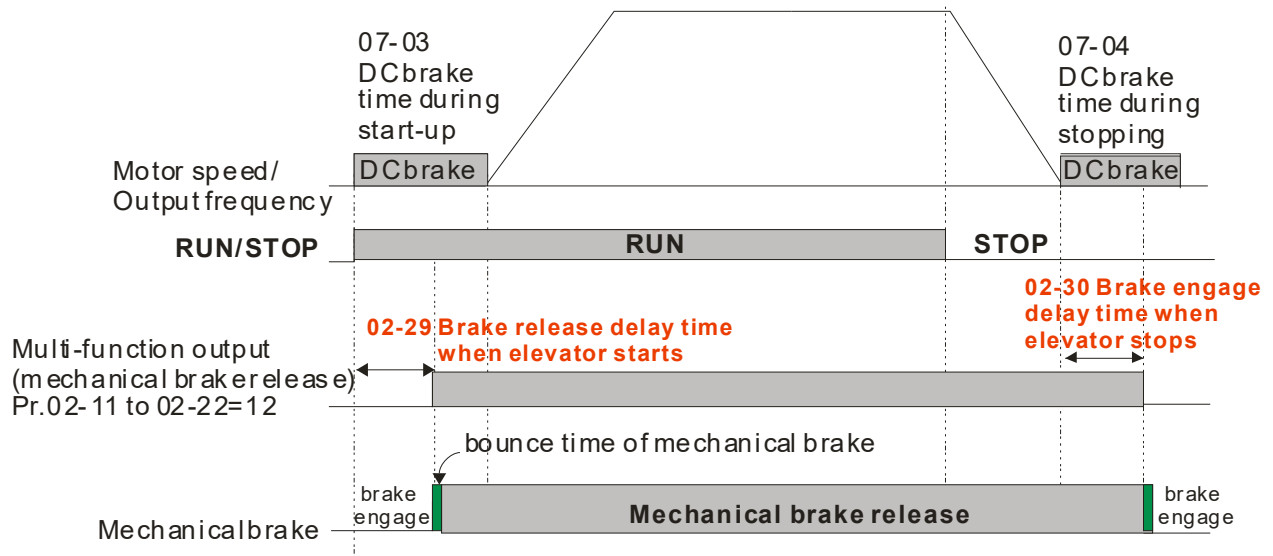
02-30 Brake Engage Delay Time when Elevator Stops

Control Mode **VF VFPG SVC FOCPG TQCPG FOCPM** Default: 0.250
 Settings 0.000–65.000 sec.

📖 When the AC motor drive runs and after the delay time in Pr.02-29, 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.02-30, the corresponding multi-function output terminal (12: mechanical brake release) is OFF.

📖 Use this function with the DC brake function.



- **02-31** Magnetic Contactor Contracting Delay Time between Drive and Motor
- **02-32** Magnetic Contactor Release Delay Time between Drive and Motor

Control Mode **VF VFPG SVC FOC PG TQCPG FOC PM** Default: 0.200
 Settings 0.010–65.000 sec.

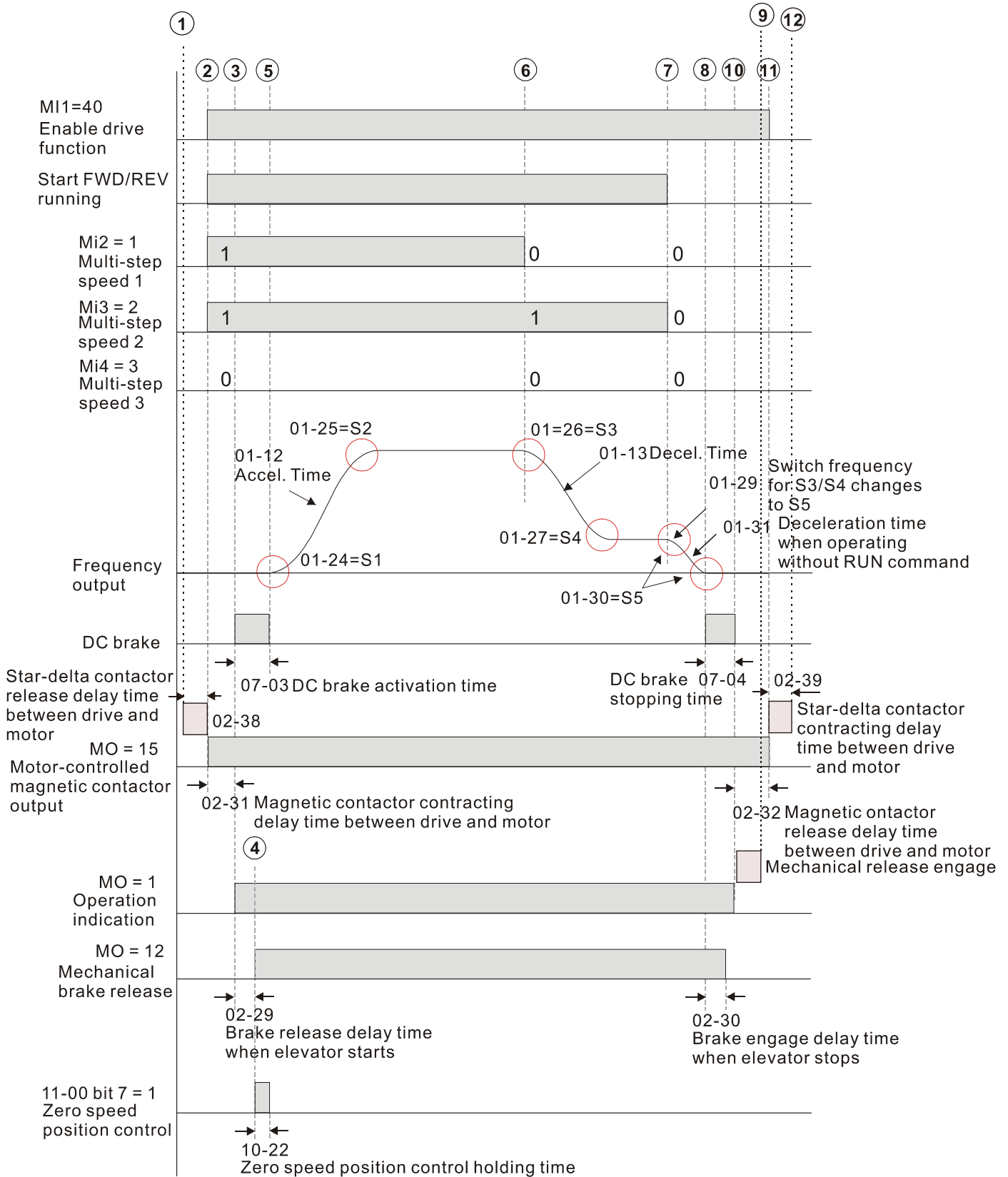
After running, use these parameters with multifunction input terminal setting 40 (Enable drive function), and multifunction output terminal setting 15 (motor-controlled magnetic contactor output). When the multifunction output terminals are ON, the drive starts outputting after the delay time in Pr.02-31. When the drive stops outputting, multifunction output terminals release after the delay time in Pr.02-32.

- **02-38** Star-delta Contactor Release Delay Time between Drive and Motor

Control Mode **VF VFPG SVC FOC PG TQCPG FOC PM** Default: 0.200
 Settings 0.0010~65.000 sec.

- **02-39** Star-delta Contactor Contracting Delay Time between Drive and Motor

Control Mode **VF VFPG SVC FOC PG TQCPG FOC PM** Default: 0.200
 Settings 0.0010~65.000 sec.



- | | | |
|---------------------------------|-------------------------------|--|
| ① Elevator starts running | ⑥ Start of deceleration | ⑪ Magnetic contactor release |
| ② Star-delta contactor release | ⑦ End of creeping | ⑫ Star-delta contactor contracting (motor release) |
| ③ Magnetic contactor is ON | ⑧ Start of <DC brake at stop> | |
| ④ Mechanical brake release | ⑨ Brake release engage | |
| ⑤ End of <DC brake at start-up> | ⑩ End of <DC brake at stop> | |

02-33 External Terminal Output Current Level

Control Mode **VF** **VFP** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: 0
 Settings 0–100%

- When output current is \geq Pr.02-33, it activates the multi-function output terminal (Pr.02-11–Pr.02-22 are set to 27).
- When output current is $<$ Pr.02-33, it activates the multi-function output terminal (Pr.02-11–Pr.02-22 are set to 28).

02-34 External Terminal Output Speed Limit

Control Mode **VF** **VFP** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: 0.00
 Settings 0.00– \pm 400.00 Hz (this is motor speed when using with PG)

- When output frequency is \geq 02-34, it activates the multi-function terminal (Pr.02-11–Pr.02-22 are set to 29).
- When output frequency is $<$ 02-34, it activates the multi-function terminal (Pr.02-11–Pr.02-22 are set to 30).

02-35 Mechanical Brake Detection Time

Control Mode **VF** **VFP** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: 0.00
 Settings 0.00–10.00 sec.

- When the mechanical brake function (Pr.02-01–Pr.02-08 are set to 42) is not enabled within this setting time, the drive displays error code 64 (MBF) mechanical brake error.

02-36 Magnetic Contactor Detection Time

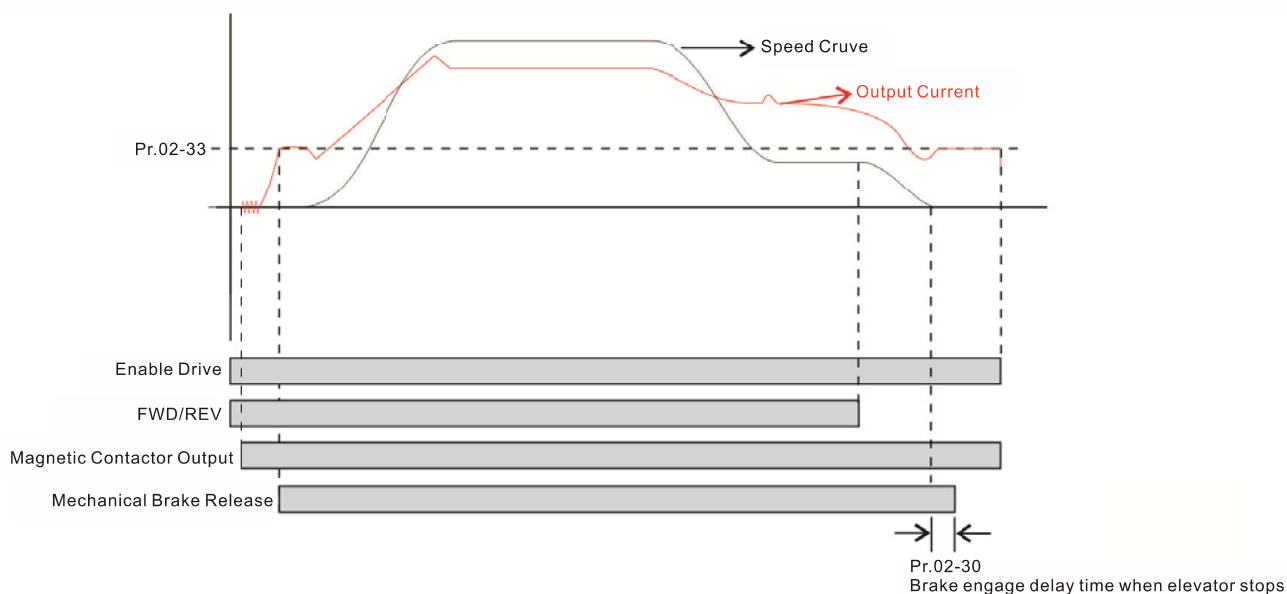
Control Mode **VF** **VFP** **SVC** **FOCPG** **TQCPG** **FOCPM** Default:0.00
 Settings 0.00–10.00 sec.

- When the magnetic contactor function (Pr.02-01–02-08 are set to 41) is not enabled within this setting time, the drive displays error code 66 (MCF) magnetic contactor error.

02-37 Torque Check

Control Mode **VF** **VFP** **SVC** **FOCPG** **TQCPG** **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.



03 Analog Input / Output Parameters

↗: You can set this parameter during operation.

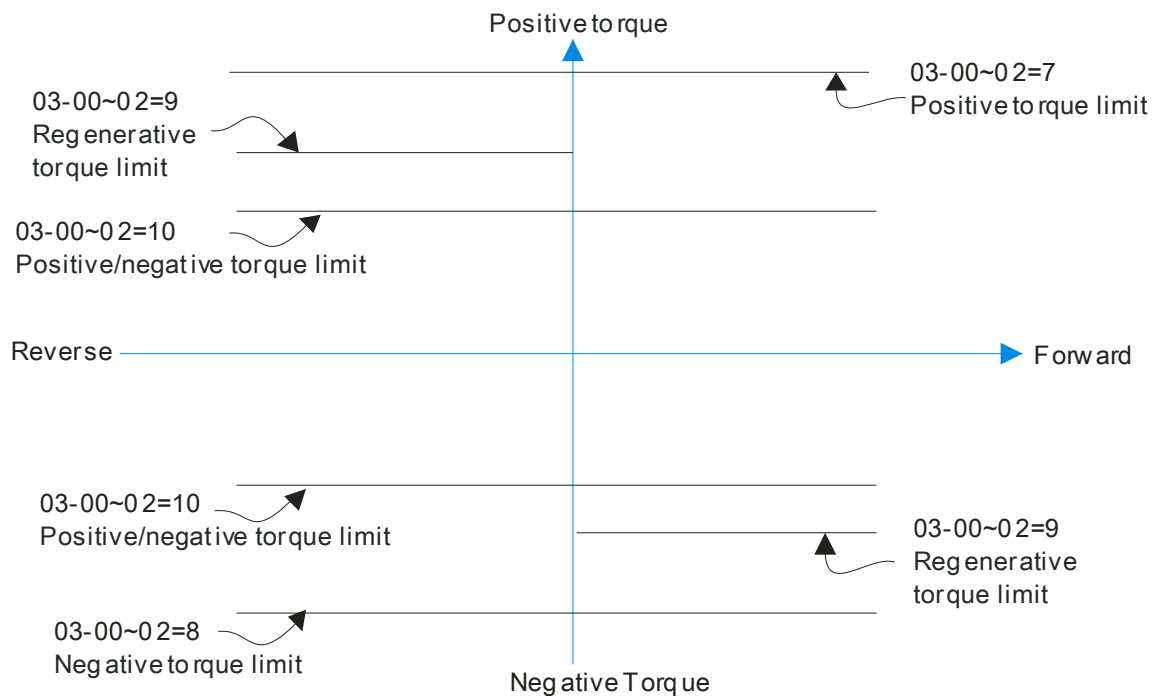
↗ **03-00** Analog Input 1 (AUI1) Default:1

03-01 Reserved

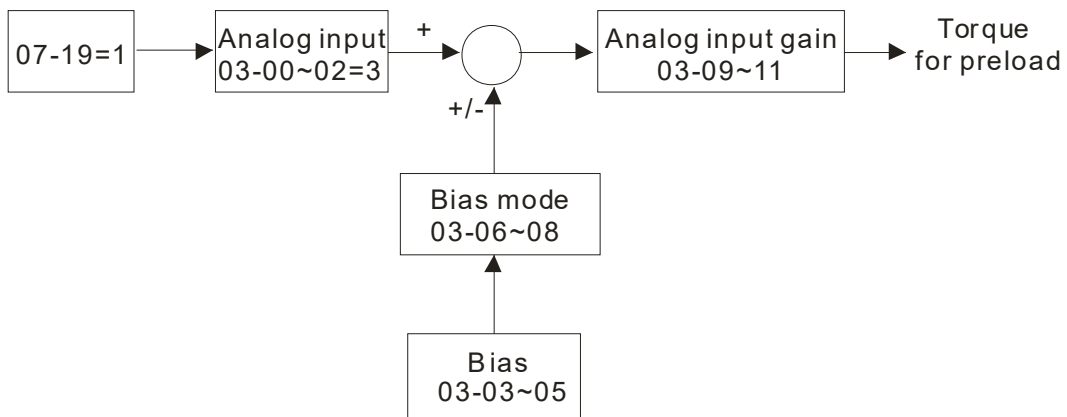
↗ **03-02** Analog Input 2 (AUI2) Default: 0

Settings	Control Mode	VF	VFPG	SVC	FOCPG	TQCPCG	FOCPM
0: No function		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
1: Frequency command (speed limit under torque control mode)		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2: Torque command (torque limit under speed mode)						<input type="radio"/>	
3: Preload input		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4-5: Reserved							
6: P.T.C. thermistor input value		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7: Positive torque limit					<input type="radio"/>		<input type="radio"/>
8: Negative torque limit					<input type="radio"/>		<input type="radio"/>
9: Regenerative torque limit					<input type="radio"/>		<input type="radio"/>
10: Positive/negative torque limit					<input type="radio"/>		<input type="radio"/>

- When using the Frequency command or speed limit under torque control mode, the corresponding value for 0 to ±10 V or 4–20 mA is 0–maximum output frequency (Pr.01-00).
- When using the Torque command or torque limit, the corresponding value for 0 to ±10 V or 4–20 mA is 0–maximum output torque (Pr.07-14).
- When using torque compensation, the corresponding value for 0 to ±10 V or 4–20 mA is 0–moto’s rated torque.



07-19: Source of torque offset
 03-00~02: Analog input selections (AUI1/A CI/AUI2)
 03-03~05: Analog input bias (AUI1/A CI/AUI2)
 03-06~08: AUI1/A CI/AUI2 bias mode



⚡ **03-03** Analog Input Bias 1 (AUI1)

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

Settings -100.0–100.0%

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

03-04 Reserved

⚡ **03-05** Analog Input Bias 1 (AUI2)

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

Settings -100.0–100.0%

📖 Sets the corresponding AUI2 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.

03-07 Reserved

⚡ **03-06** AUI1 Positive/negative Bias Mode

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

⚡ **03-08** AUI2 Positive/negative Bias Mode

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

Settings 0: Zero bias

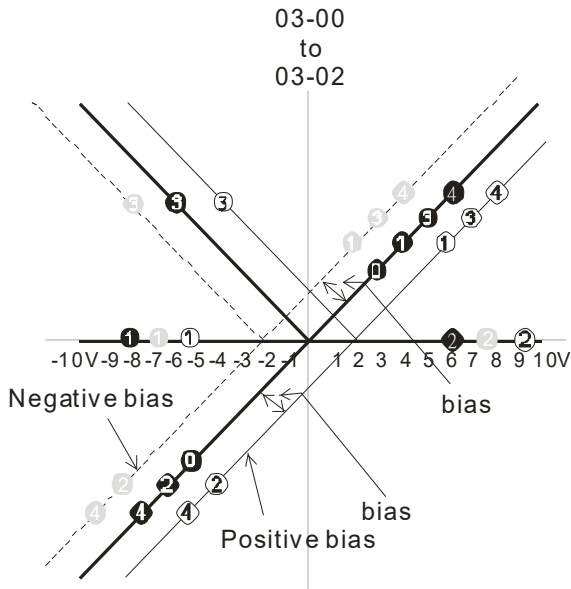
1: Lower than or equal to bias

2: Higher than or equal to bias

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

4: Using bias as the base (unipolar)

📖 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.



03-09~03-11 gain is positive

- 0 Zero bias
- 1 Serve bias as the center, lower than bias = bias
- 2 Serve bias as the center, greater than bias = bias
- 3 The absolute value of the bias voltage while serving as the center (unipolar)
- 4 Serve bias as the center (unipolar)

➤ **03-09** Analog Input Gain 1 (AUI1)

Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: 100.0
Settings	0.0~500.0%						

03-10 Reserved

➤ **03-11** Analog Input Gain 1 (AUI2)

Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: 100.0
Settings	0.0~500.0%						

📖 Pr.03-03~03-11 are used when the Frequency command source is the analog voltage/current signal.

➤ **03-12** Analog Input Filter Time (AUI1)

Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: 0.01
Settings	0.00~2.00 sec.						

03-13 Reserved

➤ **03-14** Analog Input Filter Time (AUI2)

Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: 0.01
Settings	0.00~2.00 sec.						

📖 Analog signals, such as those entering AUI1 and AUI2, 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.03-14 is large, the control is more stable, but the response to the input is slower. If Pr.03-14 is small, the control may be unstable, but the response to the input is faster.

03-15 Reserved


03-16 Reserved

↗ **03-17** Analog Output Selection 1

↗ **03-20** Analog Output Selection 2

Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** **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.

↗ **03-18** Analog Output Gain 1

↗ **03-21** Analog Output Gain 2

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

Settings 0–200.0%

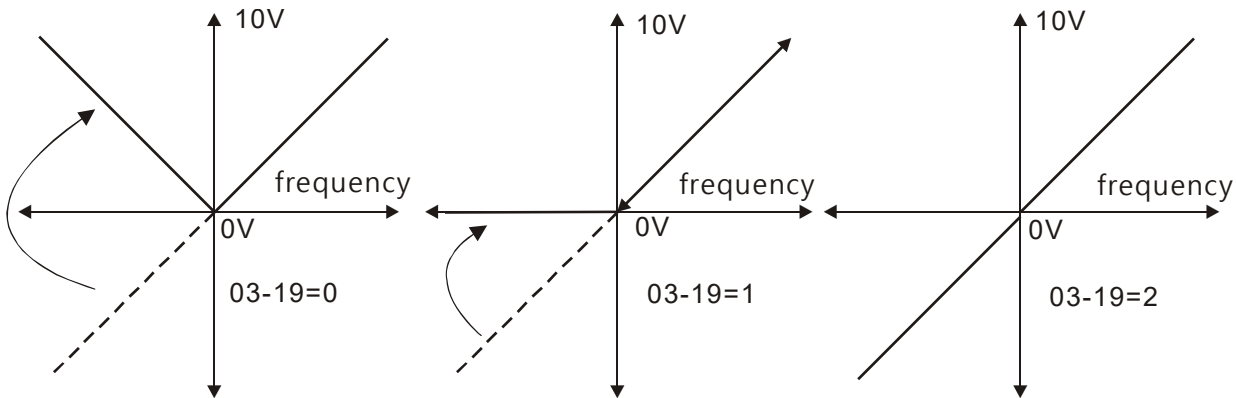
 Sets the corresponding voltage for the analog output 0.

↗ **03-19** Analog Output Value in REV Direction 1

↗ **03-22** Analog Output Value in REV Direction 2

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

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



Selection for the analog output direction

03-23 Analog Input Type (AUI1)

03-24 Analog Input Type (AUI2)

Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** **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.03-00=1 or 2, AUI decides the operation direction.
- 1: And Pr.03-00=1, the FWD/REV terminal decides the operation direction.
- 1: And Pr.03-00=2, setting Pr.02-01–Pr.02-08 to 39 decides the operation direction.

04 Multi-step Speed Parameters

↗: You can set this parameter during operation.

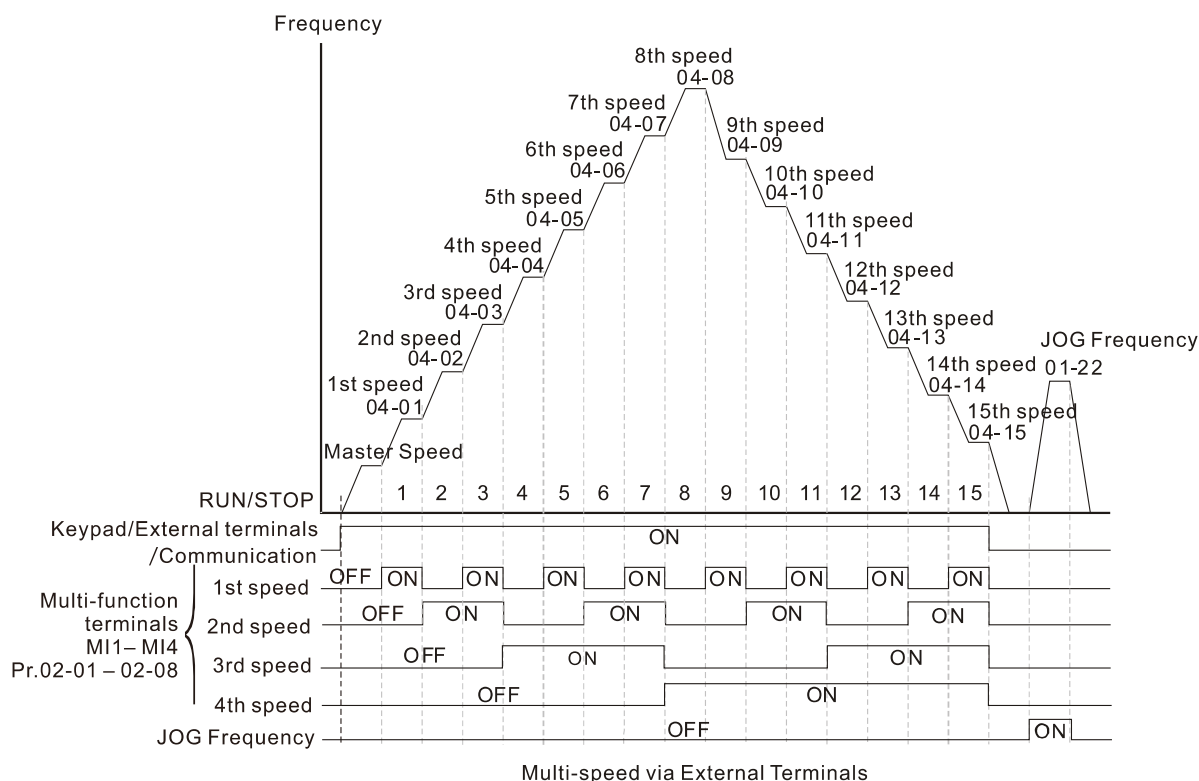
- ↗ **04-00** Zero Step Speed Frequency
- ↗ **04-01** 1st Step Speed Frequency
- ↗ **04-02** 2nd Step Speed Frequency
- ↗ **04-03** 3rd Step Speed Frequency
- ↗ **04-04** 4th Step Speed Frequency
- ↗ **04-05** 5th Step Speed Frequency
- ↗ **04-06** 6th Step Speed Frequency
- ↗ **04-07** 7th Step Speed Frequency
- ↗ **04-08** 8th Step Speed Frequency
- ↗ **04-09** 9th Step Speed Frequency
- ↗ **04-10** 10th Step Speed Frequency
- ↗ **04-11** 11th Step Speed Frequency
- ↗ **04-12** 12th Step Speed Frequency
- ↗ **04-13** 13th Step Speed Frequency
- ↗ **04-14** 14th Step Speed Frequency
- ↗ **04-15** 15th Step Speed Frequency

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0.00
 Settings 0.00–400.00 Hz

📖 The multi-function input terminals (refer to Pr.02-01–Pr.02-08) select one of the AC motor drive multi-step speeds (including the master frequency, in total 16 speeds). Pr.04-00–Pr.04-15 determine the speeds (frequencies) as shown above.

📖 When Pr.00-14 = 1, the master frequency is Pr.01-00.

📖 When Pr.00-14 = 3, the master frequency is Pr.04-00.



↗ 04-16

- Direct docking mode only

04-99

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: -

Settings Contact Delta for more information

05 IM Parameters

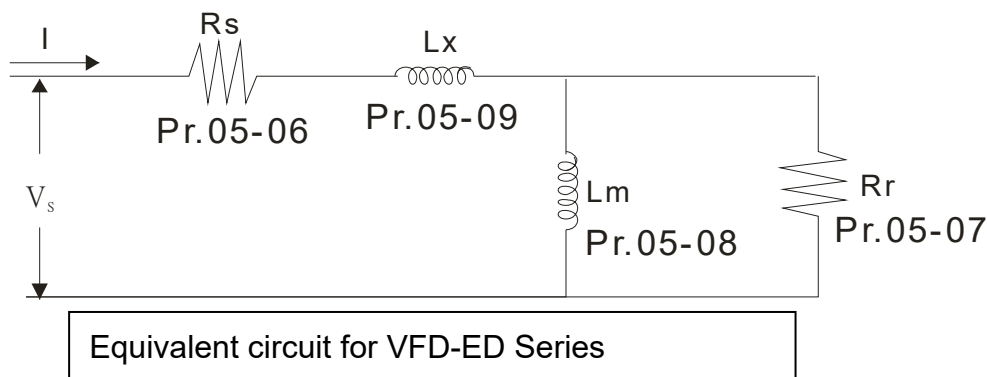
⚡: You can set this parameter during operation.

05-00 Motor Auto-tuning

Control Mode **VF** Default: 0

- Settings
- 0: No function
 - 1: Dynamic test (Rs, Rr, Lm, Lx, no-load current) [motor runs]
 - 2: Static Test [motor does not run]

- 📖 Start auto-tuning by pressing the RUN key on the keypad. It writes the measured value into Pr.05-05–Pr.05-09 (Rs, Rr, Lm, Lx, no-load current).
- 📖 The steps for auto-tuning are: (when you set this parameter to 1: dynamic test)
 1. Make sure that all the 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 2 if you cannot separate the motor from the load.
 3. Enter the correct values for Pr.01-02, Pr.01-01, Pr.05-01, Pr.05-02, Pr.05-03 and Pr.05-04. Refer to motor capacity to set the acceleration/deceleration time.
 4. When you set Pr.05-00 to 1, the AC motor drive executes auto-tuning immediately after receiving a RUN command (NOTE: the motor will run!).
 5. After executing auto-tuning, check if Pr.05-05–Pr.05-09 all have values.
 6. Equivalent circuit diagram:



※ If Pr.05-00 is set to <2: Static Test>, the value in Pr.05-05 is required.

📖 NOTE

1. In torque/vector control mode, do not run motors in parallel.
2. Do not use torque/vector control mode if the motor rated power exceeds the rated power for the AC motor drive.
3. The no-load current is usually 20–50% of the rated current.
4. The rated speed cannot be larger or equal to 120 f/p (f: output frequency Pr.01-01, p: Number of Motor Poles Pr.05-04).
5. After the auto-tuning, activate the drive again to make it operate when the auto-tuning command source is the external terminal.

05-01 Motor Full-load Current

Control Mode **VF** **VFP** **SVC** **FOCPG** **TQCPG** Unit: Amp
Default: #.##

Settings (40–120%)* Pr.00-01 Amps

- 📖 Set this value according to the rated motor frequency 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	30	40	50	60	75	100
	Motor drive's output (kW)	2.2	3.7	4	5.5	7.5	11	15	18.5	22	30	37	45	55	75
230V	Motor Full Load Current (A) Default	9.82	13.91	16.36	19.64	24.54	36.82	47.46	63	71.18	108	131.72			
460V	Motor Full Load Current (A) Default			9.41	10.64	13.91	18.82	24.54	31.1	36.82	47.46	65.46	81.82	104.72	135

*: single-phase models.

05-02 Motor Rated Power

Control Mode **SVC FOC PG TQCPG** Default: ###
 Settings 0.00–655.35 kW

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

05-03 Motor Rated Speed (rpm)

Control Mode **VFPG SVC FOC PG TQCPG** Default: 1710
 Settings 0–65535

📖 Sets the motor rated speed from the value on the motor nameplate.

05-04 Number of Motor Poles

Control Mode **VF VFPG SVC FOC PG TQCPG** Default: 4
 Settings 2–48

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

05-05 Motor No-load Current

Control Mode **VFPG SVC FOC PG TQCPG** Unit: Amp
 Default: ###
 Settings 0–Pr.05-01 default

📖 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	30	40	50	60	75	100
	Motor drive's output (kW)	2.2	3.7	4	5.5	7.5	11	15	18.5	22	30	37	45	55	75
230V	Motor Current w/o load (A) Default	3.44	4.87	5.73	6.85	8.5	12.56	15.97	20.78	23.22	33.51	39.52			
460V	Motor Current w/o load (A) Default			3.29	3.71	4.81	6.43	8.26	10.28	11.99	15	19.64	24.55	31.42	40.5

*: single-phase models.


05-06 Rs of Motor

05-07 Rr of Motor

Control Mode **SVC FOC PG TQCPG** Default: 0.000
 Settings 0.000–65.535 Ω

05-17 Hunting Gain

Control Mode **VF** **VFPG** **SVC** Default: 2000
 Settings 0–10000
 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.05-17.

05-18 Accumulated Motor Operation Time (Min.)

Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: 0
 Settings 0–1439 minutes

05-19 Accumulated Motor Operation Time (Day)

Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: 0
 Settings 0–65535 days

 Pr.05-18 and Pr.05-19 record the motor operation time. You can clear the records by setting the values to 0. Operating time that is less than 60 seconds is not recorded.

05-20 Core Loss Compensation

Control Mode **SVC** Default: 10
 Settings 0–250%

05-21 Accumulated Motor Power-on Time (Min.)

Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: 0
 Settings 0–1439 minutes

05-22 Accumulated Motor Power-on Time (day)


Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: 0
 Settings 0–65535 days


05-23 Slip Compensation Gain % (power generation mode)

Control Mode **VF** **SVC** Default: 0.0
 Settings 0.0–100.0%

05-24 Slip Compensation Gain % (electricity mode)

Control Mode **VF** **SVC** Default: 0.0
 Settings 0.0–100.0%

 When in VF mode, you do NOT have to set Pr.05-13. To satisfy the demand for different compensation gains in power generation mode and electricity mode, set Pr.05-23 and Pr.05-24.

 When in SVC mode, set Pr.05-13 first. To satisfy the demand for different compensation gains in power generation mode and electricity mode, set Pr.05-23 and Pr.05-24.

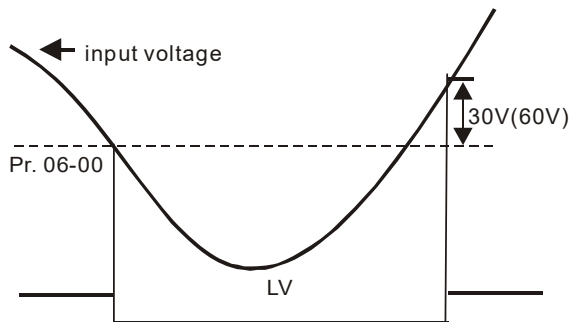
06 Protection Parameters

↗: You can set this parameter during operation.

↗ 06-00 Low Voltage Level

Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: 180.0/360.0
 Settings 230V series: 160.0–220.0 V
 460V series: 320.0–440.0 V

📖 Sets the Lv level.



↗ 06-01 Phase-loss Protection

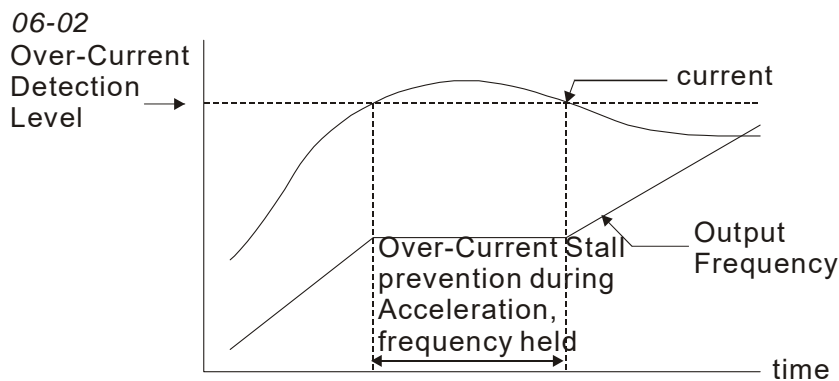
Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: 2
 Settings 0: Warn and keep operation
 1: Fault and ramp to stop
 2: Fault and coast to stop

📖 Sets the phase-loss action. The phase-loss affects the drive's control characteristics and life.

↗ 06-02 Over-current Stall Prevention during Acceleration

Control Mode **VF** **VFPG** **SVC** Default: 0
 Settings 0: Disable
 0–250% (rated current of the motor drive)

📖 During acceleration, the AC motor drive output current may increase abruptly and exceed the value specified in Pr.06-02 due to rapid acceleration or excessive load on the motor. When you enable this function, the AC motor drive stops accelerating and keeps the output frequency constant until the current drops below the maximum value.

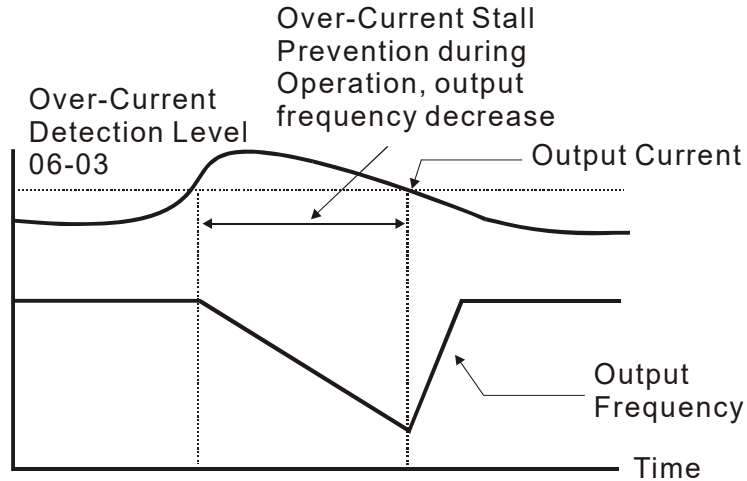


actual acceleration time when over-current stall prevention is enabled

➤ **06-03** Over-current Stall Prevention during Operation

Control Mode **VF VFPG SVC** Default: 0
 Settings 0: Disable
 0–250% (rated current of the motor drive)

📖 If the output current exceeds the setting specified in Pr.06-03 when the drive is operating, the drive decreases its output frequency according to the Pr.06-04 setting to prevent motor stall. If the output current is lower than the setting in Pr.06-03, the drive accelerates (according to Pr.06-04) again to catch up with the Frequency command value.



over-current stall prevention during operation

➤ **06-04** Acceleration/Deceleration Time for Stall Prevention at Constant Speed

Control Mode **VF VFPG SVC** Default: 0
 Settings 0: Use the current acceleration/deceleration time
 1: Use the 1st acceleration/deceleration time
 2: Use the 2nd acceleration/deceleration time
 3: Use the 3rd acceleration/deceleration time
 4: Use the 4th acceleration/deceleration time
 5: Use the auto-acceleration/auto-deceleration time

📖 Sets the acceleration/deceleration time when stall prevention occurs at constant speed.

➤ **06-05** Over-torque Detection (OT1)

Control Mode **VF VFPG SVC FOC PG TQCPG FOC PM** 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

➤ **06-06** Over-torque Detection Level (OT1)

Control Mode **VF VFPG SVC FOC PG TQCPG FOC PM** Default: 150
 Settings 10–250% (rated current of the motor drive)

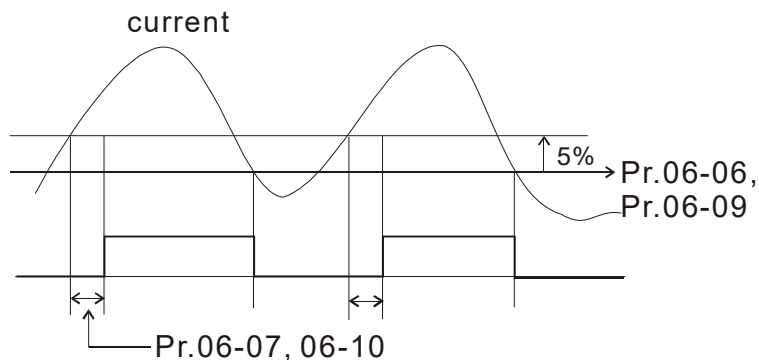
↗ **06-07** Over-torque Detection Time (OT1)
 Control Mode **VF VFPG SVC FOC PG TQCPG FOC PM** Default: 0.1
 Settings 0.1–60.0 sec.

↗ **06-08** Over-torque Detection (OT2)
 Control Mode **VF VFPG SVC FOC PG TQCPG FOC PM** 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

↗ **06-09** Over-torque Detection Level (OT2)
 Control Mode **VF VFPG SVC FOC PG TQCPG FOC PM** Default: 150
 Settings 10–250% (rated current of the motor drive)

↗ **06-10** Over-torque Detection Time (OT2)
 Control Mode **VF VFPG SVC FOC PG TQCPG FOC PM** Default: 0.1
 Settings 0.1–60.0 sec.

- 📖 Pr.06-05 and Pr.06-08 determine 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.06-06, default is 150%) and also exceeds the over-torque detection time (Pr.06-07, default is 0.1 second), the keypad displays the fault code "OT1/OT2". If using a multi-function output terminal for over-torque detection, the output is ON. Refer to Pr.02-11–02-22 for details.



↗ **06-11** Current Limit
 Control Mode **FOCPG TQCPG FOC PM** Default: 200
 Settings 0–250% (rated current of the motor drive)

📖 Sets the drive's current limit.

06-12 Electronic Thermal Relay
 Control Mode **VF VFPG SVC FOC PG TQCPG FOC PM** Default: 2
 Settings 0: Standard motor
 1: Inverter motor
 2: Disabled

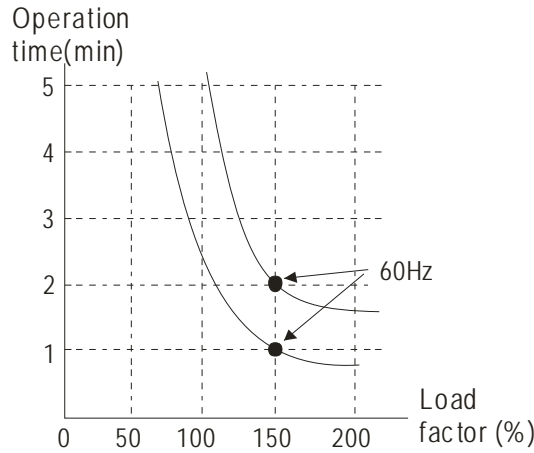
Prevents self-cooled motor from overheating at low speeds. You can use an electrical thermal relay to limit the drive's output power.

06-13 Electronic Thermal Characteristic

Control Mode **VF** **VFP** **SVC** **FOCP** **TQCP** **FOCPM** Default: 60.0

Settings 30.0–600.0 sec.

The parameter is set by the drive's output frequency, current and operation time for activating the I²t electronic thermal protection function. The function is activated for 150% of the setting current in Pr.06-13.



06-14 Heat Sink Overheat (OH) Warning

Control Mode **VF** **VFP** **SVC** **FOCP** **TQCP** **FOCPM** Default: 90.0

Settings 0.0–110.0°C

06-15 Stall Prevention Limit Level

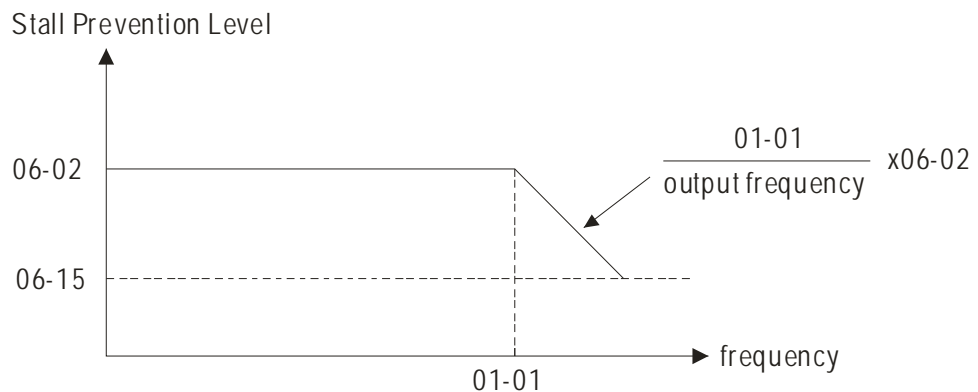
Control Mode **VF** **VFP** **SVC** Default: 50

Settings 0–100% (Refer to Pr.06-02, Pr.06-03)

When the operating frequency is larger than Pr.01-01, Pr.06-02 = 150%, Pr.06-03 = 100% and Pr.06-15 = 80%:

Stall Prevention Level during acceleration = Pr.06-02 x Pr.06-15 = 150% x 80% = 120%.


Stall Prevention Level at constant speed = Pr.06-03 x Pr.06-15 = 100% x 80% = 80%.




- 06-16** Present Fault Record
- 06-17** Second Most Recent Fault Record
- 06-18** Third Most Recent Fault Record
- 06-19** Fourth Recent Fault Record
- 06-20** Fifth Most Recent Fault Record
- 06-21** Sixth Most Recent Fault Record


Control mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: 0
Settings		0:	No fault				
		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:	Input phase loss (PHL)				
		16:	IGBT overheat (oH1)				
		17:	Bulk capacitor overheat (oH2)				
		18:	Abnormal IGBT temperature detected (tH1o)				
		19:	Abnormal bulk capacitor temperature detected (tH2o)				
		20:	Unusual cooling fan operation (FAn)				
		21:	Overload (oL) (150%; 1 minute, motor drive overloaded)				
		22:	Motor overload (EoL1)				
		23:	Reserved				
		24:	Motor PTC overheat (oH3)				
		25:	Reserved				
		26:	Over-torque 1 (ot1)				
		27:	Over-torque 2 (ot2)				
		28:	Reserved				
		29:	Reserved				
		30:	Memory writing error (cF1)				
		31:	Memory reading error (cF2)				
		32:	Isum current detection error (cd0)				
		33:	U-phase current detection error (cd1)				
		34:	V-phase current detection error (cd2)				
		35:	W-phase current detection error (cd3)				
		36:	cc current clamp hardware error (Hd0)				
		37:	oc (over-current) hardware error (Hd1)				
		38:	ov (over-voltage) hardware error (Hd2)				
		39:	GFF (ground fault) hardware error (Hd3)				
		40:	Auto-tuning error on motor's parameter (AuE)				
		41:	Reserved				
		42:	PG feedback error (PGF1)				
		43:	PG feedback loss (PGF2)				


44:	PG feedback stall (PGF3)
45:	PG slip error (PGF4)
46:	Reserved
47:	Reserved
48:	Reserved
49:	External fault input (EF)
50:	Emergency stop from external terminals (EF1)
51:	Reserved
52:	Password error after three attempts (Pcod)
53:	Reserved
54:	Illegal communication command (cE01)
55:	Illegal communication address (cE02)
56:	Communication data length error (cE03)
57:	Communication attempts to write to a read-only address (cE04)
58:	Modbus transmission time-out (cE10)
59:	Keypad transmission time-out (cP10)
60:	Brake chopper error (BF)
61–63:	Reserved
64:	Mechanical brake feedback error (MBF)
65:	PGF5 hardware error
66:	Magnetic contactor error (MCF)
67:	Output phase loss (MPHL)
68:	CAN BUS disconnected
69–71:	Reserved
72:	Safe torque loss (STL1)
73:	PGcd hardware error
74:	PG absolute signal error (PGHL)
75:	PG Z phase signal loss (PGAF)
76:	Safe torque output stops (STO)
77:	Safe torque loss 2 (STL2)
78:	Safe torque loss 3 (STL3)

 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.

 **06-30** Fault Output Setting Method

Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: 0
Settings	0: According to settings in Pr.06-22–06-25						
	1: According to the binary setting						

 This parameter is used with the settings 35–38 in Pr.02-11–Pr.02-22 (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.06-22–Pr.06-25.

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

Example:

Assume that:

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Pr.02-13 (Multi-function output 3 R1A (Relay 3)) is set to 35 Fault output option 1 (Pr.06-22).

Pr.02-14 (Multi-function output 4 R2A (Relay4)) is set to 36 Fault output option 2 (Pr.06-23).

Pr.02-15 (Multi-function output 5 (MO1)) is set to 37 Fault output option 3 (Pr.06-24).

Pr.02-16 (Multi-function output 6 (MO2)) is set to 38 Fault output option 4 (Pr.06-25).

Also assume that external fault outputs with the following signal: R1A = 1, R2A = 1, MO1 = 0 and MO2 = 1.

The corresponding Bit 3–0 is 1011.

Bit 3	Bit 2	Bit 1	Bit 0	Fault code
-	-	-	-	0: No fault
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: Input phase loss (PHL)
0	1	0	0	16: IGBT overheat (oH1)
				17: Bulk capacitor overheat (oH2)
				18: Abnormal IGBT temperature detected (tH1o)
19: Abnormal bulk capacitor temperature detected (tH2o)				
1	0	0	0	20: Unusual cooling fan operation (FAn)
0	1	0	1	21: Overload (oL) (150%; 1 minute, motor drive overloaded)
0	1	1	0	22: Motor overload (EoL1)
				24: Motor PTC overheat (oH3)
0	1	1	1	26: Over-torque 1 (ot1)
				27: Over-torque 2 (ot2)
1	0	0	0	30: Memory writing error (cF1)
				31: Memory reading error (cF2)
				32: Isum current detection error (cd0)
				33: U-phase current detection error (cd1)
				34: V-phase current detection error (cd2)
				35: W-phase current detection error (cd3)
				36: cc (current clamp) hardware error (Hd0)
				37: oc (over-current) hardware error (Hd1)
				38: ov (over-voltage) hardware error (Hd2)
				39: GFF (ground fault) hardware error (Hd3)
1	0	0	1	40: Auto-tuning error on motor's parameter (AUE)
1	0	1	0	41: Reserved
				42: PG feedback error (PGF1)
				43: PG feedback loss (PGF2)
0	1	1	1	44: PG feedback stall (PGF3)
1	0	1	0	45: PG slip error (PGF4)
				46: Reserved
				47: Reserved
				48: Reserved
1	0	1	1	49: External fault input (EF)
				50: Emergency stop from external terminals (EF1)
1	0	0	1	52: Password error after three attempts (Pcod)
1	1	0	0	54: Illegal communication command (cE01)
				55: Illegal communication address (cE02)
				56: Communication data length error (cE03)
				57: Communication attempts to write to a read-only address (cE04)

Bit 3	Bit 2	Bit 1	Bit 0	Fault code
				58: Modbus transmission time-out (cE10)
				59: Keypad transmission time-out (cP10)
1	0	0	0	60: Brake chopper error (BF)
1	0	1	1	61–63: Reserved
				64: Mechanical brake feedback error (MBF)
1	0	0	0	65: PGF5 hardware error
1	0	1	1	66: Magnetic contactor error (MCF)
1	0	1	1	67: Output phase loss (MPHL)
1	1	0	1	68: CAN BUS disconnected
1	1	1	0	72: Safe torque loss (STL1)
1	0	0	0	73: PGcd hardware error
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 output stops (STO)
1	1	1	0	77: Safe torque loss 2 (STL2)
1	1	1	0	78: Safe torque loss 3 (STL3)

- ✎ **06-22** Fault Output Option 1
- ✎ **06-23** Fault Output Option 2
- ✎ **06-24** Fault Output Option 3
- ✎ **06-25** Fault Output Option 4

Control Mode **VF** **VFP** **SVC** **FOCPG** **TQCPG** **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.02-11–Pr.02-22 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.06-22–Pr.06-25.

Fault code	Bit0	Bit1	Bit2	Bit3	Bit4	Bit5	Bit6
	current	Volt.	OL	SYS	FBK	EXI	CE
0: No fault							
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: Input phase loss (PHL)						●	
16: IGBT overheat (oH1)			●				
17: Bulk capacitor overheat (oH2)			●				

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Fault code	Bit0	Bit1	Bit2	Bit3	Bit4	Bit5	Bit6
	current	Volt.	OL	SYS	FBK	EXI	CE
18: Abnormal IGBT temperature detected (tH1o)			●				
19: Abnormal bulk capacitor temperature detected (tH2o)			●				
20: Unusual cooling fan operation (FAn)						●	
21: Overload (oL) (150%; 1 minute, motor drive overloaded)			●				
22: Motor overload (EoL1)			●				
23: Reserved							
24: Motor PTC overheat (oH3)			●				
25: Reserved							
26: Over-torque 1 (ot1)			●				
27: Over-torque 2 (ot2)			●				
28: Reserved							
29: Reserved							
30: Memory writing error (cF1)				●			
31: Memory reading error (cF2)				●			
32: Isum current detection error (cd0)				●			
33: U-phase current detection error (cd1)				●			
34: V-phase current detection error (cd2)				●			
35: W-phase current detection error (cd3)				●			
36: cc (current clamp) hardware error (Hd0)				●			
37: oc (over-current) hardware error (Hd1)				●			
38: ov (over-voltage) hardware error (Hd2)				●			
39: GFF (ground fault) hardware error (Hd3)				●			
40: Auto-tuning error on motor's parameter (AUE)				●			
41: Reserved					●		
42: PG feedback error (PGF1)					●		
43: PG feedback loss (PGF2)					●		
44: PG feedback stall (PGF3)					●		
45: PG slip error (PGF4)					●		
46: Reserved					●		
47: Reserved						●	
48: Reserved						●	
49: External fault input (EF)						●	
50: Emergency stop from external terminals (EF1)						●	

Fault code	Bit0	Bit1	Bit2	Bit3	Bit4	Bit5	Bit6
	current	Volt.	OL	SYS	FBK	EXI	CE
51: Reserved							
52: Password error after three attempts (Pcod)				●			
53: Reserved							
54: Illegal communication command (cE01)							●
55: Illegal communication address (cE02)							●
56: Communication data length error (cE03)							●
57: Communication attempts to write to a read-only address (cE04)							●
58: Modbus transmission time-out (cE10)							●
59: Keypad transmission time-out (cP10)							●
60: Brake chopper error (BF)						●	
61–62: Reserved							
63: Reserved				●			
64: Mechanical brake feedback error (MBF)						●	
65: PGF5 hardware error				●			
66: Magnetic contactor error (MCF)						●	
67: Output phase loss (MPHL)						●	
68: CAN BUS disconnected (CANF)							●
72: Safe torque loss (STL1)				●			
73: PGcd hardware error				●			
74: PG absolute signal error (PGHL)				●			
75: PG Z phase signal loss (PGAF)				●			
76: Safe torque output stops (STO)				●			
77: Safe torque loss 2 (STL2)				●			
78: Safe torque loss 3 (STL3)				●			

⚡ **06-26** PTC (Positive Temperature Coefficient) Detection Action

Control Mode **VF VFPG SVC FOC PG TQCPG FOC PM** Default: 0

Settings 0: Warn and keep operation
1: Fault and ramp to stop

📖 Sets the action after detecting PTC.

⚡ **06-27** PTC Level

Control Mode **VF VFPG SVC FOC PG TQCPG FOC PM** Default: 50.0

Settings 0.0–100.0%

📖 Sets the PTC level. 100% PTC level corresponds to the maximum analog input value.

06-28 PTC Detection Filter Time

Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: 0.20
 Settings 0.00–10.00 sec.

See Parameter Group 03 Analog Input/ Output Parameters for details.

06-31 Phase Loss Detection of Drive Output at Start-up (MPHL)

Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** **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 "67" to indicate motor output phase loss.

06-32 Accumulated Drive Power-on Time at the First Fault (min.)

06-34 Accumulated Drive Power-on Time at the Second Fault (min.)

06-36 Accumulated Drive Power-on Time at the Third Fault (min.)

06-38 Accumulated Drive Power-on Time at the Fourth Fault (min.)

06-40 Accumulated Drive Power-on Time at the Fifth Fault (min.)

06-42 Accumulated Drive Power-on Time at the Sixth Fault (min.)

Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** Default: Read only
 Settings 0–65535 min.

06-33 Accumulated Drive Power-on Time at the First Fault (day)

06-35 Accumulated Drive Power-on Time at the Second Fault (day)

06-37 Accumulated Drive Power-on Time at the Third Fault (day)

06-39 Accumulated Drive Power-on Time at the Fourth Fault (day)

06-41 Accumulated Drive Power-on Time at the Fifth Fault (day)

06-43 Accumulated Drive Power-on Time at the Sixth Fault (day)


Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** Default: Read only
 Settings 0–65535 day

06-45 Fault and Warning Action

Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: 0
 Settings Bit 0 = 0: Display Lv fault and coast to stop
 Bit 0 = 1: Display Lv warn and coast to stop
 Bit 1 = 0 : Fan lock, fault and coast to stop
 Bit 1 = 1: Fan lock, warn and coast to stop
 Bit 2 = 0: Software GFF protection enabled
 Bit 2 = 1: Software GFF protection disabled

06-29 Voltage of Emergency Power

Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: 24.0/48.0
 Settings 24.0–375.0 V_{DC}
 48.0–750.0 V_{DC}

 This parameter works with setting 43 (EPS function) for Pr.02-01–Pr.02-08 (multi-function input commands).

06-44 Emergency Power (EPS) Mode Operation Speed

Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: 0.00
Settings	0.00–400.00 Hz						

06-46 Emergency Power (EPS) ON Operation Direction


Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	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.

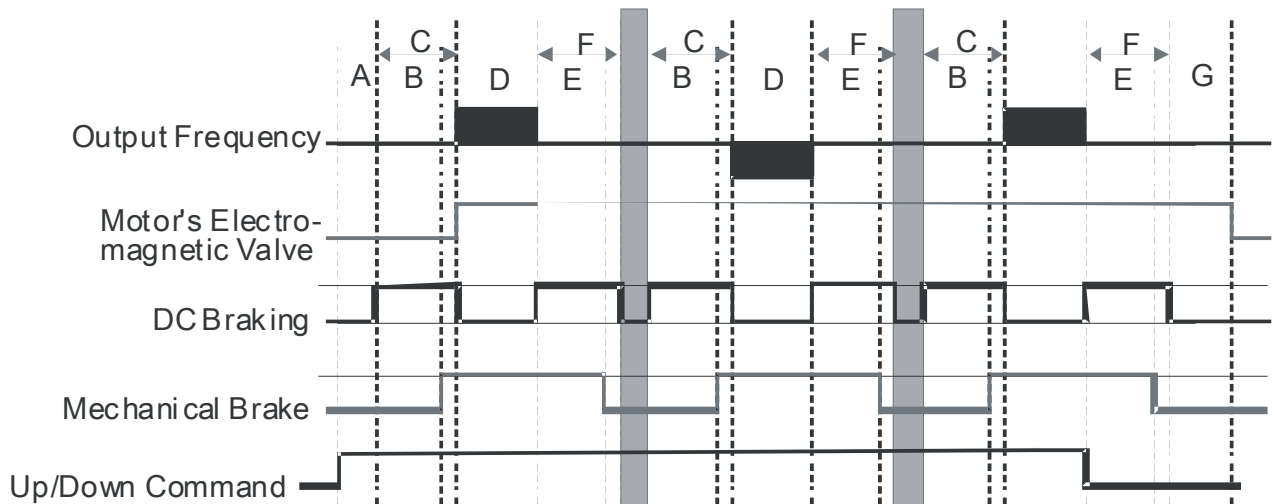
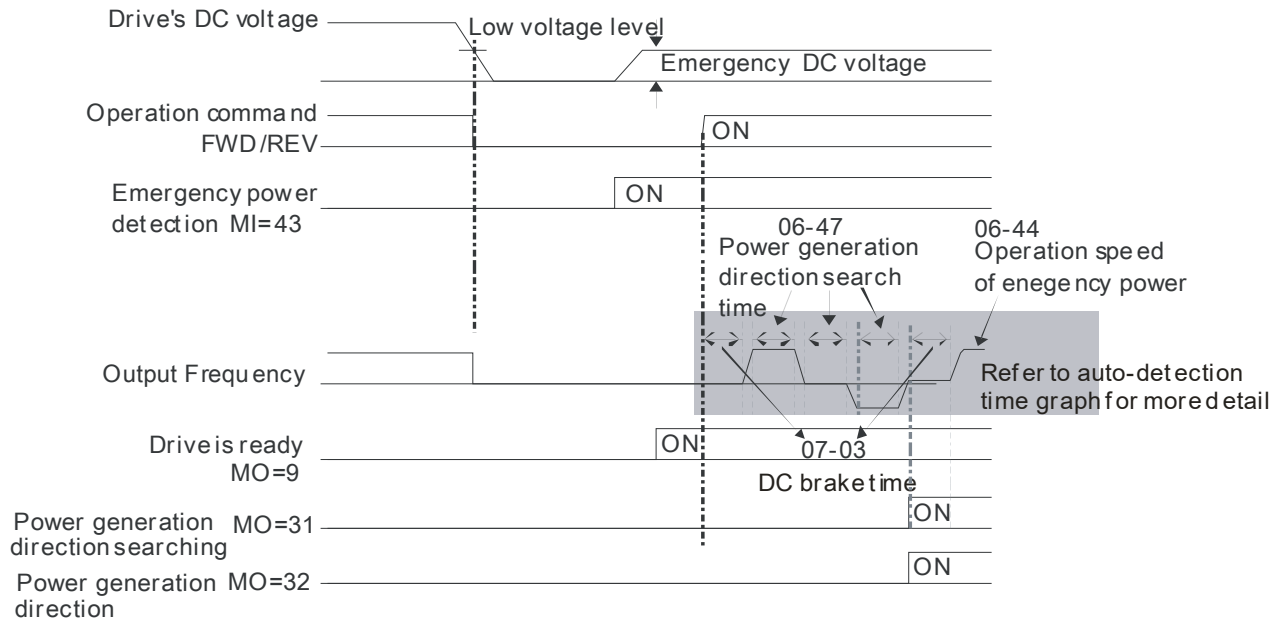
 Pr.06-46 is enabled when the external terminal detects the emergency power signal EPS (MI=43).

 When you set Pr.06-46 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.06-46 to 4 (motor with gear box):


1. When the normal mode runs to the largest power factor angle, the results are saved in Pr.06-69.
2. Compare the power factor angle detected by the power generation direction with Pr.06-86 setting value, if the value is larger than Pr.06-68, the current direction is saved in Pr.06-70.
3. When in emergency power mode, the drive runs according to the Pr.06-70 operation direction.

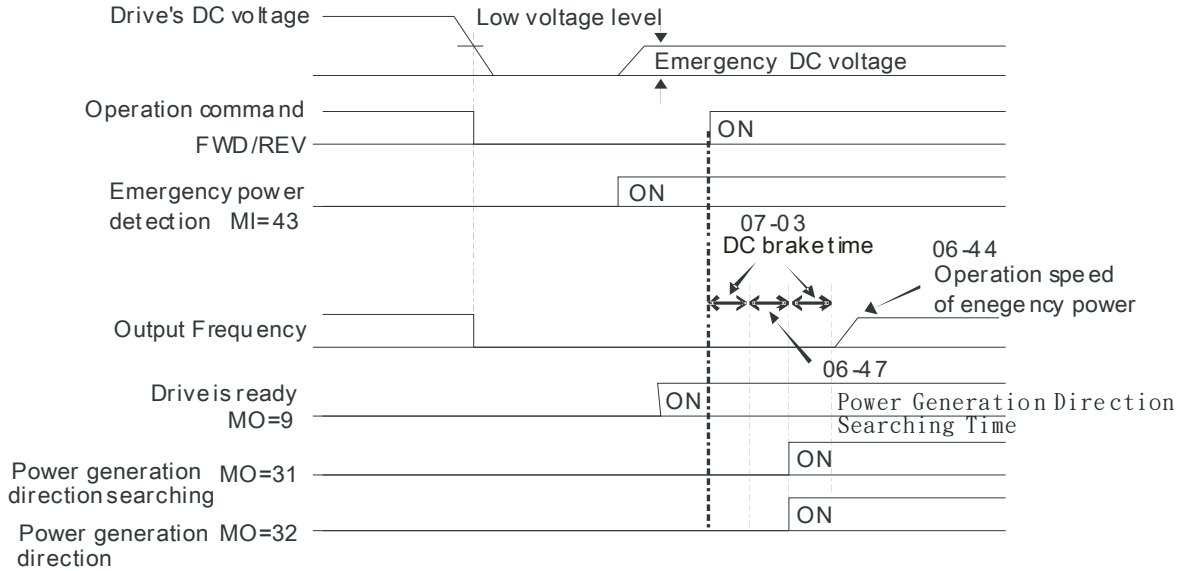
 VF and SVC control modes: In the time setting in Pr.06-47, the drive detects the elevator loading status by performing forward/reverse run. Then the elevator operates in the power regeneration direction (the motor is in power generating status). Refer to the diagram below for the Auto-Detection Timing Graph.



- | | |
|--|---|
| A Pr.02-31: Magnetic Contactor Contracting Delay
Time between Drive and Motor | E Pr.02-30: Brake Engage Delay Time when
Elevator Stops |
| B Pr.02-29: Brake Release Delay Time when Elevator
Starts | F Pr.07-04: DC Brake Stopping Time |
| C Pr.07-03: DC Brake Activation Time | G Pr.02-32: Magnetic Contactor Release
Delay Time between Drive and
Motor |
| D Pr.06-47: Power Generation Direction Search Time | |

Auto-detection Timing Diagram

 **FOCPG/PM Control Mode:** In the time setting in Pr.06-47, 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 diagram below for the Auto-Detection Timing Graph.



06-47 Power Generation Direction Search Time

Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: 1.0
 Settings 0.0–5.0 sec.

06-48 Power Capacity of Emergency Power (EPS)

Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** **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.06-44) with the following equation.



$$I_{motor_rated} = 05 - 01 \text{ (Induction Motor)} / 08 - 01 \text{ (PM Motor)}$$

$$V_{eps_max} = \frac{06 - 48 \times 0.5}{\sqrt{3} \times I_{motor_rated}}$$

$$f_{eps_limit} = \frac{V_{eps_max}}{01 - 02} \times 01 - 01 \times 0.5$$

When the Frequency command > f_{EPS} , the operation speed of emergency power (EPS) is f_{EPS} .
 When the Frequency command $\leq f_{EPS}$, the operation speed of emergency power (EPS) is set according to the current Frequency command.

06-68 Power Factor Angle Level for Power Generation Direction

Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: 70.0
 Settings 0.0–150.0°



During operation, if the largest power factor angle is larger than Pr.06-68 setting value, the power generation direction is the current operation direction.

06-69 Reference Level for Power Factor Angle during Operation

Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: Read only
 Settings -200.0–200.0°



The largest power factor angle during operation.

06-70 Power Generation Direction

Control Mode **VF** **VFP** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: Read only
 Settings 0: FWD
 1: REV

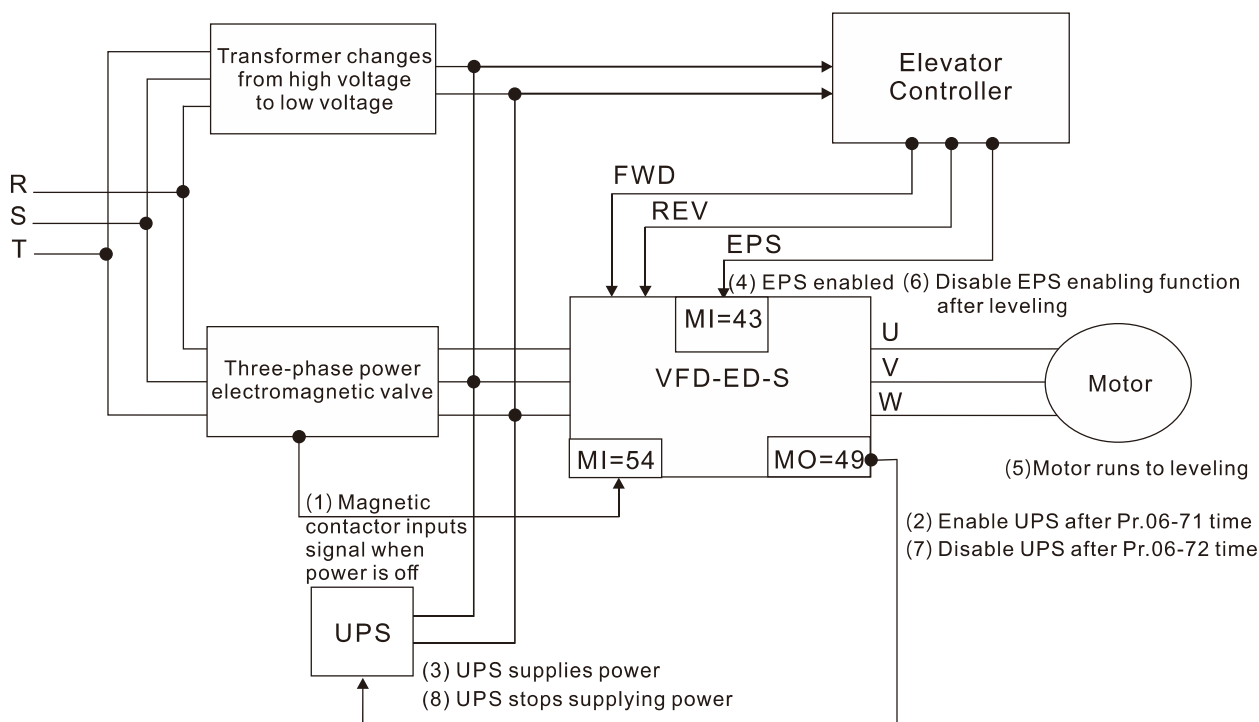
06-71 UPS Output Delay Time

Control Mode **VF** **VFP** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: 1.0
 Settings 0.0–10.0 sec.

06-72 UPS Stops Output Delay Time

Control Mode **VF** **VFP** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: 3.0
 Settings 0.0–60.0 sec.

- Pr.06-71: At power failure, the electromagnetic valve sends a MI signal to inform the drive to activate UPS. Then, the drive sends a MO signal to activate the UPS electromagnetic valve after Pr.06-71 delay time.
- Pr.06-72: After the controller deactivates the emergency power mode, it stops sending a MO signal to deactivate the UPS power after Pr.06-72 delay time.
- Related parameters: multi-function input commands Pr.02-01–Pr.02-08 function setting 54 (Power failure signal) and multi-function output terminals Pr.02-11–Pr.02-16 function setting 49 (Emergency power mode action).



EPS Flow Chart

06-49 STO Latch Selection

Control Mode **VF** **VFP** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: 0
 Settings 0: STO alarm latch
 1: STO alarm no latch
 2: STO latch (Warn and record running commands when stop)
 3: STO no latch (Warn and record running commands when stop)

- When Pr.06-49 = 0, the STO alarm is latched, which means that once the cause of the alarm is cleared, you must use a Reset command to clear the STO alarm.

- 📖 When Pr.06-49 = 1, STO alarm is NOT latched, which means that once the cause of the alarm is cleared, the STO alarm clears automatically.
- 📖 When Pr.06-49 = 2, the STO alarm is latched, which means once the cause of the alarm is cleared, you must use a Reset command to clear the STO alarm. If the STO alarm is latched and the drive receives a running command when it is at stop, the drive runs according to this running command after the STO reset.
- 📖 When Pr.06-49 = 3, the STO alarm is NOT latched, which means that once the cause of the alarm is cleared, the STO alarm clears automatically. If the STO alarm is latched and the drive receives a running command when it is at stop, the drive runs according to this running command after the STO automatically clears.
- 📖 When in STL1–STL3 mode, the STO alarm is latched and you cannot set Pr.06-49.

↗ **06-50** MO's Action when Retrying after Fault

Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	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: Input Phase loss (PHL)

📖 Two MO terminals are affected by this parameter and should be set up as:

- MO = 10: Low voltage warning (LV)
- MO = 11: Fault Indication

↗ **06-51** Number of Times to Retry after Fault

Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	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: Input 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:

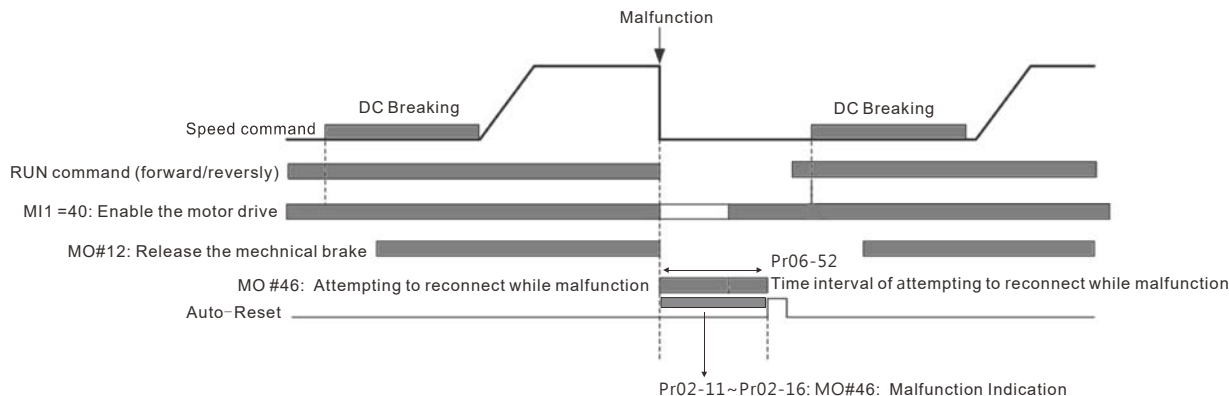
1. Reset the fault manually.
2. After running normally for 10 minutes, the motor drive returns to the prior setting.
3. The motor drive is powered on and powered off again.

06-52 Time Interval between Retries

Control Mode **VF VFPG SVC FOC PG TQCPG FOC PM** 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: Input Phase loss (PHL)



06-53 Frequency Command when the Most Recent Fault Occurred

Control Mode **VF VFPG SVC FOC PG TQCPG FOC PM** Default: Read only
 Settings 0.00–655.35 Hz

06-54 Output Frequency when the Most Recent Fault Occurred

Control Mode **VF VFPG SVC FOC PG TQCPG FOC PM** Default: Read only
 Settings 0.00–655.35 Hz

06-55 Output Current when the Most Recent Fault Occurred

Control Mode **VF VFPG SVC FOC PG TQCPG FOC PM** Default : Read only
 Settings 0.00–655.35 Amps

06-56 Motor Frequency when the Most Recent Fault Occurred

Control Mode **VF VFPG SVC FOC PG TQCPG FOC PM** Default : Read only
 Settings 0.00–655.35 Hz

06-57 Output Voltage when the Most Recent Fault Occurred

Control Mode **VF VFPG SVC FOC PG TQCPG FOC PM** Default: Read only
 Settings 0.0–6553.5 V

06-58 DC BUS Voltage when the Most Recent Fault Occurred

Control Mode **VF VFPG SVC FOC PG TQCPG FOC PM** Default : Read only
 Settings 0.0–6553.5 V

06-59	Output Power when the Most Recent Fault Occurred						
Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default : Read only
Settings	0.0–6553.5 kW						
06-60	Output Torque when the Most Recent Fault Occurred						
Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: Read only
Settings	0.00–655.35%						
06-61	IGBT Temperature when the Most Recent Fault Occurred						
Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: Read only
Settings	-3276.8–3276.7°C						
06-62	Multi-input Terminals Status when the Most Recent Fault Occurred						
Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: Read only
Settings	0000h–FFFFh						
06-63	Multi-output Terminals Status when the Most Recent Fault Occurred						
Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: Read only
Settings	0000h–FFFFh						
06-64	Motor Drive Status when the Most Recent Fault Occurred						
Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: Read only
Settings	0000h–FFFFh						
06-73	Permanent Operation Direction Count (H)						
Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: Read only
Settings	0–60000						
06-74	Permanent Operation Direction Count (L)						
Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: Read only
Settings	0–9999						
06-75	Single Operation Direction Count (H)						
Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: Read only
Settings	0–20						
06-76	Single Operation Direction Count (L)						
Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: Read only
Settings	0–9999						
06-77	Number of Times for Single Operation Reset						
Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: Read only
Settings	0–100						
06-78	Number of Times for Operation Direction						
Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: 2.00
Settings	0.00–200.00 k						

06-79 Function Selection for Operation Times

Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: 0
Settings		0-2					

- When you set Pr.06-79 to 0:
 Disable the operation direction count function and clear parameters (Pr.06-75, 06-76, and 06-78), and add one time to the number of time for single operation reset (pr.06-77).
- When you set Pr.06-79 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.06-78, it displays a ERV warning and continues operation.
- When you set Pr.06-79 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.06-78, it displays a SERV warning and decelerates to stop.

06-80 Output Frequency when Fault 2 Occurred

Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: Read only
Settings		0.00-655.35 Hz					

06-81 DC BUS Voltage when Fault 2 Occurred

Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: Read only
Settings		0.0-6553.5 V					

06-82 Output Current when Fault 2 Occurred

Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: Read only
Settings		0.00-655.35 Amps					

06-83 IGBT Temperature when Fault 2 Occurred

Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: Read only
Settings		-3276.8-3276.7 °C					

06-84 Output Frequency when Fault 3 Occurred

Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: Read only
Settings		0.00-655.35 Hz					

06-85 DC BUS Voltage when Fault 3 Occurred

Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: Read only
Settings		0.0-6553.5 V					

06-86 Output Current when Fault 3 Occurred

Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: Read only
Settings		0.00-655.35 Amps					

06-87 IGBT Temperature when Fault 3 Occurred

Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: Read only
Settings		-3276.8-3276.7 °C					

06-88 Output Frequency when Fault 4 Occurred

Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: Read only
Settings		0.00-655.35 Hz					

06-89 DC BUS Voltage when Fault 4 Occurred

Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: Read only
Settings		0.0-6553.5 V					

06-90	Output Current when Fault 4 Occurred						
Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: Read only
Settings			0.00–655.35 Amps				
06-91	IGBT Temperature when Fault 4 Occurred						
Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: Read only
Settings			-3276.8–3276.7 °C				
06-92	Output Frequency when Fault 5 Occurred						
Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: Read only
Settings			0.00–655.35 Hz				
06-93	DC BUS Voltage when Fault 5 Occurred						
Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: Read only
Settings			0.0–6553.5 V				
06-94	Output Current when Fault 5 Occurred						
Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: Read only
Settings			0.00–655.35 Amps				
06-95	IGBT Temperature when Fault 5 Occurred						
Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: Read only
Settings			-3276.8–3276.7 °C				
06-96	Output Frequency when Fault 6 Occurred						
Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: Read only
Settings			0.00–655.35 Hz				
06-97	DC BUS Voltage when Fault 6 Occurred						
Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: Read only
Settings			0.0–6553.5 V				
06-98	Output Current when Fault 6 Occurred						
Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: Read only
Settings			0.00–655.35 Amps				
06-99	IGBT Temperature when Fault 6 Occurred						
Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: Read only
Settings			-3276.8–3276.7 °C				

07 Special Parameters

↗: You can set this parameter during operation.

↗ 07-00 Brake Chopper Level

Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: 380.0/760.0
 Settings 230V series: 350.0–450.0 V_{DC}
 460V series: 700.0–900.0 V_{DC}

📖 Sets the DC BUS voltage at which the brake chopper is activated.

07-01 Reserved

↗ 07-02 DC Brake Current Level at Start-up

Control Mode **VF** **VFPG** **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.00-01) 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/TQCPG/FOCPM mode, you can enable the DC brake function without setting up this parameter.

↗ 07-03 DC Brake Activation Time

Control Mode **VF** **VFPG** **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.

↗ 07-04 DC Brake Stopping Time

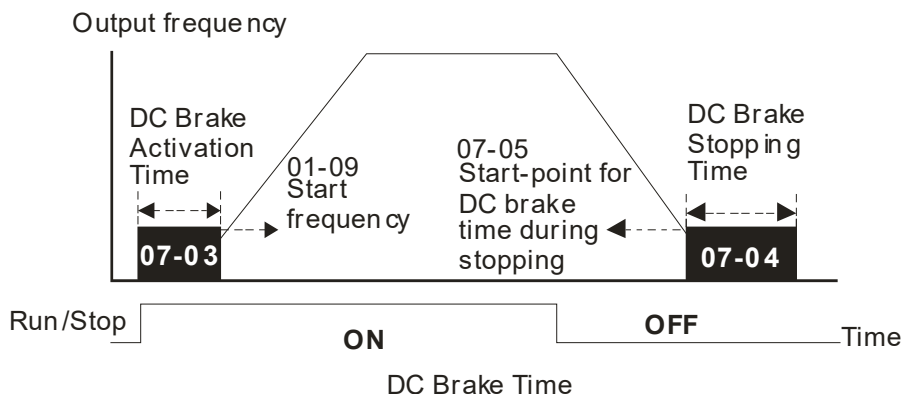
Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0.7
 Settings 0.0–60.0 sec.

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

↗ 07-05 Start-point for DC Brake

Control Mode **VF** **VFPG** **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.01-09), the start-point for the DC brake begins at the minimum frequency.



↗ **07-06** DC Brake Proportional Gain
 Control Mode **VF** **VFPG** **SVC** Default: 50
 Settings 1–500

📖 Sets the output voltage gain when DC braking.

↗ **07-07** Dwell Time at Acceleration
 Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0.00
 Settings 0.00–600.00 sec.

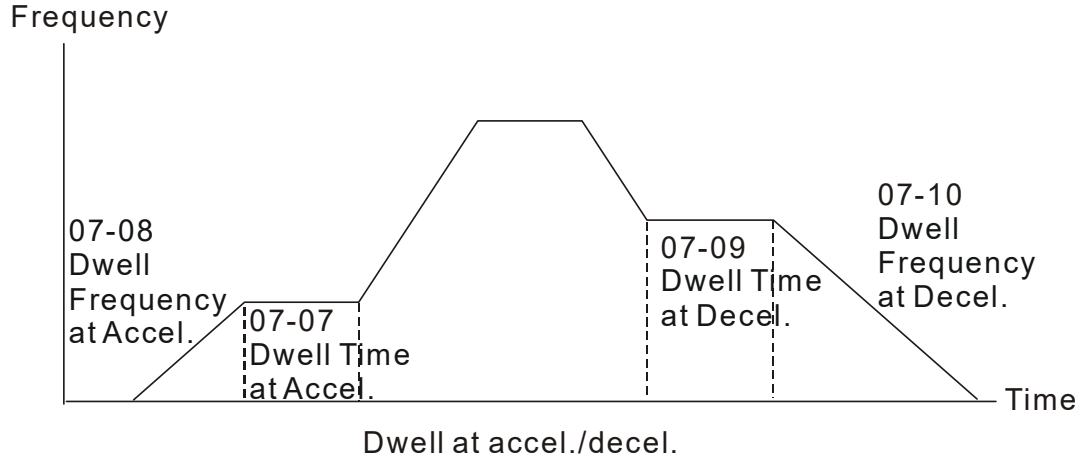
↗ **07-09** Dwell Time at Deceleration
 Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0.00
 Settings 0.00–600.00 sec.

↗ **07-08** Dwell Frequency at Acceleration
 Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0.00
 Settings 0.00–400.00 Hz

↗ **07-10** Dwell Frequency at Deceleration
 Control Mode **VF** **VFPG** **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.07-07–Pr.07-10 with heavy load to prevent over-voltage or over-current.



↗ **07-11** Cooling Fan Control
 Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** **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 set to 3, the fan starts to run until the heat sink temperature is less than 40°C if temperature exceeds 40°C.

➤ **07-12** Torque Command

Control Mode **TQCPG** Default: 0.0
 Settings -150.0–150.0% (Pr.07-14 setting = 100%)

📖 This parameter sets the Torque command. When Pr.07-14 is 250% and Pr.07-12 is 100%, the actual Torque command = 250x100% =250% of the motor rated torque.

➤ **07-13** Torque Command Source

Control Mode **TQCPG** Default: 2
 Settings 0: Use the KPC-CC01 digital keypad
 1: Use the RS-485 serial communication
 2: Use the analog signal (Pr.03-00)

📖 Specifies the Torque command source (Torque command is in Pr.07-12).

➤ **07-14** Maximum Torque Command

Control Mode **VF VFPG SVC FOC PG TQCPG FOC PM** Default: 100
 Settings 0–300% of the rated motor drive torque

📖 Sets the maximum Torque command value (the motor rated torque is 100%).

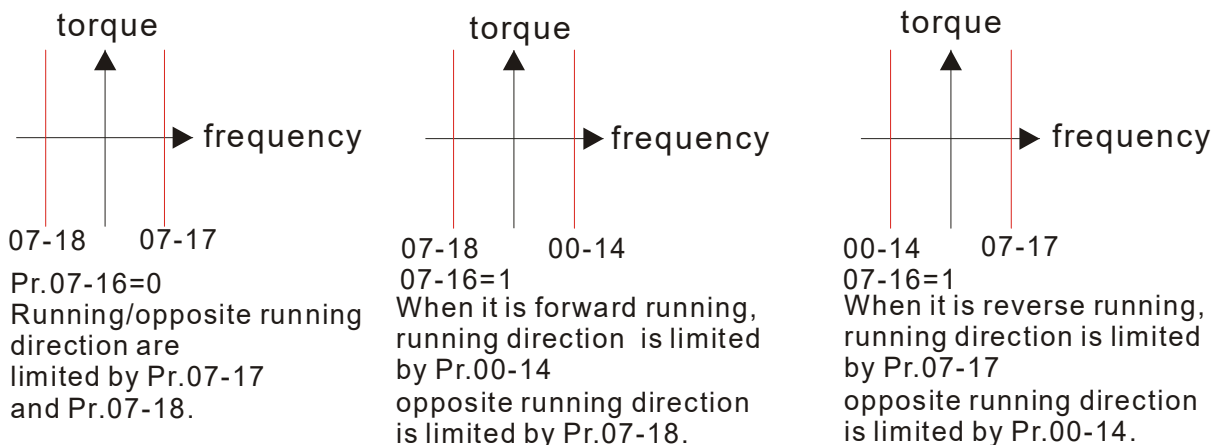
➤ **07-15** Torque Command Filter Time

Control Mode **TQCPG** Default: 0.000
 Settings 0.000–1.000 sec.

📖 When the setting is too long, the control is stable but the control response is delayed. When the setting is too short, the response is quick but the control may be unstable. Adjust the setting according to your control and response situation.

07-16 Speed Limit

Control Mode **TQCPG** Default: 0
 Settings 0: Use the settings in Pr.07-17 and Pr.07-18
 1: Use the Frequency command source (Pr.00-14)



➤ **07-17** Torque Mode + Speed Limit

Control Mode **TQCPG** Default: 10
 Settings 0–120%

➤ **07-18** Torque Mode - Speed Limit

Control Mode **TQCPG** Default: 10
 Settings 0–120%

📖 Limits the speed for forward and reverse running in torque mode (Pr.01-00 Maximum Output Frequency = 100%).

➤ **07-19** Torque Offset Source

Control Mode **SVC FOC PG TQCPG FOC PM** Default: 0
 Settings 0: Disable
 1: Use the analog input (Pr.03-00)
 2: Use the torque offset setting (Pr.07-20)
 3: Use the external terminals (by Pr.07-21–Pr.07-23)

📖 Specifies the torque offset source.

📖 When set to 3, the torque offset sources are Pr.07-21, Pr.07-22 and Pr.07-23 according to the multi-function input terminal settings (31, 32 or 33).

Pr.02-01–Pr.02-08 is set to 31	Pr.02-01–Pr.02-08 is set to 32	Pr.02-01–Pr.02-08 is set to 33	Torque offset
OFF	OFF	OFF	N/A
OFF	OFF	ON	07-23
OFF	ON	OFF	07-22
OFF	ON	ON	07-23+07-22
ON	OFF	OFF	07-21
ON	OFF	ON	07-21+07-23
ON	ON	OFF	07-21+07-22
ON	ON	ON	07-21+07-22+07-23

➤ **07-20** Torque Offset Setting

Control Mode **SVC FOC PG TQCPG FOC PM** Default: 0.0
 Settings 0.0–100.0% (motor drive rated torque)

📖 Sets the torque offset. The motor rated torque is 100%.

➤ **07-21** High Torque Offset

Control Mode **SVC FOC PG TQCPG FOC PM** Default: 30.0
 Settings 0.0–100.0% (motor drive rated torque)

➤ **07-22** Middle Torque Offset

Control Mode **SVC FOC PG TQCPG FOC PM** Default: 20.0
 Settings 0.0–100.0% (motor drive rated torque)

➤ **07-23** Low Torque Offset

Control Mode **SVC FOC PG TQCPG FOC PM** Default: 10.0
 Settings 0.0–100.0% (motor drive rated torque)

📖 When set to 3, the torque offset sources are Pr.07-21, Pr.07-22 and Pr.07-23 according to the multi-function input terminal settings (31, 32 or 33). The motor rated torque is 100%.

➤ **07-24** Forward Motor Torque Limit

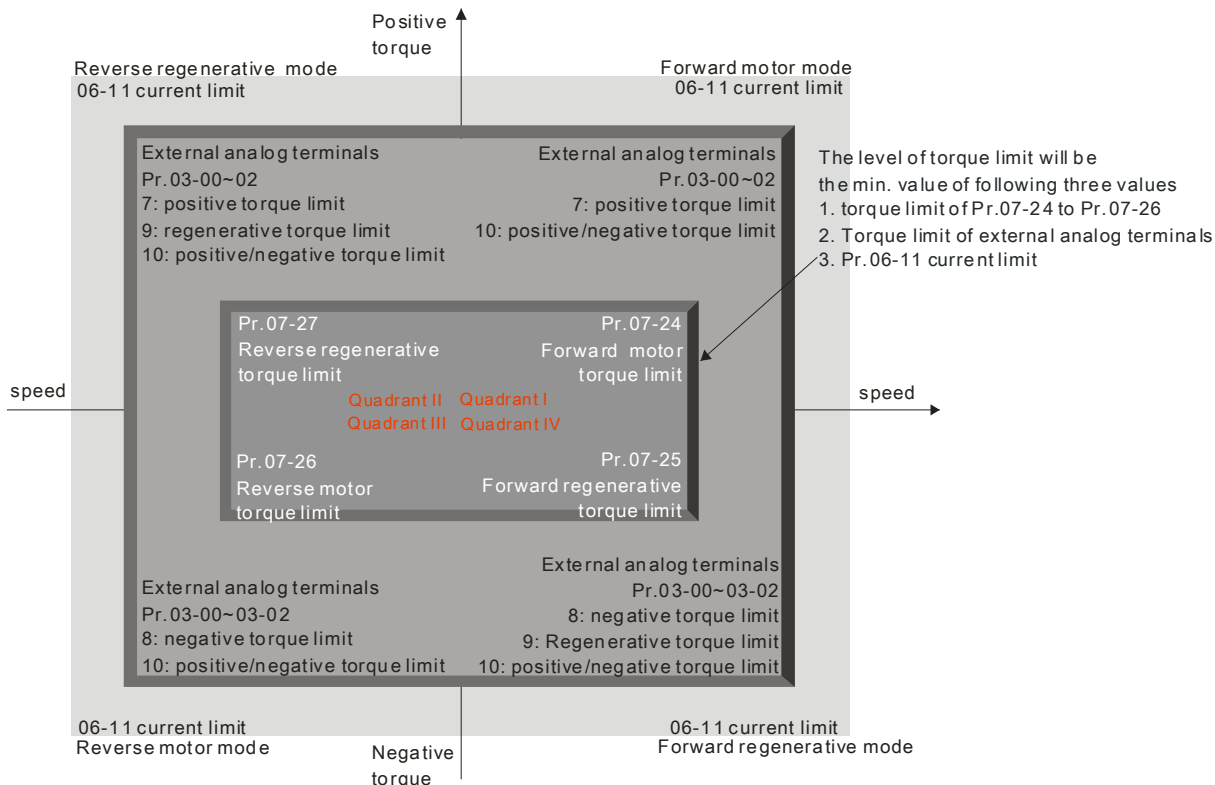
➤ **07-25** Forward Regenerative Torque Limit

⚡ **07-26** Reverse Motor Torque Limit

⚡ **07-27** Reverse Regenerative Torque Limit

Control Mode **FOCPG TQCPG FOCPM** Default: 200
 Settings 0–300% (rated torque of the motor drive)

📖 The motor rated torque is 100%. The settings for Pr.07-24–Pr.07-27 compare with Pr.03-00=5, 6, 7, 8. The minimum of the comparison result is torque limit. The diagram below illustrates the torque limit.



⚡ **07-28** Emergency Stop (EF) & Forced Stop

Control Mode **VF VFPG SVC FOCPG TQCPG 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.01-31

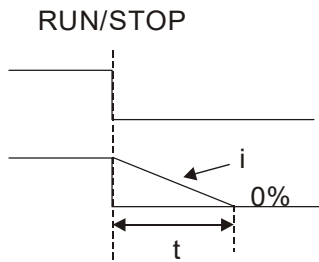
📖 When the multi-function input terminal is set to 10 or 18 and is ON, the AC motor drive is controlled according to the setting in Pr.07-28.

⚡ **07-29** Time for Decreasing Torque at Stop

Control Mode **FOCPG TQCPG 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%.



$$\frac{i}{00-01} \times \frac{100\%}{300\%} \times (07-29) = t$$

⚡ **07-30** DC Brake Current Level at Stop

Control Mode **VF** **VFP** **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.00-01) 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/TQCPG/FOCPM control mode, you can enable the DC brake without setting up Pr.07-30.

08 PM Parameters

↗: You can set this parameter during operation.

08-00 Motor Auto-tuning

Control Mode

FOCPM





Default: 0

Settings 0: No function

1: Only for an unloaded motor; auto-measures the angle between magnetic pole and PG origin (Pr.08-09)

2: For PM parameters (suggested to lock the brake)


3: Auto-measures the angle between magnetic pole and PG origin (Pr.08-09)

-  1: Auto-measures the angle between the magnetic pole and the PG origin. Follow the steps below when measuring:
1. Unload before auto-tuning.
 2. If the drive controls the brake, the drive can auto-tune 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 state before auto-tuning.
-  3: Auto-measures the angle between the magnetic pole and the PG origin. Follow the steps below when measuring:
1. The motor can be loaded or unloaded before auto-tuning.
 2. If the drive controls the brake, the drive can auto-tune 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 state before auto-tuning.
 4. Make sure the setting for Pr.10-02 is correct. Incorrectly setting Pr.10-02 causes incorrect positioning of the magnetic pole and results in the wrong angle between the magnetic pole and PG origin.
-  2: Starts auto-tuning by pressing RUN on the keypad. The drives write the measured values into Pr.08-05, Pr.08-07 (Rs, Lq) and Pr.08-08 (Back EMF).
The steps for auto-tuning for static measurement are:
1. Make sure that all the parameters are set to defaults and the motor wiring is correct.
 2. Motor: Set Pr.08-01, Pr.08-02, Pr.08-03 and Pr.08-04 with correct values. Refer to the motor capacity to set the acceleration and deceleration time.
 3. When you set Pr.08-00 to 2, the AC motor drive executes auto-tuning immediately after receiving a RUN command. (NOTE: the motor will run! The shaft needs to be locked by an external force).
 4. After executing, check that all values are filled in Pr.08-05 and Pr.08-07.
-  **NOTE**
- The rated speed cannot be larger than or equal to 120 f/p.
 - Note that if the electromagnetic valve and brake are not controlled by the AC motor drive, release it manually.
 - Set Pr.08-00 to 1 (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.08-00 = 3. It will have a difference of 15–30° for the different encoder types. Refer to the reference table for auto-tuning for Pr.10-00 (PG Signal Type).
 - The warning message “Auto tuning” displays on the digital keypad during measuring until it finishes measuring. Then it saves the result in Pr.08-09.
 - “Auto Tuning Err” displays on the keypad 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 digital keypad, change the setting of Pr.10-02 (if set to 1, change it to 2). If “PG Fbk Loss” displays on the digital keypad, check the feedback of Z-phase pulse.

08-01 Motor Full-load Current

Control Mode **FOCPM** Unit: Amp
Default: ###

Settings (40–120%) * Pr.00-01 Amps

 Sets according to the motor rated frequency as indicated on the motor nameplate. The default is 90% of the rated current.

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 case, the current range is from 10 A (25 * 40%) to 30 A (25 * 120%).

08-02 Motor Rated Power

Control Mode **FOCPM** Default: ###


Settings 0.00–655.35 kW

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

08-03 Motor Rated Speed (rpm)

Control Mode **FOCPM** Default: 1710

Settings 0–65535 rpm

 Sets the motor rated speed according to the motor nameplate.

08-04 Number of Motor Poles

Control Mode **FOCPM** Default: 4

Settings 2–96

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

08-05 Motor Rs

Control Mode **FOCPM** Default: 0.000

Settings 0.000–65.535 Ω

08-06 Motor Ld**08-07** Motor Lq


Control Mode **FOCPM** Default: 0.0


Settings 0.0–6553.5 mH

08-08 Back Electromotive Force

Control Mode **FOCPM** Default: 0.0

Settings 0.0–6553.5 Vrms


 Sets the back electromotive force (phase-phase RMS value) when the motor is operated at the rated speed.

 You can get the RMS value by setting Pr.08-00 = 2 (Motor Auto-tuning).

08-09 Angle between Magnetic Pole and PG Origin

Control Mode **FOCPM** Default: 360.0

Settings 0.0–360.0°




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

08-10 Magnetic Pole Re-orientation

Control Mode **FOCPM** Default: 0

Settings 0: Disable

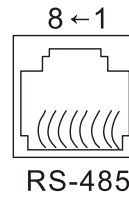
1: Enable

-
-  Use with Pr.11-00 bit15 = 1.
 -  Use this function to search for the magnetic pole position only for permanent magnet motors.
 -  When there is no origin-adjustment for encoder (Pr.08-09 is 360.0), it only ensures that the motor operation efficiency can be up to 86% of the best efficiency. In this situation, when the operation efficiency needs to be improved, you can restart or set Pr.08-10 to 1 to get the magnetic pole orientation.

09 Communication Parameters

↗: You can set this parameter during operation.

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



Modbus RS-485

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

↗ 09-00 Communication Address

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** **VFPG** **SVC** **FOCPG** **TQCPG** **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 Transmission Fault Treatment

Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: 3

Settings 0: Warn and keep operation
 1: Warn 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.

↗ 09-03 Time-out Detection

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

Settings 0.0–100.0 sec.
 0.0: Disable

📖 Sets the communication time-out value.

↗ 09-04 Communication Protocol


Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** **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).

1. Code Description

The communication protocol is in hexadecimal, ASCII: "0", "9", "A", "F", every 16 hexadecimal represents an ASCII code. For example:

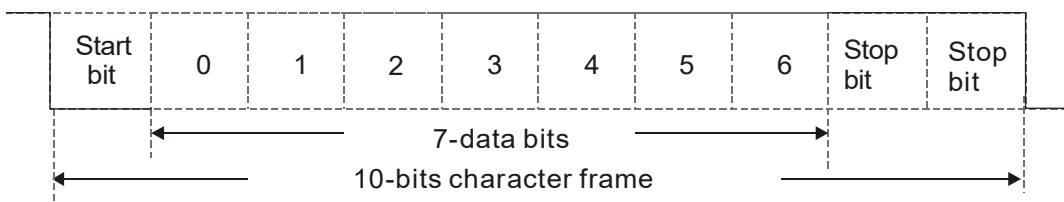
Character	'0'	'1'	'2'	'3'	'4'	'5'	'6'	'7'
ASCII code	30H	31H	32H	33H	34H	35H	36H	37H

Character	'8'	'9'	'A'	'B'	'C'	'D'	'E'	'F'
ASCII code	38H	39H	41H	42H	43H	44H	45H	46H

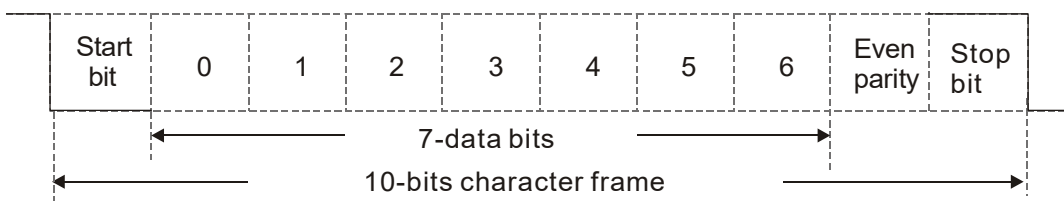
2. Data Format

10-bit character frame (For ASCII):

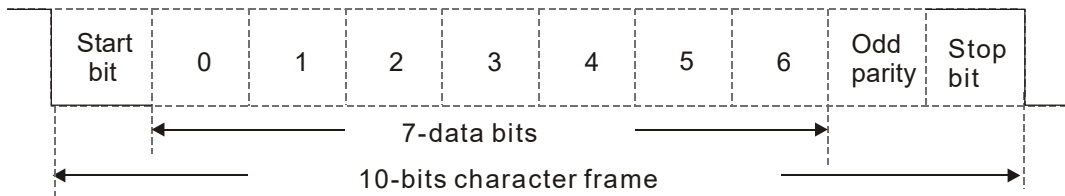
(Format: 7, N, 2)



(Format: 7, E, 1)

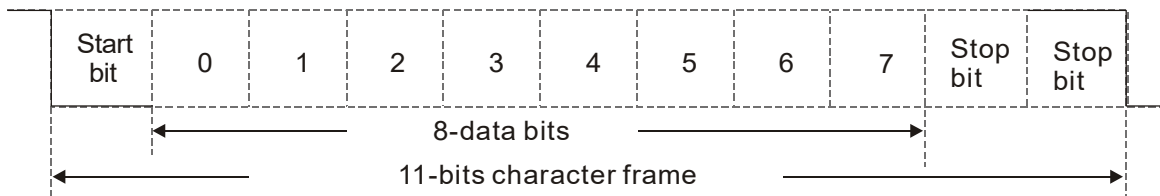


(Format: 7, O, 1)

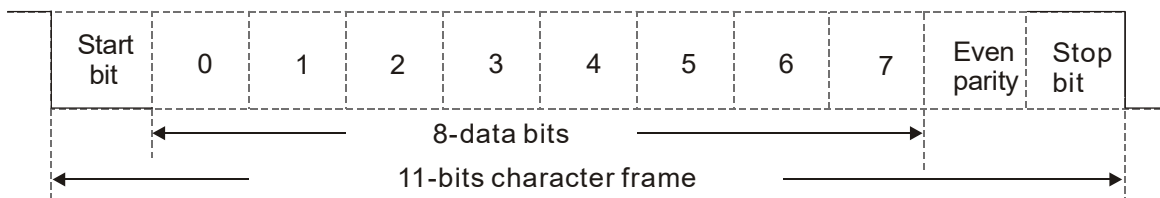


11-bit character frame (For RTU)

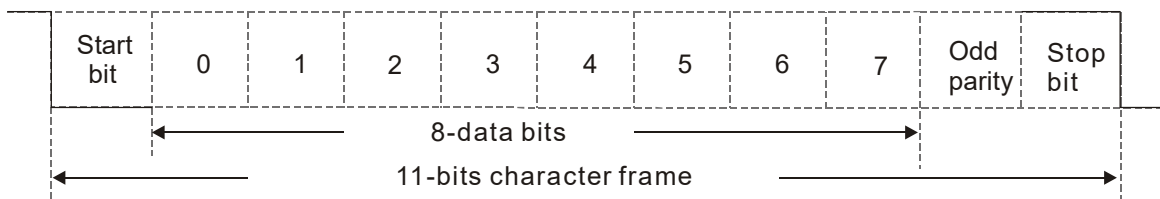
(Format: 8, N, 2)



(Format: 8, E, 1)



(Format 8, O, 1)



3. Communication Protocol

3.1 Communication Data Frame

ASCII mode:

STX	Start character ':' (3AH)
Address Hi	Communication address: 8-bit address consists of 2 ASCII codes
Address Lo	
Function Hi	Command code: 8-bit command code consists of 2 ASCII codes
Function Lo	
DATA (n-1) to DATA 0	Contents of data: Nx8-bit data consists of 2n ASCII codes n<=16, maximum of 32 ASCII codes (20 sets of data)
LRC CHK Hi	LRC checksum: 8-bit checksum consists of 2 ASCII codes
LRC CHK Lo	
END Hi	End characters: END1= CR (0DH), END0 = LF(0AH)
END Lo	

RTU mode:

START	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 CHK Low	CRC checksum: 16-bit CRC checksum consists of 2 8-bit binary characters
CRC CHK High	
END	A silent interval of larger than/equal to 10 ms

3.2 Address (Communication 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

3.3 Function (Function code) and DATA (data characters)

(1) 03H: Read data from register

Example: reading continuous 2-data from register address 2102H, AMD address is 01H.

ASCII mode:

Command Message		Response Message	
STX	‘.’	STX	‘.’
Address	‘0’	Address	‘0’
	‘1’		‘1’
Function	‘0’	Function	‘0’
	‘3’		‘3’
Starting address	‘2’	Number of data (count by byte)	‘0’
	‘1’		‘4’
	‘0’		‘1’
Number of data (count by word)	‘2’	Content of starting address 2102H	‘7’
	‘0’		‘7’
	‘0’		‘0’
	‘0’		‘0’
	‘2’		‘0’
LRC Check	‘D’	Content of address 2103H	‘0’
	‘7’		‘0’
	CR		‘0’
END	LF	LRC Check	‘7’
			‘1’
		END	CR
			LF

RTU mode:

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

(2) 06H: Single write, write single data to register

06H: Single write, write single data to register (can write at most 20 sets of data simultaneously).

Example: writing data 6000 (1770H) to register 0100H. AMD address is 01H.

ASCII mode:

Command Message		Response Message	
STX	‘.’	STX	‘.’
Address	‘0’	Address	‘0’
	‘1’		‘1’
Function	‘0’	Function	‘0’
	‘6’		‘6’
Data address	‘0’	Data address	‘0’
	‘1’		‘1’
	‘0’		‘0’
	‘0’		‘0’
Data content	‘1’	Data content	‘1’
	‘7’		‘7’
	‘7’		‘7’
	‘0’		‘0’
LRC Check	‘7’	LRC Check	‘7’
	‘1’		‘1’
END	CR	END	CR
	LF		LF

RTU mode:

Command Message		Response Message	
Address	01H	Address	01H
Function	06H	Function	06H
Data address	01H	Data address	01H
	00H		00H
Data content	17H	Data content	17H
	70H		70H
CRC CHK Low	86H	CRC CHK Low	86H
CRC CHK High	22H	CRC CHK High	22H

(3) 10H: Write multiple registers (write multiple data to registers)

Example: Set the multi-step speed,

Pr.04-00 = 50.00 (1388H), Pr.04-01 = 40.00 (0FA0H). AC motor drive address is 01H.

ASCII mode:

Command Message		Response Message	
STX	‘.’	STX	‘.’
ADR 1	‘0’	ADR 1	‘0’
ADR 0	‘1’	ADR 0	‘1’
CMD 1	‘1’	CMD 1	‘1’
CMD 0	‘0’	CMD 0	‘0’
Target Register	‘0’	Target Register	‘0’
	‘5’		‘5’
	‘0’		‘0’
	‘0’		‘0’
Number of Register (Count by word)	‘0’	Number of Register (Count by word)	‘0’
	‘0’		‘0’
	‘0’		‘0’
	‘2’		‘2’
Number of Register (Count by byte)	‘0’	LRC Check	‘E’
	‘4’		‘8’
The first data content	‘1’	END	CR
	‘3’		LF
	‘8’		

	'8'
The second data content	'0'
	'F'
	'A'
	'0'
LRC Check	'9'
	'A'
END	CR
	LF

RTU mode:

Command Message		Response	
ADR	01H	ADR	01H
CMD	10H	CMD 1	10H
Target	05H	Target	05H
Register	00H	Register	00H
Number of Register	00H	Number of Register	00H
(Count by word)	02H	(Count by word)	02H
Number of Register(Byte)	04	CRC Check Low	41H
The first	13H	CRC Check High	04H
Data content	88H		
The second	0FH		
Data content	A0H		
CRC Check Low	'9'		
CRC Check High	'A'		

3.4 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.

For example, as shown in the above Section 3.3.1,

$01H + 03H + 21H + 02H + 00H + 02H = 29H$, the 2's-complement negation of 29H is **D7H**.

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 with MSB zero filling, then repeat step 3. If the LSB of CRC register is 1, shift the CRC register one bit to the right with MSB zero filling, Exclusive OR the CRC register with the polynomial value A001H, then repeat step 3.

Step 5: Repeat step 3 and 4 until eight shifts have been performed. When this is done, a complete 8-bit byte will have been processed.

Step 6: Repeat step 2 to 5 for the next 8-bit byte of the command message. Continue doing this until all bytes have been 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, i.e. 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

```


4. ACMD Modbus Communication Address List

The following table shows the contents of available addresses.

Content	Address	Function		
AC motor drive Parameters	GGnnH	GG means parameter group, nn means parameter number, for example, the address of Pr.04-01 is 0401H.		
Command Write only	2000H	Bit 0–3	0: No function 1: Stop 2: Run 3: Jog + Run	
		Bit 4–5	00B: No function 01B: FWD 10B: REV 11B: Change direction	
		Bit 6–7	00B: First acceleration/deceleration 01B: Second acceleration/deceleration 10B: Third acceleration/deceleration 11B: Fourth acceleration/deceleration	
		Bit 8–11	0000B: master speed	
			0001B: 1st step speed	
			0010B: 2nd step speed	
			0011B: 3rd step speed	
			0100B: 4th step speed	
			0101B: 5th step speed	
			0110B: 6th step speed	
			0111B: 7th step speed	
			1000B: 8th step speed	
			1001B: 9th step speed	
			1010B: 10th step speed	
			1011B: 11th step speed	
			1100B: 12th step speed	
			1101B: 13th step speed	
			1110B: 14th step speed	
		1111B: 15th step speed		
Bit 12	1: Enable bit 06–11			
Bit 13–14	00B: No function			
	01B: Operated by digital keypad			
	10B: Operated by Pr.00-15 setting			
	11B: Change operation source			
Bit 15	Reserved			
2001H	Frequency command			
2002H	Bit 0	1: EF (external fault) ON		
	Bit 1	1: Reset		
	Bit 2	1: B.B. ON		
	Bit 3–15	Reserved		
2100H	Fault code: refer to Pr.06-16–Pr.06-21			
2119H	Bit 0–1	00: Stop		
		01: Deceleration		
		10: Ready for operation		
		11: Operation		
	Bit 2	1: JOG command		
	Bit 3–4	00: FWD command, FWD output		
		01: FWD command, REV output		
		10: REV command, FWD output		
		11: Reserved		
	Bit 5–7	Reserved		
Bit 8	1: Master frequency controlled by communication interface			
Bit 9	1: Master frequency controlled by analog/external terminal signals (EXT)			
Bit 10	1: Operation command controlled by communication interface (PU)			
Bit 11	1: Parameters locked			
Status monitor Read only	2001H	Bit 0	1: EF (external fault) ON	
		Bit 1	1: Reset	
		Bit 2	1: B.B. ON	
		Bit 3–15	Reserved	
		2100H	Fault code: refer to Pr.06-16–Pr.06-21	
		2119H	Bit 0–1	00: Stop
				01: Deceleration
				10: Ready for operation
				11: Operation
			Bit 2	1: JOG command
			Bit 3–4	00: FWD command, FWD output
				01: FWD command, REV output
10: REV command, FWD output				
11: Reserved				
Bit 5–7	Reserved			
Bit 8	1: Master frequency controlled by communication interface			
Bit 9	1: Master frequency controlled by analog/external terminal signals (EXT)			
Bit 10	1: Operation command controlled by communication interface (PU)			
Bit 11	1: Parameters locked			

Content	Address	Function	
		Bit 12	1: Enable copy parameter from keypad
		Bit 13–15	Reserved
	2102H	Frequency command (F)	
	2103H	Output frequency (H)	
	2104H	Output current (Axxx.X)	
	2105H	DC BUS Voltage (Uxxx.X)	
	2106H	Output voltage (Exxx.X)	
	2107H	Current step number of multi-step speed operation	
	2116H	Multi-function displays (Pr.00-04)	
	2201H	Pr.00-05 user-defined setting	
	2203H	AUI1 analog input (xxx.xx %)	
	2204H	AUI2 analog input (xxx.xx %)	
	2205H	Reserved	
	2206H	Display temperature of IGBT (°C)	
	2207H	Display temperature of heat sink (°C) (only for model 40 HP and above)	
	2208H	Digital input state	
	2209H	Digital output state	

5. Exception Response

The AC motor drive is expected to return a normal response after receiving command messages from the master device. The following describes the conditions when no normal response is sent to the master device.

The AC motor drive does not receive the messages due to a communication error; thus, the AC motor drive gives no response. The master device eventually processes a time-out condition.

The AC motor drive receives the messages without a communication error, but cannot handle them. It returns an exception response to the master device and displays an error message “CExx” on the AC motor drive keypad. The xx of “CExx” is a decimal code equal to the exception code (described below).

In the exception response, the most significant bit (bit7) of the original command code is set to 1 (function code and 80H), and it returns an exception code that explains the condition that caused the exception.

Example:

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

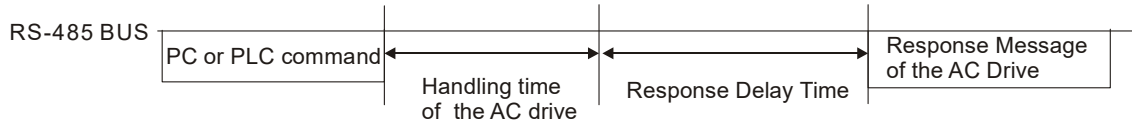
The following table describes the exception codes.

Exception Code	Description
1	Incorrect data contents: the contents of data are too large, and not recognized by the motor drive.
2	Incorrect parameter address: The parameter addresses are not recognized by the motor drive.
3	Password locked: parameters cannot be changed.
4	Parameters cannot be changed during operation.
10	Transmission time-out

09-05 Response Delay Time

Control Mode **VF VFPG SVC FOCPG TQCPG 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.



09-06
 - Direct docking mode only

09-13
 Control Mode **VF VFPG SVC FOCPG FOCPM** Default: -
 Settings Contact Delta for more information

09-14 PDO Transmission Interval

Control Mode **VF VFPG SVC FOCPG TQCPG FOCPM** Default: 0
 Settings 0–65535 ms

10 Feedback Control Parameters

↗: You can set this parameter during operation.

In this parameter group, ASR is the abbreviation for Adjust Speed Regulator and PG is the abbreviation for Pulse Generator.

10-00 Selection of Encoder

Control Mode	VFPG	FOCPG	TQCPG	FOCPM	Default: 0
Settings	0: Disable				
	1: ABZ				
	2: ABZ+Hall				
	3: SIN/COS + Sinusoidal				
	4: SIN/COS + Endat				
	5: SIN/COS				
	6: SIN/COS + Hiperface				

📖 When you set Pr.10-02 to 3, 4 or 5, you can set Pr.10-00 only to 0, 1 or 2, and you cannot use 3, 4, 5 and 6.

📖 When you set Pr.10-00 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 $90^\circ \pm 5$ elec. (EX: ERN 1185 ERN 1387)

📖 When you set Pr.10-00 to 4 or 6, wait for two seconds after applying the power before executing the RUN command.

📖 When you set Pr.10-00 to 5, you must set Pr.08-09 to 360.

📖 Detection of the magnetic pole:

(1) 1 or 5: The AC motor 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 AC motor drive detects the position of the magnetic pole with the UVW encoder signal.

(3) 3: The AC motor drive detects the position of the magnetic pole with the sine encoder signal.

(4) 4 or 6: The AC motor drive detects the position of the magnetic pole with the communication encoder signal.

📖 The following table is the reference auto-tuning

PG Signal Type Setting	PG Signal Type	Applicable PG Card	Pr.08-00=1	Pr.08-00=3
Pr.10-00=1	A, B, Z	EMED-PGAB/ABD-1	N/A	N/A
Pr.10-00=2	A, B, Z+U, V, W	EMED-PGABD-1	Rolling test* ¹	Rolling test* ¹
Pr.10-00=3	SIN/COS+ Sinusoidal	EMED-PGHSD-1	Rolling test* ¹	Rolling test* ¹
Pr.10-00=4	SIN/COS+Endat	EMED-PGSD-1	Dynamic test* ¹	Static test* ¹
Pr.10-00=5	SIN/COS	EMED-PGHSD-1	N/A	N/A
Pr.10-00=6	SIN/COS + Hiperface	EMED-PGHSD-1	Dynamic test* ¹	Static test* ¹

*1 Static: Brake engaged, no motor running. Dynamic: Brake released, motor rotates less than one revolution.


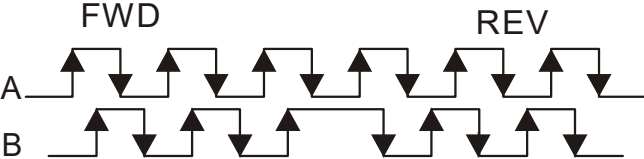
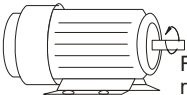
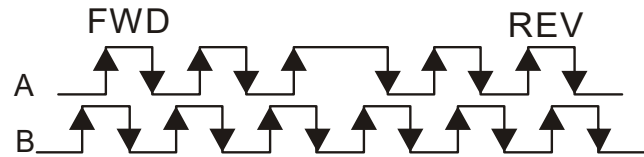

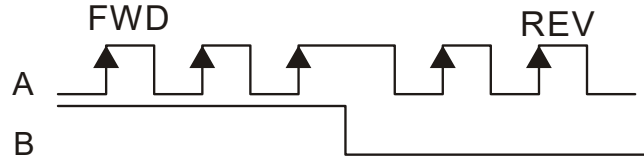

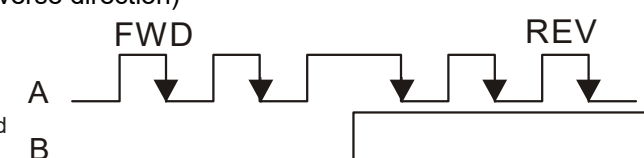

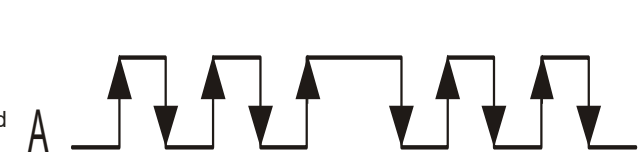
Rolling: Brake released, motor rotates more than one revolution.



10-01 Encoder Pulse

Control Mode	VFPG	FOCPG	TQCPG	FOCPM	Default: 2048
Settings	1–25000				

📖 A Pulse Generator (PG) or encoder provides a motor speed feedback signal. This parameter defines the number of pulses for each cycle of the PG control.

10-02 Encoder Input Type Setting

Control Mode	VFPG	FOCPG	TQCPG	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				
					
	3: Phase A is a pulse input and phase B is a direction input. (low input=reverse direction, high input=forward direction)				
					
	4: Phase A is a pulse input and phase B is a direction input. (low input=forward direction, high input=reverse direction)				
					
	5: Single-phase input				
					


-  When you set Pr.10-00 to 3, 4, 5 or 6, you can set Pr.10-02 only to 0, 1 or 2, and you cannot use 3, 4 and 5.
-  You must enter the correct pulse type for stable control.

10-03 Encoder Feedback Signal Fault Action (PGF1, PGF2)

Control Mode	VFPG	FOCPG	TQCPG	FOCPM	Default: 2
Settings	0: Warn and keep operation				
	1: Fault and ramp to stop				
	2: Fault and stop operation				

10-04 Encoder Feedback Signal Fault Detection Time

Control Mode	VFPG	FOCPG	TQCPG	FOCPM	Default: 1.0
Settings	0.0–10.0 sec.				

-  When there is PG loss, encoder signal error, pulse signal setting error or signal error, if time exceeds the setting for this parameter, the PG signal error occurs. Refer to the Pr.10-03 for the encoder feedback signal fault action.

➤ **10-05** Encoder Stall Level (PGF3)

Control Mode	VFPG	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.01-00 = 100%.

➤ **10-06** Encoder Stall Detection Time (maximum output frequency Pr.01-00 = 100%)

Control Mode	VFPG	SVC	FOCPG	FOCPM	Default: 0.1
Settings	0.0–2.0 sec.				

➤ **10-07** Encoder Slip Range (PGF4) (maximum output frequency Pr.01-00 = 100%)

Control Mode	VFPG	SVC	FOCPG	FOCPM	Default: 50
Settings	0–50%				
	0: Disable				

➤ **10-08** Encoder Slip Detection Time (maximum output frequency Pr.01-00=100%)

Control Mode	VFPG	SVC	FOCPG	FOCPM	Default: 0.5
Settings	0.0–10.0 sec.				

➤ **10-09** Encoder Stall and Slip Error Action (maximum output frequency Pr.01-00 = 100%)

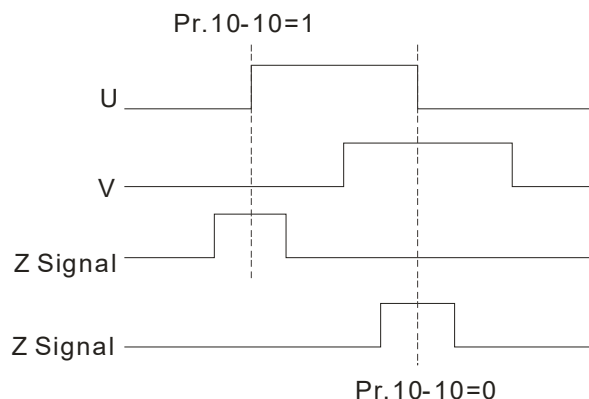
Control Mode	VFPG	SVC	FOCPG	FOCPM	Default: 2
Settings	0: Warn and keep operation				
	1: Fault and ramp to stop				
	2: Fault and stop operation				

📖 When the difference of (rotation speed – motor frequency) exceeds the Pr.10-07 setting, and the detection time exceeds Pr.10-08 or the motor frequency exceeds Pr.10-05 setting, the drive starts to count time. If the detection time exceeds Pr.10-06, the encoder feedback signal error occurs. Refer to Pr.10-09 encoder stall and slip error action.

10-10 Mode Selection for UVW Input

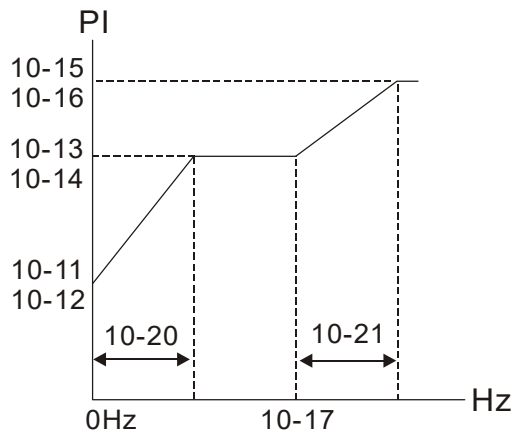
Control Mode	VFPG	FOCPG	TQCPG	FOCPM	Default: 0
Settings	0: Z signal is at the falling edge of U-phase				
	1: Z signal is at the rising edge of U-phase				

📖 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.



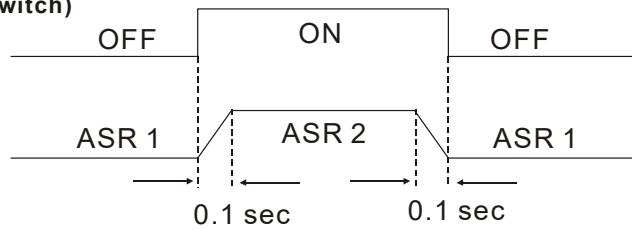
- ↗ **10-11** ASR (Auto Speed Regulation) Control (P) of Zero Speed
 Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 100.0
 Settings 0.0–1000.0%
- ↗ **10-12** ASR (Auto Speed Regulation) Control (I) of Zero Speed
 Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0.100
 Settings 0.000–10.000 sec.
- ↗ **10-13** ASR (Auto Speed Regulation) Control (P) 1
 Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 100.0
 Settings 0.0–1000.0%
- ↗ **10-14** ASR (Auto Speed Regulation) Control (I) 1
 Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0.100
 Settings 0.000–10.000 sec.
- ↗ **10-15** ASR (Auto Speed Regulation) Control (P) 2
 Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 100.0
 Settings 0.0–1000.0%
- ↗ **10-16** ASR (Auto Speed Regulation) Control (I) 2
 Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0.100
 Settings 0.000–10.000 sec.
- ↗ **10-17** ASR 1/ASR2 Switch Frequency
 Control Mode **VF** **VFPG** **SVC** **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.10-17 defines the switch frequency for the ASR1 (Pr.10-13, Pr.10-14) and ASR2 (Pr.10-15, Pr.10-16).



When using multi-function input terminals to switch ASR1/ASR2, the following diagram shows the operation.

Setting multi-function input terminal to 17
(ASR1/ASR2 switch)



➤ **10-18** ASR Primary Low Pass Filter Gain

Control Mode **VF** **VFPG** **SVC** **FOCPG** **FOCPM** Default: 0.008
Settings 0.001–0.350 sec.

Defines the ASR command filter time.

When Pr.11-00 is set to 1 ASR auto-tuning, Pr.10-18 is invalid.

➤ **10-19** Zero Speed Position Control Gain (P)

Control Mode **FOCPM** Default: 80.00
Settings 0.00–655.00%

When Pr.11-00 is set to bit 7=1, Pr.10-19 is valid

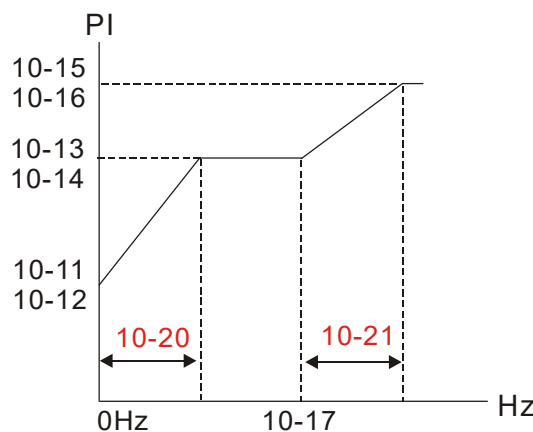
➤ **10-20** Low Speed/ASR Width Adjustment

Control Mode **VFPG** **FOCPG** **FOCPM** Default: 5.00
Settings 0.00–400.00 Hz

➤ **10-21** High Speed ASR Width Adjustment

Control Mode **VFPG** **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.10-17 to high speed.



➤ **10-22** Zero Speed Position Control Holding Time

Control Mode **FOCPM** Default: 0.250
Settings 0.001–65.535 sec.

When Pr.11-00 is set to bit 7=1, Pr.10-22 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.

10-23 Zero Speed Position Control Low Pass Filter Time
 Control Mode **FOCPM** Default: 0.004
 Settings 0.001–65.535 sec.

10-24 Zero Speed Position Control Activation Mode Selection
 Control Mode **FOCPM** Default: 0
 Settings 0: After the brake release set in Pr.02-29
 1: After the brake signal input (Pr.02-01–02-08 is set to 42)

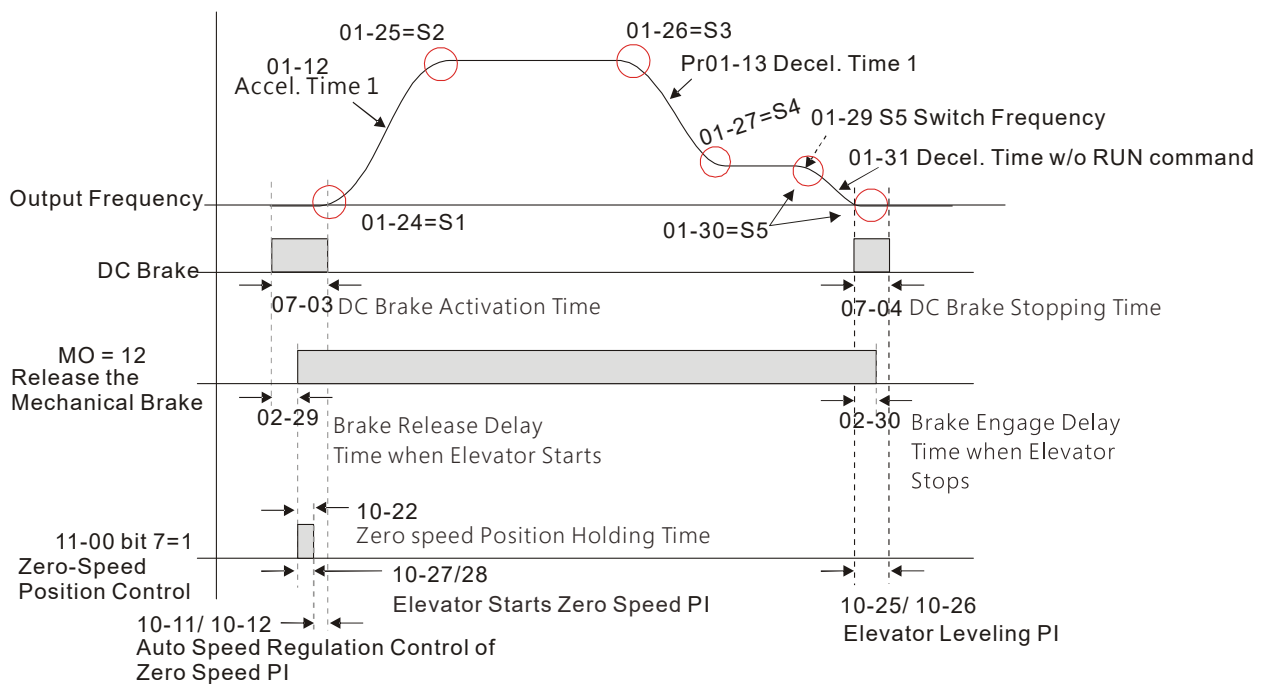
📖 When Pr.10-24 = 0, use the zero speed control with Pr.02-29 (refer to the explanations in Pr.02-32).

10-25 Elevator Leveling (Zero Speed Gain P)
 Control Mode **VF VFPG SVC FOCPG FOCPM** Default: 100.0
 Settings 0.0–1000.0%

10-26 Elevator Leveling (Zero Speed Integral I)
 Control Mode **VF VFPG SVC FOCPG FOCPM** Default: 0.100
 Settings 0.000–10.000 sec.

10-27 Elevator Starting (Zero Speed Gain P)
 Control Mode **VF VFPG SVC FOCPG FOCPM** Default: 100.0
 Settings 0.0–1000.0%

10-28 Elevator Starting (Zero Speed Integral I)
 Control Mode **VF VFPG SVC FOCPG FOCPM** Default: 0.100
 Settings 0.000–10.000 sec.



10-29 PG Card Frequency Division Output

Control Mode	VFPG	FOCPG	FOCPM	Default: 0
Settings	0–31			

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)

10-30 PG Card Frequency Division Output Type

Control Mode	VFPG	FOCPG	FOCPM	Default: 0000h
Settings	0000h–0008h			

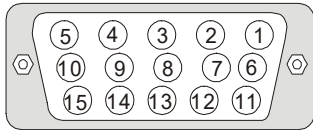
See Chapter 7 for more information about PG cards.

10-31 PG Card C+/C-

Control Mode	VFPG	FOCPG	FOCPM	Default: 0000h
Settings	0000h–0001h			

When using a Heidenhain ERN1387 encoder, use Pr.10-31 to adjust the definition of the Delta PG card EMED-PGHSD-1's terminal 10 and terminal 11 (see the table below). Refer to p.7-8 for detailed terminal descriptions.

Delta PG card: EMED-PGHSD-1 (D-sub Terminal #)



Terminal #	Heidenhain ERN1387	
	Pr.10-31=0000h	Pr.10-31=0001h
10	C-	C+
11	C+	C-

After connecting Delta PG card EMED-PGHSD-2 according to the descriptions in Section 7-3, **you must set Pr.10-31=0001h.**

10-32 Over-acceleration Level

Control Mode	VF	VFPG	SVC	FOCPG	FOCPM	Default: 0.0
Settings	0.0–20.0 m/s ²					

10-33 Over-acceleration Detection Time

Control Mode	VF	VFPG	SVC	FOCPG	FOCPM	Default: 0.05
Settings	0.0–5.00 sec.					

10-34 Over-acceleration Detection Selection

Control Mode	VF	VFPG	SVC	FOCPG	FOCPM	Default: 0
Settings	0: Always detect					
	1: Detect during operation					

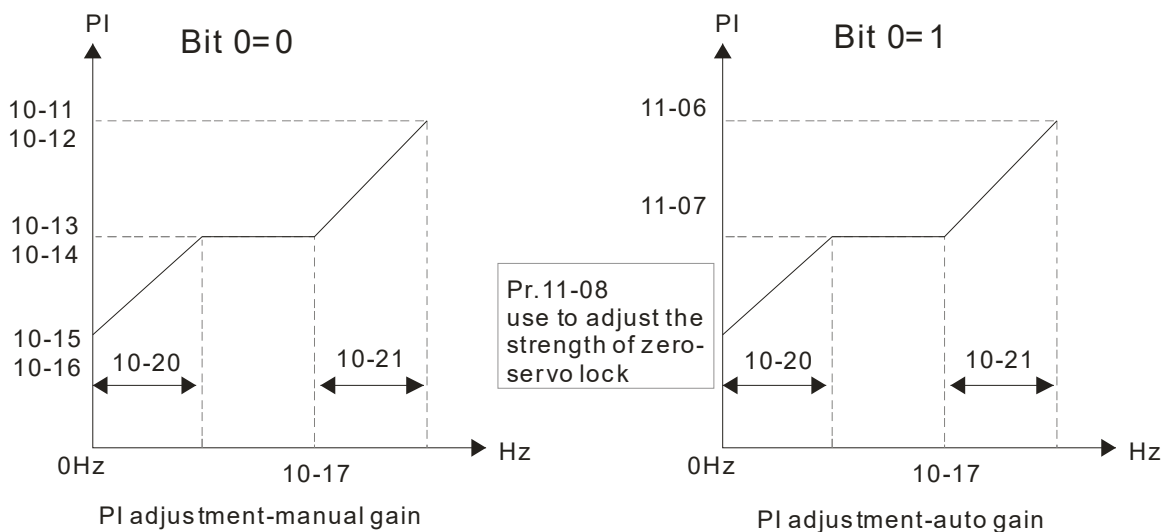
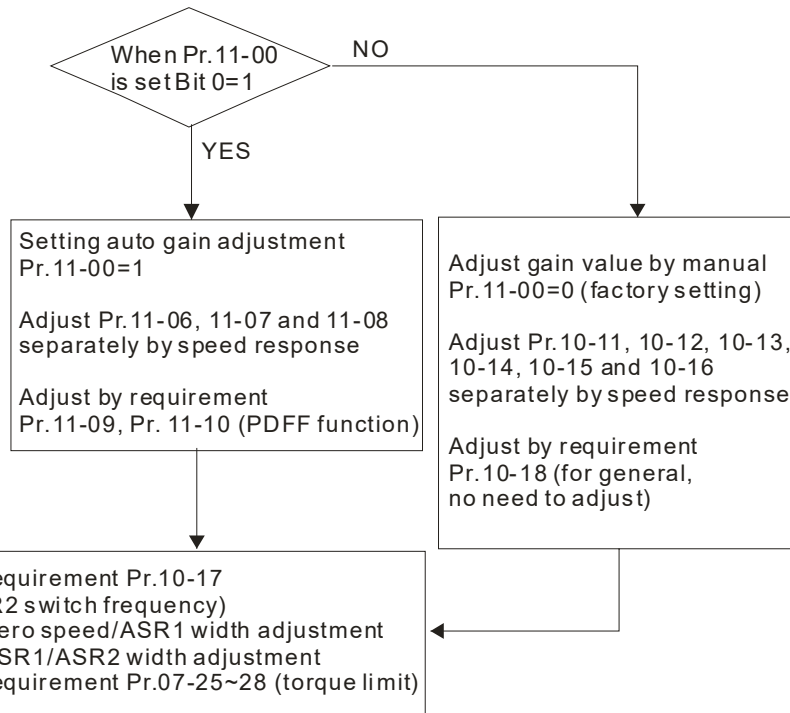
11 Advanced Parameters

↗: You can set this parameter during operation.

11-00 System Control

Control Mode	FOCPG	FOCPM	Default: 0000h
Settings	Bit 0 = 0: No function Bit 0 = 1: ASR auto-tuning, enable PDFF	Bit 7 = 0: No function Bit 7 = 1: Zero speed position control is enabled	
	Bit 9 = 0: Dynamic PG origin auto-tuning with load (support by PGHSD-1) Bit 9 = 1: Static PG origin auto-tuning with load by enabling PGHSD-1		
	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		

Bit 0 = 1: Enable the PDFF function and the system generates an ASR setting. At this time, Pr.10-11~Pr.10-16 are invalid and Pr.11-09~Pr.11-10 are valid.



📖 When Bit 7 = 1, zero speed position control is enabled (refer to p.12-25 timing diagram). Pr.10-22 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.10-00 is set to 3, and the mechanical brake must be in engaged state.

↗ **11-01** Elevator Speed

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

↗ **11-02** Sheave Diameter

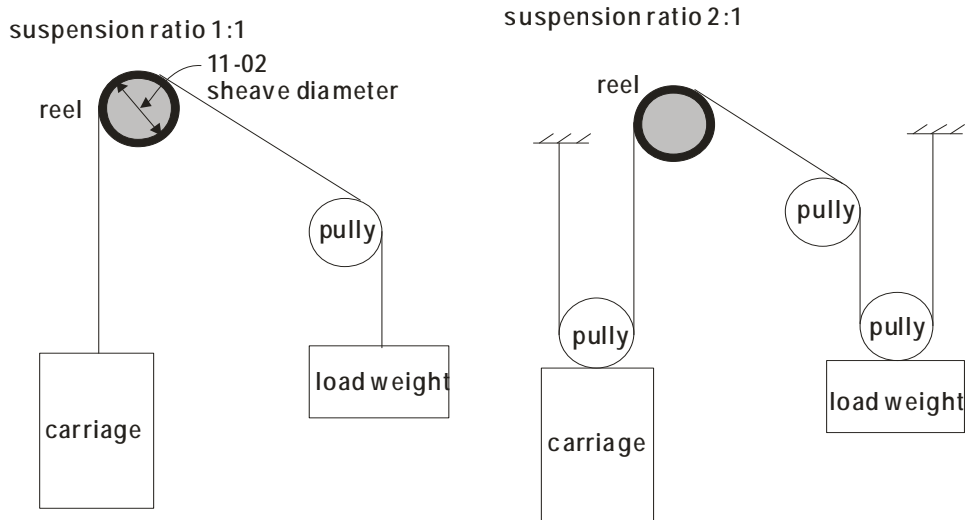
Control Mode	FOCPG	FOCPM	Default: 400
Settings	100–2000 mm		

↗ **11-03** Mechanical Gear Ratio

Control Mode	FOCPG	FOCPM	Default: 1.00
Settings	1.00–100.00		

11-04 Suspension Ratio

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



↗ **11-05** 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.11-02 Sheave Diameter, Pr.11-14 Motor Current at Acceleration and Pr.11-15 Carriage Acceleration. You can use this parameter to adjust the load inertia ratio.

📖 Inertia reference value (%):

Load/Motor	IM	PM
No-load	40	10
With load	80–120	40

↗ **11-06** Zero speed Bandwidth

Control Mode	FOCPG	FOCPM	Default: 10
Settings	1–40 Hz		

↗ **11-07** Low speed Bandwidth

Control Mode	FOCPG	FOCPM	Default: 10
Settings	1–40 Hz		

↗ **11-08** High speed Bandwidth

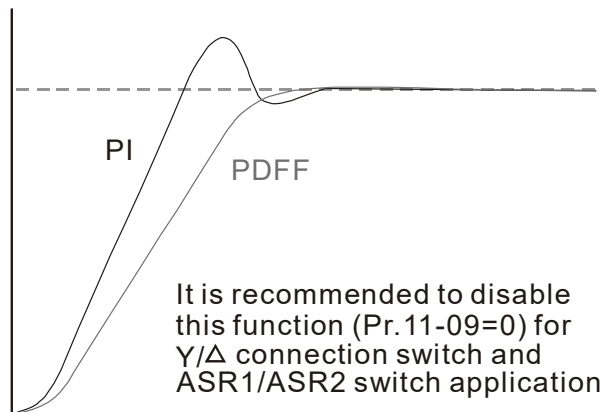
Control Mode	FOCPG	FOCPM	Default: 10
Settings	1–40 Hz		

📖 After estimating the inertia and setting Pr.11-00 =1 (auto-tuning), you can adjust parameters Pr.11-06, Pr.11-07 and Pr.11-08 separately by speed response. The larger the value, the faster the response. Pr.10-17 is the switch frequency between the low speed and high speed bandwidth.

↗ **11-09** PDFF Gain Value

Control Mode	FOCPG	FOCPM	Default: 30
Settings	0–200%		

- 📖 After you estimate and set Pr.11-00=1 (auto-tuning), use Pr.11-09/11-10 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.11-00 to 1
 3. Adjust Pr.11-09 and Pr.11-10 (a larger value suppresses overshoot better). Adjust according to the actual condition.



↗ **11-10** Speed Feed Forward Gain

Control Mode	FOCPG	FOCPM	Default: 0
Settings	0–500		


📖 Pr.11-09 and Pr.11-10 are enabled when Pr.11-00 is set to Bit 0 = 1.


↗ **11-11** Notch Filter Depth


Control Mode	FOCPG	FOCPM	Default: 0
Settings	0–20 db		

↗ **11-12** 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.

 **11-13** Keypad Display for Low Pass Filter Time

Control Mode **VF** **VFP** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: 0.500
 Settings 0.001–65.535 sec.

 Lowers the blinking frequency of the LCD display.

 **11-14** Motor Current at Acceleration

Control Mode **FOCPM** Default: 150
 Settings 50–200%


 **11-15** Carriage Acceleration

Control Mode **FOCPM** Default: 0.75
 Settings 0.20–2.00 m/s²

11-16 Reserved

11-17 Reserved

11-18 Reserved





 **11-19** Zero Speed Parking Bandwidth

Control Mode **FOCPG** **FOCPM** Default: 10
 Settings 1–40 Hz

 **11-20** PWM Mode (Pulse-Width Modulation Mode)

Control Mode Default: 0
 Settings 0: DPWM Mode (Digital Pulse-Width Modulation Mode)
 1: SVPWM mode (Space-Vector Pulse Width Modulation Mode)

↗	12-22	User-defined Parameter 23						
Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: 0638	
Settings	0-9999							
↗	12-23	User-defined Parameter 24						
Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: 0639	
Settings	0-9999							
↗	12-24	User-defined Parameter 25						
Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: 0620	
Settings	0-9999							
↗	12-25	User-defined Parameter 26						
Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: 0640	
Settings	0-9999							
↗	12-26	User-defined Parameter 27						
Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: 0641	
Settings	0-9999							
↗	12-27	User-defined Parameter 28						
Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: 0621	
Settings	0-9999							
↗	12-28	User-defined Parameter 29						
Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: 0642	
Settings	0-9999							
↗	12-29	User-defined Parameter 30						
Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: 0643	
Settings	0-9999							
↗	12-30	User-defined Parameter 31						
Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: 0	
Settings	0-9999							
↗	12-31	User-defined Parameter 32						
Control Mode	VF	VFPG	SVC	FOCPG	TQCPG	FOCPM	Default: 0	
Settings	0-9999							

-  You can define commonly used parameters in parameter group 12.
 -  You can enter the parameters from group 00 to group 11 into group 12 (it can save up to 32 parameters).
 -  The saved values can also be the parameter addresses (but you must convert the hexadecimal value to a decimal value).
 -  Examples of user-defined parameters
- Example 1:

If you want to enter Pr.08-03 into Pr.12-00, enter 0803 into Pr.12-00. Then, the keypad displays the setting for Pr.08-03 in Pr.13-00.

Example 2:

If you need to enter parameter addresses 2102H and 211BH with the digital keypad, convert 211BH to a decimal value before entering (see below for details).

The setting method for 211BH:

Convert 211BH (hexadecimal) to a decimal value:

$$\begin{array}{c} 2 \ 1 \ 1 \ B \\ \swarrow \quad \searrow \\ \underline{1} \times 16^1 + \underline{11} \times 16^0 = 16 + 11 = 27 \quad \text{input } 2127 \end{array}$$

13 View User-defined Parameters

↗: You can set this parameter during operation.

13-00 View User-defined Parameters

Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: -
 Settings Pr.00-00–Pr.11-20

13-00 Present Fault Record

Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: -
 Display 0616 (Same as Pr.06-16)
 Address

13-01 Motor Operation at Present Fault Time (min.)

Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: -
 Display 0632 (Same as Pr.06-32)
 Address

13-02 Motor Operation at Present Fault Time (day)

Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: -
 Display 0633 (Same as Pr.06-33)
 Address

13-03 Frequency Command at Present Fault

Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: -
 Display 0653 (Same as Pr.06-53)
 Address

13-04 Output Frequency at Preset Fault

Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: -
 Display 0654 (Same as Pr.06-54)
 Address

13-05 Output Current at Present Fault

Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: -
 Display 0655 (Same as Pr.06-55)
 Address

13-06 Motor Frequency at Present Fault

Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: -
 Display 0656 (Same as Pr.06-56)
 Address

13-07 Output Voltage at Present Fault

Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: -
 Display 0657 (Same as Pr.06-57)
 Address

13-08 DC BUS Voltage at Present Fault

Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: -
 Display 0658 (Same as Pr.06-58)
 Address

13-09 Output Power at Present Fault

Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: -
 Display 0659 (Same as Pr.06-59)
 Address

13-10 Output Torque at Present Fault

Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: -
 Display 0660 (Same as Pr.06-60)
 Address

13-11 Power Module IGBT Temperature at Present Fault

Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: -
 Display 0661 (Same as Pr.06-61)
 Address

13-12 Multi-function Terminal Input Status at Present Fault

Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: -
 Display 0662 (Same as Pr.06-62)
 Address

13-13 Multi-function Terminal Output Status at Present Fault

Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: -
 Display 0663 (Same as Pr.06-63)
 Address

13-14 Drive Status at Present Fault

Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: -
 Display 0664 (Same as Pr.06-64)
 Address

13-15 Second Most Recent Fault Record

Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: -
 Display 0617 (Same as Pr.06-17)
 Address

13-16 Motor Operation at Second Most Recent Fault Time (min.)

Control Mode **VF VFPG SVC FOCPG TQCPG FOCPM** Default: -
 Display 0634 (Same as Pr.06-34)
 Address

13-17 Motor Operation at Second Most Recent Fault Time (day)

Control Mode **VF VFPG SVC FOCPG TQCPG FOCPM** Default: -
 Display 0635 (Same as Pr.06-35)
 Address

13-18 Third Most Recent Fault Record

Control Mode **VF VFPG SVC FOCPG TQCPG FOCPM** Default: -
 Display 0618 (Same as Pr.06-18)
 Address

13-19 Motor Operation at Third Most Recent Fault Time (min.)

Control Mode **VF VFPG SVC FOCPG TQCPG FOCPM** Default: -
 Display 0636 (Same as Pr.06-36)
 Address

13-20 Motor Operation at Third Most Recent Fault Time (day)

Control Mode **VF VFPG SVC FOCPG TQCPG FOCPM** Default: -
 Display 0637 (Same as Pr.06-37)
 Address

13-21 Fourth Most Recent Fault Record

Control Mode **VF VFPG SVC FOCPG TQCPG FOCPM** Default: -
 Display 0619 (Same as Pr.06-19)
 Address

13-22 Motor Operation at Fourth Most Recent Fault Time (min.)

Control Mode **VF VFPG SVC FOCPG TQCPG FOCPM** Default: -
 Display 0638 (Same as Pr.06-38)
 Address

13-23 Motor Operation at Fourth Most Recent Fault Time (day)

Control Mode **VF VFPG SVC FOCPG TQCPG FOCPM** Default: -
 Display 0639 (Same as Pr.06-39)
 Address

13-24 Fifth Most Recent Fault Record

Control Mode **VF VFPG SVC FOCPG TQCPG FOCPM** Default: -
 Display 0620 (Same as Pr.06-20)
 Address

13-25 Motor Operation at Fifth Most Recent Fault Time (min.)

Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: -
 Display 0640 (Same as Pr.06-40)
 Address

13-26 Motor Operation at Fifth Most Recent Fault Time (day)

Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: -
 Display 0641 (Same as Pr.06-41)
 Address

13-27 Sixth Most Recent Fault Record

Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: -
 Display 0621 (Same as Pr.06-21)
 Address

13-28 Motor Operation at Sixth Most Recent Fault Time (min.)

Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: -
 Display 0642 (Same as Pr.06-42)
 Address

13-29 Motor Operation at Sixth Most Recent Fault Time (day)

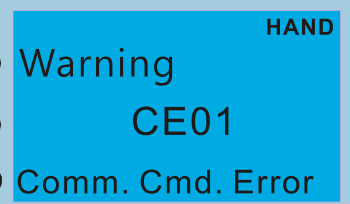
Control Mode **VF** **VFPG** **SVC** **FOCPG** **TQCPG** **FOCPM** Default: -
 Display 0643 (Same as Pr.06-43)
 Address

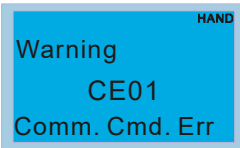
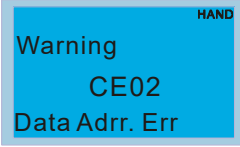
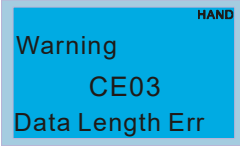
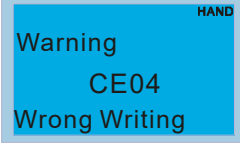
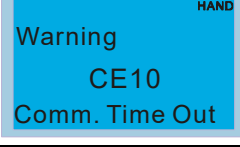
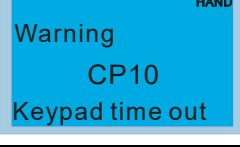
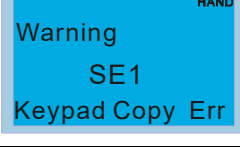
13-30 No default

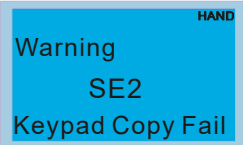
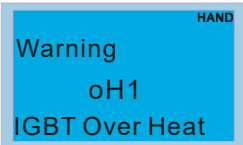
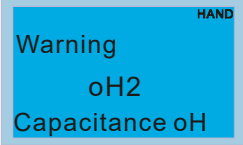
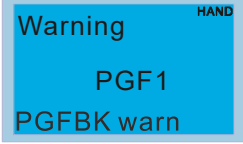
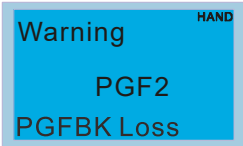
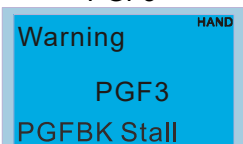
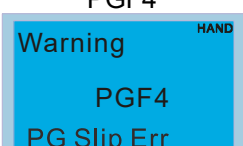
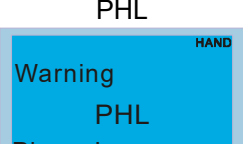
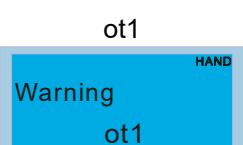
13-31 No default

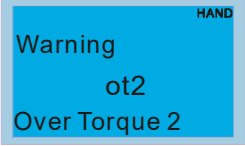
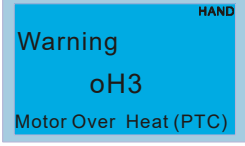
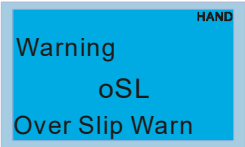
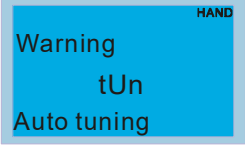
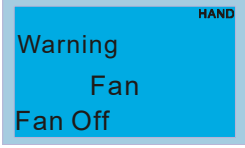
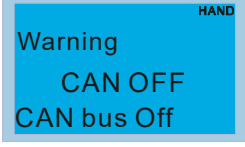
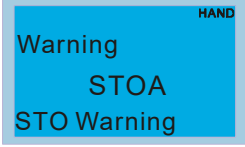
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Chapter 13 Warning Codes

- | | | |
|--|---|---|
| <p>① Warning</p> <p>② CE01</p> <p>③ Comm. Cmd. Error</p> |  | <p>① Display error signal</p> <p>② Abbreviated error code.
The code is displayed as shown on KPC-CE01.</p> <p>③ Display error description</p> |
|--|---|---|

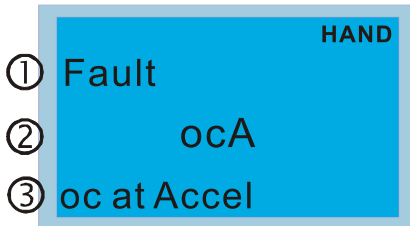
ID No.	Display on KPED-LE01	Display on LCM Keypad	Descriptions
1	CE01	CE01 	Illegal communication command Cause Communication command error
2	CE02	CE02 	Illegal data address Cause Data address error
3	CE03	CE03 	Communication data length error Cause Communication data length exceeds 1–20 characters
4	CE04	CE04 	Attempt to write to a read-only address. Cause Communication error occurred when attempting to write values into 0x21xx, 0x22xx read-only address.
5	CE 10	CE10 	Modbus transmission time-out Cause Communication cable error
6	CP 10	CP10 	Digital keypad KPC-CC01 transmission time-out Cause Communication cable or digital keypad error
7	SE 1	SE1 	Keypad copy parameter error Cause Keypad copy errors, including communication delays, communication error (keypad received error FF86) and parameter value error.

ID No.	Display on KPED-LE01	Display on LCM Keypad	Descriptions
8	SE2	<p>SE2</p> 	<p>Keypad copy parameter failure</p> <p>Cause Keypad copy done but parameter writing error</p>
9	oH1	<p>oH1</p> 	<p>IGBT overheat warning</p> <p>Cause IGBT temperature is over the default 90°C (Pr.06-14).</p>
10	oH2	<p>oH2</p> 	<p>Capacitor overheat warning</p> <p>Cause The temperature of the capacitor is over 65°C.</p>
15	PGF1	<p>PGF1</p> 	<p>PG feedback error</p> <p>Cause When Pr.10-03 = 0 (default = 2), a warning message displays instead of a fault message when an error occurs.</p>
16	PGF2	<p>PGF2</p> 	<p>PG feedback loss warning</p> <p>Cause Pr.10-03 = 0 (default = 2), a warning message displays instead of a fault message when an error occurs.</p>
17	PGF3	<p>PGF3</p> 	<p>PG feedback stall warning</p> <p>Cause Pr.10-09 = 0 (default = 2), a warning message displays instead of a fault message when an error occurs.</p>
18	PGF4	<p>PGF4</p> 	<p>PG slip error warning</p> <p>Cause Pr.10-09 = 0 (default = 2), a warning message displays instead of a fault message when an error occurs.</p>
19	PHL	<p>PHL</p> 	<p>Phase loss</p> <p>Cause When Pr.06-01 =0 (default = 2), a warning message displays instead of a fault message when a phase loss occurs.</p>
20	ot1	<p>ot1</p> 	<p>Over-torque 1</p> <p>Cause When Pr.06-05 =1 or 3 (default = 0), a warning message displays instead of a fault message when there is an over-torque detection.</p>

ID No.	Display on KPED-LE01	Display on LCM Keypad	Descriptions
21	ot2	<p>ot2</p> 	<p>Over-torque 2</p> <p>Cause When Pr.06-05 = 1 or 3 (default = 0), a warning message displays instead of a fault message when there is an over-torque detection.</p>
22	oH3	<p>oH3</p> 	<p>Motor overheat (PTC)</p> <p>Cause When Pr.06-26 = 0 (default = 0), a warning message displays when there is a PTC detection.</p>
24	oSL	<p>oSL</p> 	<p>Over-slip error</p> <p>Cause When Pr.05-16 = 0 (default = 0), a warning message displays when the slip deviation level is over the setting in Pr.05-14 and the slip deviation detection time is longer than the setting in Pr.05-15.</p>
25	tUn	<p>tUn</p> 	<p>Auto-tuning in process</p>
26	FAn	<p>FAn</p> 	<p>Fan error warning</p> <p>Cause When Pr.06-45 bit 1 = 1, a warning message displays when the cooling fan is locked (when bit1 = 1, there is an output error).</p>
27	dCA _n	<p>dCA_n</p> 	<p>CAN Bus off</p> <p>Cause CAN Bus disconnection or PDO communication time-out</p>
28	StOA	<p>StOA</p> 	<p>Safe Torque Off alarm</p> <p>Cause Safe torque output function is off and Pr.06-49 = 1 or 3.</p>

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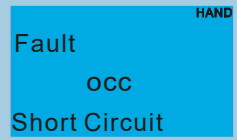
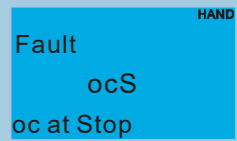
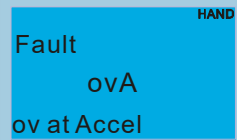
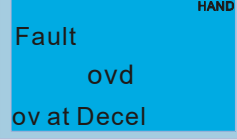
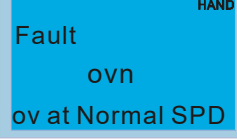
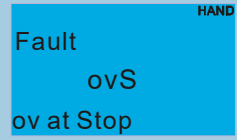
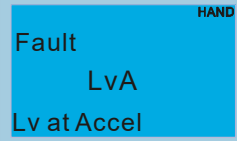
Chapter 14 Fault Codes

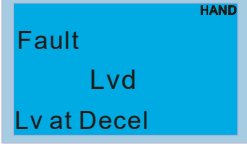
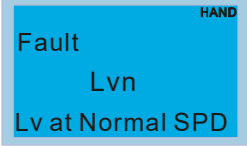
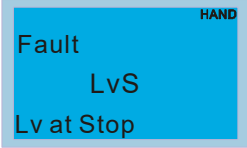
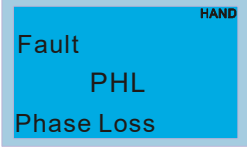
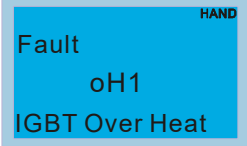
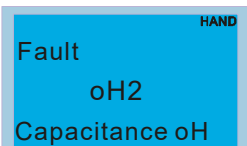


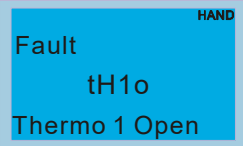
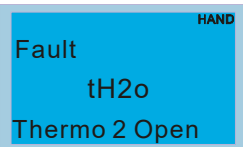

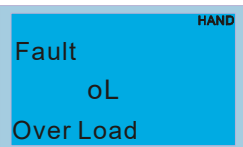
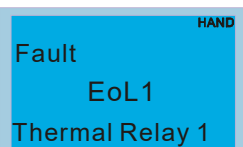
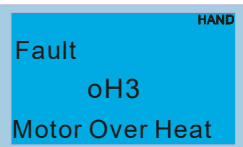
- ① Fault
- ② `ocA`
- ③ `oc at Accel`
- ① Display fault (error) signal
- ② Abbreviated fault (error) code.
The code is displayed as shown on KPC-CE01.
- ③ Display fault (error) description

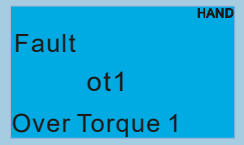
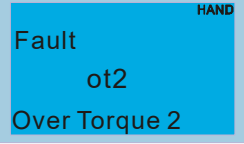
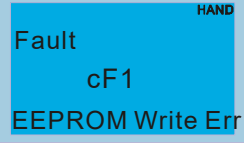
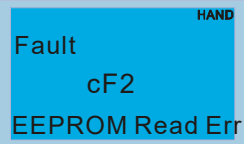
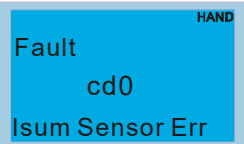
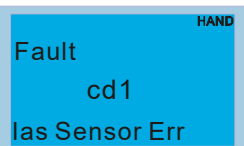
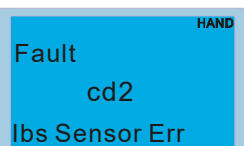
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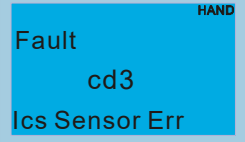
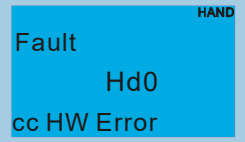
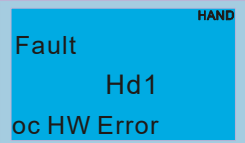
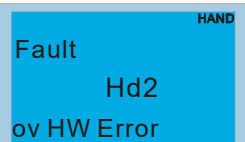
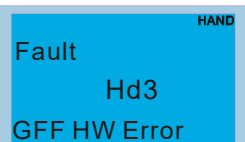
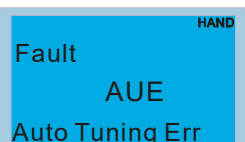
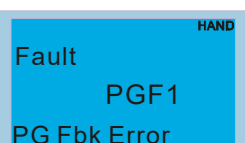
ID*	Display on KPED-LE01	LCM Panel Display	Descriptions
1	<code>ocA</code>		<p>Over-current during acceleration (output current exceeds three times the drive's rated current during acceleration).</p> <p>corrective action</p> <ol style="list-style-type: none"> Short-circuit at motor output: Check for possible poor insulation at the output. Acceleration Time is too short: Increase the Acceleration Time. AC motor drive output power is too small: Replace the AC motor drive with a higher power model.
2	<code>ocd</code>		<p>Over-current during deceleration (output current exceeds three times the drive's rated current during deceleration).</p> <p>corrective action</p> <ol style="list-style-type: none"> Short-circuit at motor output: Check for possible poor insulation at the output. Deceleration Time is too short: Increase the Deceleration Time. AC motor drive output power is too small: Replace the AC motor drive with a higher power model.
3	<code>ocn</code>		<p>Over-current during steady operation (output current exceeds three times the drive's rated current during constant speed).</p> <p>corrective action</p> <ol style="list-style-type: none"> Short-circuit at motor output: Check for possible poor insulation at the output. Sudden increase in motor load: Check for possible motor stall. AC motor drive output power is too small: Replace the AC motor drive with a higher power model.
4	<code>GFF</code>		<p>Ground fault When one or more of the output terminals is (are) grounded, and the short circuit current is more than 60% of the AC motor drive rated current, the AC motor drive power module may be damaged. NOTE: The short circuit protection is to protect the AC motor drive, not to protect you.</p> <p>corrective action</p> <ol style="list-style-type: none"> Check the wiring connections between the AC motor drive and motor for possible short circuits, also check connection to ground. Check whether the IGBT power module is damaged. Check for possible poor insulation at the output.

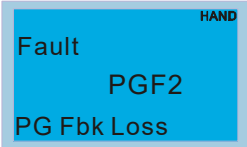
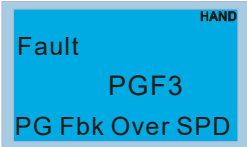
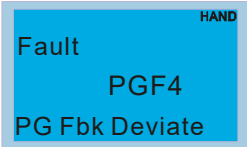
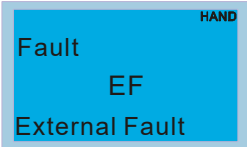

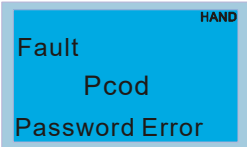
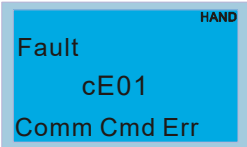
5	occ		<p>Short circuit is detected between the IGBT module upper bridge and lower bridge.</p> <p>corrective action Contact the dealer or manufacturer to return the motor drive to the factory for repair.</p>
6	ocS		<p>Over-current at stop Hardware failure in over-current detection</p> <p>corrective action Contact the dealer or manufacturer to return the motor drive to the factory for repair.</p>
7	ovA		<p>DC BUS over-voltage during acceleration 230V: 405 V_{DC}; 460V: 810 V_{DC}</p> <p>corrective action</p> <ol style="list-style-type: none"> 1. Check if the input voltage falls in the rated AC motor drive input voltage range. 2. Check for possible voltage transients. 3. If DC BUS over-voltage is due to regenerative voltage, increase the Acceleration Time or add an optional brake resistor.
8	ovd		<p>DC BUS over-voltage during deceleration 230V: 405 V_{DC}; 460V: 810 V_{DC}</p> <p>corrective action</p> <ol style="list-style-type: none"> 1. Check if the input voltage falls in the rated AC motor drive input voltage range. 2. Check for possible voltage transients. 3. If DC BUS over-voltage due to regenerative voltage, increase the Deceleration Time or add an optional brake resistor.
9	ovN		<p>DC BUS over-voltage at constant speed 230V: 405 V_{DC}; 460V: 810 V_{DC}</p> <p>corrective action</p> <ol style="list-style-type: none"> 1. Check if the input voltage falls in the rated AC motor drive input voltage range. 2. Check for possible voltage transients. 3. If DC BUS over-voltage due to regenerative voltage, increase the Deceleration Time or add an optional brake resistor.
10	ovS		<p>Over-voltage at stop Hardware failure in voltage detection.</p> <p>corrective action</p> <ol style="list-style-type: none"> 1. Check if the input voltage falls in the rated AC motor drive input voltage range. 2. Check for possible voltage transients.
11	LvA		<p>DC BUS voltage during acceleration is less than the setting in Pr.06-00.</p> <p>corrective action</p> <ol style="list-style-type: none"> 1. Check if the input voltage is normal. 2. Check for possible sudden load change.

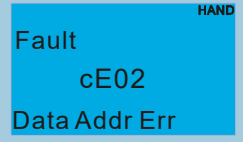
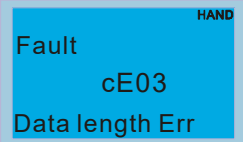
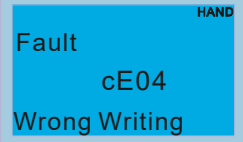
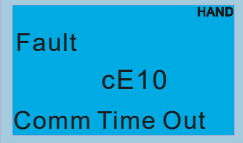
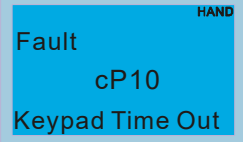
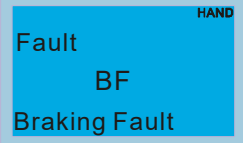
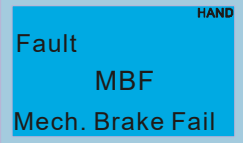
12	Lvd	 <p>Fault Lvd Lv at Decel</p>	<p>DC BUS voltage during deceleration is less than the setting in Pr.06-00.</p> <p>corrective action</p> <ol style="list-style-type: none"> 1. Check if the input voltage is normal. 2. Check for possible sudden load change.
13	Lvn	 <p>Fault Lvn Lv at Normal SPD</p>	<p>DC BUS voltage at constant speed is less than the setting in Pr.06-00</p> <p>corrective action</p> <ol style="list-style-type: none"> 1. Check if the input voltage is normal. 2. Check for possible sudden load change.
14	LvS	 <p>Fault LvS Lv at Stop</p>	<p>Low voltage at stop</p> <p>corrective action</p> <ol style="list-style-type: none"> 1. Check if the input voltage is normal. 2. Check for possible sudden load change.
15	PHL	 <p>Fault PHL Phase Loss</p>	<p>Phase Loss</p> <p>corrective action</p> <p>Check power source input to make sure all three input phases are connected correctly.</p>
16	oH1	 <p>Fault oH1 IGBT Over Heat</p>	<p>IGBT overheating</p> <p>IGBT temperature exceeds protection level</p> <p>3–5 HP, 50–60 HP: 105°C</p> <p>7.5–30 HP: 95°C</p> <p>40–100 HP: 110°C</p> <p>corrective action</p> <ol style="list-style-type: none"> 1. Ensure that the ambient temperature falls in the specified temperature range. 2. Make sure heat sink is not obstructed. Check if the fan is operating 3. Check if there is enough ventilation clearance for the AC motor drive.
17	oH2	 <p>Fault oH2 Capacitance oH</p>	<p>Capacitor overheating</p> <p>Capacitor's temperature exceeds the protection level.</p> <p>3–100 HP: 65°C</p> <p>corrective action</p> <ol style="list-style-type: none"> 1. Ensure that the ambient temperature falls in the specified temperature range. 2. Make sure heat sink is not obstructed. Check if the fan is operating 3. Check if there is enough ventilation clearance for the AC motor drive.

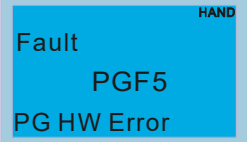
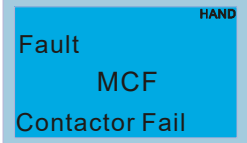
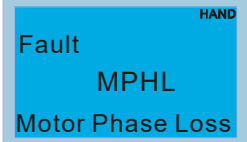
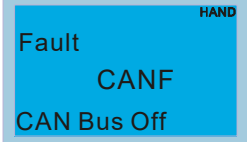
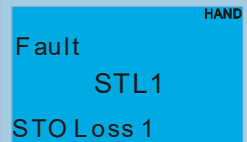
18	tH1o		<p>IGBT overheating protection fault</p> <p>corrective action</p> <p>Contact the dealer or manufacturer to return the motor drive to the factory for repair.</p>
19	tH2o		<p>Capacitor module overheating fault</p> <p>corrective action</p> <p>Contact the dealer or manufacturer to return the motor drive to the factory for repair.</p>
20	FAn		<p>Cooling fan does not run properly.</p> <p>corrective action</p> <p>Check if the cooling fan is covered by dust and needs to be cleaned. Contact the dealer or manufacturer to return the motor drive to the factory for repair if necessary.</p>
21	oL		<p>The output current causes the motor drive to be overload. If the output current is 150% higher than the drive's rated current, the motor drive can sustain the output for a maximum of 60 seconds.</p> <p>corrective action</p> <ol style="list-style-type: none"> 1. Check if the motor is overloaded. 2. Increase the output capacity of the motor drive.
22	EoL1		<p>The output current causes the motor to be overload. If the output current is 150% higher than the drive's rated current, the motor can sustain the output for a maximum of 60 seconds.</p> <p>corrective action</p> <ol style="list-style-type: none"> 1. Check the setting for motor full-load current (Pr.05-01). 2. Check if motor is overloaded and change to a higher power motor.
24	oH3		<p>Motor overheating</p> <p>The AC motor drive internal temperature exceeds the setting in Pr.06-27 (PTC level).</p> <p>corrective action</p> <ol style="list-style-type: none"> 1. Make sure that the motor is not obstructed. 2. Ensure that the ambient temperature falls in the specified temperature range. 3. Change to a higher power motor.

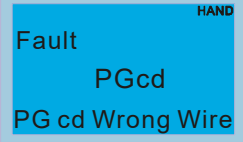
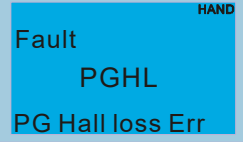
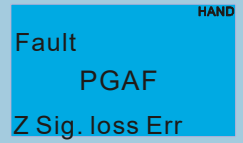
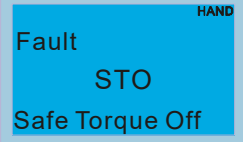
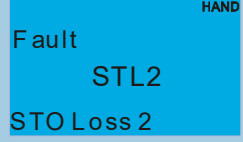
26	ot 1	 <p>Fault ot1 Over Torque 1</p>	<p>The ot1 and ot2 fault codes appear when the following conditions occur:</p> <ul style="list-style-type: none"> - The output current exceeds the setting in Pr.06-06 (Over-torque Detection Level (OT1)> and Pr.06-09 (Over-torque Protection Level (OT2)). - The output current lasts longer than the time setting in Pr.06-07 and Pr.06-10. - You set Pr.06-05 or Pr.06-08 to 2 or 4.
27	ot2	 <p>Fault ot2 Over Torque 2</p>	<p>corrective action</p> <ol style="list-style-type: none"> 1. Check if the motor is overloaded. 2. Check if the setting in Pr.05-01 IM (Motor Full-load Current) and Pr.08-01 PM (Motor Full-load Current) are appropriate. 3. If necessary, increase the motor output capacity.
30	cF 1	 <p>Fault cF1 EEPROM Write Err</p>	<p>Cannot program internal EEPROM.</p> <p>corrective action</p> <ol style="list-style-type: none"> 1. Press RESET key to reset to the default. 2. Contact the dealer or manufacturer to return the motor drive to the factory for repair.
31	cF2	 <p>Fault cF2 EEPROM Read Err</p>	<p>Cannot read internal EEPROM.</p> <p>corrective action</p> <ol style="list-style-type: none"> 1. Press RESET key to reset to the default. 2. Contact the dealer or manufacturer to return the motor drive to the factory for repair.
32	cd0	 <p>Fault cd0 Isum Sensor Err</p>	<p>Hardware failure in current detection</p> <p>corrective action</p> <p>Reboot the motor drive. If fault code continues to display on the keypad, contact the dealer or manufacturer to return the motor drive to the factory for repair.</p>
33	cd 1	 <p>Fault cd1 Ias Sensor Err</p>	<p>U-phase current detection error</p> <p>corrective action</p> <p>Reboot the motor drive. If fault code continues to display on the keypad, contact the dealer or manufacturer to return the motor drive to the factory for repair.</p>
34	cd2	 <p>Fault cd2 Ibs Sensor Err</p>	<p>V-phase current detection error</p> <p>corrective action</p> <p>Reboot the motor drive. If fault code continues to display on the keypad, contact the dealer or manufacturer to return the motor drive to the factory for repair.</p>

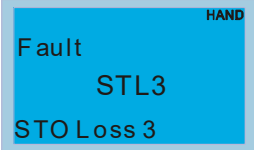
35	cd3		<p>W-phase current detection error</p> <p>corrective action</p> <p>Reboot the motor drive. If fault code continues to display on the keypad, contact the dealer or manufacturer to return the motor drive to the factory for repair.</p>
36	Hd0		<p>CC (current clamp) hardware error</p> <p>corrective action</p> <p>Reboot the motor drive. If fault code continues to display on the keypad, contact the dealer or manufacturer to return the motor drive to the factory for repair.</p>
37	Hd1		<p>OC hardware error</p> <p>corrective action</p> <p>Reboot the motor drive. If fault code continues to display on the keypad, contact the dealer or manufacturer to return the motor drive to the factory for repair.</p>
38	Hd2		<p>OV hardware error</p> <p>corrective action</p> <p>Reboot the motor drive. If fault code continues to display on the keypad, contact the dealer or manufacturer to return the motor drive to the factory for repair.</p>
39	Hd3		<p>GFF hardware error</p> <p>corrective action</p> <p>Reboot the motor drive. If fault code continues to display on the keypad, contact the dealer or manufacturer to return the motor drive to the factory for repair.</p>
40	AUE		<p>Auto-tuning error</p> <p>corrective action</p> <ol style="list-style-type: none"> 1. Check the cabling between drive and motor. 2. Check if the motor capacity and the parameter settings are appropriate and try again.
42	PGF 1		<p>PG feedback error (command direction is different from the feedback direction)</p> <p>corrective action</p> <p>When PG feedback control is enabled, check if Pr.10-01 (Encoder Pulse) is set to 0.</p>

43	<i>PGF2</i>		PG feedback loss corrective action Check the PG feedback wiring.
44	<i>PGF3</i>		PG feedback stall corrective action 1. Check the PG feedback wiring. 2. Check if the settings for PI gain and acceleration/deceleration are appropriate (Pr.10-05, Pr.10-06). 3. Contact the dealer or manufacturer to return the motor drive to the factory for repair.
45	<i>PGF4</i>		PG slip error corrective action 1. Check the PG feedback wiring. 2. Check if the settings for PI gain and acceleration/deceleration are appropriate (Pr.10-07, Pr.10-08). 3. Contact the dealer or manufacturer to return the motor drive to the factory for repair.
49	<i>EF</i>		External Fault When you set the Multi-Function Input command (MI1–MI8) to #10 EF input (Pr.07-28) and when multi-function input terminals are triggered to close, the motor drive stops running. corrective action Press RESET after you clear the fault.
50	<i>EF 1</i>		Emergency Stop When you set the Multi-Function Input command (MI1–MI8) to #28 Emergency stop (EF1) (Motor coasts to stop), the motor drive stops running. corrective action Press RESET after you clear the fault.
52	<i>Pcod</i>		Password error After entering the wrong password three consecutive times, the keypad is locked. corrective action Refer to Pr.00-07 and Pr.00-08 settings for more information. Cycle the power for the motor drive to clear the lock and enter the correct password.
54	<i>cE01</i>		Illegal function code corrective action Check if the function code is correct (function code must be 03, 06, 10, 63).

55	cE02		<p>Illegal data address (00H to 254H)</p> <p>The data address for 0X2XX is between 0X2000–0X2005. Any address out of this range is a fault.</p> <p>corrective action</p> <p>Check if the communication data address is correct.</p>
56	cE03		<p>Illegal data length</p> <p>The data length must be between 1 to 20 digits. Any length out of this range is a fault.</p> <p>corrective action</p> <p>Check if the data length is smaller than the minimum value or larger than the maximum value.</p>
57	cE04		<p>Attempt to write value to read-only communication address</p> <p>Communication addresses such as 0X21XX, 0X22XX are read-only. Any command sent to these addresses causes a fault.</p> <p>corrective action</p> <p>Check if the communication address is correct.</p>
58	cE 10		<p>Modbus communication time-out (Pr.09-02–Pr.09-03)</p> <p>corrective action</p> <p>Check if the communication wiring is correct.</p>
59	cP 10		<p>Keypad KPC-CC01 transmission time-out</p> <p>corrective action</p> <ol style="list-style-type: none"> 1. Check if the communication wiring is correct 2. Check if there is anything wrong with the keypad
60	bF		<p>Brake resistor fault</p> <p>corrective action</p> <p>If the fault code continues to display on the keypad after you press RESET key, contact the dealer or manufacturer to return the motor drive to the factory for repair.</p>
64	mbF		<p>Mechanical brake failure</p> <p>The feedback signal and the release signal are not consistent.</p> <p>corrective action</p> <ol style="list-style-type: none"> 1. Check if the mechanical brake signal is correct. 2. Check if the mechanical brake detection time setting (Pr.02-35) is correct.

65	PGF5	 <p>Fault PGF5 PG HW Error</p>	<p>PG card hardware error</p> <p>corrective action</p> <ol style="list-style-type: none"> 1. Check if the PG feedback wiring is correct. 2. If fault code continues to display on the keypad, contact the dealer or manufacturer to return the motor drive to the factory for repair.
66	MCF	 <p>Fault MCF Contactor Fail</p>	<p>Magnetic contactor error</p> <p>The feedback signal and the release signal are not consistent.</p> <p>corrective action</p> <ol style="list-style-type: none"> 1. Check if the magnetic contactor signal is correct. 2. Check if the magnetic contactor detection time setting (Pr.02-36) is correct.
67	MPHL	 <p>Fault MPHL Motor Phase Loss</p>	<p>Motor phase loss.</p> <p>corrective action</p> <ol style="list-style-type: none"> 1. Check the cabling between drive and motor. 2. Check if there is any output from the motor drive. 3. Contact the dealer or manufacturer to return the motor drive to the factory for repair.
68	CANF	 <p>Fault CANF CAN Bus Off</p>	<p>CAN Bus off</p> <p>corrective action</p> <ol style="list-style-type: none"> 1. Check that the CAN Bus is wired correctly. 2. Verify that there is no PDO communication time-out.
69	Reserved		
70	Reserved		
71	Reserved		
72	STL1	 <p>Fault STL1 STO Loss 1</p>	<p>STO1–SCM1 internal hardware error.</p> <p>corrective action</p> <ol style="list-style-type: none"> 1. Check the STO1/SCM1 wiring. 2. Reset the emergency switch (ON) and reboot the motor drive. 3. Check the voltage at least > 11 V. 4. Check the wiring between STO1 and E24V, and the wiring between SCM1 and DCM. 5. After checking all the wiring, reboot the motor drive. If STL1 still appears, contact the local dealer or manufacturer.

73	PGcd	 <p>Fault PGcd PG cd Wrong Wire</p>	<p>PG card wiring error</p> <p>corrective action</p> <p>Incorrect wiring for pin C+, C-, D+, D-. Verify if the wiring matches the descriptions in Section 7-2 (EMED-PGHSD-1) and Section 7-3 (EMED-PGHSD-2).</p>
74	PGHL	 <p>Fault PGHL PG Hall loss Err</p>	<p>PG absolute signal error</p> <p>corrective action</p> <ol style="list-style-type: none"> 1. Check if the encoder absolute positions (C+/C- and D+/D-) and PG card are properly wired. 2. 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.
75	PGAF	 <p>Fault PGAF Z Sig. loss Err</p>	<p>PG Z-phase signal loss</p> <p>corrective action</p> <ol style="list-style-type: none"> 1. Check if the encoder's Z-phase signal and PG card are properly wired. 2. 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.
76	StO	 <p>Fault StO Safe Torque Off</p>	<p>Safe Torque Off function is enabled.</p> <p>corrective action</p> <ol style="list-style-type: none"> 1. Check the wiring for STO1/SCM1 and STO2/SCM2. 2. Reset the emergency switch (ON) and reboot the motor drive. 3. Check the voltage at least > 11 V. 4. Check the wiring between STO1/STO2 and E24V, and the wiring between SCM1/SCM2 and DCM. 5. After checking all the wiring, reboot the motor drive. If STO still appears, contact the local dealer or manufacturer.
77	StL2	 <p>Fault StL2 STO Loss 2</p>	<p>STO2–SCM2 internal hardware error.</p> <p>corrective action</p> <ol style="list-style-type: none"> 1. Check the STO2/SCM2 wiring. 2. Reset the emergency switch (ON) and reboot the motor drive. 3. Check the voltage at least > 11 V. 4. Check the wiring between STO2 and E24V, and the wiring between SCM2 and DCM. 5. After checking all the wiring, reboot the motor drive. If STL2 still appears, contact the local dealer or manufacturer.

78	STL3		<p>Internal hardware error.</p> <p>corrective action</p> <p>After checking all the wiring, reboot the motor drive. If STL3 still appears, contact the local dealer or manufacturer.</p>
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Chapter 15 Suggestions and Error Corrections for Standard AC Motor Drives

- 15-1 Maintenance and Inspections
- 15-2 Greasy Dirt Problems
- 15-3 Fiber Dust Problems
- 15-4 Corrosion Problems
- 15-5 Industrial Dust Problems
- 15-6 Installation and Wiring Problems
- 15-7 Multi-function Input / Output Terminal Application Problems

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 error display from the AC motor drive and look up the corresponding causes and solutions. 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	<ul style="list-style-type: none">☑ Wait five seconds after a fault has been cleared before pressing RESET with the input terminal keypad.☑ The Hybrid Servo Controller must first be switched off for at least five minutes for ≤ 22 kW models, and 10 minutes for ≥ 30 kW models until the charging indicator turns off, and the voltage between terminals $\oplus-\ominus$ 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.
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15-1 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 ($\leq 25 V_{DC}$).

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 electromagnetic 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 printed circuit board 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.

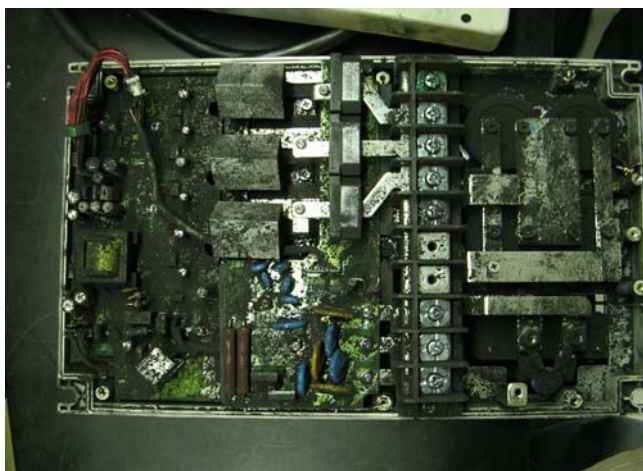
15-2 Greasy Dirt Problems

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.



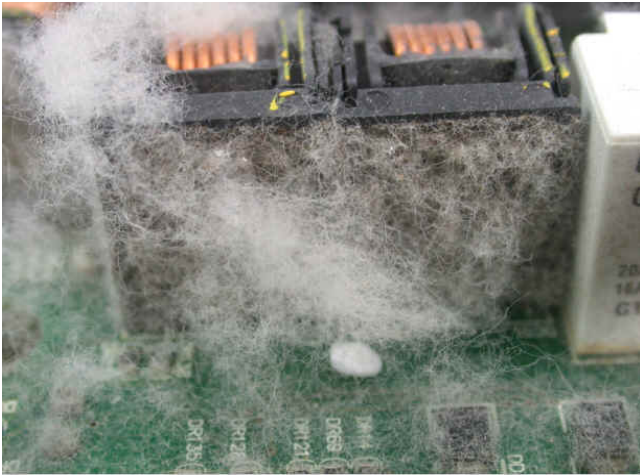
15-3 Fiber Dust Problems

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.



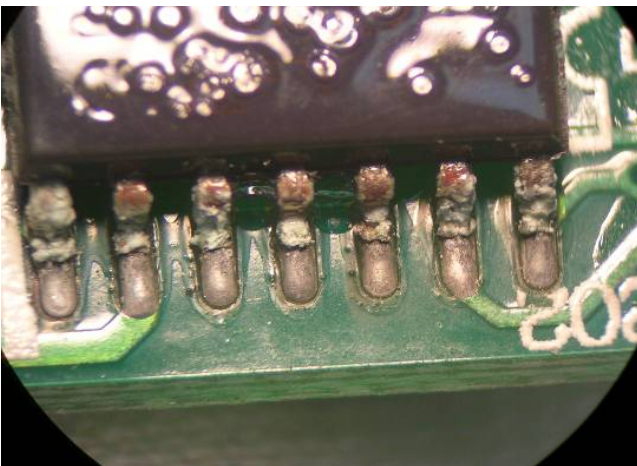
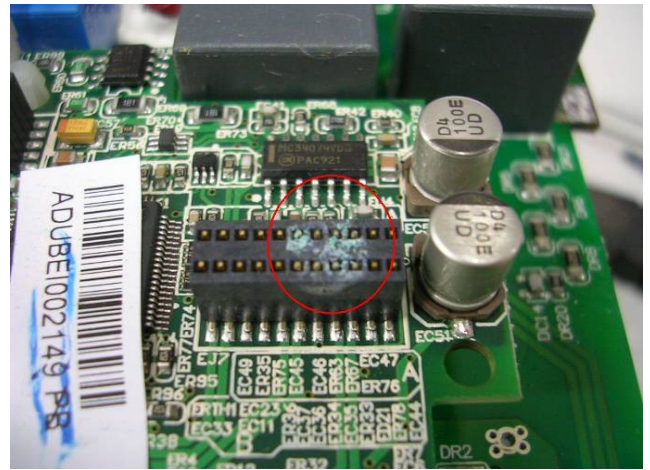
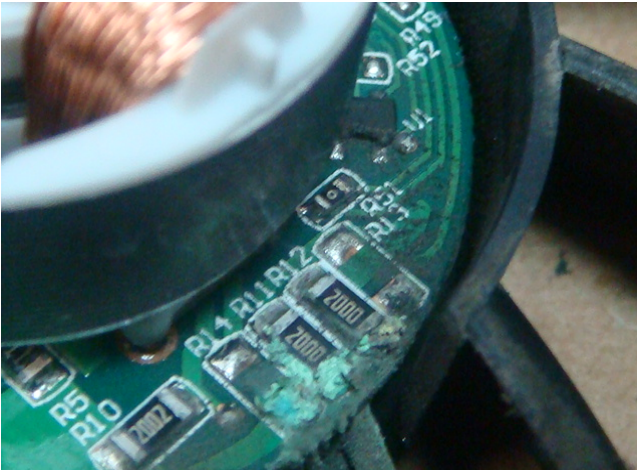
15-4 Corrosion Problems

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.



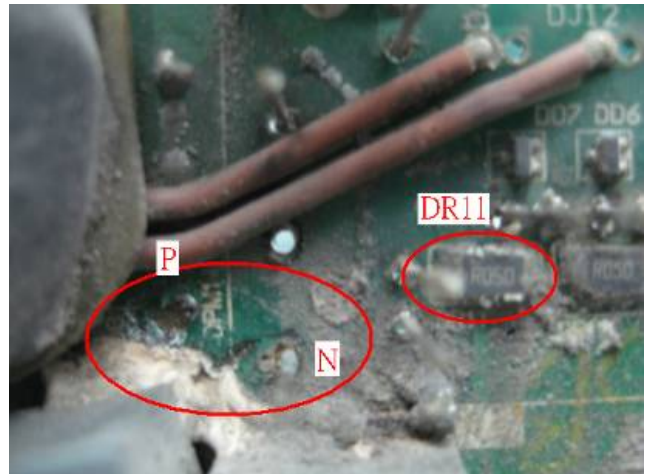
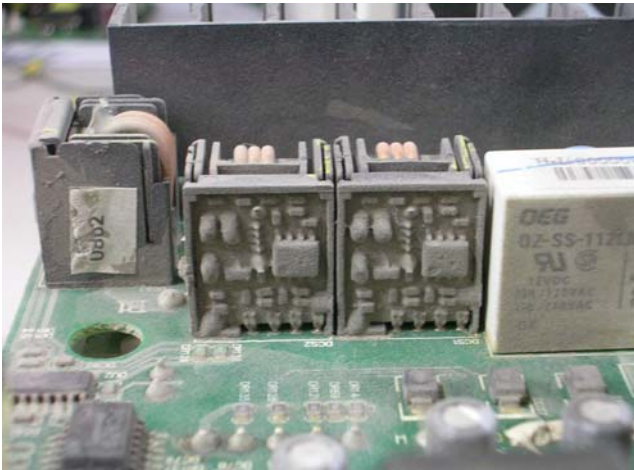
15-5 Industrial Dust Problems

Serious industrial dust pollution frequently occur 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.

Solution

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.



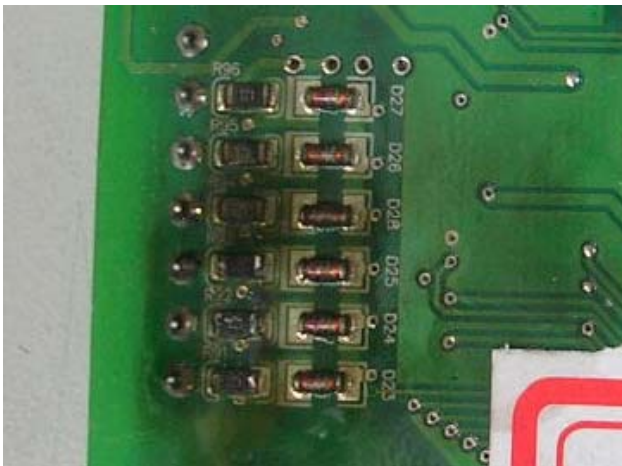
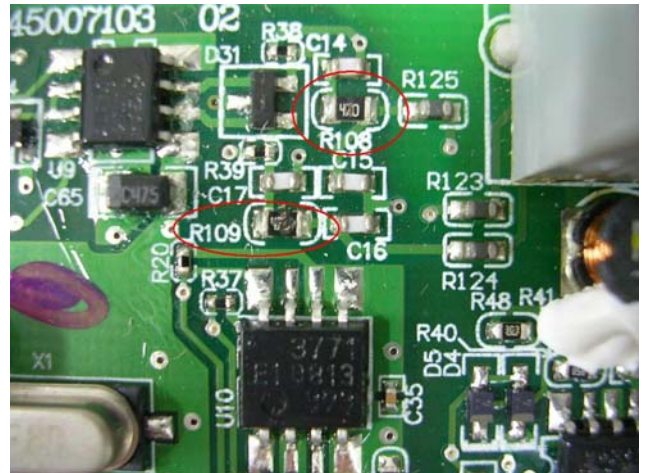
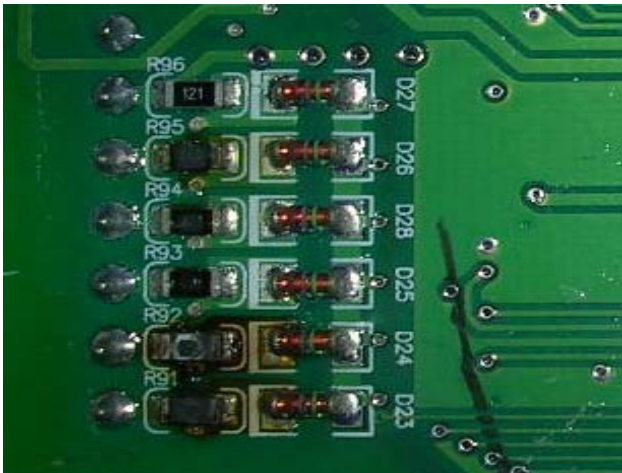
15-7 Multi-function Input / Output Terminal Application Problems

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.



Chapter 16 Safe Torque Off Function

16-1 Failure Rate of the Drive's Safety Function

16-2 Description of STO's Functions

16-3 Wiring Diagram

16-4 Related Parameters

16-5 Timing Diagram Description

16-6 Fault Codes Related to STO

16-1 Failure Rate of the Drive's Safety Function

Item	Definition	Standard	Performance
SFF	Safe Failure Fraction	IEC61508	Channel 1: 80.08% Channel 2: 68.91%
HFT (Type A subsystem)	Hardware Fault Tolerance	IEC61508	1
SIL	Safety Integrity Level	IEC61508	SIL 2
		IEC62061	SILCL 2
PFH	Average frequency of dangerous failure [h ⁻¹]	IEC61508	9.56×10^{-10}
PFD _{av}	Probability of Dangerous Failure on Demand	IEC61508	4.18×10^{-6}
Category	Category	ISO13849-1	Category 3
PL	Performance level	ISO13849-1	d
MTTF _d	Mean time to dangerous failure	ISO13849-1	High
DC	Diagnostic coverage	ISO13849-1	Low

16-2 Description of STO's Functions

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

The following table describes the terminal functions.

Table 1: Terminal Function Descriptions

Signal	Channel	Status of Photo Coupler			
STO Signal	STO1–SCM1	ON (High)	ON (High)	OFF (Low)	OFF (Low)
	STO2–SCM2	ON (High)	OFF (Low)	ON (High)	OFF (Low)
Drive Output Status		Ready	STL2 mode (Torque output off)	STL1 mode (Torque output off)	STO mode (Torque output Off)

 STO is Safe Torque Off

 STL1–STL3 means an STO internal hardware error.

 STL3 means STO1–SCM1 and STO2–SCM2 has an internal circuit error.

 STO1–SCM1 ON (High): means STO1–SCM1 has connection to a +24 V_{DC} power supply.

 STO2–SCM2 ON (High): means STO2–SCM2 has connection to a +24 V_{DC} power supply.

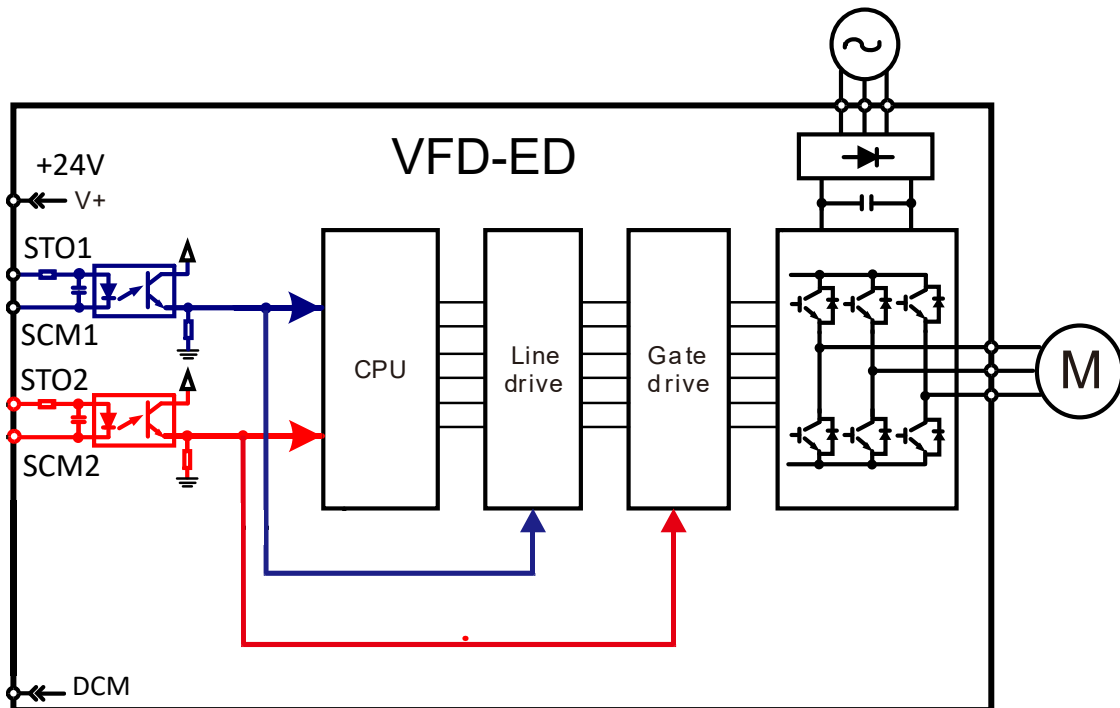
 STO1–SCM1 OFF (Low): means STO1–SCM1 has no connection to a +24 V_{DC} power supply.

 STO2–SCM2 OFF (Low): means STO2–SCM2 has no connection to a +24 V_{DC} power supply.

16-3 Wiring Diagram

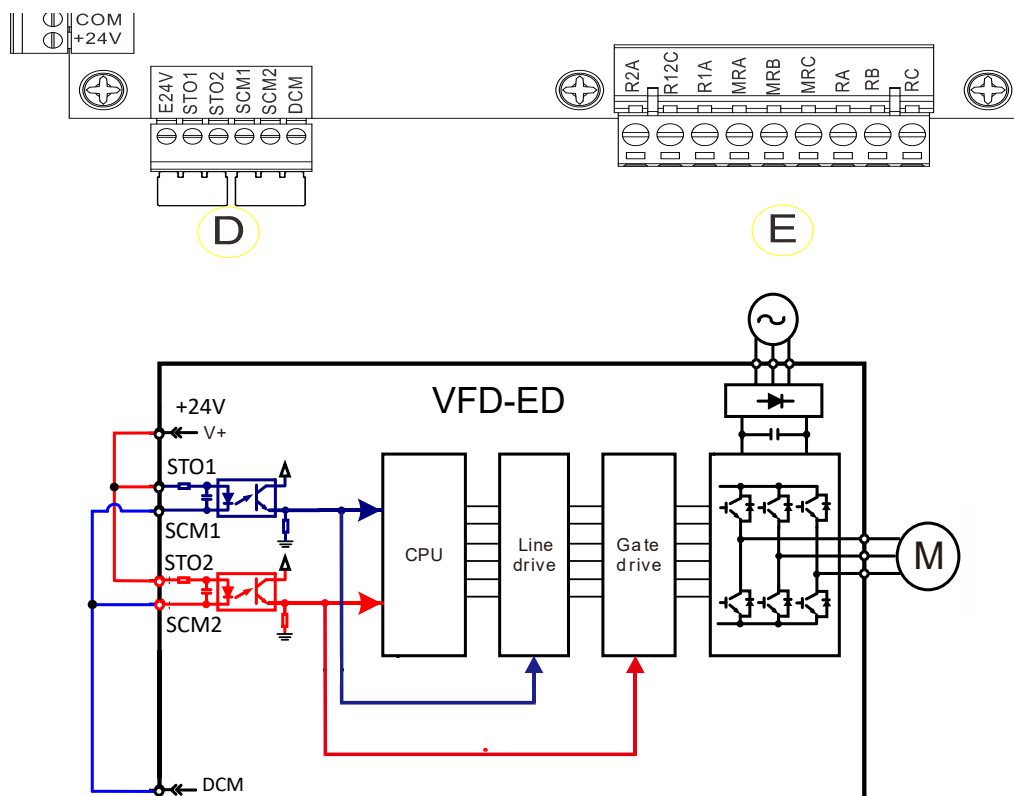
16-3-1 Internal Safety Circuit

The following diagram shows the drive's Internal Safety Circuit.



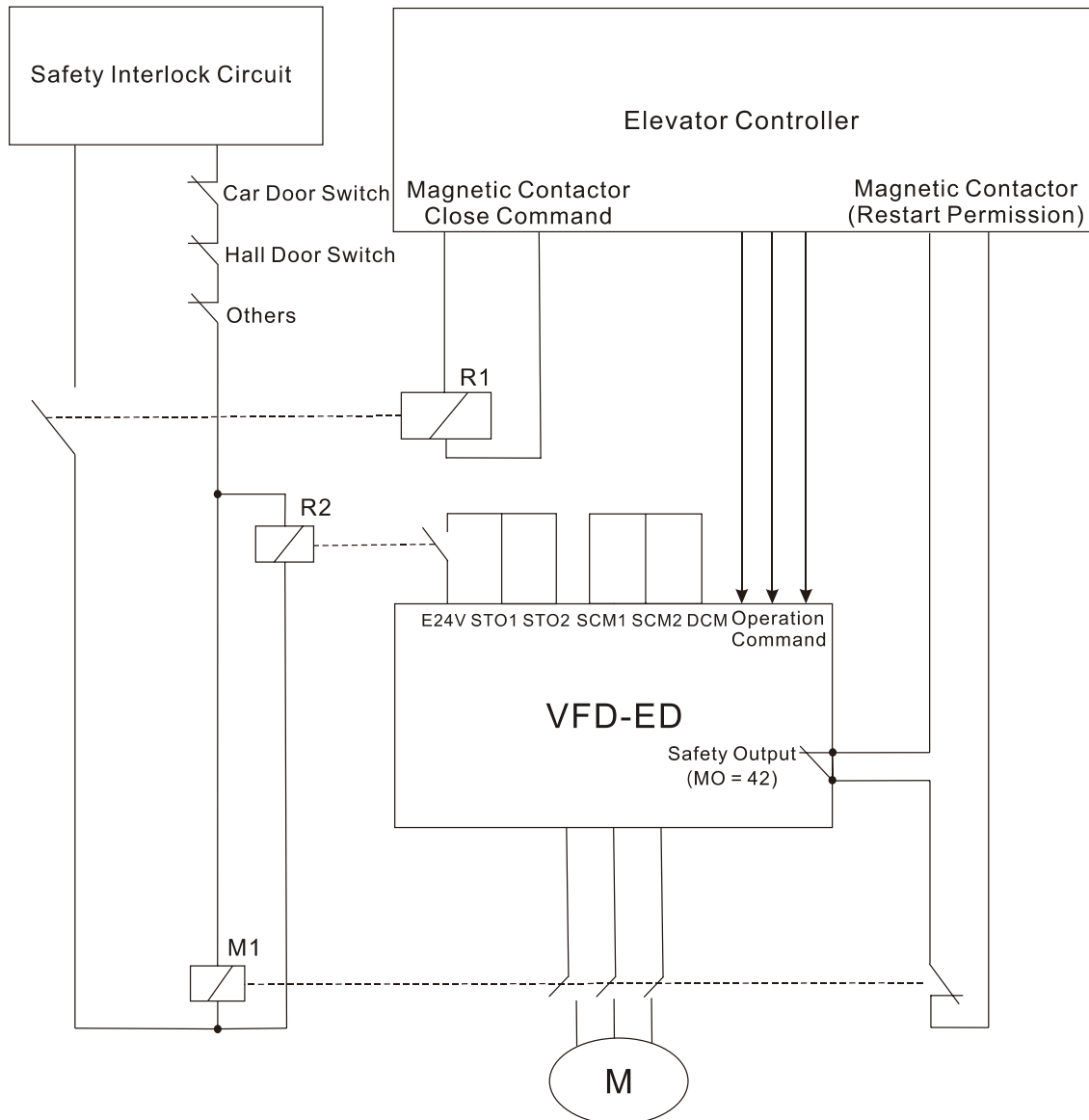
16-3-2 Internal Safety Circuit Terminals

The part D in the diagram below shows the default for terminals +24V-STO1-STO2 and terminals SCM1-SCM2-DCM in the drive's Internal Safety Circuit, which are short-circuited when they are delivered from the factory.



16-3-3 Drive's Control Circuit Wiring Diagram

1. Remove the E24V-STO1-STO2 short circuit.
2. The following diagram shows the wiring. The contract for safety interlock circuit must be closed during the normal situation so that the motor drive can run.
3. In STO mode, if you switch on the safety interlock circuit, the motor drive stops outputting and the keypad displays STO.
4. If the restart permission signal is OFF before the elevator controller issues the command to start the elevator, it means that the STO function is currently malfunctioned or M1 magnetic contactor error has occurred, and then the elevator is unable to start (R1 cannot be ON).



Note: "R" in R1/R2 stands for Relay; "M" in M1 stands for MC (Magnetic Contactor)

16-4 Related Parameters

06-49 STO Latch Selection

Default: 0

Settings 0: STO alarm latch
1: STO alarm no latch

- 0: The STO alarm is latched, which means that once the cause of the alarm is cleared, you must use a Reset command to clear the STO alarm.
- 1: The STO alarm is NOT latched which, means that once the cause of the alarm is cleared, the STO alarm clears automatically.
- When in STL1–STL3 mode, STO alarm is latched and you cannot set Pr.06-49.

02-11 Multi-function Output 1: RA, RB, RC (Relay 1)

Default: 11

02-12 Multi-function Output 2: MRA, MRB, MRC (Relay 2)

Default: 1

02-13 Multi-function Output 3: R1A, R12C (Relay 3)

02-14 Multi-function Output 4: R2A, R12C (Relay 4)

02-15 Multi-function Output 5: MO1

02-16 Multi-function Output 6: MO2

Default: 0

Settings 0: No function
1: Operation indication
11: Malfunction indication
42: STO Output Error

02-23 Multi-output Direction

Default: 0

This parameter uses bit setting. If the bit is 1, the multi-function output terminal acts in the opposite direction.

Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
-	-	-	-	-	-	MO2	MO1	R2A	R1A	MRA	RA

- STO output default: Pr.02-15 (MO1 =42 Logic Output A). You can also set Pr.02-23 (Multi-output direction) to choose Logic Output B.

Motor Drive Status	Output Safety Status	
	Logic Output A (Pr.02-15 = 42)	Logic Output B (Pr.02-15 = 42) (Pr.02-23 = 16)
Normal	Broken circuit (Open)	Short circuit (Closed)
STO	Short circuit (Closed)	Broken circuit (Open)
STL1–STL3	Short circuit (Closed)	Broken circuit (Open)

16-5 Timing Diagram Description

16-5-1 Normal Operation Status

As shown in Figure 1, when the STO1–SCM1 and STO2–SCM2 are ON (safety function is not required), the motor drive executes “Operating” or “Output Stop” according to the RUN/STOP command.

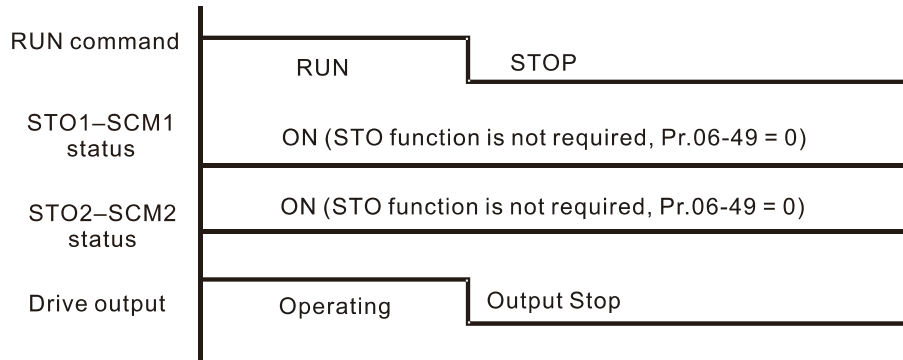


Figure 1

16-5-2 Pr.06-49 = 0, STO alarm latch

As shown in Figure 2, when both STO1–SCM1 and STO2–SCM2 channels are OFF during operation (safety function is required), the STO function is enabled and the motor drive stops outputting regardless of the command type.

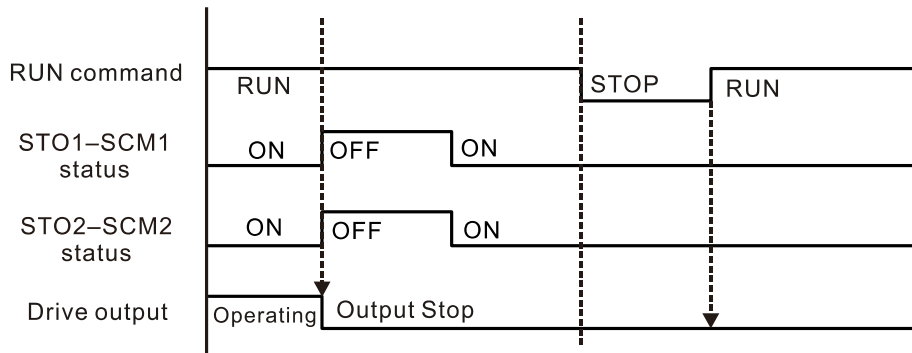


Figure 2

16-5-3 Pr.06-49 = 1, STO alarm no latch

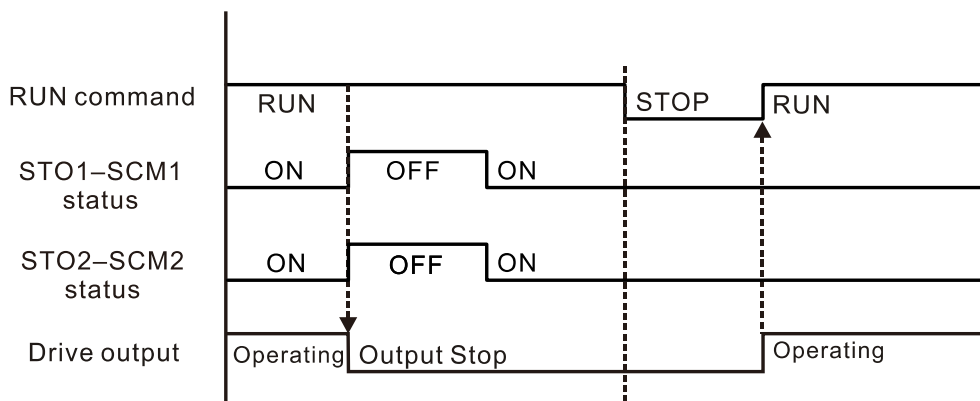


Figure 3

16-5-4 STL1

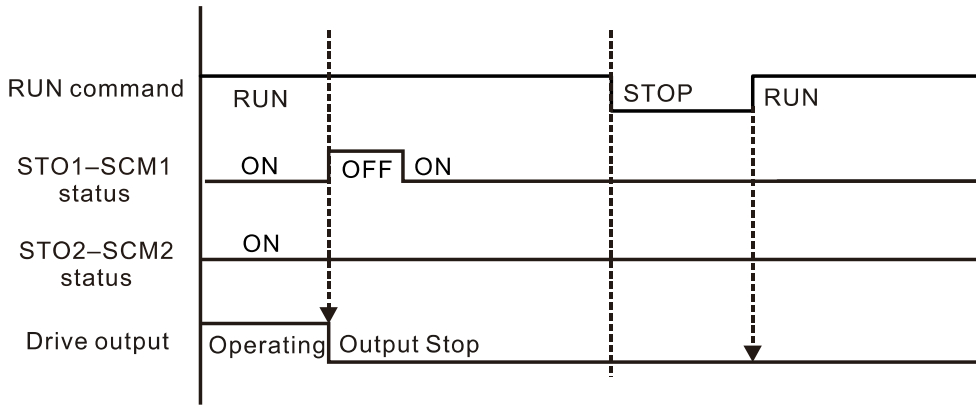


Figure 4

16-5-5 STL2

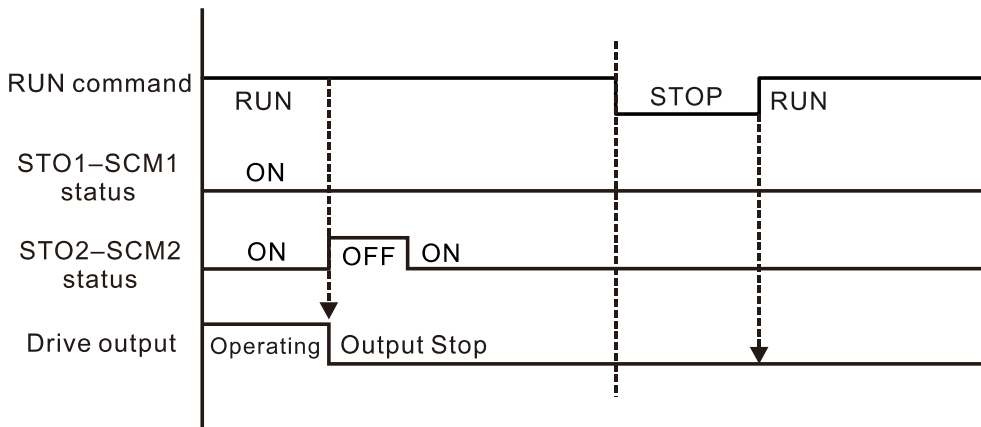


Figure 5

16-6 Fault Codes Related to STO

06-16	Present Fault Record
06-17	Second Most Recent Fault Record
06-18	Third Most Recent Fault Record
06-19	Fourth Recent Fault Record
06-20	Fifth Most Recent Fault Record
06-21	Sixth Most Recent Fault Record

Settings

- 72: Safe torque loss (STL1)
- 76: Safe torque output stops (STO)
- 77: Safe torque loss 2 (STL2)
- 78: Safe torque loss 3 (STL3)

Error Code	Reading	Description
72 (STL1)	Safe torque loss (STL1)	STO1–SCM1 internal circuit error.
76 (STO)	Safe torque output stops (STO)	Safe Torque Off function is enabled while Pr.06-49 is set to 0 or 2.
77 (STL2)	Safe torque loss 2 (STL2)	STO2–SCM2 internal circuit error.
78 (STL3)	Safe torque loss 3 (STL3)	STO1–SCM1 and STO2–SCM2 internal circuit error.

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Appendix A.

AC Motor Drives EMC Standard Installation Guide EMC Compliance Practice

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

- Ascertain 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

- Grounding
- Shielding
- Filtering

Table of Contents

1. Introduction
 - 1.1 What is EMC
 - 1.2 EMC for AC Motor Drive
2. How to prevent EMI
 - 2.1 Types of EMI: common-mode and differential mode noise
 - 2.2 How does EMI transmit? (Noise transmission)
3. Solution to EMI: Grounding
 - 3.1 Protective Grounding & Functional Grounding
 - 3.2 Ground Loops
 - 3.3 Earthing Systems
4. Solution to EMI: Shielding
 - 4.1 What is Shielding?
 - 4.2 How to Reduce EMI by Shielding?
5. Solution to EMI: Filter
 - 5.1 Filter
 - 5.2 Harmonic Interference

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.

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 drive is usually applied in industrial environments with a strong electromagnetic interference. Under such conditions, an AC drive could disturb or be disturbed.

Delta's AC motor drives are designed for EMC and comply with EMC standard EN61800-3 2004. Installing the AC motor drive accurately will decrease EMI 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, please follow the instructions and measures as indicated in this EMC Standard Installation Guide.

How to prevent EMI

2.1 Types of EMI: 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.

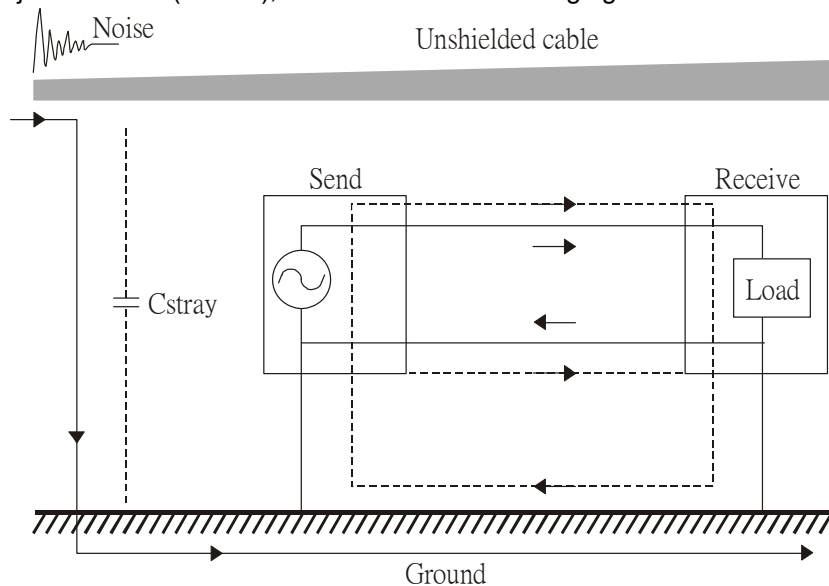
EMC problems can be more serious when the following conditions apply:

- 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.

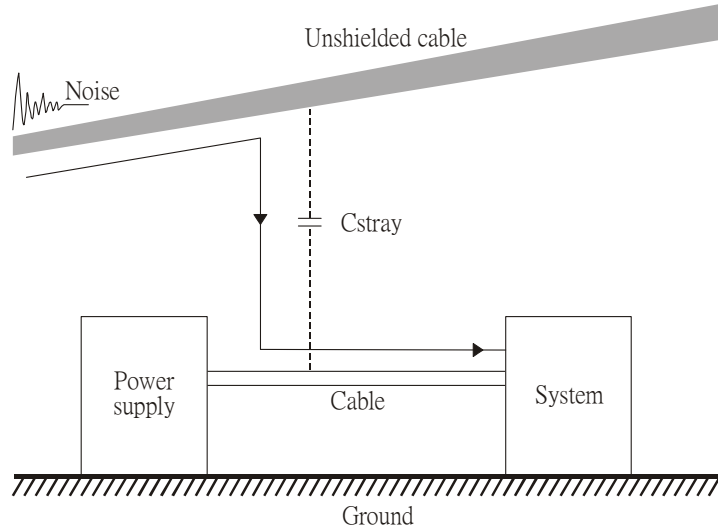
2.2 How does EMI transmit? (Noise transmission path)

Noise disturbs peripheral high-sensitivity electrical devices/systems via conduction and radiation, their transmission paths are shown hereafter:

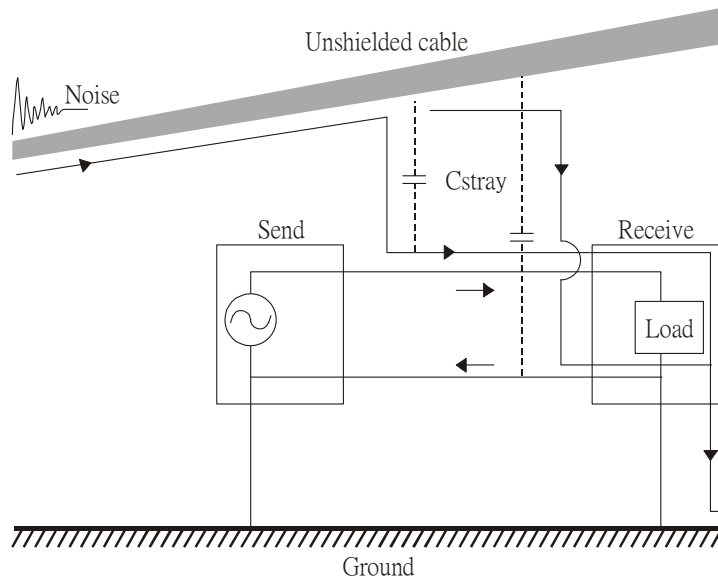
1. Noise current in the unshielded power cable is conducted to ground via stray capacitances into a common-mode voltage. Whether or not other modules are capable to resist this common-mode noise depends on their Common-Mode Rejection Ratio (CMRR), as shown in the following figure.



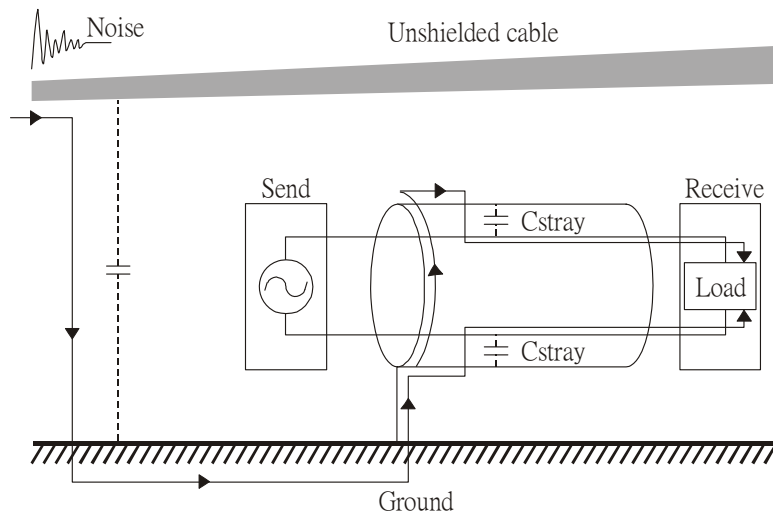
2. Common-mode noise in the power cable is transmitted through the stray capacitance and coupled into the adjacent signal cable, as shown in Figure 2. Several methods can be applied to reduce the effect of this common-mode noise; for example, shield the power cable and/or the signal cables, separate 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.



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 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 4.



5. When excessive pulse modulated currents pass through an un-grounded AC drive cable, it acts as an antenna and creates radiated interference.

Solution to EMI: 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.

3.1 Protective Grounding & Functional Grounding

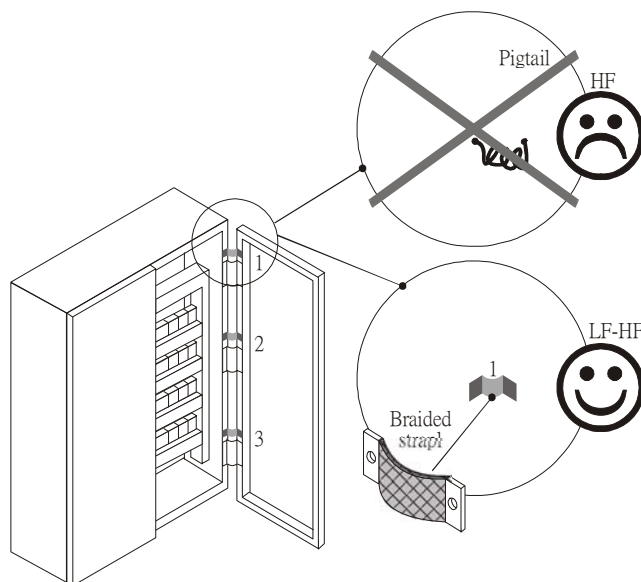
Please carefully read the following instruction if two types of grounding are applied at the same time.

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.

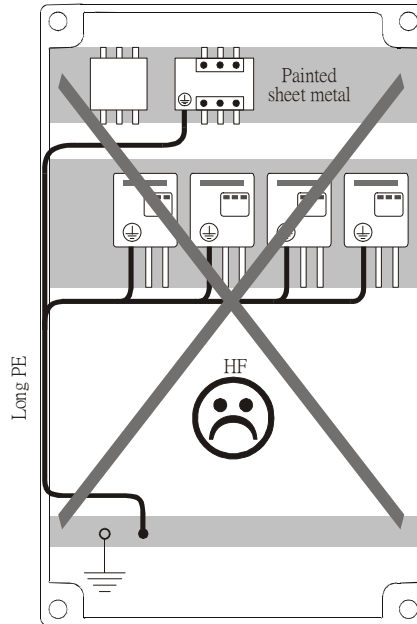
- *Single Point Grounding*: all signal grounds of all IT equipment are connected in series to form a single reference point. This point can be grounded directly to earth; to the designated grounding point or to the safety point that is already grounded.
- *Multiple Point Grounding*: all signals of all 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 following figure.



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.

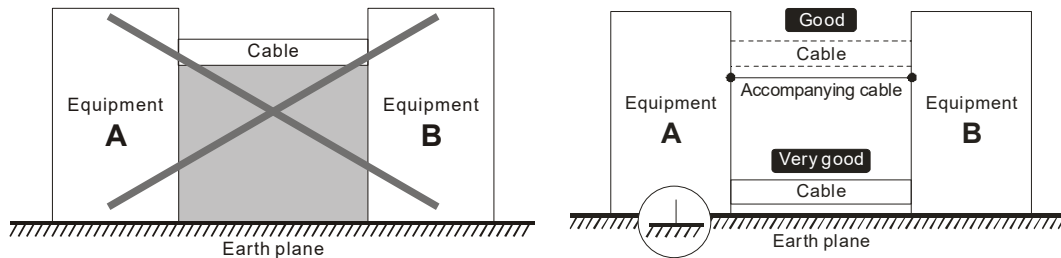
If the grounding wire is too long, its inductance may interfere structure of the building or the control cabinet and form mutual inductance and stray capacitance. As shown in the following figure, a long grounding wire could become a vertical antenna and turn into a source of noise.



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



In order to avoid “Common Mode Noise”, please 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.

3.3 Earthing Systems

The international standard IEC60364 distinguishes three different earthing system categories, using the two-letter codes TN, TT, IT.

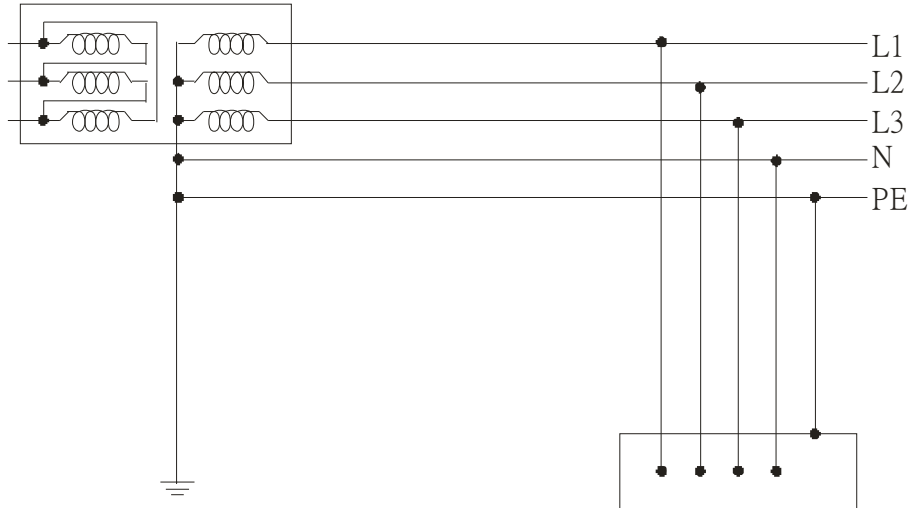
- The **first letter** indicates the type of earthing for the power supply equipment (generator or transformer).
 - T**: One or more points of the power supply equipment are connected directly to the same earthing point.
 - I**: Either no point is connected to earth (isolated) or it is connected to earth 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.

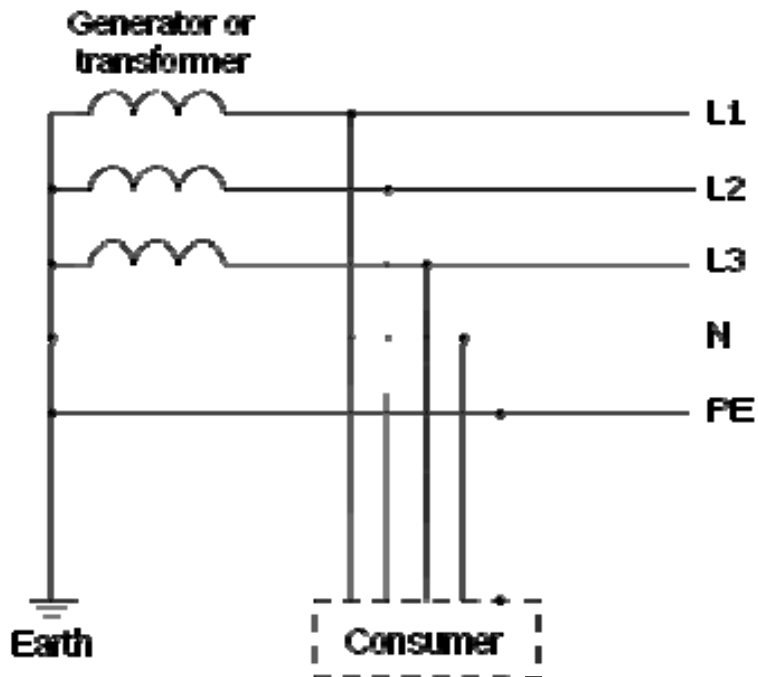
Protective earth (PE): The conductor that connects the exposed metallic parts of the consumer.

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.



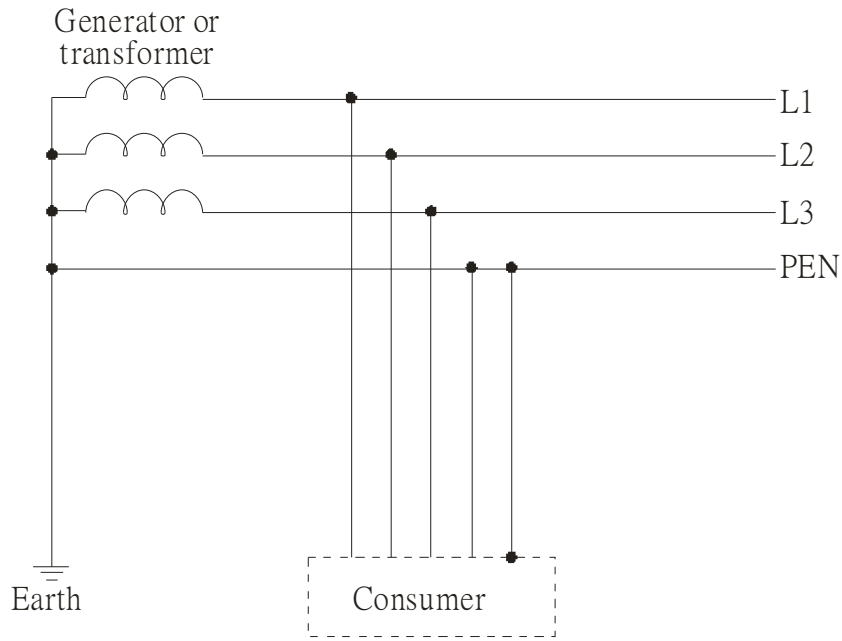
TN-S system

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.



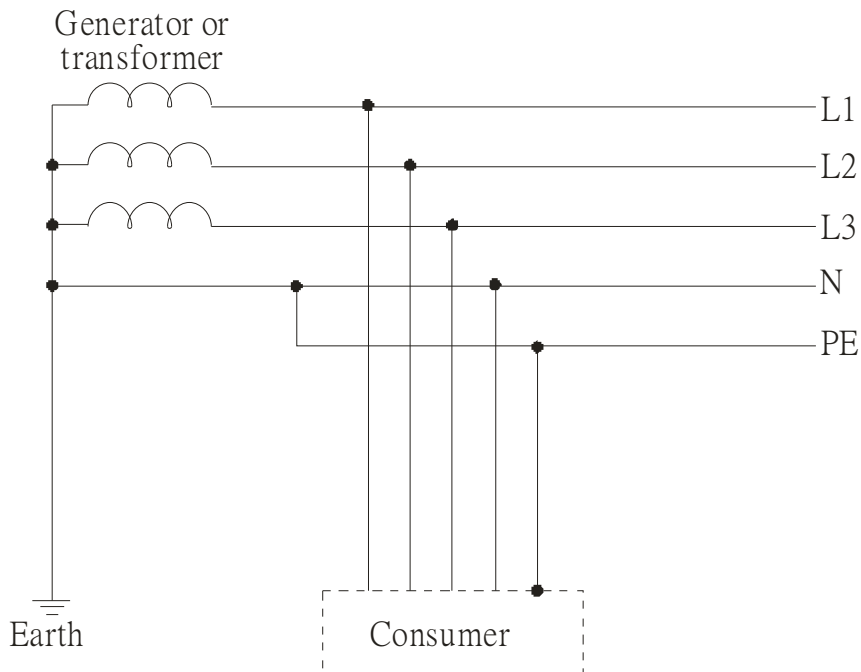
TN-C system

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.



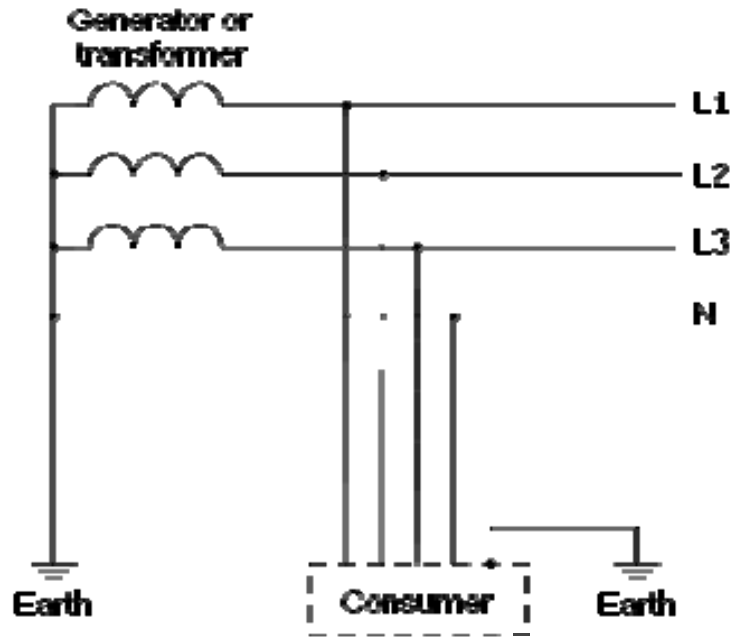
TN-C-S system

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



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.

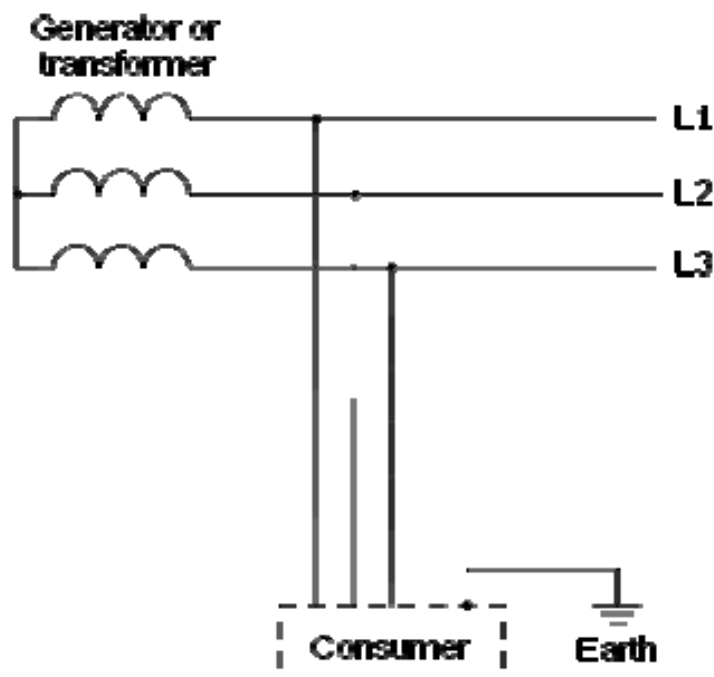


IT system

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.



Criteria for Earthing System and EMC

	TN-S	TN-C	TT	IT
Safety of Personnel	<p>Good</p> <p>Continuity of the PE conductor must be ensured throughout the installation</p>	<p>Good</p> <p>Continuity of the PE conductor must be ensured throughout the installation</p>	<p>Good</p> <p>RCD is mandatory</p>	<p>Good</p> <p>Continuity of the PE conductor must be ensured throughout the installation</p>
Safety of Property	<p>Poor</p> <p>High fault current (around 1kA)</p>	<p>Poor</p> <p>High fault current (around 1kA)</p>	<p>Good</p> <p>Medium fault current (< a few dozen amperes)</p>	<p>Good</p> <p>Low current at the first fault (< a few dozen mA) but high current at the second fault</p>
Availability of Energy	<p>Good</p>	<p>Good</p>	<p>Good</p>	<p>Excellent</p>
EMC Behavior	<p>Excellent</p> <p>Few equipotential</p> <p>Problems:</p> <ul style="list-style-type: none"> - Need to handle the high leaking currents problem of the device - High fault current (transient disturbances) 	<p>Poor (prohibited)</p> <ul style="list-style-type: none"> - Neutral and PE are the same - Circulation of disturbance currents in exposed conductive parts (high magnetic-field radiation) - High fault currents (transient disturbances) 	<p>Good</p> <ul style="list-style-type: none"> - Over-voltage risk - Equipotential <p>Problems:</p> <ul style="list-style-type: none"> - Need to handle the high leaking currents problem of the device - RCD (Residual-current device) 	<p>Poor (should be avoided)</p> <ul style="list-style-type: none"> - 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

Solution to EMI: Shielding

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.

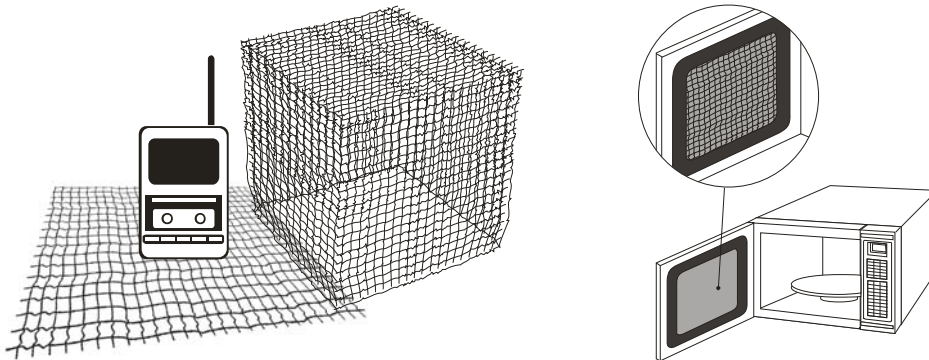
A *Faraday cage* can be made from a mesh of metal or a conductive material.

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.

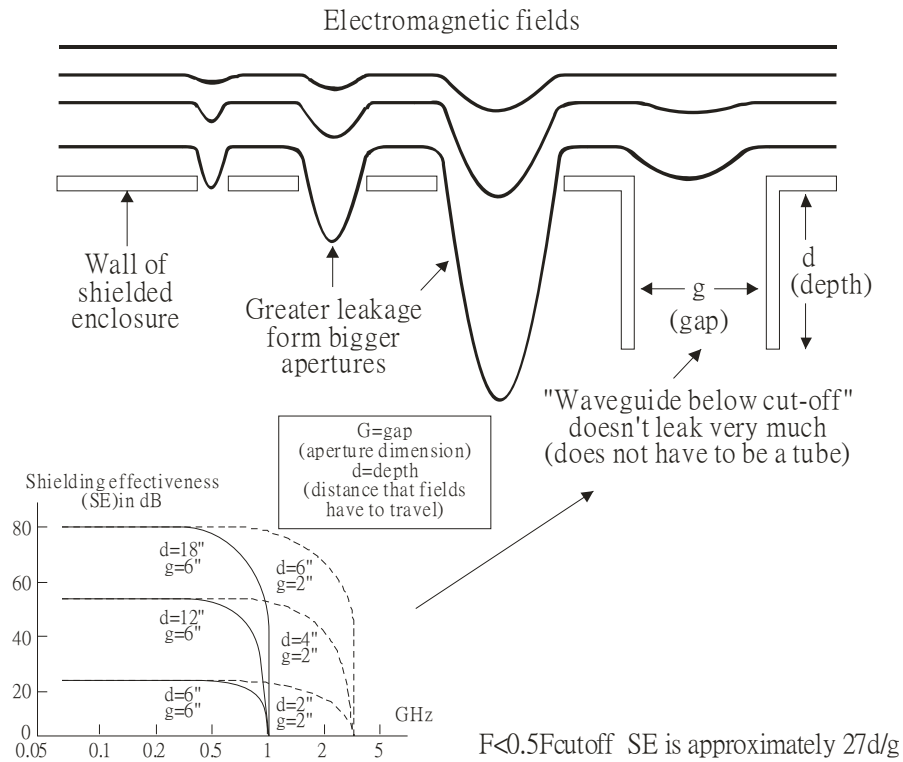
Electromagnetic shielding is applied to some electrical devices and measurement equipment for the purpose of blocking interference. Examples of shielding include:

- 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.



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.



4.2 How to reduce EMI 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 EMI institution.

Metallic Shielding Effectiveness

Shielding Effectiveness (SE) is used to assess the applicability of the shielding shell. The formula is:

$$SE_{dB} = A + R + B \quad (\text{Measures in dB})$$

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:

$$AdB = 1.314(f\sigma\mu)^{1/2}t$$

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

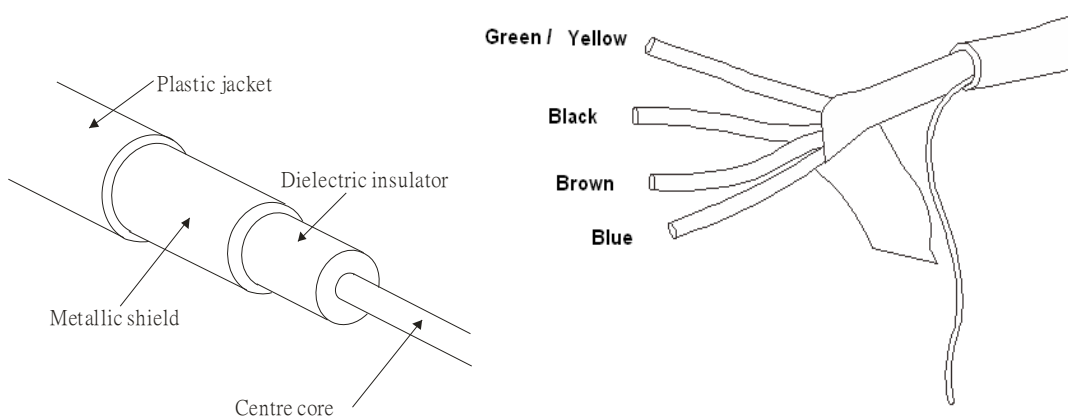
Shielded Twisted Pair (STP) is a type of cable where two insulated copper wires are twisted together with a metal mesh surrounding the twisted pair that forms the electromagnetic shielding and can also be used for grounding.

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.
 - A. 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.
 - B. 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.



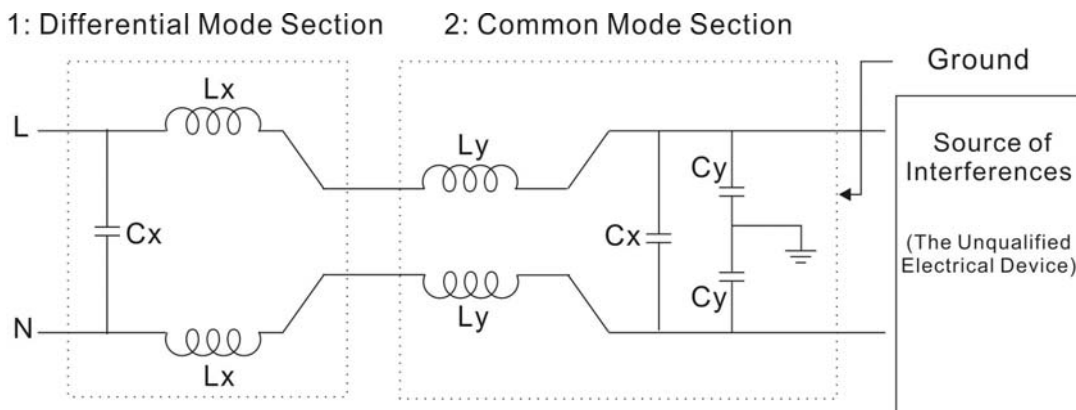
Solution to EMI: Filter

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.

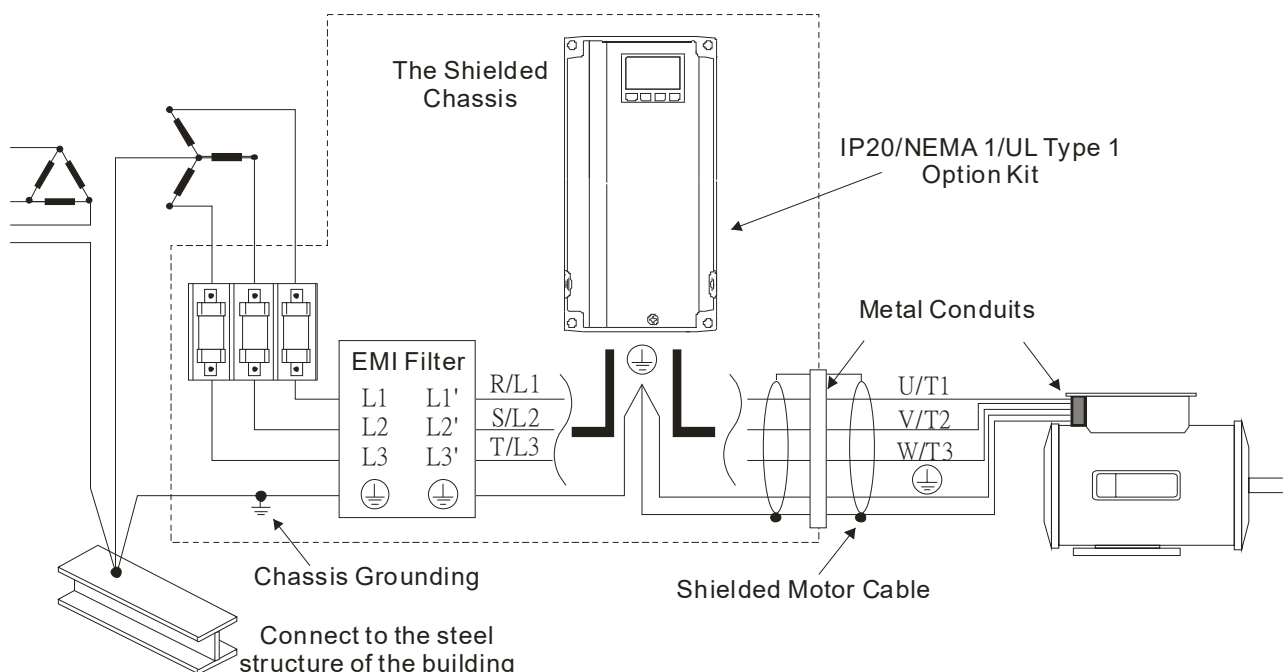
High-frequency interference at the power side can be eliminated or attenuated by mounting a filter. The filter consists of coils and capacitors. Some drives do not have a built-in filter, in which case the installation of an external option filter is required. The drawing below shows a standard filter diagram:



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 C_y is earthed to lead the harmonic currents to the ground.

External Filter

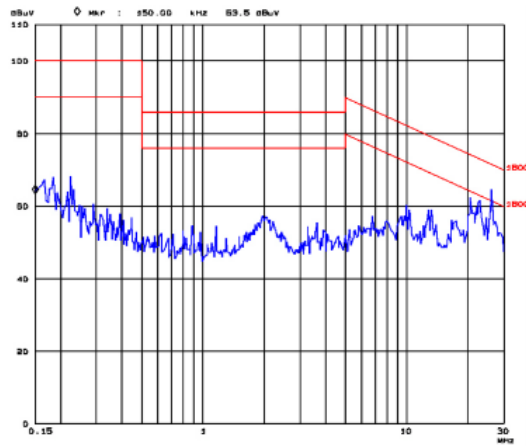
The filter and the AC drive should be installed in the control cabinet or on the mounting plate that is earthed to ground. The motor cable must be shielded and as short as possible. Please use the filters recommended by Delta to ensure compliance with EMC standards.



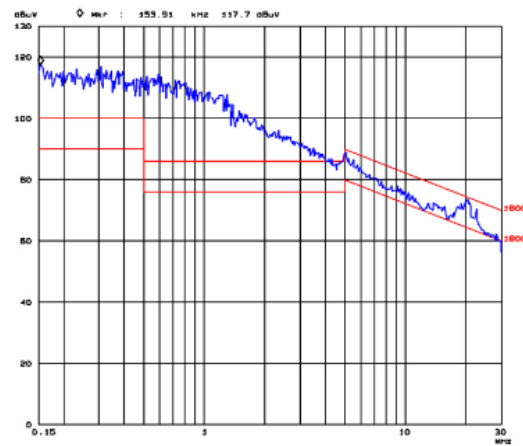
AC Motor Drives with Built-in Filter

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)



<15m@60Hz with EMI Filter>



<15m@60Hz without EMI Filter>

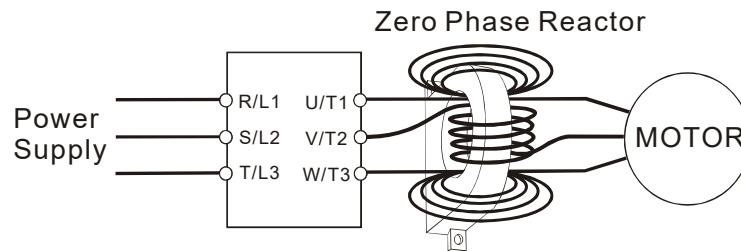
Zero Phase Reactor (Choke)

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.

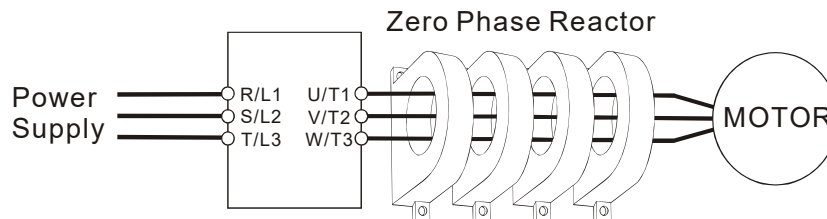
Zero Phase Reactor Installation

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.



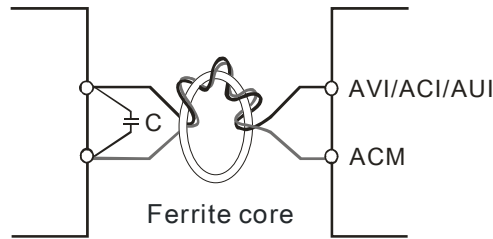
2. Place all wires through the middle of four zero-phase reactors without winding.



Analog Input Signals

If the analog input signals are affected by noise from the AC motor drive, please connect a capacitor and a ferrite core as indicated in the following diagram.

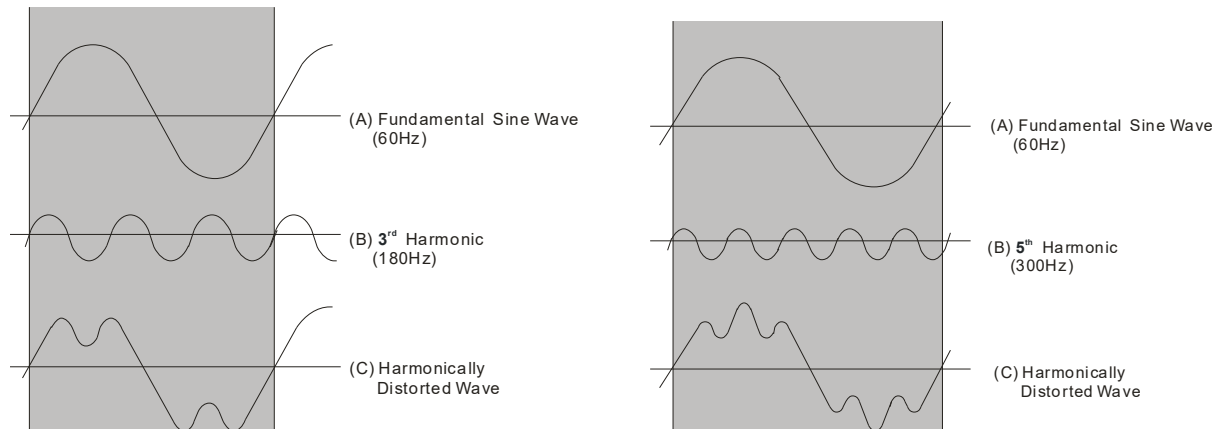
Wind the wires around the core in same direction for 3 times or more.



5.2 Harmonic Interference

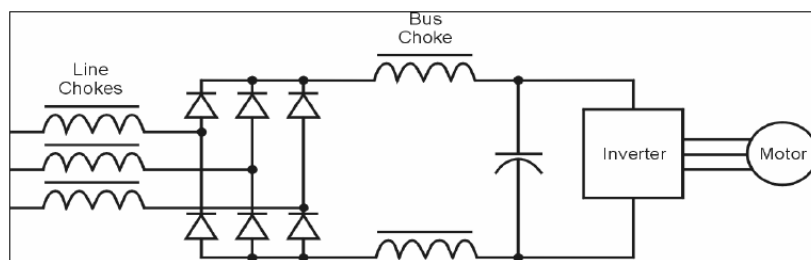
The AC motor drive's input current is non-linear, the input rectifier generates harmonics. Harmonics must be limited to within a certain range to avoid impact the mains power and to avoid current distortion to ensure surrounding devices are not influenced. An AC Motor Drive with built-in DC reactor suppresses 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



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.



AC Reactor

Installed in series with the power supply and is effective in reducing low order current harmonics.

Features of an AC reactor include:

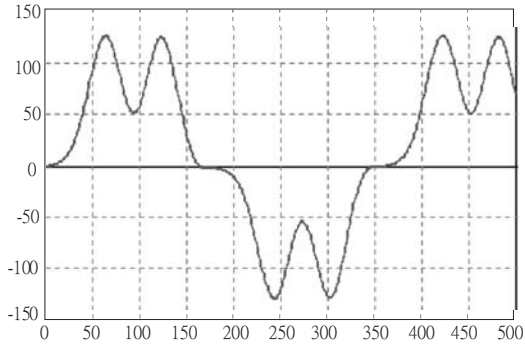
1. Reduces the harmonic currents to the AC Motor Drive and increases the impedance of the power supply.
2. Absorbs interferences generated by surrounding devices (such as surge voltages, currents, and mains surge voltages) and reduce their effect on the AC Motor Drive.
3. Increases the power factor.

DC Reactor

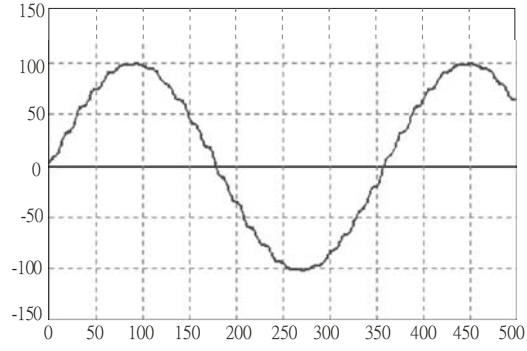
A DC-Reactor is installed between the rectifier and the DC-bus capacitor to suppress harmonic currents and to achieve a higher power factor.

Current Wave Diagrams

Without Reactor



With Reactor



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Appendix B. Revision History

Newly Added	
Description	Chapter
Copyright notice and limitation of liability added	Preface
EC 60664-1 for pollution degree 2 added	Chapter 2
<ul style="list-style-type: none"> ● "HP" and "Min. Braking Power" columns are added for 6-1 Brake Resistors and Brake Units Used in AC Motor Drives, and notes for 6 and 7 under the tables are also added. ● One-phase models for Section 6-2 non-fuse circuit breaker added ● Installation precaution for Section 6-5 Zero Phase Reactor added ● Recommended maximum wiring gauge reference table for Section 6-5 added 	Chapter 6
<ul style="list-style-type: none"> ● Notes for terminal function table and descriptions for the third item (and hereinafter) for setting the frequency division signal for EMED-PGHSD-1 added ● Descriptions for the third item (and hereinafter) for setting the frequency division signal for EMED-PGHSD-2 added 	Chapter 7
Operation, Storage and Transportation Environments\EMC level added	Chapter 8
<ul style="list-style-type: none"> ● The descriptions for text color under menu item "5. Display Setup" for Section 9-4 Digital Keypad KPC-CC01 Functions added 	Chapter 9
<ul style="list-style-type: none"> ● The curve and descriptions for elevator performance fine-tuning added ● Explanations for the auto-tuning steps added: Step 5: Inertia reference value (%) Step 7: (1) Enable slip compensation (VF, SVC), (2) Comfort adjustment for normal operation (FOCPG, FOCPM), and (4) DC brake adjustment. 	Chapter 10
Parameter settings and detailed descriptions added: <ul style="list-style-type: none"> ● Parameter Group 01: 01-33–01-40 ● Parameter Group 02: 02-11–02-22 function setting #49 ● Parameter Group 04: 04-15 ● Parameter Group 06: 06-68–06-72, 06-73–06-99 	Chapter 11 Chapter 12

Major Changes	
Description	Chapter
Vdc is corrected to V_{DC} ; Vac is corrected to V_{AC} .	All sections
“Before Using” updated	Preface
<ul style="list-style-type: none"> ● For Section 1-5 RFI Switch, all “cut off RFI short circuit cable” is corrected to “remove RFI switch”, “according to IEC 61800-3” is deleted, one “RFI capacitor” is corrected to “RFI switch” for particular attention under Isolating Main Power from Ground. ● Figure, dimension, and notes for Frame C are updated in Section 1-6 Dimensions. 	Chapter 1
Models’ information about horsepower and capacity are combined into one table for Section 2-2 Minimum Mounting Clearance.	Chapter 2
Frame E wiring diagram (braking resistor added) updated	Chapter 3
Main circuit diagram for frame E updated (braking resistor added)	Chapter 4
<ul style="list-style-type: none"> ● Figures for control board switch are respectively placed into the Default (NPN mode) column for SG1+ and SG1- terminals and SW2 terminal. ● The figure for AUI and AUI2 analog voltage frequency updated ● Descriptions for AFM1 and AFM2 Default (NPN mode) are combined into one column. 	Chapter 5
<ul style="list-style-type: none"> ● Table for brake resistors and brake units used in AC motor drives updated: table is changed from one to two (10% ED and 30% ED), “Braking Resistor Value Spec. for Each AC Motor Drive” column is deleted, “Braking Resistor Value Spec. for Each AC Motor Drive” column is corrected to “Delta’s Part No.”, values in the tables are all updated, note 1 under the tables are updated. ● Section 6-4 AC/DC Reactor all updated ● Zero phase reactors are changed into two types: casing with mechanical fixed part and casing without mechanical fixed part ● Diagrams for installing zero phase reactors are changed into two methods: single turn and multi-turn. ● Zero phase reactor models for input side (R/S/T) of 220V and 460V models updated. Zero phase reactor models for output side (U/V/W) of 220V and 460V models deleted. ● Figures for EMC filters updated ● Menu items under MENU key for KPC-CC01 keypad functions are corrected to 13 items and unsupported item 4, 5 and 7 are noted. ● HAND and AUTO keys for KPC-CC01 keypad functions are corrected to “no function” ● LED function descriptions updated ● The method for downloading the driver file (IFD6530_Drivers.exe) is changed from CD to URL address. 	Chapter 6

Major Changes	
Description	Chapter
<ul style="list-style-type: none"> ● The table for screw specification for optional card terminal is deleted and screw specifications are respectively placed into the right bottom corner for each PG card figure. ● The number of PG cards for Vertical View of the Motor Drive & Screw Specifications are corrected from two to three: EMED-PGABD-1, EMED-PGHSD-1 and EMED-PGHSD-2. ● Applicable encoders for EMED-PGHSD-1 and EMED-PGHSD-2 updated ● EMED-PGABD-1\Terminal TB2\Terminals A/O and B/O\ SW2 is corrected to SW3 in Descriptions column ● EMED-PGHSD-2 (Terminal TB2) pin definitions depend on the encoder type \Terminals\ Change terminal order in the terminal table to match that in the terminal figure, and information of the second row is deleted. “Must set Pr.10-31=1” to terminals C+ and C- for Heidenhain ERN1387 is added. ● Terminal UP is corrected into Up. ● Terminal Vp is corrected into VP. ● Terminal DVin is corrected into Vin. 	Chapter 7
<ul style="list-style-type: none"> ● General Specifications\brake torque updated ● General Specifications\certifications updated ● Operation temperature updated 	Chapter 8
<ul style="list-style-type: none"> ● Menu items under MENU key for KPC-CC01 keypad functions are corrected to 13 items and unsupported item 4, 5 and 7 are noted. ● Unsupported menu items under Section 9-4 Digital Keypad KPC-CC01 Functions are corrected from two items (4 and 5) to three items (4, 5 and 7). ● Language selections for Language Setup are corrected to three languages: English, Traditional Chinese and Simplified Chinese and that only these three languages are currently supported are noted. ● Subsection 3) Edit Main Page is deleted because the contents are the same as those in subsection 2) Edit Main Page & Example of Download under Section 9-6 TPEditor Installation. 	Chapter 9
<ul style="list-style-type: none"> ● Flow chart for the auto-tuning process updated ● Explanations for the auto-tuning steps updated: Step 1: Pr.00-02, Pr.00-14, Pr.00-15, Pr.02-01–02-08, Pr.02-15–02-16 settings Step 2: Encoder Settings Step 3: Pr.00-09 and Pr.01-02 settings, 【 PM Motor 】 \Motor Auto-tuning\ Pr.08-00 NOTE1 descriptions, and Pr.08-00 NOTE2 descriptions under Measure the Angle between the Magnetic Pole and the PG Origin. Step 4: Pr.01-12–01-19 NOTE description, and analog setting Step 7: Pr.11-00, Pr.11-06–11-08 settings, (3) Start-up adjustment (FOCPM), 	Chapter 10

Major Changes	
Description	Chapter
Pr.11-00, Pr.10-19, Pr.10-22, Pr.03-00, Pr.07-19, Pr.03-06, Pr.03-09 settings, and (5) Set drive stop.	
Parameter settings and detailed descriptions updated: <ul style="list-style-type: none"> ● Parameter Group 00: 00-01, 00-02, 00-09, 00-11, 00-14, 00-15 ● Parameter Group 01: 01-21, 01-29 ● Parameter Group 02: 02-01–02-08, 02-10, 02-11–02-22, 02-34, 02-37, 02-38, 02-39, 02-44 ● Parameter Group 03: 03-00–03-02, 03-17 & 03-20, 03-23 & 03-24 ● Parameter Group 05: 05-01, 05-05, 05-18, 05-19, 05-21, 05-22 ● Parameter Group 06: 06-02, 06-03, 06-10, 06-11, 06-16–06-21, 06-28, 06-32–06-43, 06-46, 06-49–06-64 ● Parameter Group 07: 07-03, 07-11, 07-23, 07-28, 07-29 ● Parameter Group 08: 08-00 ● Parameter Group 09: 09-02, 09-04 ● Parameter Group 10: 10-00, 10-06–10-09, 10-19, 10-24, 10-29, 10-30, 10-31 ● Parameter Group 11: 11-03, 11-04, 11-05, 11-16–11-18, 11-20 ● Parameter Group 12: 12-00–12-31 ● Parameter Group 13: 13-00–13-31 	Chapter 11 Chapter 12
Descriptions for warning codes CE01, CE02, CE03, CE04, CE10, CP10, PGF1, PGF4, ot1, ot2, oH3, oSL, FAn, dCAn updated	Chapter 13
Descriptions for fault codes ocA, ocd, ocn, GFF, occ, ocS, ovS, LvA, Lvd, Lvn, LvS, PHL, oH1, tH1o, tH2o, FAn, oL, EoL1, oH3, ot1&ot2, cF1, cF2, cd0, cd1, cd2, cd3, Hd0, Hd1, Hd2, Hd3, PGF1, PGF3, PGF4, EF, EF1, Pcod, cE02, BF, MBF, PGF5, MCF, MPHL, CANF, STL1, PGcd, PGHL, PGAF, PGcd, STO, STL2, STL3 updated	Chapter 14
Descriptions for Suggestions and Error Corrections for Standard AC Motor Drives updated	Chapter 15
<ul style="list-style-type: none"> ● The descriptions and contents for Table 1 Terminal Function Descriptions updated: The status of photo coupler between channel STO2–SCM2 and STL1 mode (Torque output off) is corrected from ON(Low) to ON(High) ● Descriptions and the figure for Section 16-3-3 Control Circuit Wiring Diagram updated (change from ESTOP to Safety Interlock Circuit) ● Descriptions for Fault Codes related to STO updated 	Chapter 16