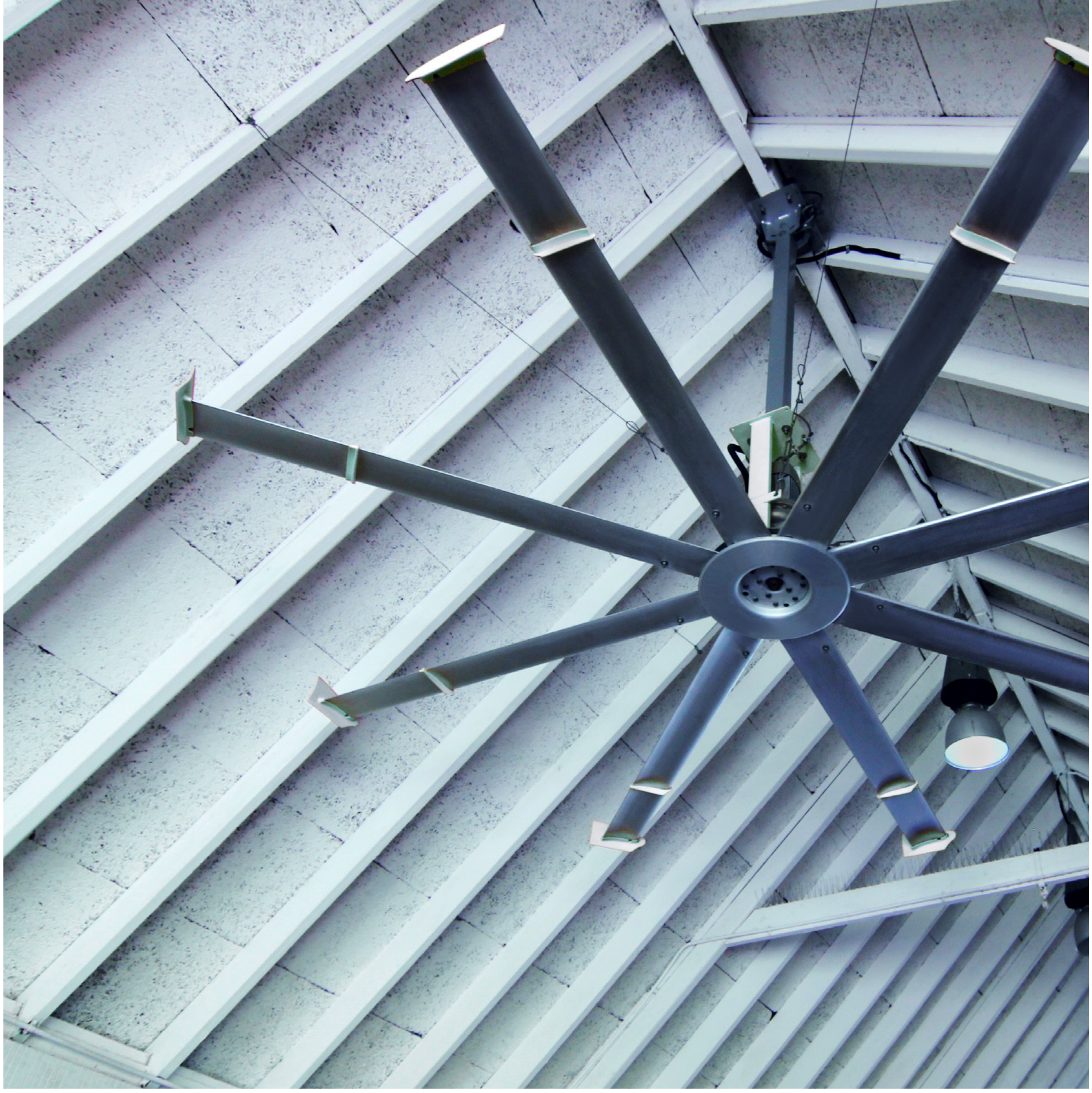
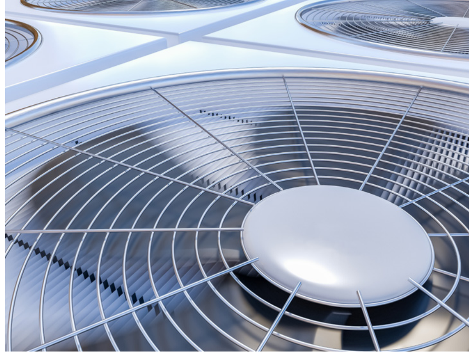

Delta Basic Compact Drive
ME300 Series User Manual

www.deltaww.com

Smarter. Greener. Together.

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(Translation of the original instructions)

READ PRIOR TO INSTALLATION FOR SAFETY.

DANGER

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

☑ Turn OFF the AC motor drive power before doing any wiring. A charge with hazardous voltages may remain in the DC bus capacitors even after the power has been turned off for a short time. Do not touch the internal circuits and components before the POWER LED (behind the digital keypad) is OFF. For your safety, measure the remaining voltage with a DC voltmeter on +1/DC+ and DC- and do not start wiring before the voltage drops to a safe level (less than 25 V_{DC}). Installing wiring with a residual voltage may cause personal injury, sparks and short circuit.

☑ There are highly sensitive MOS components on the printed circuit boards. These components are especially sensitive to static electricity. Take anti-static measures before touching these components or the circuit boards.

☑ Never modify the internal components or wiring.

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

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

CAUTION

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

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

☑ The rated voltage of power system to install motor drives is listed below. Ensure that the installation voltage is in the correct range when installing a motor drive.
For 115V models, the range is between 85–132 V.
For 230V models, the range is between 170–264 V.
For 460V models, the range is between 323–528 V.

☑ Refer to the table below for short circuit rating:

Model (Power)	Short circuit rating
115V	5 kA
230V	5 kA
460V	5 kA

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

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

☑ If you store the AC motor drive in a not-charged condition for more than three months, the ambient temperature should not be higher than 30°C. Storage longer than one year is not recommended and could result in the degradation of the electrolytic capacitors.

☑ Pay attention to the following when transporting and installing this package (including wooden crate, wood stave and carton box).

1 If you need to sterilize or deworm the wooden crate or carton box, do not use steamed sterilization or you will damage the VFD. Use other methods to

	sterilize or deworm. 2 You may use high temperatures to sterilize or deworm. Leave the packaging materials in an environment of over 56°C for 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 drive generates leakage current over AC 3.5 mA or DC 10 mA on a grounding conductor, compliance with local grounding regulations or IEC61800-5-1 standard is the minimum requirement for grounding.

NOTE

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

Table of Contents

Issued Edition: 01
Firmware Version: V2.02 (Refer to Pr.00-06 on the product for the firmware version.)
Issued Date: 2025/1

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Chapter 1 Introduction

After receiving the AC motor drive, check for 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 matches the part number indicated on the nameplate.
2. Make sure that the mains voltage is within the range indicated on the nameplate. Install the AC motor drive according to the instructions in this manual.
3. Before applying power, make sure that all devices, including mains power, motor, control board and digital keypad, are connected correctly.
4. When wiring the AC motor drive, make sure that the wiring of input terminals "R/L1, S/L2, T/L3" and output terminals "U/T1, V/T2, W/T3" are correct to prevent damage to the drive.
5. When power is applied, use the digital keypad to set parameters. When executing a trial run, begin with a low speed and then gradually increase the speed to the desired speed.

1-1 Nameplate Information

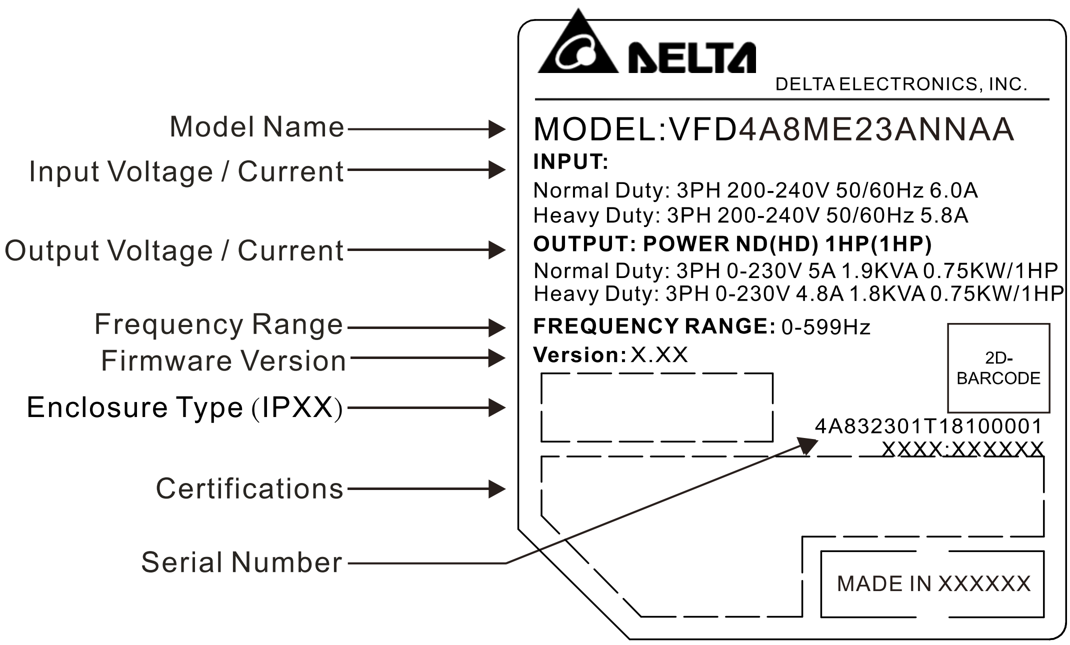
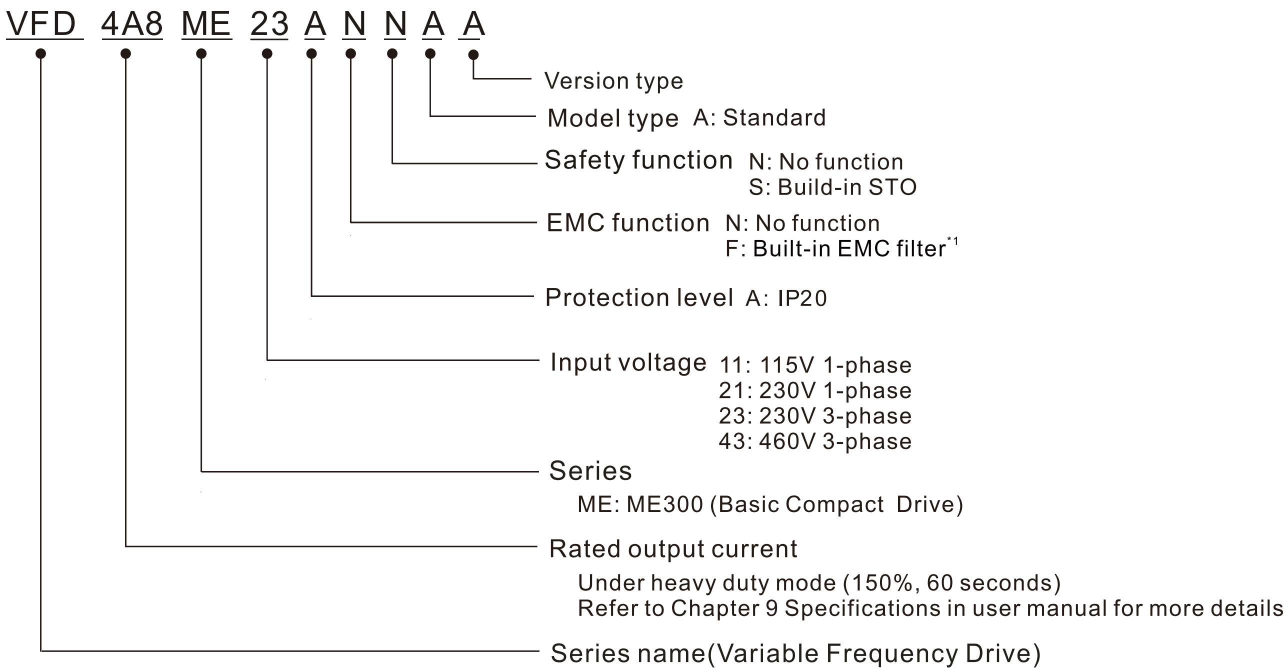


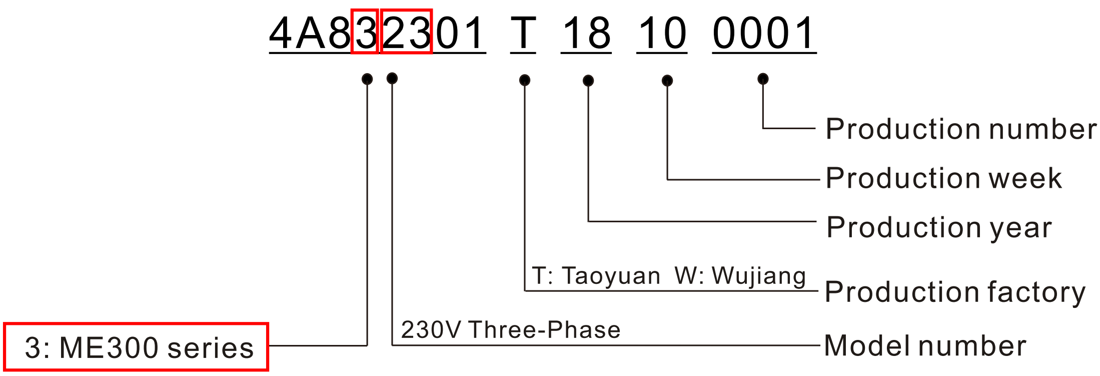
Figure 1-1

1-2 Model Name



*1 For 230V input voltage (one-phase) and 460V input voltage (three-phase) models only.

1-3 Serial Number



1-4 Apply After-Sales Service by Mobile Device

1-4-1 Location of Service Link Label

Service link label (Service Label) is pasted on the area as the drawing below shows.

Frame A, B

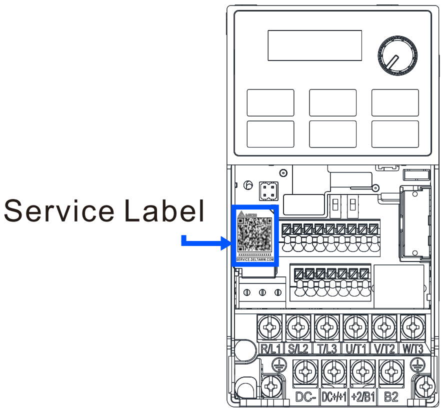


Figure 1-2

Frame C, D

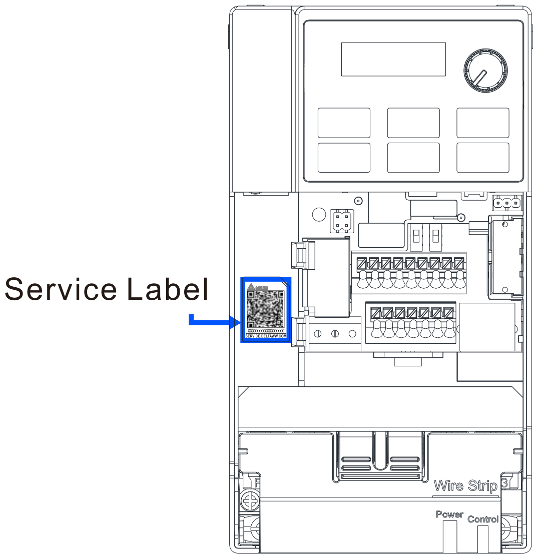


Figure 1-3

1-4-2 Service Link Label

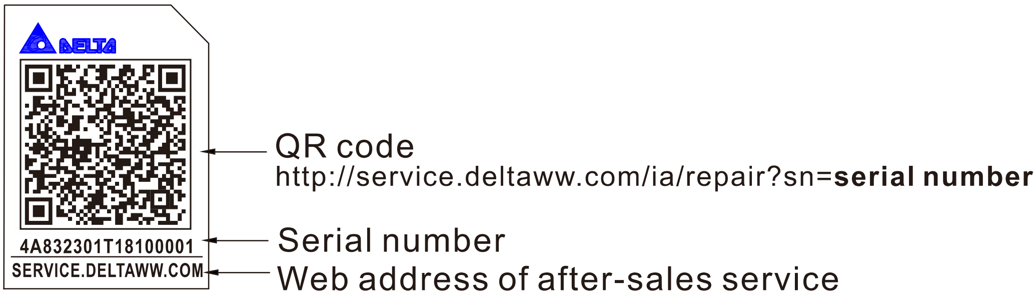


Figure 1-4

Scan QR Code to request service

1. Find the QR code sticker (as shown above).
2. Use a smartphone to run a QR Code reader APP.
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 your information into the column marked with an orange star.
6. Enter the CAPTCHA and click “Submit” to complete the application.

Cannot find the QR Code

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

1-5 RFI Jumper

RFI Jumper:

1. The drive contains Varistors / MOVs that are connected from phase to phase and from phase to ground to prevent the drive from unexpected stop or damage caused by mains surges or voltage spikes. Because the Varistors / MOVs from phase to ground are connected to ground with the RFI jumper, removing the RFI jumper disables the protection.
2. In models with a built-in EMC filter, the RFI jumper connects the filer capacitors to ground to form a return path for high frequency noise in order to isolate the noise from contaminating the mains power. Removing the RFI jumper strongly reduces the effect of the built-in EMC filter. Although a single drive complies with the international standards for leakage current, an installation with several drives with built-in EMC filters can trigger the RCD. Removing the RFI jumper helps, but the EMC performance of each drive is no longer guaranteed.

Models without built-in EMC filter

Frame A–D

Screw Torque: 4–6 kg-cm / [3.5–5.2 lb-in.] / [0.39–0.59 Nm]

Loosen the screw and remove the RFI jumper (as shown below). Tighten the screw again after you remove the RFI jumper.

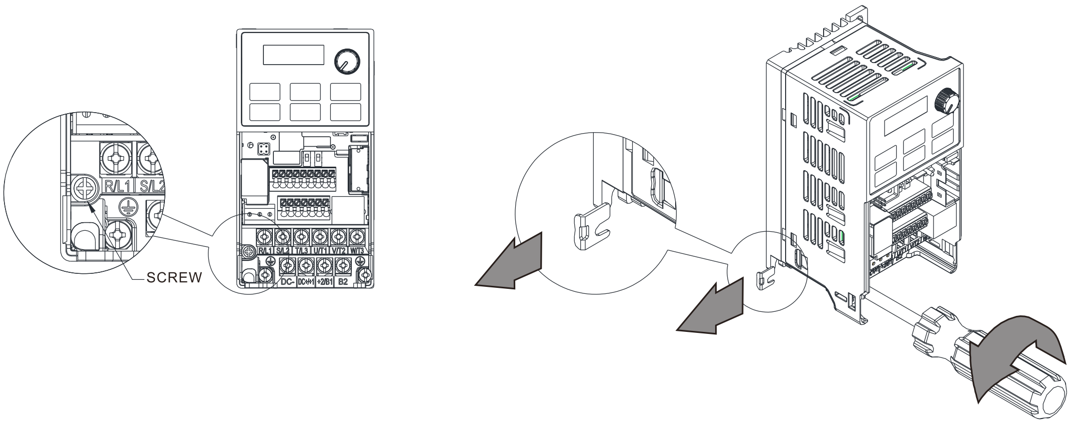


Figure 1-5

Models with built-in EMC filter

Frame B–D

Remove the RFI jumper with a slotted screwdriver (as shown below).

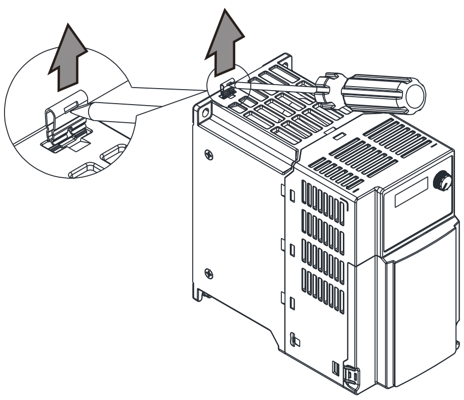


Figure 1-6

Isolating main power from ground

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

Important points regarding ground connection

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

☑ The diameter of the grounding cables must comply with the local 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 aforementioned points are met.

☑ When installing multiple drives, do not connect the ground terminals of the drive in a single-point series grounding method, but connect them in a single-point parallel grounding method. The following pictures show the correct and wrong ways to connect the grounds.

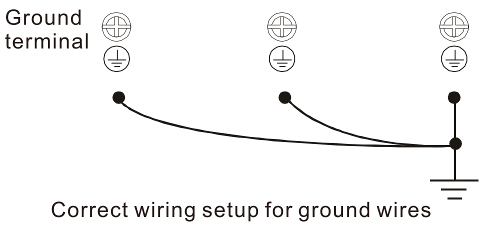


Figure 1-7

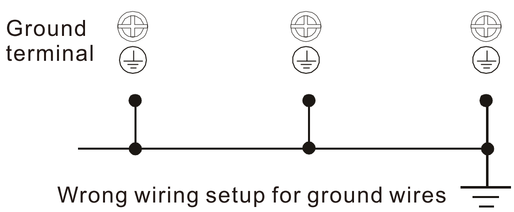


Figure 1-8

Pay particular attention to the following points:

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

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

☑ Removing the RFI jumper also cuts the capacitor conductivity of the surge absorber to ground and the built-in EMC filter capacitors. Compliance with the EMC specifications is no longer guaranteed.

☑ Do not remove the RFI jumper if the mains power is a symmetrical grounded power system in order to maintain the efficiency for EMC circuit.

☑ Remove the RFI jumper when conducting high voltage tests. When conducting a high voltage test to the entire facility, disconnect the mains 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, an ungrounded system, or a high impedance/ resistance (greater than 30 Ω) grounded system.

☑ Remove the RFI jumper to disconnect the ground cable from the internal filter capacitor and surge absorber.

☑ 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.

☑ In situations where EMC is required, use an EMC filter specifically for IT system if necessary. Disconnecting the ground cable from the filter prevents damage to the motor drive but compliance with EMC is no longer guaranteed.

☑ 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.

Asymmetric Ground System (Corner Grounded TN Systems)

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

In the following four situations, you must remove the RFI jumper. This is to prevent the system from grounding through the RFI and filter capacitors and damaging the drive.

<table>
<tr><th colspan="2">You must remove the RFI jumper for an asymmetric ground system</th></tr>
<tr><td>1. Grounding at a corner in a triangle configuration

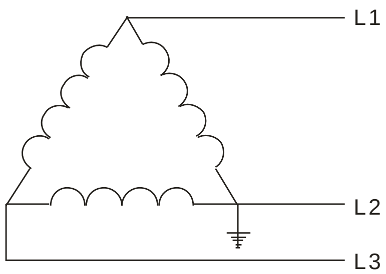



Figure 1-9</td><td>2. Grounding at a midpoint in a polygonal configuration

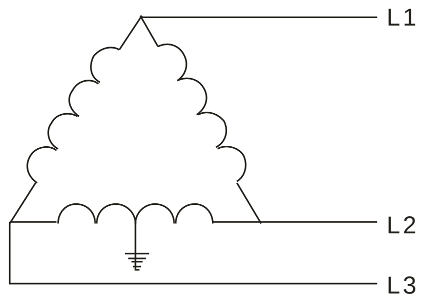



Figure 1-10</td></tr>
<tr><td>3. Grounding at one end in a single-phase configuration

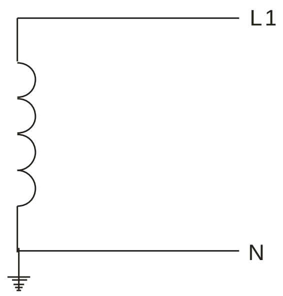



Figure 1-11</td><td>4. No stable neutral grounding in a three-phase autotransformer configuration

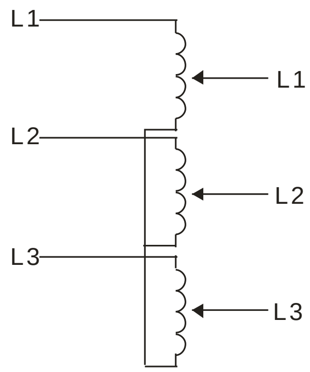
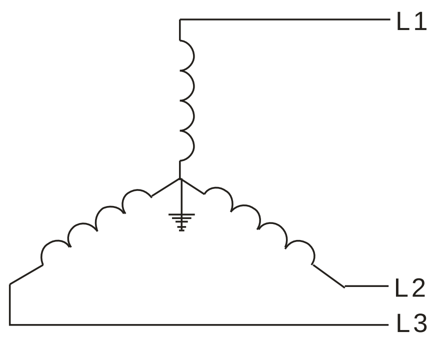



Figure 1-12</td></tr>
<tr><th colspan="2">You can use the RFI jumper for a symmetrical grounding power system</th></tr>
<tr><td>In a situation with a symmetrical grounding power system, you can use the RFI jumper to maintain the effect of the built-in EMC filter and surge absorber. For example, the diagram on the right is a symmetrical grounding power system.</td><td>
Figure 1-13</td></tr>
</table>

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Chapter 2 Dimensions

2-1 Frame A

A1: VFD0A8ME11ANNAA; VFD0A8ME11ANSAA; VFD0A8ME21ANNAA; VFD0A8ME21ANSAA; VFD0A8ME23ANNAA; VFD0A8ME23ANSAA; VFD1A6ME11ANNAA; VFD1A6ME11ANSAA; VFD1A6ME21ANNAA; VFD1A6ME21ANSAA; VFD1A6ME23ANNAA; VFD1A6ME23ANSAA

A2: VFD2A8ME23ANNAA; VFD2A8ME23ANSAA

A3: VFD2A5ME11ANNAA; VFD2A5ME11ANSAA; VFD2A8ME21ANNAA; VFD2A8ME21ANSAA

A4: VFD1A5ME43ANNAA; VFD1A5ME43ANSAA

A5: VFD4A8ME23ANNAA; VFD4A8ME23ANSAA

A6: VFD2A7ME43ANNAA; VFD2A7ME43ANSAA

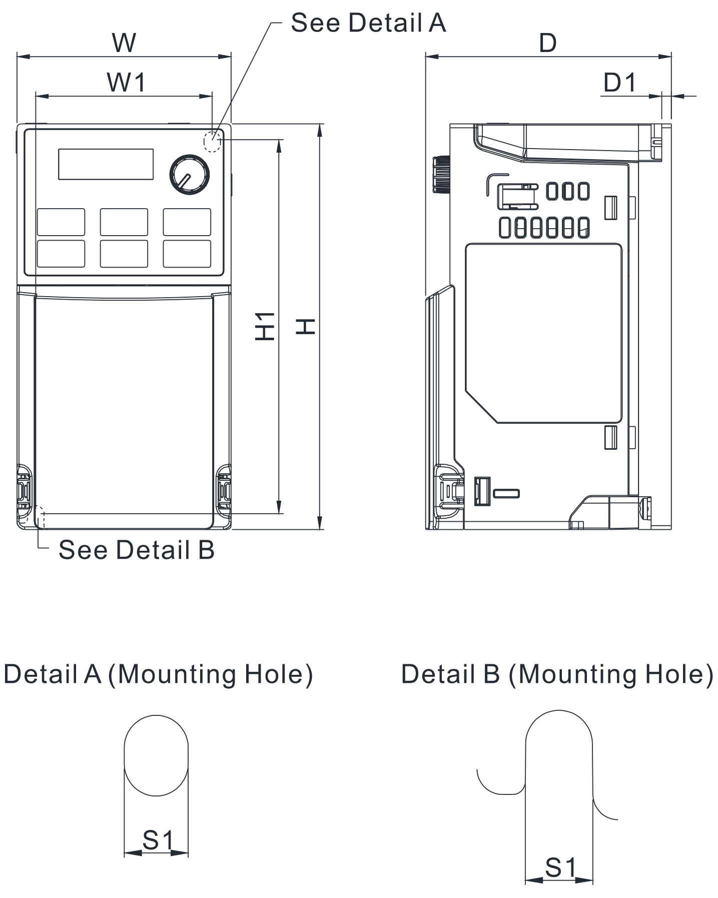


Figure 2-1

Unit: mm (inch)

Frame	W	H	D	W1	H1	D1	S1
A1	68.0 (2.68)	128.0 (5.04)	78.0 (3.07)	56.0 (2.20)	118.0 (4.65)	3.0 (0.12)	5.2 (0.20)
A2	68.0 (2.68)	128.0 (5.04)	92.0 (3.62)	56.0 (2.20)	118.0 (4.65)	3.0 (0.12)	5.2 (0.20)
A3	68.0 (2.68)	128.0 (5.04)	107.0 (4.21)	56.0 (2.20)	118.0 (4.65)	3.0 (0.12)	5.2 (0.20)
A4	68.0 (2.68)	128.0 (5.04)	113.0 (4.45)	56.0 (2.20)	118.0 (4.65)	3.0 (0.12)	5.2 (0.20)
A5	68.0 (2.68)	128.0 (5.04)	125.0 (4.92)	56.0 (2.20)	118.0 (4.65)	3.0 (0.12)	5.2 (0.20)
A6	68.0 (2.68)	128.0 (5.04)	127.0 (5.00)	56.0 (2.20)	118.0 (4.65)	3.0 (0.12)	5.2 (0.20)

Table 2-1

2-2 Frame B

B1: VFD7A5ME23ANNAA; VFD7A5ME23ANSAA; VFD4A2ME43ANNAA; VFD4A2ME43ANSAA
B2: VFD4A8ME21ANNAA; VFD4A8ME21ANSAA
B3: VFD0A8ME21AFNAA; VFD0A8ME21AFSAA; VFD1A6ME21AFNAA; VFD1A6ME21AFSAA; VFD2A8ME21AFNAA; VFD2A8ME21AFSAA; VFD4A8ME21AFNAA; VFD4A8ME21AFSAA; VFD1A5ME43AFNAA; VFD1A5ME43AFSAA; VFD2A7ME43AFNAA; VFD2A7ME43AFSAA; VFD4A2ME43AFNAA; VFD4A2ME43AFSAA

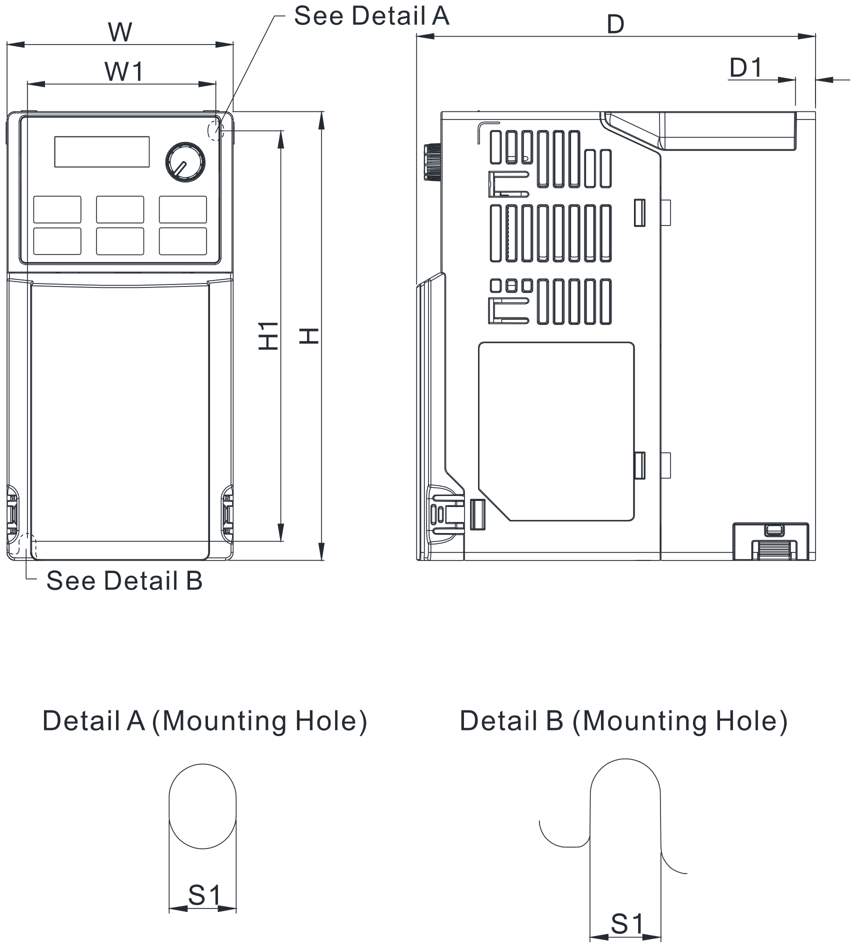


Figure 2-2

Unit: mm (inch)

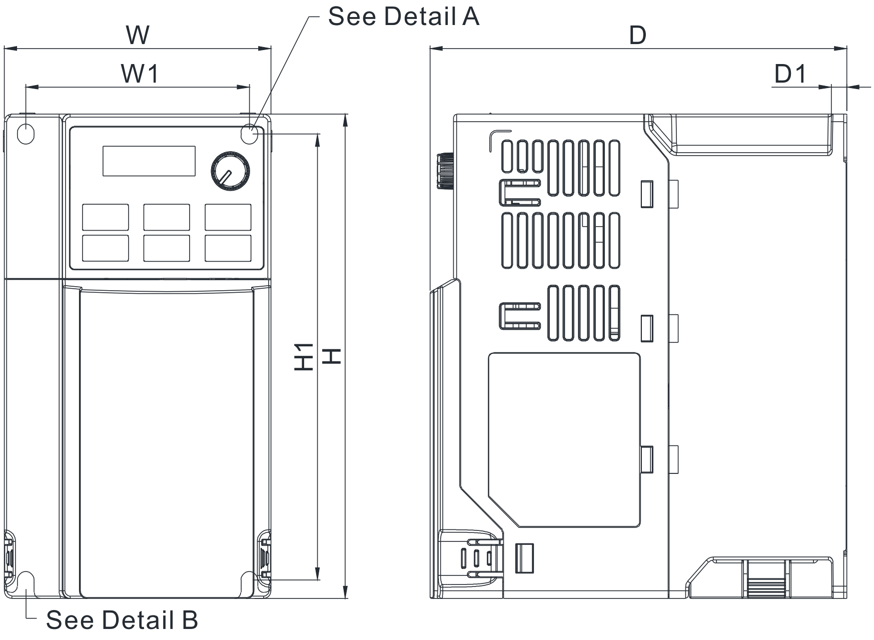
Frame	W	H	D	W1	H1	D1	S1
B1	72.0 (2.83)	142.0 (5.59)	127.0 (5.00)	60.0 (2.36)	130.0 (5.12)	6.4 (0.25)	5.2 (0.20)
B2	72.0 (2.83)	142.0 (5.59)	127.0 (5.00)	60.0 (2.36)	130.0 (5.12)	3.0 (0.12)	5.2 (0.20)
B3	72.0 (2.83)	142.0 (5.59)	143.0 (5.63)	60.0 (2.36)	130.0 (5.12)	4.3 (0.17)	5.2 (0.20)

Table 2-2

2-3 Frame C

C1: VFD4A8ME11ANNAA ; VFD4A8ME11ANSAA; VFD7A5ME21ANNAA; VFD7A5ME21ANSAA; VFD11AME21ANNAA; VFD11AME21ANSAA; VFD11AME23ANNAA; VFD11AME23ANSAA; VFD17AME23ANNAA; VFD17AME23ANSAA; VFD5A5ME43ANNAA; VFD5A5ME43ANSAA; VFD7A3ME43ANNAA; VFD7A3ME43ANSAA; VFD9A0ME43ANNAA; VFD9A0ME43ANSAA

C2: VFD7A5ME21AFNAA; VFD7A5ME21AFSAA; VFD11AME21AFNAA; VFD11AME21AFSAA; VFD5A5ME43AFNAA; VFD5A5ME43AFSAA; VFD7A3ME43AFNAA; VFD7A3ME43AFSAA; VFD9A0ME43AFNAA; VFD9A0ME43AFSAA



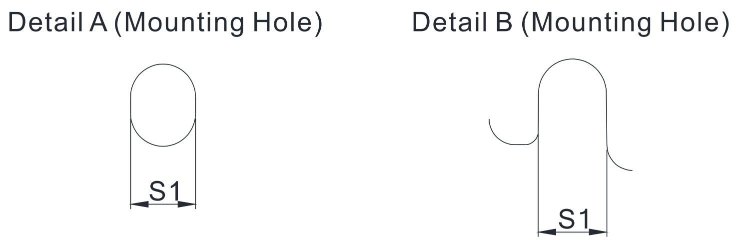


Figure 2-3

Unit: mm (inch)

Frame	W	H	D	W1	H1	D1	S1
C1	87.0 (3.43)	157.0 (6.18)	136.0 (5.35)	73.0 (2.87)	144.5 (5.69)	5.0 (0.20)	5.5 (0.22)
C2	87.0 (3.43)	157.0 (6.18)	163.0 (6.42)	73.0 (2.87)	144.5 (5.69)	5.0 (0.20)	5.5 (0.22)

Table 2-3

2-4 Frame D

D1: VFD25AME23ANNAA; VFD25AME23ANSAA; VFD13AME43ANNAA; VFD13AME43ANSAA;
VFD17AME43ANNAA; VFD17AME43ANSAA

D2: VFD13AME43AFNAA; VFD13AME43AFSAA; VFD17AME43AFNAA; VFD17AME43AFSAA

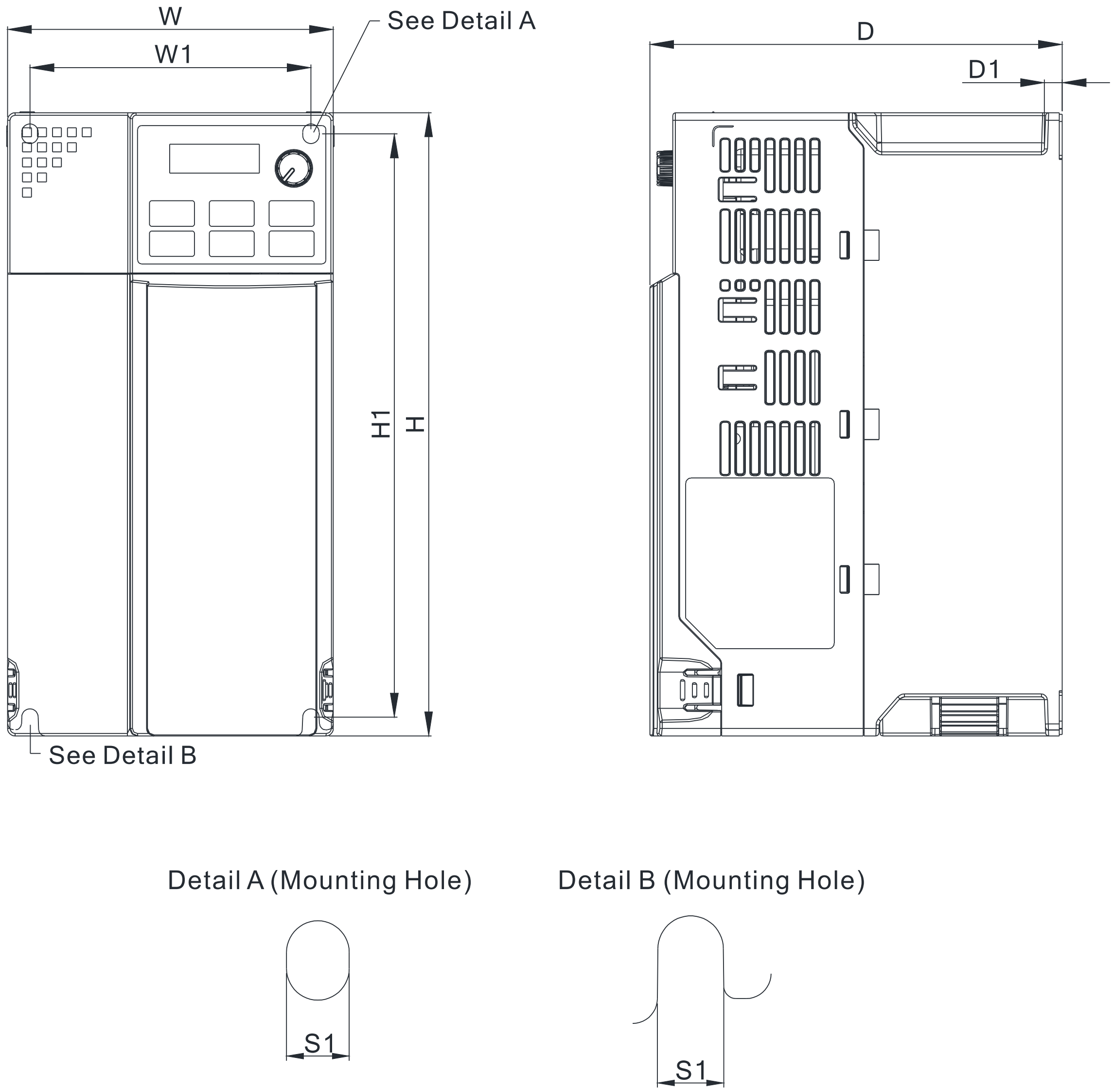


Figure 2-4

Unit: mm (inch)

Frame	W	H	D	W1	H1	D1	S1
D1	109.0 (4.29)	207.0 (8.15)	138.0 (5.43)	94.0 (3.70)	193.8 (7.63)	6.0 (0.24)	5.5 (0.22)
D2	109.0 (4.29)	207.0 (8.15)	171.0 (6.73)	94.0 (3.70)	193.8 (7.63)	6.0 (0.24)	5.5 (0.22)

Table 2-4

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Chapter 3 Installation

3-1 Mounting Clearance

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

☑ Install the AC motor drive in a metal cabinet. 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 accident.

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

☑ Mount the drive in an IP54 cabinet in order to maintain the Pollution Degree 2 or in a pollution-controlled environment. When installing the AC motor drive in a Pollution Degree 2 (IEC/EN 60664-1) environment, only nonconductive pollution occurs for the electrical equipment in the cabinet and thermostatic chamber and temporary conductivity caused by condensation is expected.

The appearances shown in the following figures are for reference only. The actual motor drives may look different.

Airflow direction   Outflow   Distance

Single drive installation

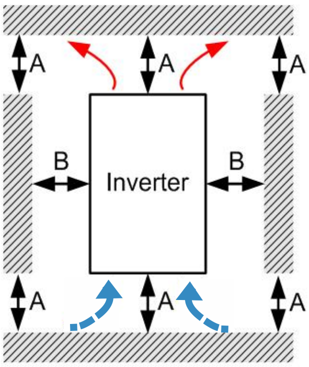


Figure 3-1

Side-by-side horizontal installation / Zero stack installation

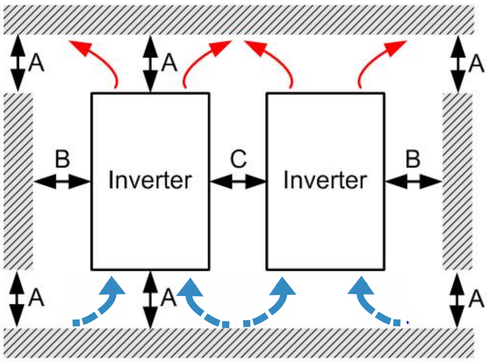


Figure 3-2

Minimum mounting clearance

Installation method	A (mm)	B (mm)	C (mm)	Max. Ambient Temperature (°C)	
				Without Derating	Derating
Single drive installation	50	30	-	50	60
Side-by-side horizontal installation	50	30	30	50	60
Zero stack installation	50	30	0	40	50

Table 3-1

Note: The minimum mounting clearances A–C stated in the table above apply to AC motor drives installation. Failing to follow the minimum mounting clearances may cause the fan to malfunction and heat dissipation problems.

3-2 Airflow and Power Dissipation

Frame	Airflow Rate for Cooling			Power Dissipation for AC Motor Drive		
	Model No.	Flow Rate (cfm)	Flow Rate (m^3 / hr)	Loss External (Heat sink, unit: W)	Internal (W)	Total (W)
A	VFD2A5ME11ANNAA VFD2A5ME11ANSAA	0	0	14.2	13.1	27.3
	VFD2A8ME21ANNAA VFD2A8ME21ANSAA			16.3	14.5	30.8
	VFD4A8ME23ANNAA VFD4A8ME23ANSAA			31	13.2	44.2
	VFD1A5ME43ANNAA VFD1A5ME43ANSAA			17.6	11.1	28.7
	VFD2A7ME43ANNAA VFD2A7ME43ANSAA			30.5	17.8	48.3
	VFD0A8ME11ANNAA VFD0A8ME11ANSAA			5.1	6.8	11.9
	VFD1A6ME11ANNAA VFD1A6ME11ANSAA			8	10	18
	VFD0A8ME21ANNAA VFD0A8ME21ANSAA			5.1	6.8	11.9
	VFD1A6ME21ANNAA VFD1A6ME21ANSAA			8	10.3	18.3
	VFD0A8ME23ANNAA VFD0A8ME23ANSAA			5.1	6.8	11.9
	VFD1A6ME23ANNAA VFD1A6ME23ANSAA			8.6	10	18.6
	VFD2A8ME23ANNAA VFD2A8ME23ANSAA			16.5	12.6	29.1
B	VFD0A8ME21AFNAA VFD0A8ME21AFSAA	0	0	5.1	6.8	11.9
	VFD1A6ME21AFNAA VFD1A6ME21AFSAA			8	10.3	18.3
	VFD2A8ME21AFNAA VFD2A8ME21AFSAA	10	16.99	16.3	14.5	30.8
	VFD4A8ME21AFNAA VFD4A8ME21AFSAA			29.1	20.1	49.2
	VFD4A8ME21ANNAA VFD4A8ME21ANSAA	0	0	29.1	20.1	49.2
	VFD7A5ME23ANNAA VFD7A5ME23ANSAA	10	16.99	50.1	24.2	74.3
	VFD4A2ME43ANNAA VFD4A2ME43AFNAA VFD4A2ME43ANSAA VFD4A2ME43AFSAA			45.9	21.7	67.6
	VFD1A5ME43AFNAA VFD1A5ME43AFSAA			17.6	11.1	28.7
	VFD2A7ME43AFNAA VFD2A7ME43AFSAA			30.5	17.8	48.3

Frame	Airflow Rate for Cooling			Power Dissipation for AC Motor Drive		
	Model No.	Flow Rate (cfm)	Flow Rate (m^3 / hr)	Loss External (Heat sink, unit: W)	Internal (W)	Total (W)
C	VFD4A8ME11ANNAA VFD4A8ME11ANSAA	16	27.2	29.1	23.9	53
	VFD7A5ME21ANNAA VFD7A5ME21AFNAA			46.5	31	77.5
	VFD7A5ME21ANSAA VFD7A5ME21AFSAA			46.5	31	77.5
	VFD11AME21ANNAA VFD11AME21AFNAA VFD11AME21ANSAA VFD11AME21AFSAA			70	35	105
	VFD11AME23ANNAA VFD11AME23ANSAA			76	30.7	106.7
	VFD17AME23ANNAA VFD17AME23ANSAA			108.2	40.1	148.3
	VFD5A5ME43ANNAA VFD5A5ME43AFNAA VFD5A5ME43ANSAA VFD5A5ME43AFSAA			60.6	22.8	83.4
	VFD7A3ME43ANNAA VFD7A3ME43AFNAA VFD7A3ME43ANSAA VFD7A3ME43AFSAA			75.2	30	105.2
	VFD9A0ME43ANNAA VFD9A0ME43AFNAA VFD9A0ME43ANSAA VFD9A0ME43AFSAA			93.1	42	135.1
D	VFD25AME23ANNAA VFD25AME23ANSAA	23.4	39.7	192.8	53.3	246.1
	VFD13AME43ANNAA VFD13AME43AFNAA VFD13AME43ANSAA VFD13AME43AFSAA			132.8	39.5	172.3
	VFD17AME43ANNAA VFD17AME43AFNAA VFD17AME43ANSAA VFD17AME43AFSAA			164.7	55.8	220.5

Table 3-2

Chapter 4 Wiring

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

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

4-1 System Wiring Diagram

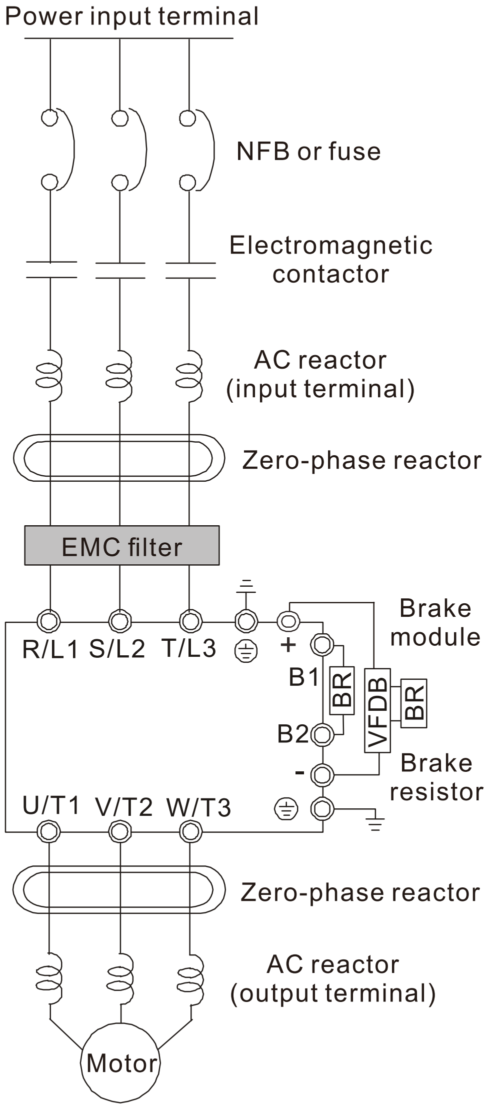
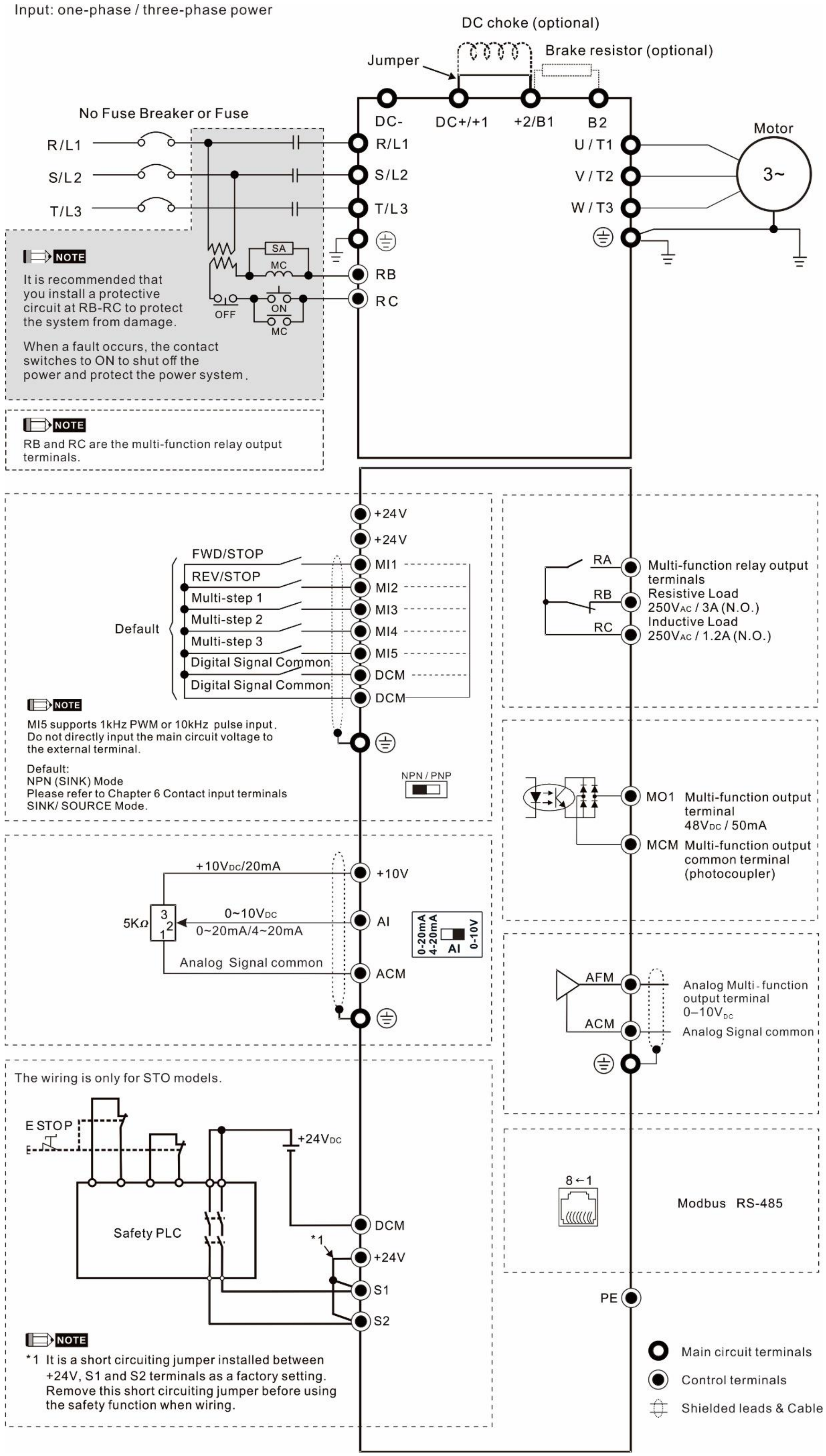


Figure 4-1

Power input terminal	Supply power according to the rated power specifications indicated in the manual. Refer to Chapter 09 Specifications for details.
NFB or fuse	There may be a large inrush current during power on. Refer to Section 7-2 Magnetic Contactor / Air Circuit Breaker and Non-fuse Circuit Breaker to select a suitable NFB or Section 7-3 Fuse Specification Chart.
Electromagnetic contactor	Switching the power ON / OFF on the primary side of the electromagnetic contactor can turn the drive ON/OFF, but frequent switching can cause machine failure. Do not switch ON / OFF more than once an hour. Do not use the electromagnetic contactor as the power switch for the drive; doing so shortens the life of the drive.
AC reactor (input terminal)	When the main power supply capacity is greater than 500 kVA, or when it switches into the phase capacitor, the instantaneous peak voltage and current generated may destroy the internal circuit of the drive. It is recommended that you install an input side AC reactor in the drive. This also improves the power factor and reduces power harmonics. The wiring distance should be within 10 m. Refer to Section 7-4 for details.
Zero phase reactor	Used to reduce radiated interference, especially in environments with audio devices, and reduce input and output side interference. The effective range is AM band to 10 MHz. Refer to Section 7-5 for details.
EMC Filter	Can be used to reduce electromagnetic interference. Refer to Section 7-6 AC/DC Reactor for details.
Brake module & Brake resistor (BR)	Used to shorten the deceleration time of the motor. Refer to Section 7-1 for details.
AC reactor (output terminal)	The motor cable length affects the size of the reflected wave on the motor end. Refer to Section 7-4 for details.

Table 4-1

4-2 Wiring


Input: one-phase / three-phase power
DC choke (optional)
Jumper
Brake resistor (optional)
No Fuse Breaker or Fuse
R/L1
S/L2
T/L3
DC-
DC+/+1
+2/B1
B2
Motor
U/T1
V/T2
W/T3
3~
SA
MC
OFF
ON
RB
RC
NOTE
It is recommended that you install a protective circuit at RB-RC to protect the system from damage.
When a fault occurs, the contact switches to ON to shut off the power and protect the power system.
NOTE
RB and RC are the multi-function relay output terminals.
+24V
+24V
FWD/STOP
REV/STOP
Multi-step 1
Multi-step 2
Multi-step 3
Digital Signal Common
Digital Signal Common
Default
MI1
MI2
MI3
MI4
MI5
DCM
DCM
NOTE
MI5 supports 1kHz PWM or 10kHz pulse input. Do not directly input the main circuit voltage to the external terminal.
Default: NPN (SINK) Mode
Please refer to Chapter 6 Contact input terminals SINK/ SOURCE Mode.
NPN / PNP
RA
RB
RC
Multi-function relay output terminals
Resistive Load
250VAC / 3A (N.O.)
Inductive Load
250VAC / 1.2A (N.O.)
MO1
Multi-function output terminal
48VDC / 50mA
MCM
Multi-function output common terminal (photocoupler)
+10VDC/20mA
+10V
5KΩ
0~10VDC
0~20mA/4~20mA
AI
Analog Signal common
ACM
0-20mA
4-20mA
AI
0-10V
AFM
ACM
Analog Multi-function output terminal
0–10VDC
Analog Signal common
The wiring is only for STO models.
E STOP
+24VDC
Safety PLC
DCM
*1
+24V
S1
S2
NOTE
*1 It is a short circuiting jumper installed between +24V, S1 and S2 terminals as a factory setting. Remove this short circuiting jumper before using the safety function when wiring.
8←1
Modbus RS-485
PE
Main circuit terminals
Control terminals
Shielded leads & Cable

Chapter 5 Main Circuit Terminals

DANGER

- ☑ Tighten the screws in the main circuit terminal to prevent sparks caused by screws loosened due to vibration.
- ☑ If necessary, use an inductive filter only at the motor output terminals U/T1, V/T2, W/T3 of the AC motor drive. DO NOT use phase-compensation capacitors or L-C (Inductance-Capacitance) or R-C (Resistance-Capacitance), unless approved by Delta.
- ☑ DO NOT connect phase-compensation capacitors or surge absorbers at the output terminals of AC motor drives.
- ☑ DO NOT connect brake resistors directly to +1/DC+ to DC-, +2/B1 to DC- to prevent damage to the drive or to the brake resistors.
- ☑ Ensure proper insulation of the main circuit wiring in accordance with the relevant safety regulations.

CAUTION

Main input power terminals

- ☑ DO NOT connect a three-phase model to single-phase power. R/L1, S/L2 and T/L3 have no phase-sequence requirement; they can be connected in any sequence.
- ☑ You must install a NFB between the three-phase power input terminals and the main circuit terminals (R/L1, S/L2, T/L3). Add a magnetic contactor (MC) to the power input wiring to cut off power quickly and reduce malfunctions when the AC motor drive protection function activates. (Both ends of the MC should have an R-C surge absorber.)
- ☑ Use voltage and current within the specifications in Chapter 09. Refer to Chapter 9 Specifications for details.
- ☑ If install an earth leakage circuit breaker (ELCB) to the AC motor drive as a protection to the electrical leakage, choose the one with a current sensitivity of more than 200 mA and an operating time of more than 0.1 seconds to avoid malfunction.
- ☑ 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 powering the main circuit 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.
- ☑ To comply with UL standards, connect the drive to a three-phase three-wire or three-phase four-wire Wye system type of mains power system.

Output terminals of the main circuit

- ☑ Use well-insulated motors to prevent any electric leakage from motors.
- ☑ When the AC drive output terminals U/T1, V/T2, and W/T3 are connected to the motor terminals U/T1, V/T2, and W/T3 respectively, the FWD LED indicator on the digital keypad is ON. This means the AC motor drive executes running forward, and the motor rotates counterclockwise (viewed from the shaft end of the motor, as

shown in Figure 5-1). On the contrary, when the REV LED indicator lights, the AC motor drive executes running in reverse, and the motor rotates in an opposite direction to Figure 5-1. If the AC motor drive executes running forward but the motor rotates in a reverse direction, exchange any two of the U/T1, V/T2 and W/T3 motor leads.

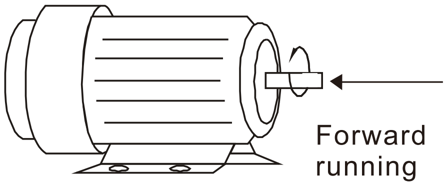


Figure 5-1

Terminals for connecting DC reactor, external brake resistor and DC circuit

☑ Use the terminals as shown below to connect a DC reactor for improving the power factor. A jumper is connected to these terminals at the factory. Remove that jumper before connecting to a DC reactor.

☑ Tighten the jumper if a DC reactor is not connected and DC+/+1 and +2/B1 terminals are used for common DC bus or brake resistors in order to prevent the AC motor drive from losing power and damage to the terminals If the jumper is missing due to wiring, refer to the recommended main circuit terminal wire gauge mentioned in Section 5-2 to short-circuit the DC+/+1 and +2/B1 terminals.

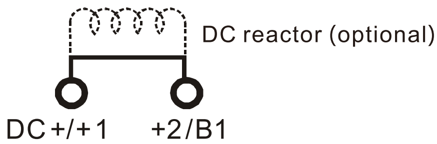


Figure 5-2

☑ Install an external brake resistor for applications in frequent deceleration to stop, short deceleration time (such as high frequency operation and heavy load operation), too low braking torque, or increased braking torque.

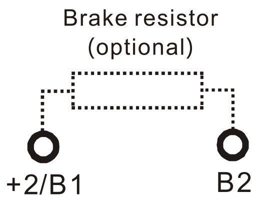


Figure 5-3

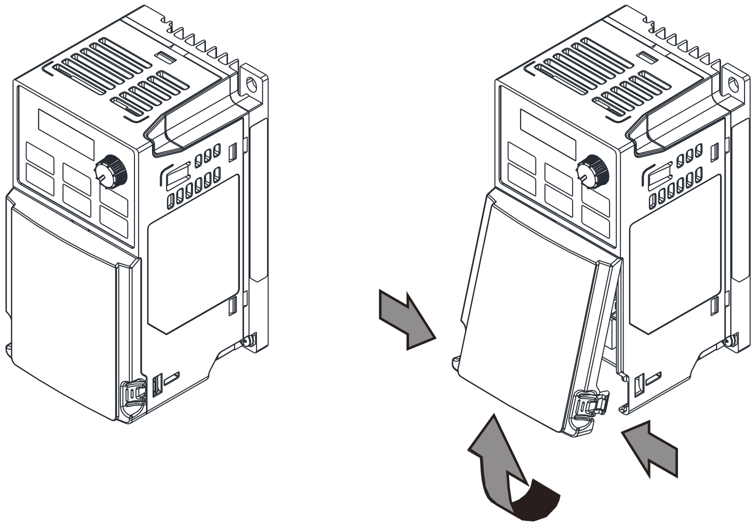
☑ Connect the external brake resistor to +2/B1, B2 terminals of the AC motor drives.

☑ DO NOT connect two ends of the brake resistor directly to DC+/+1 and DC-, +2/B1 to DC- to prevent damage to the drive and to the brake resistor.

☑ When connecting DC+/+1 and DC- in common DC bus applications, refer to Section 5-2 (Main Circuit Terminal Specifications) for the wiring terminal specification and the wire gauge information.

Remove the front cover

- Remove the front cover before wiring the main circuit terminals and control circuit terminals. Remove the cover according to the figures below.
- The example uses the Frame A model. For different frame size models, use the same removing method.



Press the clip on both sides, and then remove the cover by rotating it.

Figure 5-4

5-1 Main Circuit Diagram

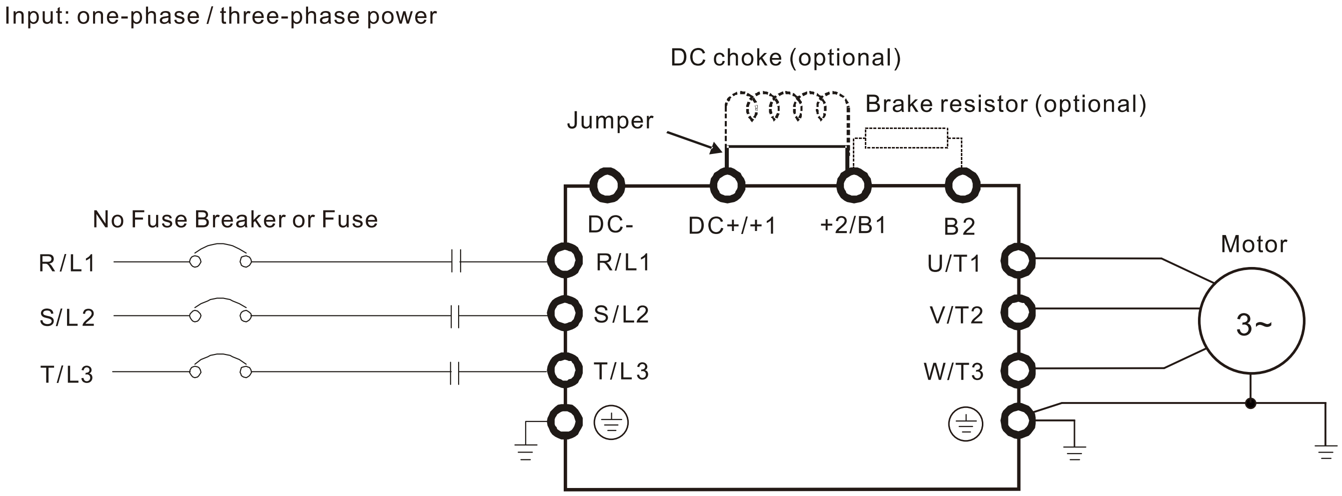


Figure 5-5

Terminals	Descriptions
R/L1, S/L2	Mains input terminals (single-phase)
R/L1, S/L2, T/L3	Mains input terminals (three-phase)
U/T1, V/T2, W/T3	AC motor drive output terminals for connecting three-phase IM and PM motors.
+1, +2	Connections for DC reactor to improve the power factor. Remove the jumper before installing a DC reactor.
DC+, DC-	Connections for brake unit (VFDB series) Common DC bus
B1, B2	Connections for brake resistor (optional). Refer to Section 7-1 for details.
⏚	Ground connection; comply with local regulations.

Table 5-1

5-2 Main Circuit Terminal Specifications

- Use the specified ring lug for main circuit terminal wiring. See Figure 5-6 and Figure 5-7 for ring lug specifications. For other types of wiring, use the wires that comply with the local regulations.
- After crimping the wire to the ring lug (must be UL and CSA approved R/C (YDPU2/8)), install heat shrink tubing rated at a minimum of 600 V_{AC} insulation over the live part. Refer to Figure 5-7.
- Main circuit terminals are R/L1, S/L2, T/L3, U/T1, V/T2, W/T3,, DC-, DC+/+1, +2/B1, B2. Single-phase models are no T/L3 terminal.

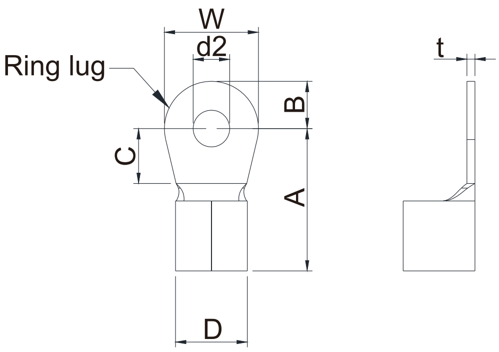


Figure 5-6

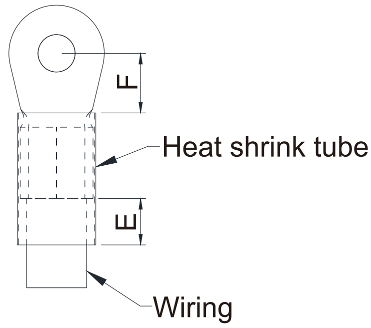


Figure 5-7

Dimensions of Ring Lug

The part number of the ring lugs (produced by K.S. Terminals Inc.) in the table below are for reference only. You can buy other ring lugs of your choice to match with different frame sizes.

Unit: mm

Frame	AWG	Kit P/N	A (MAX)	B (MAX)	C (MIN)	D (MAX)	d2 (MIN)	E (MIN)	F (MIN)	W (MAX)	t (MAX)
A	18	RNBS 1-3.7	9.8	3.2	4.8	4.1	3.7	13.0	4.2	6.6	0.8
	16	RNBS 2-3.7									
	14	RNBS 2-3.7									
B	18	RNBS1-4	12.1	3.6	6.1	5.6	4.3	13.0	4.5	7.2	1.0
	16	RNBS1-4									
	14	RNBS2-4									
	12	RNBS5-4									
C	14	RNBS2-4	17.8	5.0	6.1	7.2	4.3	13.0	5.5	10.5	1.2
	12	RNBS5-4									
	10	RNBS5-4									
	8	RNBS8-4									
D	10	RNBS5-4	17.8	5.0	6.1	7.2	4.3	13.0	5.5	10.5	1.2
	8	RNBS8-4									

Table 5-2

Note: Refer to the following tables for the wire gauge (AWG) of models in each frame.

Frame A

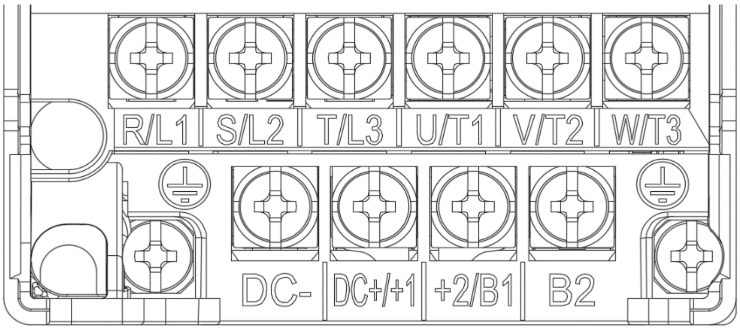


Figure 5-8

- If the installation is in an environment where the ambient temperature is above 50°C, use copper wire with a rated voltage of 600V and a temperature resistance of 90°C or above for wiring.
- If the installation is in an environment where the ambient temperature is 50°C, use copper wire with a rated voltage of 600V and a temperature resistance of 75°C or 90°C for wiring.
- For VFD2A5ME11ANNAA, VFD2A5ME11ANSAA models: If the installation is in an environment where the ambient temperature is above 40°C, use copper wire with a rated voltage of 600V and a temperature resistance of 90°C or above for wiring.
- To be UL installation compliant, you must use copper wires when installing. The wire gauge is based on a temperature resistance of 75°C, in accordance with UL requirements and recommendations. Do not reduce the wire gauge when using high-temperature resistant wires.

Models	Main Circuit Terminals R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, DC-, DC+/+1, +2/B1, B2			Terminal ⏚		
	Max. Wire Gauge	Min. Wire Gauge	Torque (±10%)	Max. Wire Gauge	Min. Wire Gauge	Torque (±10%)
VFD0A8ME11ANNAA VFD0A8ME11ANSAA	2.5mm^2 14AWG	0.75mm^2 18AWG	M3.5 9 kg-cm (7.8 lb-in.) (0.88 Nm)	2.5mm^2 (14 AWG)	2.5mm^2 (14 AWG)	M3.5 9 kg-cm (7.8 lb-in.) (0.88 Nm)
VFD1A6ME11ANNAA VFD1A6ME11ANSAA		2.5mm^2 14AWG				
VFD2A5ME11ANNAA VFD2A5ME11ANSAA						
VFD0A8ME21ANNAA VFD0A8ME21ANSAA		0.75mm^2 18AWG				
VFD1A6ME21ANNAA VFD1A6ME21ANSAA		1.5mm^2 16AWG				
VFD2A8ME21ANNAA VFD2A8ME21ANSAA		2.5mm^2 14AWG				
VFD0A8ME23ANNAA VFD0A8ME23ANSAA		0.75mm^2 18AWG				
VFD1A6ME23ANNAA VFD1A6ME23ANSAA						
VFD2A8ME23ANNAA VFD2A8ME23ANSAA						
VFD4A8ME23ANNAA VFD4A8ME23ANSAA		1.5mm^2 16AWG				
VFD1A5ME43ANNAA VFD1A5ME43ANSAA		0.75mm^2 18AWG				
VFD2A7ME43ANNAA VFD2A7ME43ANSAA						

Table 5-3

Frame B

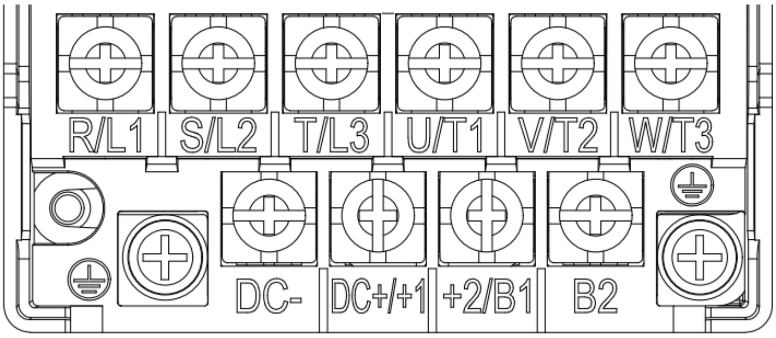


Figure 5-9

- If the installation is in an environment where the ambient temperature is above 50°C, use copper wire with a rated voltage of 600V and a temperature resistance of 90°C or above for wiring.
- If the installation is in an environment where the ambient temperature is 50°C, use copper wire with a rated voltage of 600V and a temperature resistance of 75°C or 90°C for wiring.
- To be UL installation compliant, you must use copper wires when installing. The wire gauge is based on a temperature resistance of 75°C, in accordance with UL requirements and recommendations. Do not reduce the wire gauge when using high-temperature resistant wires.

Models	Main Circuit Terminals R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, DC-, DC+/+1, +2/B1, B2			Terminal ⏚		
	Max. Wire Gauge	Min. Wire Gauge	Torque (±10%)	Max. Wire Gauge	Min. Wire Gauge	Torque (±10%)
VFD0A8ME21AFNAA VFD0A8ME21AFSAA	4 mm² (12 AWG)	0.75mm² (18AWG)	M4 15 Kg-cm (13.0 lb-in.) (1.47 Nm)	2.5mm² (14 AWG)	2.5mm² (14 AWG)	M4 15 Kg-cm (13.0 lb-in.) (1.47 Nm)
VFD1A6ME21AFNAA VFD1A6ME21AFSAA		1.5mm² (16AWG)				
VFD2A8ME21AFNAA VFD2A8ME21AFSAA		2.5mm² (14 AWG)				
VFD4A8ME21ANNAA VFD4A8ME21AFNAA VFD4A8ME21ANSAA VFD4A8ME21AFSAA		4 mm² (12 AWG)		4 mm² (12 AWG)	4 mm² (12 AWG)	
VFD7A5ME23ANNAA VFD7A5ME23ANSAA						
VFD1A5ME43AFNAA VFD1A5ME43AFSAA		0.75mm² (18AWG)		2.5mm² (14 AWG)	2.5mm² (14 AWG)	
VFD2A7ME43AFNAA VFD2A7ME43AFSAA						
VFD4A2ME43ANNAA VFD4A2ME43AFNAA VFD4A2ME43ANSAA VFD4A2ME43AFSAA		2.5mm² (14 AWG)				

Table 5-4

Frame C

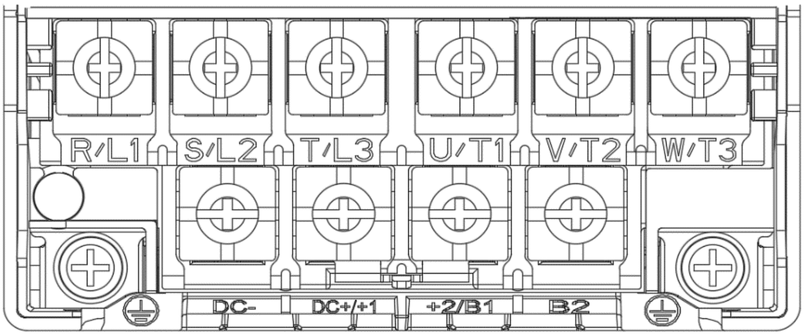


Figure 5-10

- If the installation is in an environment where the ambient temperature is above 50°C, use copper wire with a rated voltage of 600V and a temperature resistance of 90°C or above for wiring.
- If the installation is in an environment where the ambient temperature is 50°C, use copper wire with a rated voltage of 600V and a temperature resistance of 75°C or 90°C for wiring.
- To be UL installation compliant, you must use copper wires when installing. The wire gauge is based on a temperature resistance of 75°C, in accordance with UL requirements and recommendations. Do not reduce the wire gauge when using high-temperature resistant wires.

<table>
<tr><th rowspan="2">Models</th><th colspan="3">Main Circuit Terminals
R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, DC-, DC+/+1, +2/B1, B2</th><th colspan="3">Terminal ⏚</th></tr>
<tr><th>Max. Wire Gauge</th><th>Min. Wire Gauge</th><th>Torque (±10%)</th><th>Max. Wire Gauge</th><th>Min. Wire Gauge</th><th>Torque (±10%)</th></tr>
<tr><td>VFD4A8ME11ANNAA
VFD4A8ME11ANSAA</td><td rowspan="7">10 mm^2
(8 AWG)</td><td rowspan="3">10 mm^2
(8 AWG)</td><td rowspan="7">M4
20 Kg-cm
(17.4 lb-in.)
(1.96 Nm)</td><td rowspan="3">10 mm^2
(8 AWG)</td><td rowspan="3">10 mm^2
(8 AWG)</td><td rowspan="7">M4
20 Kg-cm
(17.4 lb-in.)
(1.96 Nm)</td></tr>
<tr><td>VFD7A5ME21ANNAA
VFD7A5ME21AFNAA
VFD7A5ME21ANSAA
VFD7A5ME21AFSAA</td></tr>
<tr><td>VFD11AME21ANNAA
VFD11AME21AFNAA
VFD11AME21ANSAA
VFD11AME21AFSAA</td></tr>
<tr><td>VFD11AME23ANNAA
VFD11AME23ANSAA</td><td>6 mm^2
(10 AWG)</td><td>6 mm^2
(10 AWG)</td><td>6 mm^2
(10 AWG)</td></tr>
<tr><td>VFD17AME23ANNAA
VFD17AME23ANSAA</td><td>10 mm^2
(8 AWG)</td><td>10 mm^2
(8 AWG)</td><td>10 mm^2
(8 AWG)</td></tr>
<tr><td>VFD5A5ME43ANNAA
VFD5A5ME43AFNAA
VFD5A5ME43ANSAA
VFD5A5ME43AFSAA
VFD7A3ME43ANNAA
VFD7A3ME43AFNAA
VFD7A3ME43ANSAA
VFD7A3ME43AFSAA</td><td>2.5 mm^2
(14 AWG)</td><td>2.5 mm^2
(14 AWG)</td><td>2.5 mm^2
(14 AWG)</td></tr>
<tr><td>VFD9A0ME43ANNAA
VFD9A0ME43AFNAA
VFD9A0ME43ANSAA
VFD9A0ME43AFSAA</td><td>4 mm^2
(12 AWG)</td><td>4 mm^2
(12 AWG)</td><td>4 mm^2
(12 AWG)</td></tr>
</table>

Table 5-5

Frame D

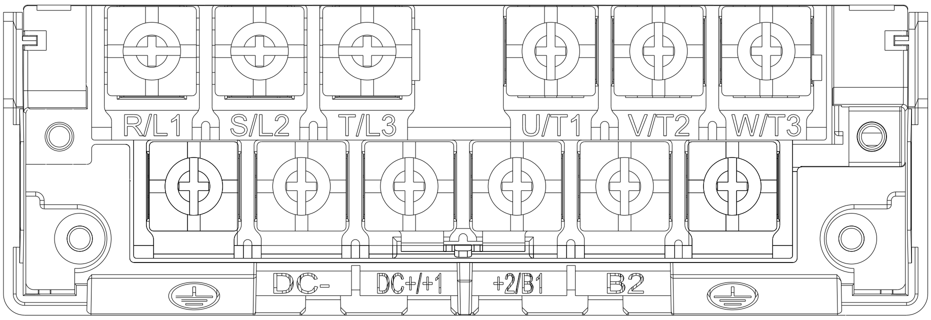


Figure 5-11

- If the installation is in an environment where the ambient temperature is above 50°C, use copper wire with a rated voltage of 600V and a temperature resistance of 90°C or above for wiring.
- If the installation is in an environment where the ambient temperature is 50°C, use copper wire with a rated voltage of 600V and a temperature resistance of 75°C or 90°C for wiring.
- For VFD25AME23ANNAA, VFD25AME23ANSAA models: If the installation is in an environment where the ambient temperature is above 45°C, use copper wire with a rated voltage of 600V and a temperature resistance of 90°C or above for wiring.
- To be UL installation compliant, you must use copper wires when installing. The wire gauge is based on a temperature resistance of 75°C, in accordance with UL requirements and recommendations. Do not reduce the wire gauge when using high-temperature resistant wires.

<table>
<tr><th rowspan="2">Models</th><th colspan="3">Main Circuit Terminals
R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, DC-, DC+/+1, +2/B1, B2</th><th colspan="3">Terminal
⏚</th></tr>
<tr><th>Max. Wire Gauge</th><th>Min. Wire Gauge</th><th>Torque (±10%)</th><th>Max. Wire Gauge</th><th>Min. Wire Gauge</th><th>Torque (±10%)</th></tr>
<tr><td>VFD25AME23ANNAA
VFD25AME23ANSAA</td><td rowspan="3">10 mm^2
(8 AWG)</td><td>10 mm^2
(8 AWG)</td><td rowspan="3">M4
20 Kg-cm
(17.4 lb-in.)
(1.96 Nm)</td><td>10 mm^2
(8 AWG)</td><td>10 mm^2
(8 AWG)</td><td rowspan="3">M4
20 Kg-cm
(17.4 lb-in.)
(1.96 Nm)</td></tr>
<tr><td>VFD13AME43ANNAA
VFD13AME43AFNAA
VFD13AME43ANSAA
VFD13AME43AFSAA</td><td>6 mm^2
(10 AWG)</td><td>6 mm^2
(10 AWG)</td><td>6 mm^2
(10 AWG)</td></tr>
<tr><td>VFD17AME43ANNAA
VFD17AME43AFNAA
VFD17AME43ANSAA
VFD17AME43AFSAA</td><td>10 mm^2
(8 AWG)</td><td>10 mm^2
(8 AWG)</td><td>10 mm^2
(8 AWG)</td></tr>
</table>

Table 5-6

Chapter 6 Control Circuit Terminals

CAUTION

Analog input terminals (AI, ACM)

☑ Analog input signals are easily affected by external noise. Use shielded wiring and keep it as short as possible (less than 20 m) with proper grounding. If the noise is inductive, connecting the shield to the ACM terminal can reduce interference.

☑ Use twisted-pair wire for weak analog signals.

☑ If the analog input signals are affected by noise from the AC motor drive, connect a capacitor and a ferrite core as shown the figure below.

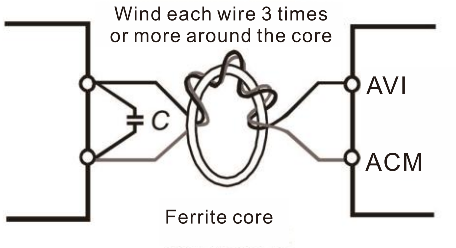


Figure 6-1

Contact input terminals (MI1–MI5, DCM, +24V$_{DC}$)

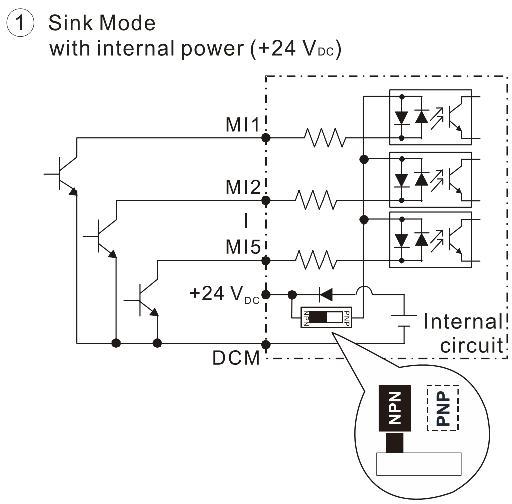


Figure 6-2

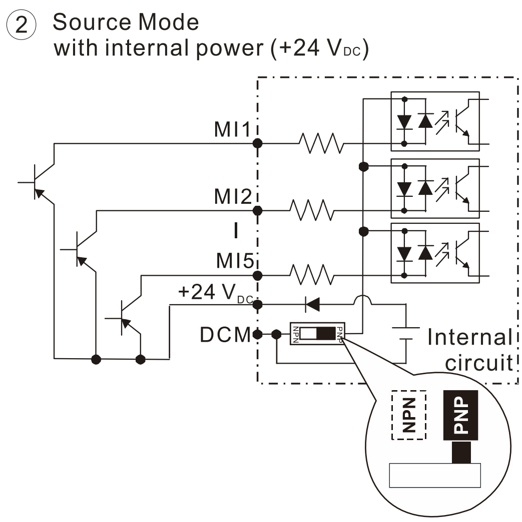


Figure 6-3

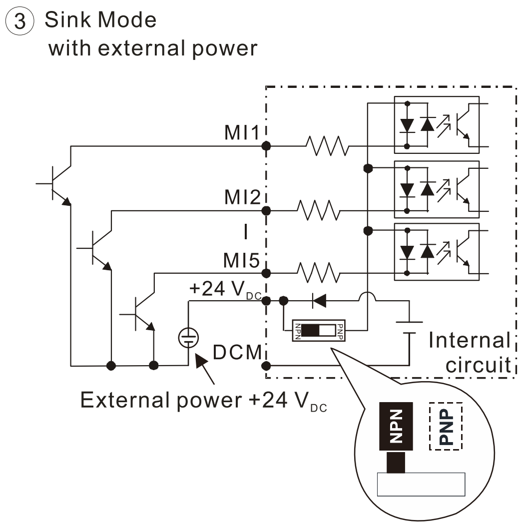


Figure 6-4

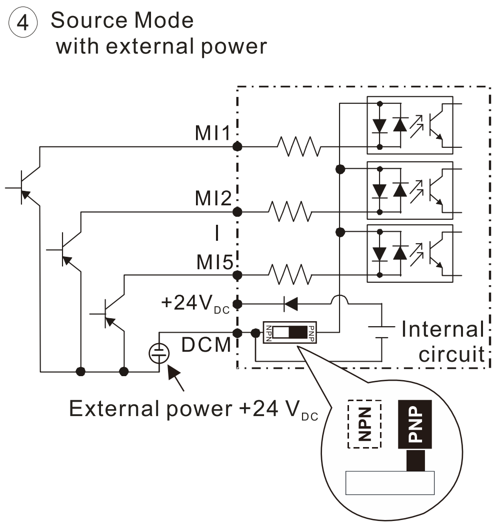


Figure 6-5

	☑ Use the internal power supply of the photocoupler, the terminal switches to NPN is wiring with 24V, and switches to PNP is wiring with DCM. ☑ It's Sink mode when the external transistor is NPN, and it's Source mode when the external transistor is PNP.
	Transistor output terminals (MO1, MCM)
	☑ Connect the digital outputs to the correct polarity. ☑ When connecting a relay to the digital outputs, connect a surge absorber across the coil and check the polarity.

6-1 Control Circuit Terminals

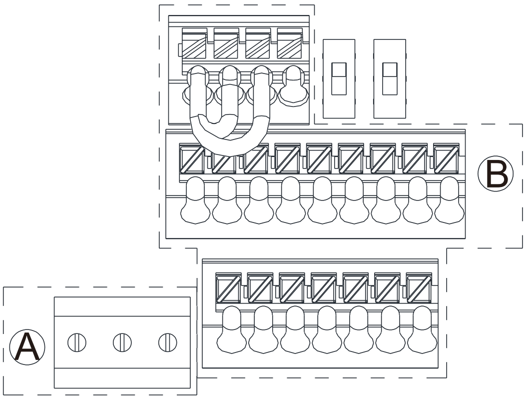


Figure 6-6 Control Circuit Terminal Distribution Diagram

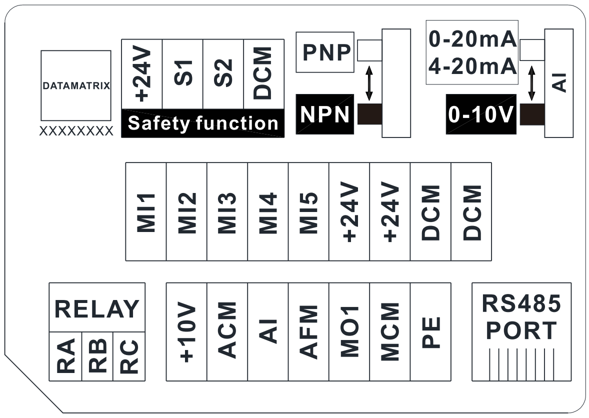


Figure 6-7 Control Circuit Terminal Location Diagram

Wiring precautions:

1. As box 1. and box 2. shown in the figure above, +24 V, S1, S2, and DCM are for built-in STO models only.
2. The default settings of +24V / S1 / S2 in built-in STO models (model: VFD_ _ _ME_ _A_ $\boxed{\text{S}}$ AA) are short-circuited (as shown in box 1. in the upper left figure).
3. The +24V terminal of the Safety function (as shown in box 1. and box 2.) is only used for STO wiring and cannot be used for other purposes.
4. RELAY terminals use screw-type terminal blocks (as area A shown in the figure above):
   - Tighten the wiring with a 2.5 mm width and 0.4 mm thickness slotted screwdriver.
   - The ideal length of stripped wire at the connection side is 9–10 mm.
   - When wiring bare wires, organize the wires neatly to be in the wiring hole.
5. Control circuit terminals use push-in type terminal blocks (as area B shown in the figure above):
   - When using solid wire wires and crimp terminals for wiring, insert the wires and terminals directly into the middle of the wiring holes without pressing down the terminal handle.
   - When using stranded wire, it is recommended to crimp the terminals first (according to the specifications in Table 6-2) and then insert them into the middle of the wiring hole directly without pressing down the terminal handle.
   - If stranded wires are wired directly without crimping terminal, use the slotted screwdriver to press down the terminal first, and then place the wires neatly in the middle of the wiring hole to prevent the wires from spreading.
   - When removing wires, use the slotted screwdriver to press down the terminal, and the suggested force is 1.5 kgf.
   - Slotted screwdriver: 2.5 mm width and 0.4 mm thickness
   - The ideal length of stripped wire at the connection side is 9 mm.

Wiring Specifications of Control Circuit Terminals:

Terminal Name	Wiring Specifications of Control Circuit Terminals:	Stripping Length (mm)	Max. Wire Gauge	Min. Wire Gauge	Torque (±10%)
RELAY Terminals	Solid wire	9–10	1.5mm² 16AWG	0.2mm² 24AWG	5 Kg-cm (4.3 lb-in.) (0.49 Nm)
	Stranded wire				
Control Circuit Terminals	Solid wire	9	0.75mm² 18AWG	0.2mm² 24AWG	
	Stranded wire				
	Crimping terminal	9	0.5mm² 20AWG		

Table 6-1

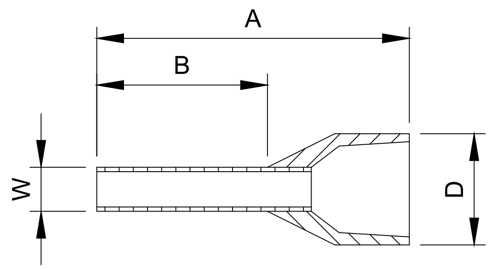


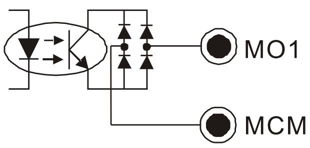
Figure 6-8

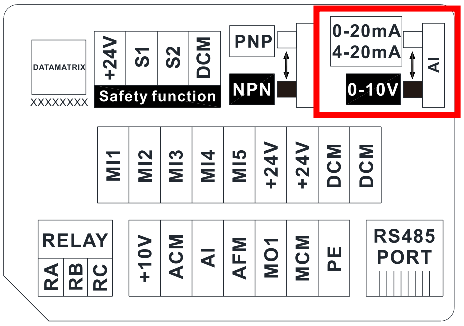
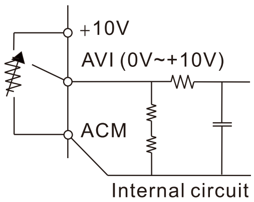
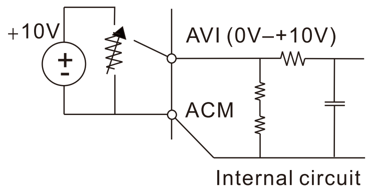
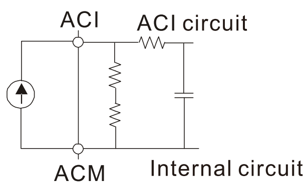
Recommended models and dimensions of crimp terminals Unit: mm

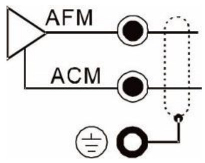
Wire Gauge	Manufacturer	Model Name	A (MAX)	B (MAX)	D (MAX)	W (MAX)
0.2mm² (24AWG)	PHOENIX CONTACT	AI 0,25- 8 YE	12.5	8	2.6	1.1
0.34mm² (22AWG)		AI 0,34- 8 TQ	12.5	8	3.3	1.3
0.5mm² (20AWG)		AI 0,5 - 8 WH	14	8	3.5	1.4
Recommended specifications and models for crimping tool: CRIMPFOX 10S - 1212045, Manufacturer: PHOENIX CONTACT DNT13-0101, Manufacturer: DINKLE						

Table 6-2

Terminal Name	Terminal function	Descriptions
+24V	Digital control signal common (Source)	+24 VDC ± 10 % 100 mA When +24V terminal is used in parallel, unequal current may occur if it equips with a feedback sensor, and there is a risk of failure.

Terminal Name	Terminal function	Descriptions
MI1 – MI5	Multi-function input 1–5	Refer to Pr.02-01–02-05 to program the multi-function inputs MI1–MI5. Source Mode ON: activation current 3.3 mA, and breakover voltage 11 V_{DC} OFF: cut-off voltage ≤ 5 V_{DC} Sink Mode ON: activation current 3.3 mA, and breakover voltage 13 V_{DC} OFF: cut-off voltage ≥ 19 V_{DC} ● When Pr.02-00 = 0, you can set multi-function options with multi-function input terminals MI1, MI2. ● When Pr.02-00 ≠ 0, the multi-function input terminals MI1, MI2 work in accordance with the setting values for Pr.02-00. ● MI5 uses pulse input, the maximum input frequency = 10 kHz. ● MI5 uses PWM pulse input, the maximum input frequency = 1 kHz.
MO1	Multi-function Output 1 (photo coupler)	The AC motor drive outputs various monitoring signals, such as drive in operation, frequency reached, and overload indication through a transistor (open collector). Max. 48 V_{DC} 50 mA  Figure 6-9
MCM	Multi-function Output Common (photocoupler)	
RA	Multi-function output (Relay N.O. a)	Resistive Load 3 A (N.O.) / 3 A (N.C.) 250 V_{AC} 5 A (N.O.) / 3 A (N.C.) 30 V_{DC} Inductive Load (COS 0.4) 1.2 A (N.O.) / 1.2 A (N.C.) 250 V_{AC} 2.0 A (N.O.) / 1.2 A (N.C.) 30 V_{DC} To output different kinds of monitoring signals such as motor drive in operation, frequency reached, and overload indication.
RB	Multi-function output (Relay N.C. b)	
RC	Multi-function relay common (Relay)	
+10V	Potentiometer power supply	Power supply for analog frequency setting: +10.5 ± 0.5 V_{DC} / 20 mA

Terminal Name	Terminal function	Descriptions
AI	Analog input	The default of AVI terminal is 0–10V voltage mode. If you want to use current mode, you must set the AVI switch to current mode (0–20 mA / 4–20 mA), and set parameter 03-28.  Figure 6-10 Voltage mode (AVI)   Figure 6-11 Figure 6-12 Impedance: 20 kΩ Range: 0–10 V = 0–maximum output frequency (Pr.01-00) Mode switching by setting Pr.03-28 AVI resolution=12 bits Current mode (ACI)  Figure 6-13 Impedance: 250 kΩ Range: 0–20 mA / 4–20 mA = 0–maximum output frequency (Pr.01-00) Mode switching by setting Pr.03-28 ACI resolution = 11 bits
AFM	Multi-function analog voltage output	Switch: the default of AFM is 0–10 V voltage mode Voltage mode

Terminal Name	Terminal function	Descriptions
		 Figure 6-14 Range: 0–10 V corresponds to the maximum operating range of the control target Maximum output current: 2 mA, Maximum load: 5 kΩ AFM resolution = 10 bits
ACM	Analog Signal Common	Analog signal common terminal
PE	RS-485 Grounding	Provide shielded network cable for grounding
RJ45	PIN 1, 2, 6: Reserved PIN 3, 7: GND2 PIN 4: SG- PIN 5: SG+ PIN 8: D+10 V (provide KPC-CC01 power supply)	

* Analog control signal wiring specification: 0.82 mm² (18 AWG) with shielded stranded wire.

Table 6-3

Chapter 7 Optional Accessories

The optional accessories listed in this chapter are available upon request. Installing additional accessories to your drive substantially improves the drive's performance. Select accessories according to your need or contact your local distributor for suggestions.

7-1 Brake Resistors and Brake Units Used in AC Motor Drives

115V single-phase

Model	Applicable Motor		125% Braking Torque / 10% ED *1						Max. Braking Torque		
	HP	kW	Braking Torque *2 (kg-m)	Resistor Value Spec. for Each AC Motor Drive	Brake Resistor for Each Brake Unit			Braking Current (A)	Min. Resistor Value (Ω)	Max. Total Braking Current (A)	Peak Power (kW)
					Part No.*3	Q'ty	Usage				
VFD0A8ME11ANNAA VFD0A8ME11ANSAA	0.13	0.1	0.1	80W 750Ω	BR080W750	1	-	0.5	237.5	1.6	0.6
VFD1A6ME11ANNAA VFD1A6ME11ANSAA	0.25	0.2	0.1	80W 750Ω	BR080W750	1	-	0.5	118.8	3.2	1.2
VFD2A5ME11ANNAA VFD2A5ME11ANSAA	0.5	0.4	0.3	80W 200Ω	BR080W200	1	-	1.9	76.0	5.0	1.9
VFD4A8ME11ANNAA VFD4A8ME11ANSAA	1	0.75	0.5	80W 200Ω	BR080W200	1	-	1.9	50.7	7.5	2.9

Table 7-1

230V single-phase

Model	Applicable Motor		125% Braking Torque / 10% ED*1						Max. Braking Torque		
	HP	kW	Braking Torque *2 (kg-m)	Resistor Value Spec. for Each AC Motor Drive	Brake Resistor for Each Brake Unit			Braking Current (A)	Min. Resistor Value (Ω)	Max. Total Braking Current (A)	Peak Power (kW)
					Part No.*3	Q'ty	Usage				
VFD0A8ME21ANNAA VFD0A8ME21AFNAA VFD0A8ME21ANSAA VFD0A8ME21AFSAA	0.13	0.1	0.1	80W 750Ω	BR080W750	1	-	0.5	237.5	1.6	0.6
VFD1A6ME21ANNAA VFD1A6ME21AFNAA VFD1A6ME21ANSAA VFD1A6ME21AFSAA	0.25	0.2	0.1	80W 750Ω	BR080W750	1	-	0.5	118.8	3.2	1.2
VFD2A8ME21ANNAA VFD2A8ME21AFNAA VFD2A8ME21ANSAA VFD2A8ME21AFSAA	0.5	0.4	0.3	80W 200Ω	BR080W200	1	-	1.9	67.9	5.6	2.1
VFD4A8ME21ANNAA VFD4A8ME21AFNAA VFD4A8ME21ANSAA VFD4A8ME21AFSAA	1	0.75	0.5	80W 200Ω	BR080W200	1	-	1.9	63.3	6.0	2.3
VFD7A5ME21ANNAA VFD7A5ME21AFNAA VFD7A5ME21ANSAA VFD7A5ME21AFSAA	2	1.5	1	200W 91Ω	BR200W091	1	-	4.2	38.0	10.0	3.8
VFD11AME21ANNAA VFD11AME21AFNAA VFD11AME21ANSAA VFD11AME21AFSAA	3	2.2	1.5	300W 70Ω	BR300W070	1	-	5.4	38.0	10.0	3.8

Table 7-2

230V three-phase

Model	Applicable Motor HP	Applicable Motor kW	125% Braking Torque / 10% ED*1 Braking Torque *2 (kg-m)	Resistor Value Spec. for Each AC Motor Drive	Brake Resistor for Each Brake Unit Part No.*3	Q'ty	Usage	Braking Current (A)	Max. Braking Torque Min. Resistor Value (Ω)	Max. Total Braking Current (A)	Peak Power (kW)
VFD0A8ME23ANNAA VFD0A8ME23ANSAA	0.13	0.1	0.1	80W 750Ω	BR080W750	1	-	0.5	237.5	1.6	0.6
VFD1A6ME23ANNAA VFD1A6ME23ANSAA	0.25	0.2	0.1	80W 750Ω	BR080W750	1	-	0.5	118.8	3.2	1.2
VFD2A8ME23ANNAA VFD2A8ME23ANSAA	0.5	0.4	0.3	80W 200Ω	BR080W200	1	-	1.9	67.9	5.6	2.1
VFD4A8ME23ANNAA VFD4A8ME23ANSAA	1	0.75	0.5	80W 200Ω	BR080W200	1	-	1.9	63.3	6.0	2.3
VFD7A5ME23ANNAA VFD7A5ME23ANSAA	2	1.5	1	200W 91Ω	BR200W091	1	-	4.2	63.3	6.0	2.3
VFD11AME23ANNAA VFD11AME23ANSAA	3	2.2	1.5	300W 70Ω	BR300W070	1	-	5.4	38.0	10.0	3.8
VFD17AME23ANNAA VFD17AME23ANSAA	5	3.7/4	2.5	400W 40Ω	BR400W040	1	-	9.5	19.0	20.0	7.6
VFD25AME23ANNAA VFD25AME23ANSAA	7.5	5.5	3.7	1000W 20Ω	BR1K0W020	1	-	19	16.5	23.0	8.7

Table 7-3

460V three-phase

Model	Applicable Motor HP	Applicable Motor kW	125% Braking Torque / 10% ED*1 Braking Torque *2 (kg-m)	Resistor Value Spec. for Each AC Motor Drive	Brake Resistor for Each Brake Unit Part No.*3	Q'ty	Usage	Braking Current (A)	Max. Braking Torque Min. Resistor Value (Ω)	Max. Total Braking Current (A)	Peak Power (kW)
VFD1A5ME43ANNAA VFD1A5ME43AFNAA VFD1A5ME43ANSAA VFD1A5ME43AFSAA	0.5	0.4	0.3	80W 750Ω	BR080W750	1	-	1	253.3	3.0	2.3
VFD2A7ME43ANNAA VFD2A7ME43AFNAA VFD2A7ME43ANSAA VFD2A7ME43AFSAA	1	0.75	0.5	80W 750Ω	BR080W750	1	-	1	140.7	5.4	4.1
VFD4A2ME43ANNAA VFD4A2ME43AFNAA VFD4A2ME43ANSAA VFD4A2ME43AFSAA	2	1.5	1	200W 360Ω	BR200W360	1	-	2.1	90.5	8.4	6.4
VFD5A5ME43ANNAA VFD5A5ME43AFNAA VFD5A5ME43ANSAA VFD5A5ME43AFSAA	3	2.2	1.5	300W 250Ω	BR300W250	1	-	3	76.0	10.0	7.6
VFD7A3ME43ANNAA VFD7A3ME43ANSAA VFD7A3ME43AFNAA VFD7A3ME43AFSAA	4	3	2	400W 150Ω	BR400W150	1	-	5.1	76.0	10.0	7.6
VFD09AME43ANNAA VFD09AME43AFNAA VFD09AME43ANSAA VFD09AME43AFSAA	5	3.7/4	2.5	400W 150Ω	BR400W150	1	-	5.1	69.1	11.0	8.4
VFD13AME43ANNAA VFD13AME43AFNAA VFD13AME43ANSAA VFD13AME43AFSAA	7.5	5.5	3.7	1000W 75Ω	BR1K0W075	1	-	10.2	50.7	15.0	11.4

VFD17AME43ANNAA VFD17AME43AFNAA VFD17AME43ANSAA VFD17AME43AFSAA	10	7.5	5.1	1000W 75Ω	BR1K0W075	1	-	10.2	40.0	19.0	14.4

Table 7-4

*1: Calculation for 125 % brake torque: (kW) x 125% x 0.8; where 0.8 is motor efficiency.
Because of the limited resistor power, the longest operation time for 10% ED is 10 seconds (ON: 10 sec. / OFF: 90 sec.).

*2 The calculation of the brake resistor is based on a four-pole motor (1800 rpm).

*3 For heat dissipation, a resistor of 400 W or lower should be fixed to the frame and maintain the surface temperature below 250°C; a resistor of 1000 W and above should maintain the surface temperature below 350°C. (If the surface temperature is higher than the temperature limit, install extra cooling or increase the size of the resistor.)

NOTE:

1. Specification and Appearance of Brake Resistors

1.1 Wire wound resistors: For 1000 W and above, refer to the following appearance of wire wound resistor (Figure7-1) and its model and specification comparison table (Table 7-5) for details.

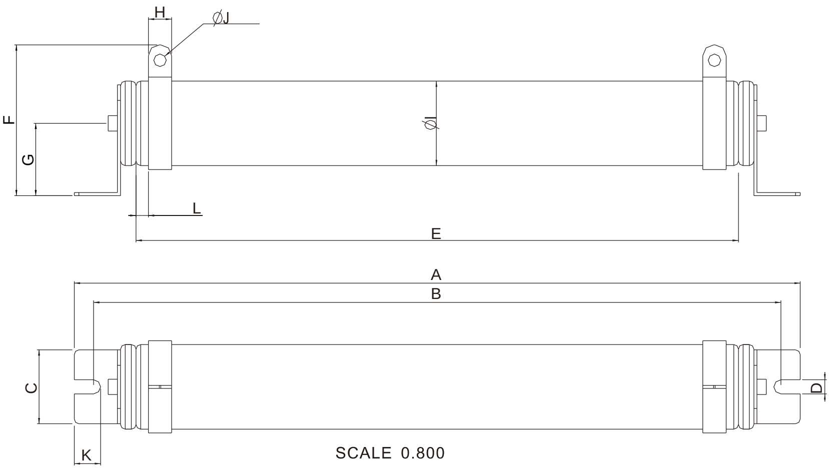


Figure 7-1

Models and Specifications Comparison Table of Wire Wound Resistors: Unit: mm

<table>
<tr><th>Models</th><th>A</th><th>B</th><th>C</th><th>D</th><th>E</th><th>F</th><th>G</th><th>H</th><th>Ø</th><th>ØJ</th><th>K</th><th>L</th></tr>
<tr><td>BR1K0W4P3</td><td rowspan="11">470±10</td><td rowspan="11">445±5</td><td rowspan="11">48±0.2</td><td rowspan="11">9.1±0.1</td><td rowspan="11">390±3</td><td rowspan="11">98±5</td><td rowspan="11">47±5</td><td rowspan="11">15±1</td><td rowspan="11">55±5</td><td rowspan="11">8.1±0.1</td><td rowspan="11">21±0.2</td><td rowspan="11">8±1</td></tr>
<tr><td>BR1K0W5P1</td></tr>
<tr><td>BR1K0W016</td></tr>
<tr><td>BR1K0W020</td></tr>
<tr><td>BR1K0W075</td></tr>
<tr><td>BR1K2W3P9</td></tr>
<tr><td>BR1K2W015</td></tr>
<tr><td>BR1K5W3P3</td></tr>
<tr><td>BR1K5W012</td></tr>
<tr><td>BR1K5W013</td></tr>
<tr><td>BR1K5W043</td></tr>
</table>

Table 7-5

1.2 Aluminum housed resistors: For below 1000 W, refer to the following appearance of aluminum-housed resistor (Figure 7-2) and its model and specification comparison table (Table 7-6) for details

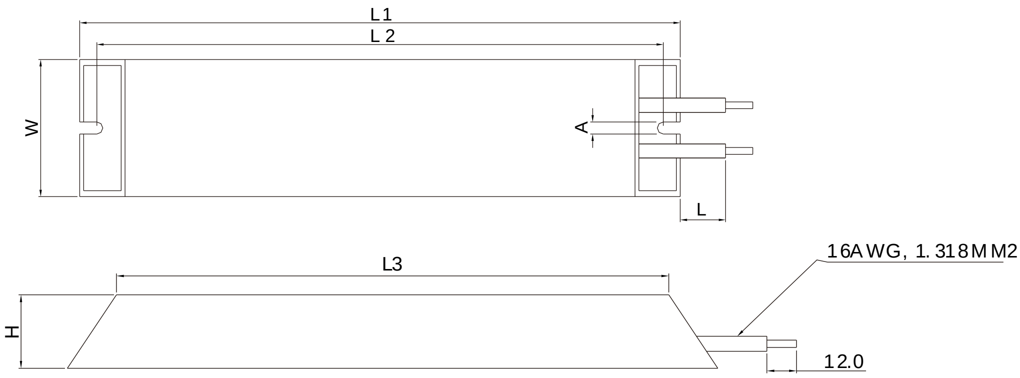


Figure 7-2

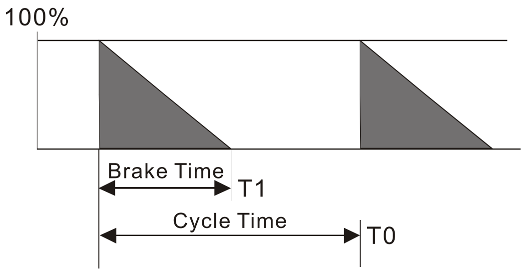
Unit: mm

<table>
<tr><th>Models</th><th>L1</th><th>L2</th><th>L3</th><th>W</th><th>H</th><th>A</th><th>L</th></tr>
<tr><td>BR080W200</td><td rowspan="2">140±2</td><td rowspan="2">125±2</td><td rowspan="2">100±1</td><td rowspan="2">40±0.5</td><td rowspan="2">20±0.5</td><td rowspan="8">5.3±0.5</td><td rowspan="8">200±20</td></tr>
<tr><td>BR080W750</td></tr>
<tr><td>BR200W091</td><td rowspan="2">165±2</td><td rowspan="2">150±2</td><td rowspan="2">125±1</td><td rowspan="6">60±0.5</td><td rowspan="6">30±0.5</td></tr>
<tr><td>BR200W360</td></tr>
<tr><td>BR300W070</td><td rowspan="2">215±2</td><td rowspan="2">200±2</td><td rowspan="2">175±1</td></tr>
<tr><td>BR300W250</td></tr>
<tr><td>BR400W040</td><td rowspan="2">265±2</td><td rowspan="2">250±2</td><td rowspan="2">225±1</td></tr>
<tr><td>BR400W150</td></tr>
</table>

Table 7-6

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

Definition for Brake Usage ED%

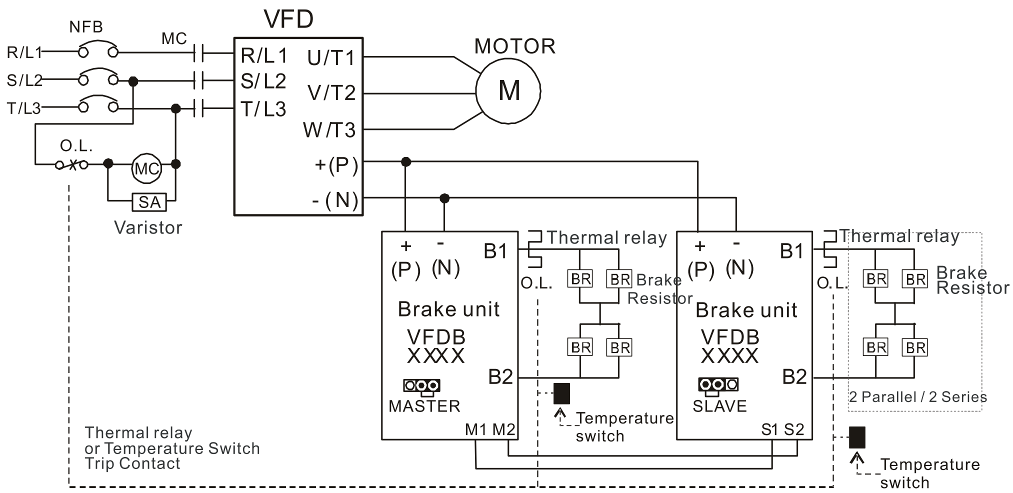


ED% = T1/T0 x 100 (%)

Explanation: Brake usage ED (%) is the amount of time needed for the brake unit and brake resistor to dissipate heat generated by braking. When the brake resistor heats up, the resistance increases with temperature, and braking torque decreases accordingly.

Figure 7-3

For safety, install a thermal overload relay (O.L) 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, brake unit and drive. NOTE: Never use it to disconnect the brake resistor.



- When AC Drive is equipped with a DC reactor, please read user manual for the correct wiring for the brake unit input circuit +(P).
- DO NOT connect input circuit -(N) to the neutral point of the power system.

Figure 7-4

3. 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.
4. Consider environmental safety factors when installing the brake resistors. If you use the minimum resistance value, consult local dealers for the power calculation.
5. When using more than two brake units, the equivalent resistor value of the parallel brake unit cannot be less than the value in the column “Min. Resistor Value (Ω)”. Install the brake unit vertically and leaves appropriate heat dissipation spaced on the top and the bottom of the brake unit. Visit the following links to get the instruction sheets for the wiring in the brake unit:
   - VFDB2015 / 2022 / 4030 / 4045 / 5055
     https://downloadcenter.deltaww.com/downloadCenterCounter.aspx?DID=47611&DocPath=1&hl=en-US
   - VFDB4110 / 4160 / 4185 Braking
     https://downloadcenter.deltaww.com/downloadCenterCounter.aspx?DID=47614&DocPath=1&hl=en-US
   - VFDB6055 / 6110 / 6160 / 6200
     https://downloadcenter.deltaww.com/downloadCenterCounter.aspx?DID=8592&DocPath=1&hl=en-US

6. The selection tables are for normal usage. If the AC motor drive requires frequent braking, increase the Watts by two to three times.
7. Thermal Overload Relay (TOR):

Thermal overload relay selection is based on its overload capacity. A standard braking capacity of the ME300 is 10% ED (Tripping time=10 s). As shown in the graph below, a 460V, 7.5 kW ME300 requires the thermal relay to take 260% overload capacity for 10 seconds (hot starting) and the braking current is 10.2 A. In this case, select a thermal overload relay rated at 5 A (5 × 260% = 13A > 10.2A). The property of each thermal relay may vary among different manufacturers. Carefully read the specification before using it.

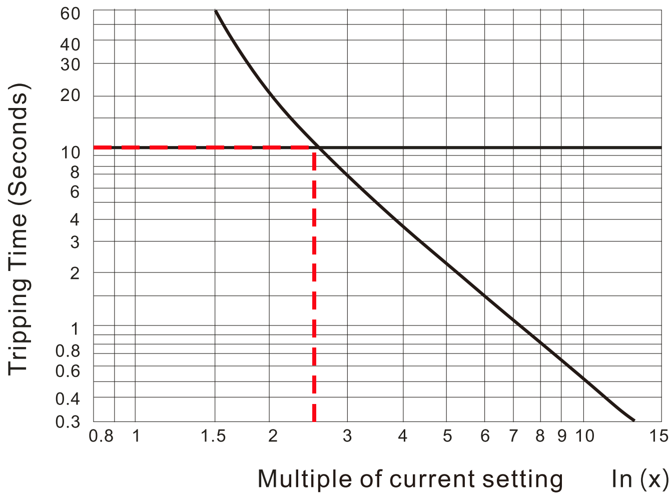


Figure 7-5

7-2 Magnetic Contactor / Air Circuit Breaker and Non-fuse Circuit Breaker

Magnetic Contactor (MC) and Air Circuit Breaker (ACB)

It is recommended the surrounding temperature for MC should be ≥ 60°C and that for ACB should be ≥ 50°C. In the meanwhile, consider temperature derating for components with ON / OFF switch in accordance with the ambient temperature of the on-site distribution panel.

115V Models

Frame	Model	Heavy duty output current [A]	Heavy duty input current [A]	Selection of MC / ACB [A]
A	VFD0A8ME11ANNAA VFD0A8ME11ANSAA	0.8	3	9
	VFD1A6ME11ANNAA VFD1A6ME11ANSAA	1.6	6	11
	VFD2A5ME11ANNAA VFD2A5ME11ANSAA	2.5	9.4	18
C	VFD4A8ME11ANNAA VFD4A8ME11ANSAA	4.8	18	32

Table 7-7

230V Models

Frame	Model	Heavy duty output current [A]	Heavy duty input current [A]	Selection of MC / ACB [A]
A	VFD0A8ME21ANNAA VFD0A8ME21ANSAA	0.8	2.6	9
	VFD1A6ME21ANNAA VFD1A6ME21ANSAA	1.6	5.1	9
	VFD2A8ME21ANNAA VFD2A8ME21ANSAA	2.8	7.3	13
	VFD0A8ME23ANNAA VFD0A8ME23ANSAA	0.8	0.95	9
	VFD1A6ME23ANNAA VFD1A6ME23ANSAA	1.6	1.9	9
	VFD2A8ME23ANNAA VFD2A8ME23ANSAA	2.8	3.4	9
	VFD4A8ME23ANNAA VFD4A8ME23ANSAA	4.8	5.8	9
B	VFD0A8ME21AFNAA VFD0A8ME21AFSAA	0.8	2.6	9
	VFD1A6ME21AFNAA VFD1A6ME21AFSAA	1.6	5.1	9
	VFD2A8ME21AFNAA VFD2A8ME21AFSAA	2.8	7.3	13
	VFD4A8ME21AFNAA VFD4A8ME21ANNAA VFD4A8ME21AFSAA VFD4A8ME21ANSAA	4.8	10.8	18
	VFD7A5ME23ANNAA VFD7A5ME23ANSAA	7.5	9	18
C	VFD7A5ME21ANNAA VFD7A5ME21AFNAA VFD7A5ME21ANSAA VFD7A5ME21AFSAA	7.5	16.5	32

Frame	Model	Heavy duty output current [A]	Heavy duty input current [A]	Selection of MC / ACB [A]
C	VFD11AME21ANNAA VFD11AME21AFNAA VFD11AME21ANSAA VFD11AME21AFSAA	11	24.2	40
	VFD11AME23ANNAA VFD11AME23ANSAA	11	13.2	22
	VFD17AME23ANNAA VFD17AME23ANSAA	17	20.4	32
D	VFD25AME23ANNAA VFD25AME23ANSAA	25	30	55

Table 7-8

460V Models

Frame	Model	Heavy duty output current [A]	Heavy duty input current [A]	Selection of MC / ACB [A]
A	VFD1A5ME43ANNAA VFD1A5ME43ANSAA	1.5	2.1	7
	VFD2A7ME43ANNAA VFD2A7ME43ANSAA	2.7	3.7	7
B	VFD1A5ME43AFNAA VFD1A5ME43AFSAA	1.5	2.1	7
	VFD2A7ME43AFNAA VFD2A7ME43AFSAA	2.7	3.7	7
	VFD4A2ME43ANNAA VFD4A2ME43AFNAA VFD4A2ME43ANSAA VFD4A2ME43AFSAA	4.2	5.8	9
C	VFD5A5ME43ANNAA VFD5A5ME43AFNAA VFD5A5ME43ANSAA VFD5A5ME43AFSAA	5.5	6.1	12
	VFD7A3ME43ANNAA VFD7A3ME43AFNAA VFD7A3ME43ANSAA VFD7A3ME43AFSAA	7.3	8.1	18
	VFD9A0ME43ANNAA VFD9A0ME43AFNAA VFD9A0ME43ANSAA VFD9A0ME43AFSAA	9	9.9	18
D	VFD13AME43ANNAA VFD13AME43AFNAA VFD13AME43ANSAA VFD13AME43AFSAA	13	14.3	32
	VFD17AME43ANNAA VFD17AME43AFNAA VFD17AME43ANSAA VFD17AME43AFSAA	17	18.7	40

Table 7-9

Non-fuse Circuit Breaker

The rated current of the non-fuse circuit breaker should be 1.6–2.6 times the drive's rated input current. The recommended current values are shown in the table below.

Compare the time characteristics of the non-fuse circuit breaker with those of the drive's overheated protection to ensure that there is no tripping.

Models	Voltage / Single-phase (Three-phase)	Breaker Rated Input Recommended Current [A]
		Heavy duty
VFD0A8ME11ANNAA VFD0A8ME11ANSAA	115V / Single-phase	20
VFD1A6ME11ANNAA VFD1A6ME11ANSAA		20
VFD2A5ME11ANNAA VFD2A5ME11ANSAA		25
VFD4A8ME11ANNAA VFD4A8ME11ANSAA		50
VFD0A8ME21ANNAA VFD0A8ME21AFNAA VFD0A8ME21ANSAA VFD0A8ME21AFSAA	230V / Single-phase	15
VFD1A6ME21ANNAA VFD1A6ME21AFNAA VFD1A6ME21ANSAA VFD1A6ME21AFSAA		15
VFD2A8ME21ANNAA VFD2A8ME21AFNAA VFD2A8ME21ANSAA VFD2A8ME21AFSAA		20
VFD4A8ME21ANNAA VFD4A8ME21AFNAA VFD4A8ME21ANSAA VFD4A8ME21AFSAA		30
VFD7A5ME21ANNAA VFD7A5ME21AFNAA VFD7A5ME21ANSAA VFD7A5ME21AFSAA		45
VFD11AME21ANNAA VFD11AME21AFNAA VFD11AME21ANSAA VFD11AME21AFSAA		70
VFD0A8ME23ANNAA VFD0A8ME23ANSAA	230V / Three-phase	15
VFD1A6ME23ANNAA VFD1A6ME23ANSAA		15
VFD2A8ME23ANNAA VFD2A8ME23ANSAA		15
VFD4A8ME23ANNAA VFD4A8ME23ANSAA		15
VFD7A5ME23ANNAA VFD7A5ME23ANSAA		25

Models	Voltage / Single-phase (Three-phase)	Breaker Rated Input Recommended Current [A]
		Heavy duty
VFD11AME23ANNAA VFD11AME23ANSAA	230V / Three-phase	40
VFD17AME23ANNAA VFD17AME23ANSAA		60
VFD25AME23ANNAA VFD25AME23ANSAA		63
VFD1A5ME43ANNAA VFD1A5ME43AFNAA VFD1A5ME43ANSAA VFD1A5ME43AFSAA	460V / Three-phase	15
VFD2A7ME43ANNAA VFD2A7ME43AFNAA VFD2A7ME43ANSAA VFD2A7ME43AFSAA		15
VFD4A2ME43ANNAA VFD4A2ME43AFNAA VFD4A2ME43ANSAA VFD4A2ME43AFSAA		15
VFD5A5ME43ANNAA VFD5A5ME43AFNAA VFD5A5ME43ANSAA VFD5A5ME43AFSAA		20
VFD7A3ME43ANNAA VFD7A3ME43ANSAA VFD7A3ME43AFNAA VFD7A3ME43AFSAA		25
VFD9A0ME43ANNAA VFD9A0ME43AFNAA VFD9A0ME43ANSAA VFD9A0ME43AFSAA		30
VFD13AME43ANNAA VFD13AME43AFNAA VFD13AME43ANSAA VFD13AME43AFSAA		32
VFD17AME43ANNAA VFD17AME43AFNAA VFD17AME43ANSAA VFD17AME43AFSAA		45

Table 7-10

7-3 Fuse Specification Chart

☑ Fuse specifications lower than the table below are allowed.

☑ UL certified fuses apply to the short-circuit protection at the input side. For the installation in the United States, the branch circuit protection must be provided in accordance with the National Electrical Code (NEC) and any applicable local codes. Use UL certified fuses to fulfill this requirement.

☑ For the installation in Canada, branch circuit protection must be provided in accordance with Canadian Electrical Code and any applicable provincial codes. Use UL certified fuses to fulfill this requirement.

Models	Voltage / Single-phase (Three-phase)	Branch Circuit Fuses Specification (600 V_{AC})	
		Output Current (A)	P/N
VFD0A8ME11ANNAA VFD0A8ME11ANSAA	115V / Single-phase	7.2	Class T JJS-10
VFD1A6ME11ANNAA VFD1A6ME11ANSAA		7.2	Class T JJS-10
VFD2A5ME11ANNAA VFD2A5ME11ANSAA		10.8	Class T JJS-10
VFD4A8ME11ANNAA VFD4A8ME11ANSAA		22	Class T JJS-25
VFD0A8ME21ANNAA VFD0A8ME21AFNAA VFD0A8ME21ANSAA VFD0A8ME21AFSAA	230V / Single-phase	7.2	Class T JJS-10
VFD1A6ME21ANNAA VFD1A6ME21AFNAA VFD1A6ME21ANSAA VFD1A6ME21AFSAA		7.2	Class T JJS-10
VFD2A8ME21ANNAA VFD2A8ME21AFNAA VFD2A8ME21ANSAA VFD2A8ME21AFNAA		12.8	Class T JJS-15
VFD4A8ME21ANNAA VFD4A8ME21AFNAA VFD4A8ME21ANSAA VFD4A8ME21AFSAA		20	Class T JJS-20
VFD7A5ME21ANNAA VFD7A5ME21AFNAA VFD7A5ME21ANSAA VFD7A5ME21AFSAA		34	Class T JJS-35
VFD11AME21ANNAA VFD11AME21AFNAA VFD11AME21ANSAA VFD11AME21AFSAA		50	Class T JJS-50
VFD0A8ME23ANNAA VFD0A8ME23ANSAA	230V / Three-phase	7.2	Class T JJS-10
VFD1A6ME23ANNAA VFD1A6ME23ANSAA		7.2	Class T JJS-10

Models	Voltage / Single-phase (Three-phase)	Branch Circuit Fuses Specification (600 V_{AC})	
		Output Current (A)	P/N
VFD2A8ME23ANNAA VFD2A8ME23ANSAA		12.8	Class T JJS-15
VFD4A8ME23ANNAA VFD4A8ME23ANSAA	230V / Three-phase	20	Class T JJS-20
VFD7A5ME23ANNAA VFD7A5ME23ANSAA		32	Class T JJS-35
VFD11AME23ANNAA VFD11AME23ANSAA		50	Class T JJS-50
VFD17AME23ANNAA VFD17AME23ANSAA		78	Class T JJS-80
VFD25AME23ANNAA VFD25AME23ANSAA		59.4	Class T JJS-60
VFD1A5ME43ANNAA VFD1A5ME43AFNAA VFD1A5ME43ANSAA VFD1A5ME43AFSAA	460V / Three-phase	7.2	Class T JJS-10
VFD2A7ME43ANNAA VFD2A7ME43AFNAA VFD2A7ME43ANSAA VFD2A7ME43AFSAA		12	Class T JJS-15
VFD4A2ME43ANNAA VFD4A2ME43AFNAA VFD4A2ME43ANSAA VFD4A2ME43AFSAA		18.4	Class T JJS-20
VFD5A5ME43ANNAA VFD5A5ME43AFNAA VFD5A5ME43ANSAA VFD5A5ME43AFSAA		26	Class T JJS-25
VFD7A3ME43ANNAA VFD7A3ME43ANSAA VFD7A3ME43AFNAA VFD7A3ME43AFSAA		35	Class T JJS-35
VFD9A0ME43ANNAA VFD9A0ME43AFNAA VFD9A0ME43ANSAA VFD9A0ME43AFSAA		42	Class T JJS-45
VFD13AME43ANNAA VFD13AME43AFNAA VFD13AME43ANSAA VFD13AME43AFSAA		34.54	Class T JJS-35
VFD17AME43ANNAA VFD17AME43AFNAA VFD17AME43ANSAA VFD17AME43AFSAA		45.1	Class T JJS-45

Table 7-11

7-4 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 from the mains power, further protecting the drive. For example, when the main power capacity is higher than 500 kVA, or when using a phase-compensation capacitor, momentary 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.

Install an AC input reactor in series between the mains power and the three input phases R S T, as shown in the figure below:

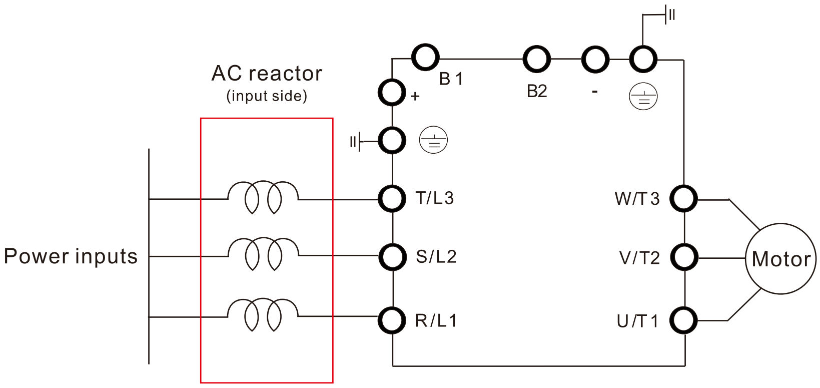


Figure 7-6

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 increases the high-frequency impedance to reduce the dv / dt and terminal voltage to protect the motor. Install an AC output reactor in series between the three output phases U V W and the motor, as shown in the figure below:

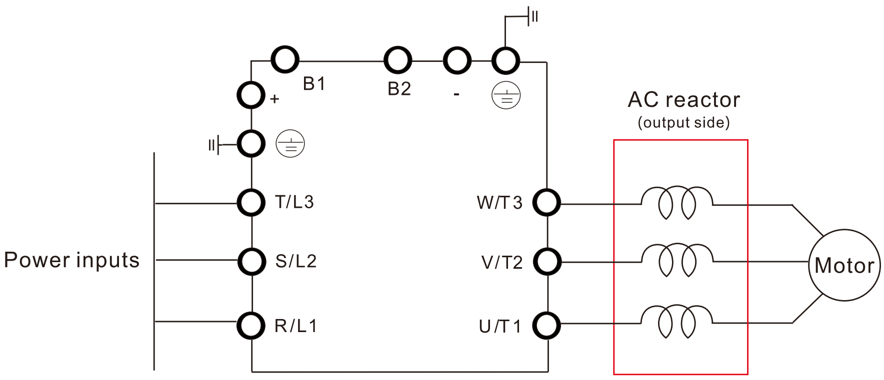


Figure 7-7

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).

Install a DC reactor between terminals +1 and +2. Remove the jumper before installing a DC reactor. See the figure below:

NOTE: 115V models have no DC choke.

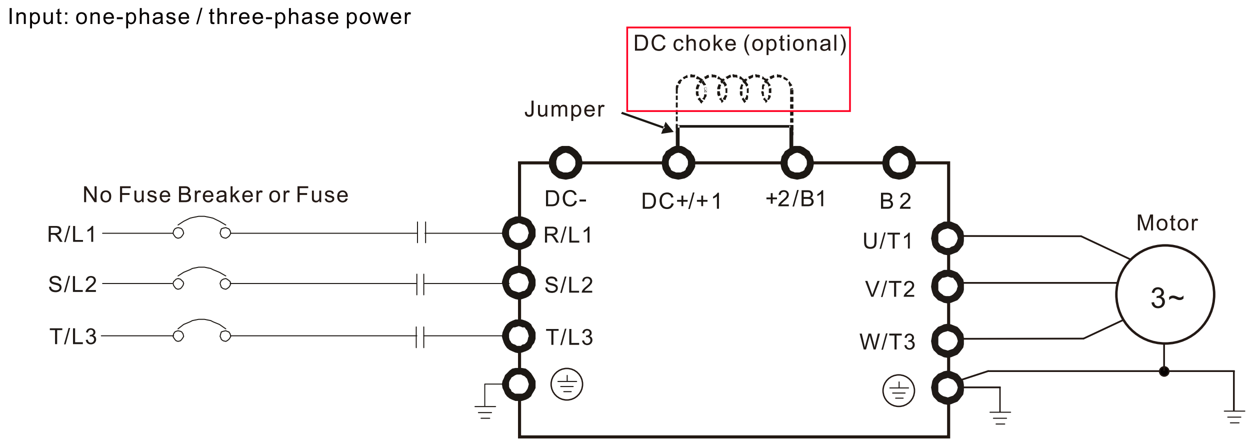


Figure 7-8

Applicable Reactors

115V, 50–60 Hz / Single-phase - Normal Duty

Models	Rated current [Arms]	Saturation Current [Arms]	Input / DC Reactor [mH]	AC Input / DC Reactor		Output Reactor [mH]	AC Output Reactor	
				Delta Part #	Weight [kg]		Delta Part #	Weight [kg]
VFD1A6ME11ANNAA VFD1A6ME11ANSAA	1.8	2.7	3.66	DR008D0366	0.8	2.54	DR005L0254	1.5
VFD2A5ME11ANNAA VFD2A5ME11ANSAA	2.7	4.05	2.66	DR011D0266	1.2	2.54	DR005L0254	1.5
VFD4A8ME11ANNAA VFD4A8ME11ANSAA	5.5	8.25	1.17	DR025D0117	2.8	1.59	DR008L0159	2.5

Table 7-12

115V, 50–60 Hz / Single-phase - Heavy Duty

Models	Rated current [Arms]	Saturation Current [Arms]	Input / DC Reactor [mH]	AC Input / DC Reactor		Output Reactor [mH]	AC Output Reactor	
				Delta Part #	Weight [kg]		Delta Part #	Weight [kg]
VFD1A6ME11ANSAA VFD1A6ME11ENSAA	1.6	3.2	3.66	DR008D0366	0.8	2.54	DR005L0254	1.5
VFD2A5ME11ANSAA VFD2A5ME11ENSAA	2.5	5	2.66	DR011D0266	1.2	2.54	DR005L0254	1.5
VFD4A8ME11ANSAA VFD4A8ME11ENSAA	5	9.6	1.17	DR025D0117	2.8	2.54	DR005L0254	1.5

Table 7-13

230V, 50–60 Hz / Single-phase - Normal Duty

Models	Rated current [Arms]	Saturation Current [Arms]	Input / DC Reactor [mH]	AC Input / DC Reactor		Output Reactor [mH]	AC Output Reactor	
				Delta Part #	Weight [kg]		Delta Part #	Weight [kg]
VFD0A8ME21ANNAA VFD0A8ME21AFNAA VFD0A8ME21ANSAA VFD0A8ME21AFSAA	1	1.5	5.857	DR005D0585	0.8	2.54	DR005L0254	1.5
VFD1A6ME21ANNAA VFD1A6ME21AFNAA VFD1A6ME21ANSAA VFD1A6ME21AFSAA	1.8	2.7	5.857	DR005D0585	0.8	2.54	DR005L0254	1.5
VFD2A8ME21ANNAA VFD2A8ME21AFNAA VFD2A8ME21ANSAA VFD2A8ME21AFSAA	3.2	4.8	3.66	DR008D0366	0.8	2.54	DR005L0254	1.5
VFD4A8ME21ANNAA VFD4A8ME21AFNAA VFD4A8ME21ANSAA VFD4A8ME21AFSAA	5	7.5	2.66	DR011D0266	1.2	2.54	DR005L0254	1.5
VFD7A5ME21ANNAA VFD7A5ME21AFNAA VFD7A5ME21ANSAA VFD7A5ME21AFSAA	8.5	12.75	1.72	DR017D0172	1.9	1.15	DR011L0115	3.0
VFD11AME21ANNAA VFD11AME21AFNAA VFD11AME21ANSAA VFD11AME21AFSAA	12.5	18.75	1.17	DR025D0117	2.8	0.746	DR017LP746	3.6

Table 7-14

230V, 50–60 Hz / Single-phase - Heavy Duty

Models	Rated current [Arms]	Saturation Current [Arms]	Input / DC Reactor [mH]	AC Input / DC Reactor		Output Reactor [mH]	AC Output Reactor	
				Delta Part #	Weight [kg]		Delta Part #	Weight [kg]
VFD0A8ME21ANNAA VFD0A8ME21AFNAA VFD0A8ME21ANSAA VFD0A8ME21AFSAA	0.8	1.6	5.857	DR005D0585	0.8	2.54	DR005L0254	1.5
VFD1A6ME21ANNAA VFD1A6ME21AFNAA VFD1A6ME21ANSAA VFD1A6ME21AFSAA	1.6	3.2	5.857	DR005D0585	0.8	2.54	DR005L0254	1.5
VFD2A8ME21ANNAA VFD2A8ME21AFNAA VFD2A8ME21ANSAA VFD2A8ME21AFSAA	2.8	5.6	3.66	DR008D0366	0.8	2.54	DR005L0254	1.5
VFD4A8ME21ANNAA VFD4A8ME21AFNAA VFD4A8ME21ANSAA VFD4A8ME21AFSAA	4.8	9.6	2.66	DR011D0266	1.2	2.54	DR005L0254	1.5
VFD7A5ME21ANNAA VFD7A5ME21AFNAA VFD7A5ME21ANSAA VFD7A5ME21AFSAA	7.5	15	1.72	DR017D0172	1.9	1.59	DR008L0159	2.5
VFD11AME21ANNAA VFD11AME21AFNAA VFD11AME21ANSAA VFD11AME21AFSAA	11	22	1.17	DR025D0117	2.8	1.15	DR011L0115	3.0

Table 7-15

230V, 50–60 Hz / Three-phase - Normal Duty

Models	Rated current [Arms]	Saturation Current [Arms]	Input / Output Reactor [mH]	AC Input Reactor		AC Output Reactor		DC Reactor [mH]	DC Reactor Delta Part #
				Delta Part #	Weight [kg]	Delta Part #	Weight [kg]		
VFD0A8ME23ANNAA VFD0A8ME23ANSAA	1	1.5	2.536	DR005A0254	1.2	DR005L0254	1.5	5.857	DR005D0585
VFD1A6ME23ANNAA VFD1A6ME23ANSAA	1.8	2.7	2.536	DR005A0254	1.2	DR005L0254	1.5	5.857	DR005D0585
VFD2A8ME23ANNAA VFD2A8ME23ANSAA	3.2	4.8	2.536	DR005A0254	1.2	DR005L0254	1.5	5.857	DR005D0585
VFD4A8ME23ANNAA VFD4A8ME23ANSAA	5	7.5	2.536	DR005A0254	1.2	DR005L0254	1.5	5.857	DR005D0585
VFD7A5ME23ANNAA VFD7A5ME23ANSAA	8	12	1.585	DR008A0159	1.7	DR008L0159	2.5	3.66	DR008D0366
VFD11AME23ANNAA VFD11AME23ANSAA	12.5	18.75	0.746	DR017AP746	3.2	DR017LP746	3.6	2.662	DR011D0266
VFD17AME23ANNAA VFD17AME23ANSAA	19.5	29.25	0.507	DR025AP507	3.8	DR025LP507	5.5	1.722	DR017D0172
VFD25AME23ANNAA VFD25AME23ANSAA	27	40.5	0.32	DR033AP320	4.5	DR033LP320	6.5	1.172	DR025D0117

Table 7-16

230V, 50–60 Hz / Three-phase - Heavy Duty

Models	Rated current [Arms]	Saturation Current [Arms]	Input / Output Reactor [mH]	AC Input Reactor		AC Output Reactor		DC Reactor [mH]	DC Reactor Delta Part #
				Delta Part #	Weight [kg]	Delta Part #	Weight [kg]		
VFD0A8ME23ANNAA VFD0A8ME23ANSAA	0.8	1.6	2.536	DR005A0254	1.2	DR005L0254	1.5	5.857	DR005D0585
VFD1A6ME23ANNAA VFD1A6ME23ANSAA	1.6	3.2	2.536	DR005A0254	1.2	DR005L0254	1.5	5.857	DR005D0585
VFD2A8ME23ANNAA VFD2A8ME23ANSAA	2.8	5.6	2.536	DR005A0254	1.2	DR005L0254	1.5	5.857	DR005D0585
VFD4A8ME23ANNAA VFD4A8ME23ANSAA	4.8	9.6	2.536	DR005A0254	1.2	DR005L0254	1.5	5.857	DR005D0585
VFD7A5ME23ANNAA VFD7A5ME23ANSAA	7.5	15	1.585	DR008A0159	1.7	DR008L0159	2.5	3.66	DR008D0366
VFD11AME23ANNAA VFD11AME23ANSAA	11	22	1.152	DR011A0115	2.5	DR011L0115	3.0	2.662	DR011D0266
VFD17AME23ANNAA VFD17AME23ANSAA	17	34	0.746	DR017AP746	3.2	DR017LP746	3.6	1.722	DR017D0172
VFD25AME23ANNAA VFD25AME23ANSAA	25	50	0.507	DR025AP507	3.8	DR025LP507	5.5	1.172	DR025D0117

Table 7-17

460V, 50–60 Hz / Three-phase - Normal Duty

Models	Rated current [Arms]	Saturation Current [Arms]	Input / Output Reactor [mH]	AC Input Reactor		AC Output Reactor		DC Reactor [mH]	DC Reactor Delta Part #
				Delta Part #	Weight [kg]	Delta Part #	Weight [kg]		
VFD1A5ME43ANNAA VFD1A5ME43AFNAA VFD1A5ME43ANSAA VFD1A5ME43AFSAA	1.8	2.7	8.102	DR003A0810	1.5	DR003L0810	1.5	18.709	DR003D1870
VFD2A7ME43ANNAA VFD2A7ME43AFNAA VFD2A7ME43ANSAA VFD2A7ME43AFSAA	3	4.5	6.077	DR004A0607	1.8	DR004L0607	2.5	18.709	DR003D1870
VFD4A2ME43ANNAA VFD4A2ME43AFNAA VFD4A2ME43ANSAA VFD4A2ME43AFSAA	4.6	6.9	4.05	DR006A0405	2.8	DR006L0405	3.0	14.031	DR004D1403
VFD5A5ME43ANNAA VFD5A5ME43AFNAA VFD5A5ME43ANSAA VFD5A5ME43AFSAA	6.5	9.75	2.7	DR009A0270	3.5	DR009L0270	3.6	9.355	DR006D0935
VFD7A3ME43ANNAA VFD7A3ME43AFNAA VFD7A3ME43ANSAA VFD7A3ME43AFSAA	8.9	13.35	2.7	DR009A0270	3.5	DR009L0270	3.6	6.236	DR009D0623
VFD9A0ME43ANNAA VFD9A0ME43AFNAA VFD9A0ME43ANSAA VFD9A0ME43AFSAA	10.5	15.75	2.315	DR010A0231	4.5	DR010L0231	5.5	5.345	DR010D0534
VFD13AME43ANNAA VFD13AME43AFNAA VFD13AME43ANSAA VFD13AME43AFSAA	15.7	23.55	1.174	DR018A0117	5.3	DR018L0117	6.4	3.119	DR018D0311
VFD17AME43ANNAA VFD17AME43AFNAA VFD17AME43ANSAA VFD17AME43AFSAA	20.5	30.75	0.881	DR024AP881	5.8	DR024LP881	7.2	3.119	DR018D0311

Table 7-18

460V, 50–60 Hz / Three-phase - Heavy Duty

Models	Rated current [Arms]	Saturation Current [Arms]	Input / Output Reactor [mH]	AC Input Reactor		AC Output Reactor		DC Reactor [mH]	DC Reactor Delta Part #
				Delta Part #	Weight [kg]	Delta Part #	Weight [kg]		
VFD1A5ME43ANNAA VFD1A5ME43AFNAA VFD1A5ME43ANSAA VFD1A5ME43AFSAA	1.5	3	8.102	DR003A0810	1.5	DR003L0810	1.5	18.709	DR003D1870
VFD2A7ME43ANNAA VFD2A7ME43AFNAA VFD2A7ME43ANSAA VFD2A7ME43AFSAA	2.7	5.4	8.102	DR003A0810	1.5	DR003L0810	1.5	18.709	DR003D1870
VFD4A2ME43ANNAA VFD4A2ME43AFNAA VFD4A2ME43ANSAA VFD4A2ME43AFSAA	4.2	8.4	6.077	DR004A0607	1.8	DR004L0607	2.5	14.031	DR004D1403
VFD5A5ME43ANNAA VFD5A5ME43AFNAA VFD5A5ME43ANSAA VFD5A5ME43AFSAA	5.5	11	4.05	DR006A0405	2.8	DR006L0405	3.0	9.355	DR006D0935

Models	Rated current [Arms]	Saturation Current [Arms]	Input / Output Reactor [mH]	AC Input Reactor		AC Output Reactor		DC Reactor [mH]	DC Reactor Delta Part #
				Delta Part #	Weight [kg]	Delta Part #	Weight [kg]		
VFD7A3ME43ANNAA VFD7A3ME43AFNAA VFD7A3ME43ANSAA VFD7A3ME43AFSAA	8.1	16.2	2.7	DR009A0270	3.5	DR009L0270	3.6	6.236	DR009D0623
VFD9A0ME43ANNAA VFD9A0ME43AFNAA VFD9A0ME43ANSAA VFD9A0ME43AFSAA	9	18	2.7	DR009A0270	3.5	DR009L0270	3.6	6.236	DR009D0623
VFD13AME43ANNAA VFD13AME43AFNAA VFD13AME43ANSAA VFD13AME43AFSAA	13	26	1.174	DR018A0117	5.3	DR018L0117	6.4	4.677	DR012D0467
VFD17AME43ANNAA VFD17AME43AFNAA VFD17AME43ANSAA VFD17AME43AFSAA	17	34	1.174	DR018A0117	5.3	DR018L0117	6.4	3.119	DR018D0311

Table 7-19

The table below shows the THDi specification when using Delta's drives to work with AC / DC reactors.

Current Harmonics	No AC / DC Reactor	3% Input AC Reactor	5% Input AC Reactor	4% DC Reactor
5^{th}	73.3%	38.5%	30.8%	34.4%
7^{th}	52.74%	15.3%	9.4%	18.6%
11^{th}	7.28%	7.1%	6.13%	7.14%
13^{th}	0.4%	3.75%	3.15%	3.41%
THDi	91%	43.6%	34.33%	38.2%

NOTE:
The THDi specification listed here assumes that there is 0.8% resistance (mains electricity) before the reactors and may be slightly different from the actual THDi, depending on the installation and environmental conditions (wires, motors).

Table 7-20

Reactor Dimension and Specifications

AC Input Reactor

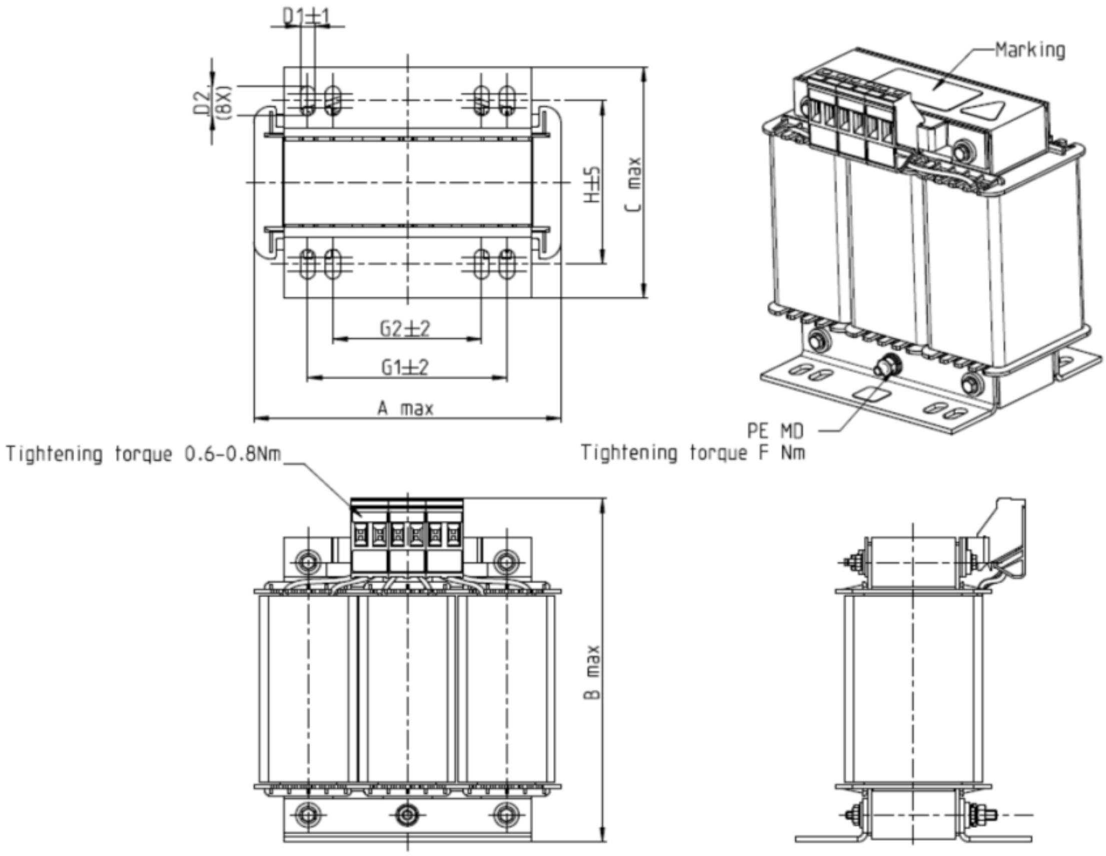


Figure 7-9

Unit: mm

AC Input Reactor 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

Table 7-21

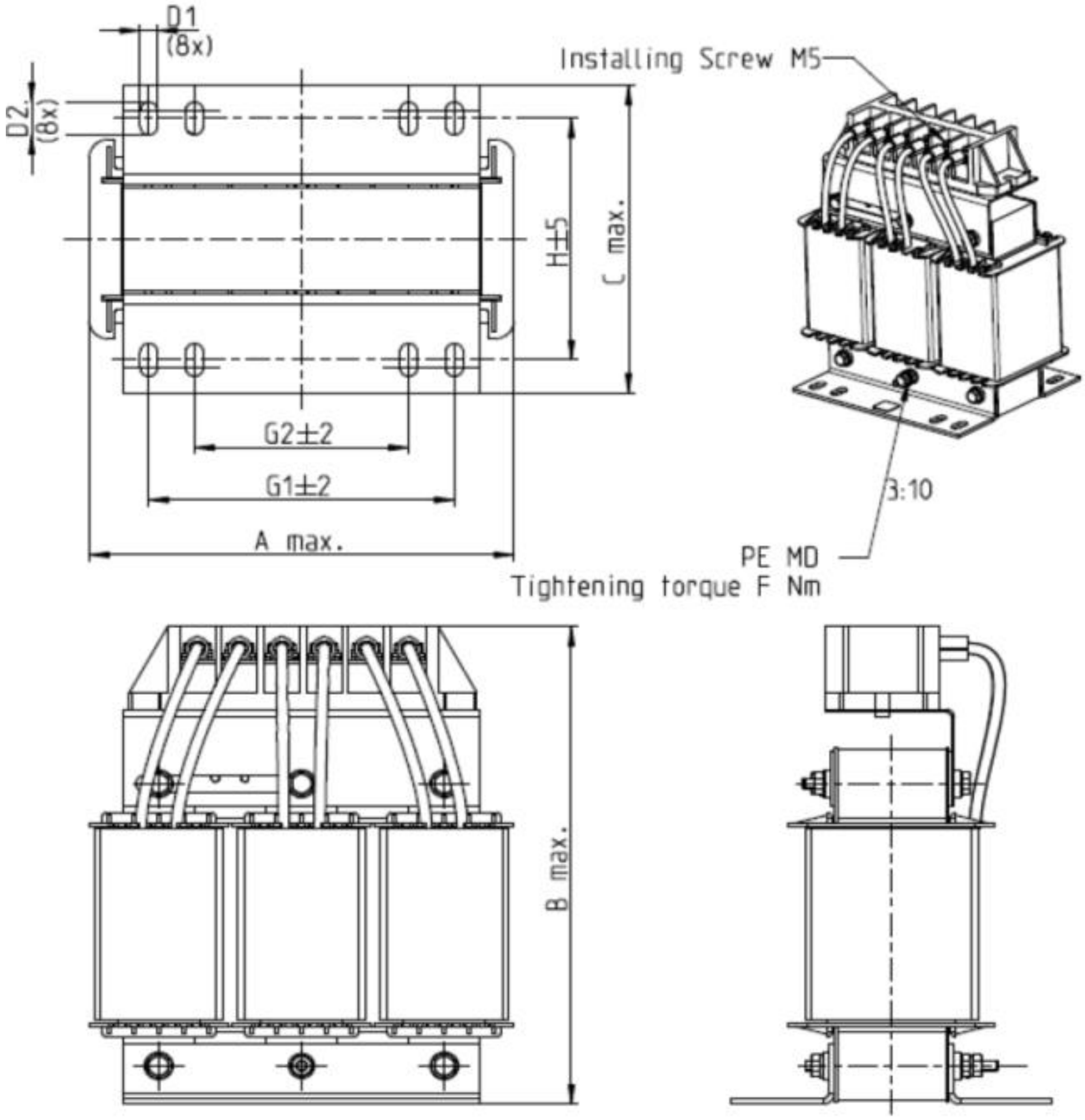


Figure 7-10

Unit: mm

AC Input Reactor Delta Part #	A	B	C	D1*D2	H	G1	G2	PE D
DR025AP507	130	195	100	6*12	65	80.5	60	M4

Table 7-22

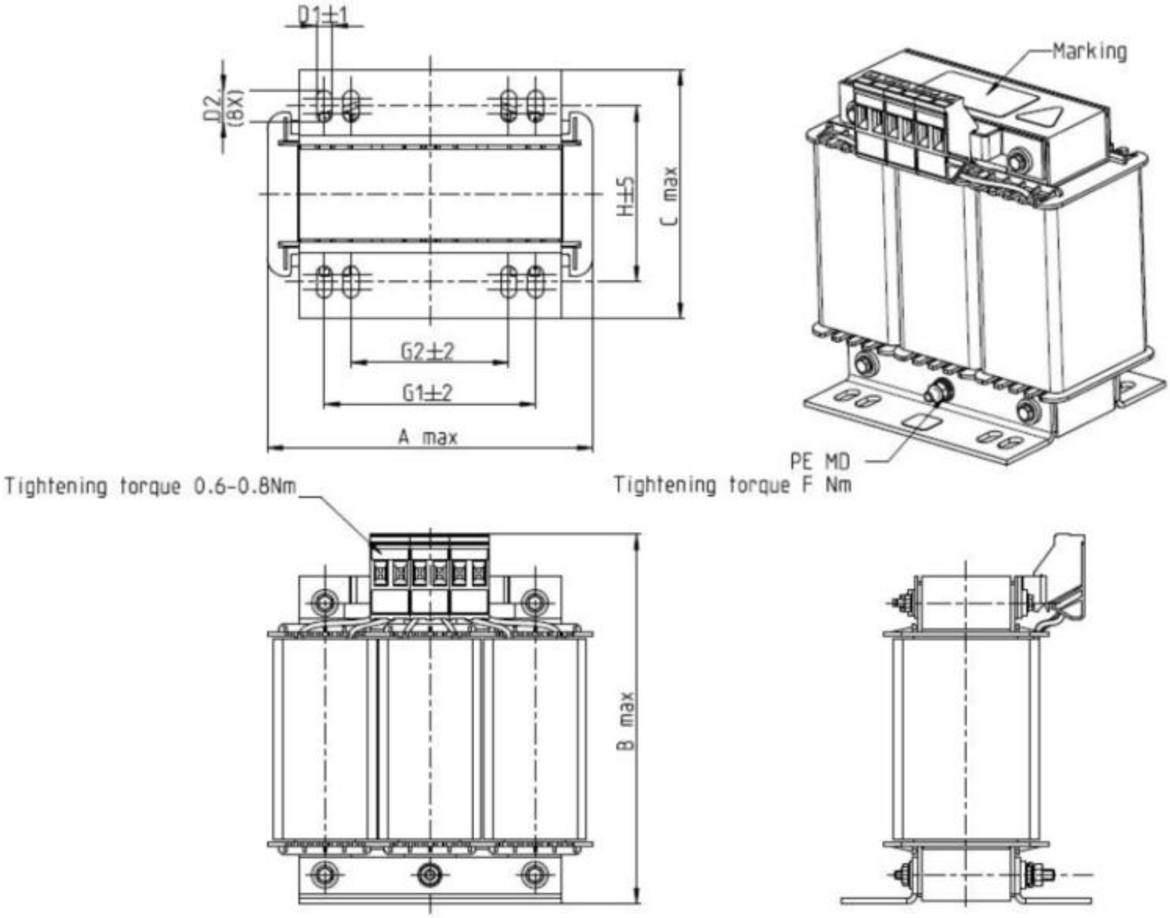


Figure 7-11

Unit: mm

AC Input Reactor 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

Table 7-23

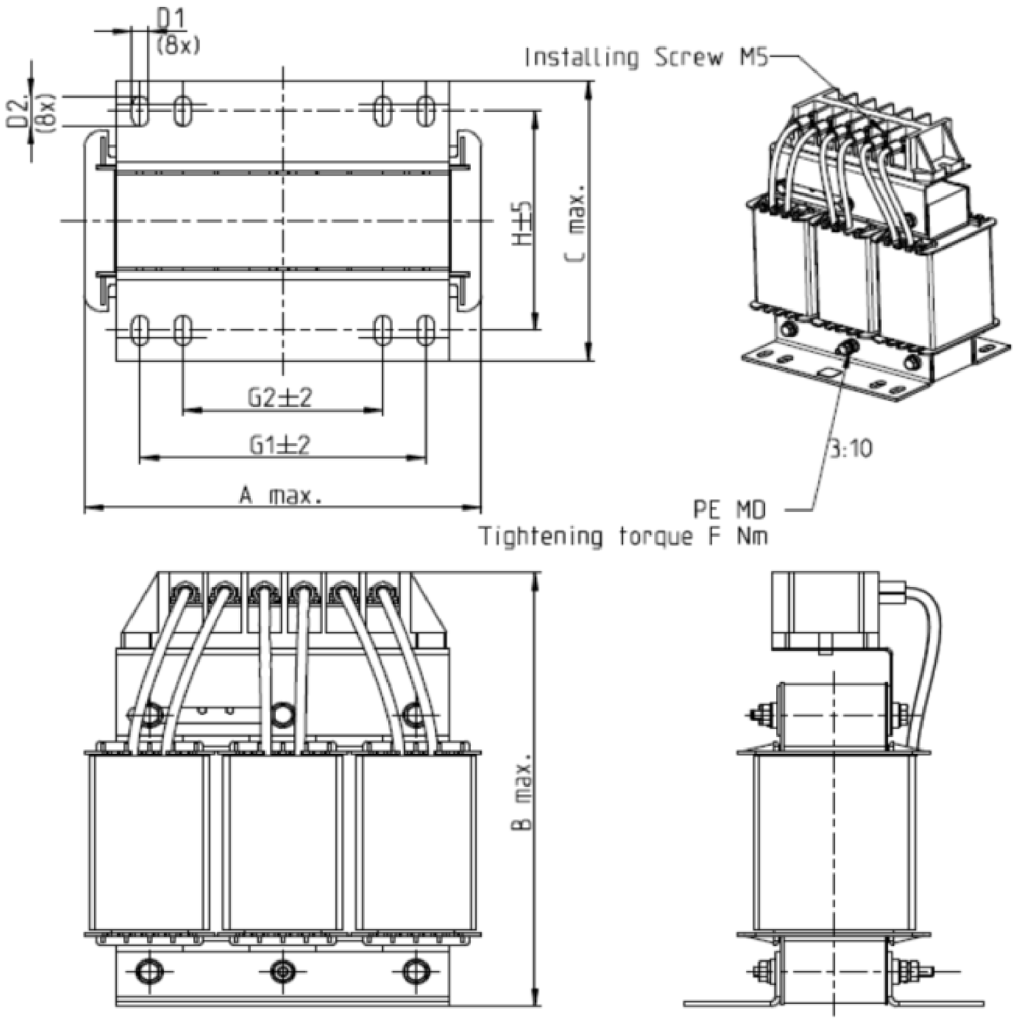


Figure 7-12

Unit: mm

AC Input Reactor Delta Part #	A	B	C	D1*D2	H	G1	G2	PE D
DR024AP881	160	175	115	6*12	90	107	75	M4

Table 7-24

AC Output Reactor

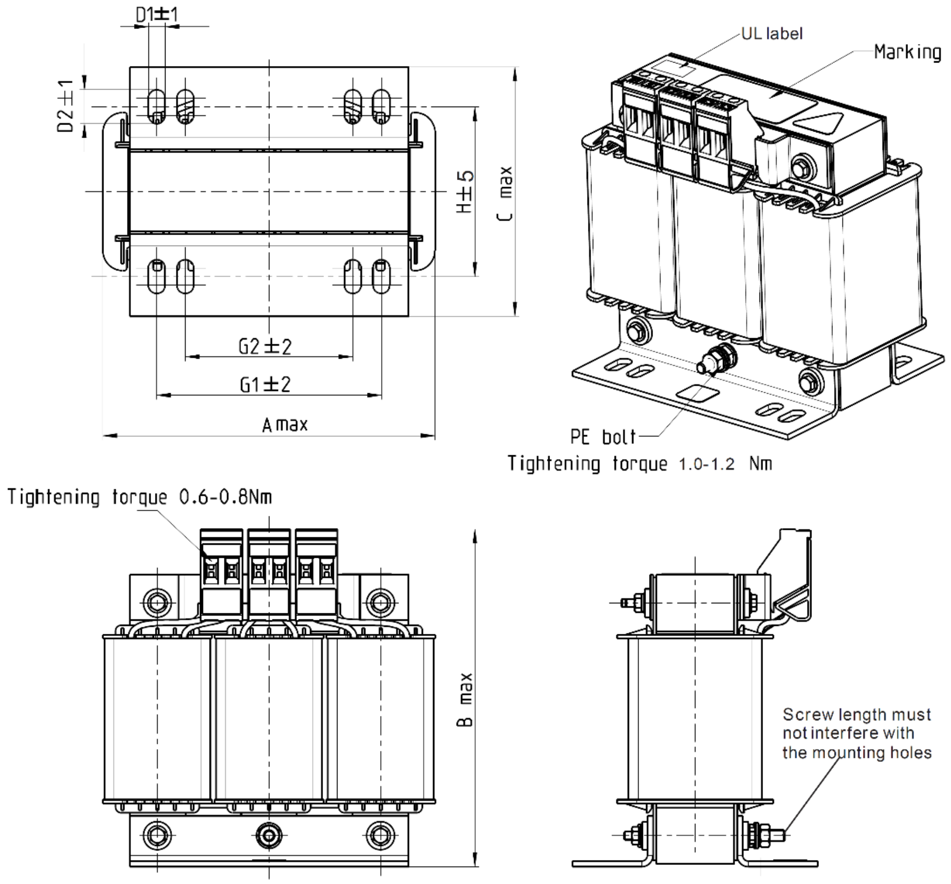


Figure 7-13

Unit: mm

AC Output Reactor 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

Table 7-25

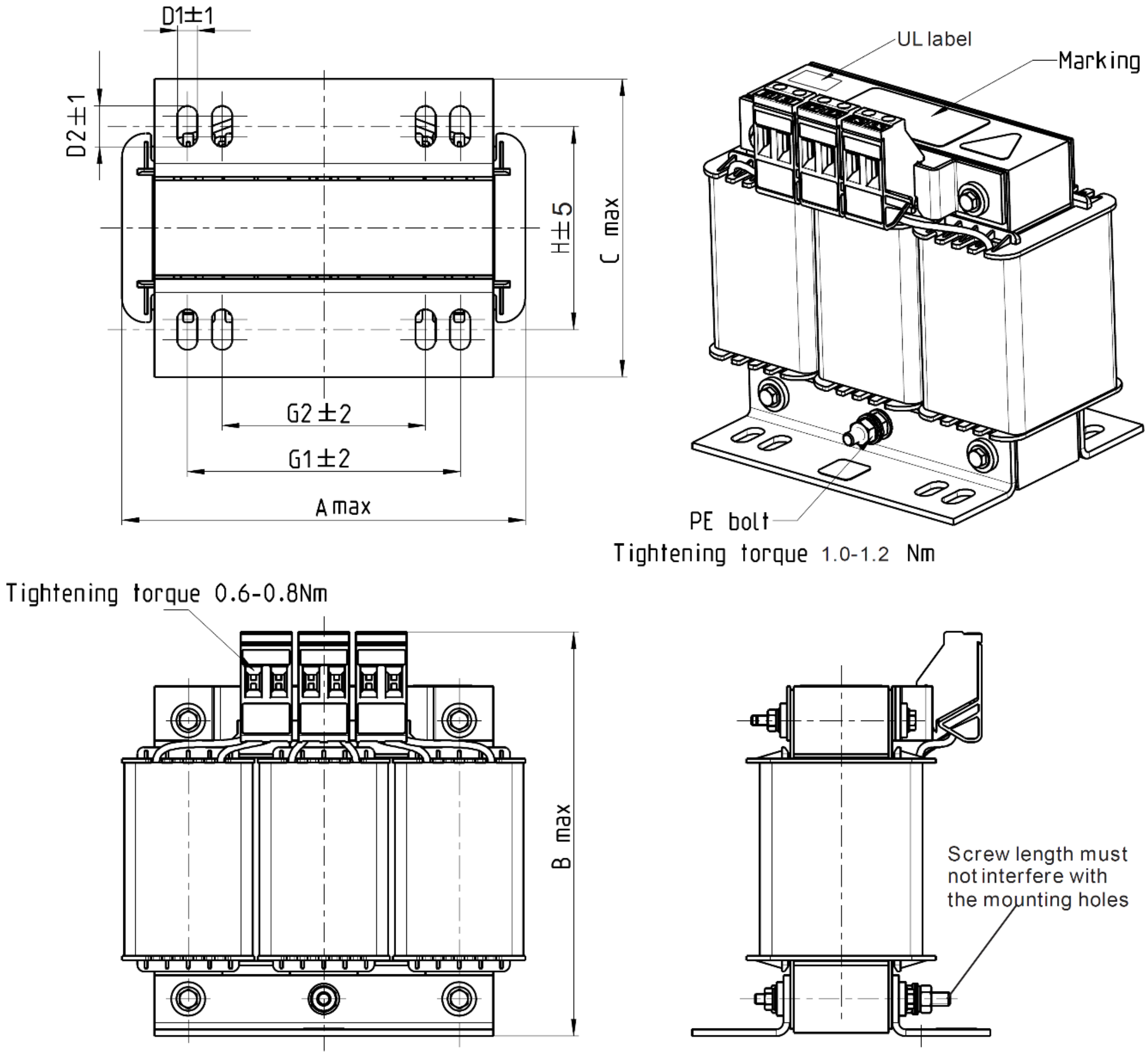


Figure 7-14

Unit: mm

AC Output Reactor 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

Table 7-26

DC Reactor

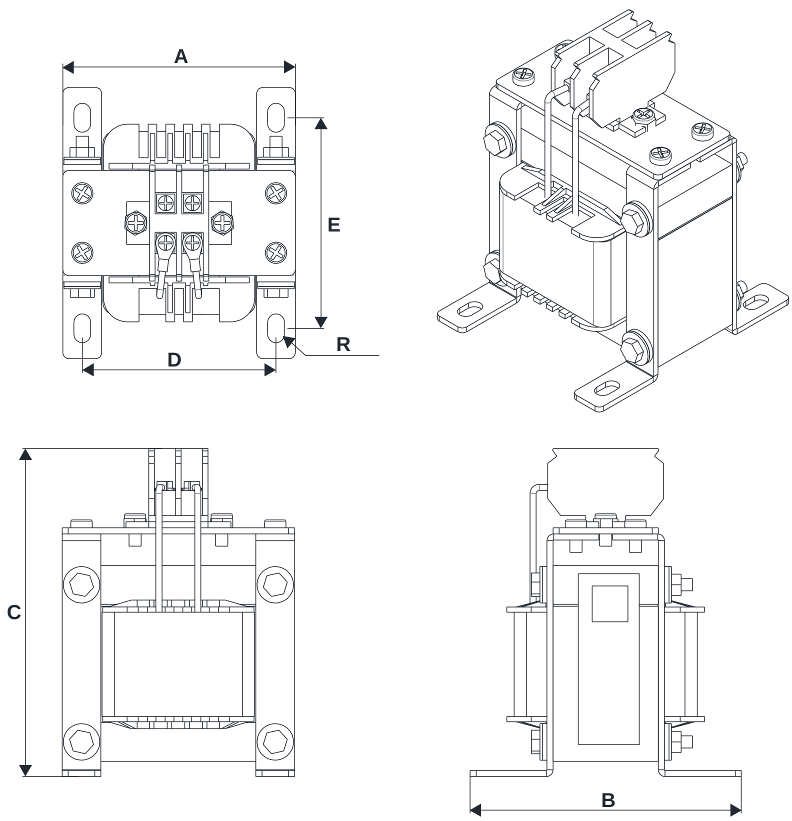


Figure 7-15

DC Reactor Delta Part #	Rated current [Arms]	Saturation Current [Arms]	DC Reactor [mH]	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	R (mm)
DR005D0585	5	8.64	5.857	79	78	112	64±2	56±2	9.5*5.5
DR008D0366	8	12.78	3.660	79	78	112	64±2	56±2	9.5*5.5
DR011D0266	11	18	2.662	79	92	112	64±2	69.5±2	9.5*5.5
DR017D0172	17	28.8	1.722	79	112	112	64±2	89.5±2	9.5*5.5
DR025D0117	25	43.2	1.172	99	105	128	79±2	82.5±2	9.5*5.5
DR033DP851	33	55.8	0.851	117	110	156	95±2	87±2	10*6.5
DR049DP574	49	84.6	0.574	117	120	157	95±2	97±2	10*6.5
DR065DP432	65	111.6	0.432	117	140	157	95±2	116.5±2	10*6.5
DR003D1870	3	5.22	18.709	79	78	112	64±2	56±2	9.5*5.5
DR004D1403	4	6.84	14.031	79	92	112	64±2	69.5±2	9.5*5.5
DR006D0935	6	10.26	9.355	79	92	112	64±2	69.5±2	9.5*5.5
DR009D0623	9	14.58	6.236	79	112	112	64±2	89.5±2	9.5*5.5
DR010D0534	10.5	17.1	5.345	99	93	128	79±2	70±2	9.5*5.5
DR012D0467	12	19.8	4.677	99	105	128	79±2	82.5±2	9.5*5.5
DR018D0311	18	30.6	3.119	117	110	144	95±2	87±2	10*6.5
DR024D0233	24	41.4	2.338	117	120	144	95±2	97±2	10*6.5
DR032D0175	32	54	1.754	117	140	157	95±2	116.5±2	10*6.5
DR038D0147	38	64.8	1.477	136	135	172	111±2	112±2	10*6.5
DR045D0124	45	77.4	1.247	136	135	173	111±2	112±2	10*6.5

Table 7-27

The Motor Cable Length

1. Consequence of leakage current on the motor

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 one AC motor drive, the total wiring length should be the sum of the wiring length from AC motor drive to each motor.

For the 460V models 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 (see Pr.00-17).

2. Consequence of the surge voltage on the motor

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

(1) Use a motor with enhanced insulation.
(2) Reduce the cable length between the AC motor drive and motor to suggested values.
(3) Connect an output reactor (optional) to the output terminals of the AC motor drive.

Refer to the following tables for the suggested motor shielded cable length. Use a motor with a rated voltage ≤ 500 V_{AC} and an insulation level ≥ 1.35 kVp-p in accordance with IEC 60034-17.

<table>
<tr><th rowspan="2">115V_Single-Phase Models</th><th rowspan="2">Normal Duty Rated Current [Arms]</th><th colspan="2">Without an AC Output Reactor</th><th colspan="2">With an AC Output Reactor</th></tr>
<tr><th>Shielded Cable [meter]</th><th>Non-shielded Cable [meter]</th><th>Shielded Cable [meter]</th><th>Non-shielded Cable [meter]</th></tr>
<tr><td>VFD0A8ME11ANNAA
VFD0A8ME11ANSAA</td><td>1</td><td rowspan="4">50</td><td rowspan="4">75</td><td rowspan="4">75</td><td rowspan="4">115</td></tr>
<tr><td>VFD1A6ME11ANNAA
VFD1A6ME11ANSAA</td><td>1.8</td></tr>
<tr><td>VFD2A5ME11ANNAA
VFD2A5ME11ANSAA</td><td>2.7</td></tr>
<tr><td>VFD4A8ME11ANNAA
VFD4A8ME11ANSAA</td><td>5.5</td></tr>
</table>

Table 7-28

<table>
<tr><th rowspan="2">230V_Single-Phase Models</th><th rowspan="2">Normal Duty Rated Current [Arms]</th><th colspan="2">Without an AC Output Reactor</th><th colspan="2">With an AC Output Reactor</th></tr>
<tr><th>Shielded Cable [meter]</th><th>Non-shielded Cable [meter]</th><th>Shielded Cable [meter]</th><th>Non-shielded Cable [meter]</th></tr>
<tr><td>VFD0A8ME21ANNAA
VFD0A8ME21AFNAA
VFD0A8ME21ANSAA
VFD0A8ME21AFSAA</td><td>1</td><td rowspan="2">50</td><td rowspan="2">75</td><td rowspan="2">75</td><td rowspan="2">115</td></tr>
<tr><td>VFD1A6ME21ANNAA
VFD1A6ME21AFNAA
VFD1A6ME21ANSAA
VFD1A6ME21AFSAA</td><td>1.8</td></tr>
</table>

230V_Single-Phase Models	Normal Duty Rated Current [Arms]	Without an AC Output Reactor		With an AC Output Reactor	
		Shielded Cable [meter]	Non-shielded Cable [meter]	Shielded Cable [meter]	Non-shielded Cable [meter]
VFD2A8ME21ANNAA VFD2A8ME21AFNAA VFD2A8ME21ANSAA VFD2A8ME21AFSAA	3.2	50	75	75	115
VFD4A8ME21ANNAA VFD4A8ME21AFNAA VFD4A8ME21ANSAA VFD4A8ME21AFSAA	5	50	75	75	115
VFD7A5ME21ANNAA VFD7A5ME21AFNAA VFD7A5ME21ANSAA VFD7A5ME21AFSAA	8.5				
VFD11AME21ANNAA VFD11AME21AFNAA VFD11AME21ANSAA VFD11AME21AFSAA	12.5				

Table 7-29

230V_Three-Phase Models	Normal Duty Rated Current [Arms]	Without an AC Output Reactor		With an AC Output Reactor	
		Shielded Cable [meter]	Non-shielded Cable [meter]	Shielded Cable [meter]	Non-shielded Cable [meter]
VFD0A8ME23ANNAA VFD0A8ME23ANSAA	1	50	75	75	115
VFD1A6ME23ANNAA VFD1A6ME23ANSAA	1.8				
VFD2A8ME23ANNAA VFD2A8ME23ANSAA	3.2				
VFD4A8ME23ANNAA VFD4A8ME23ANSAA	5				
VFD7A5ME23ANNAA VFD7A5ME23ANSAA	8				
VFD11AME23ANNAA VFD11AME23ANSAA	12.5				
VFD17AME23ANNAA VFD17AME23ANSAA	19.5				
VFD25AME23ANNAA VFD25AME23ANSAA	27				

Table 7-30

460V_Three-Phase Models	Normal Duty Rated Current [Arms]	Without an AC Output Reactor		With an AC Output Reactor	
		Shielded Cable [meter]	Non-shielded Cable [meter]	Shielded Cable [meter]	Non-shielded Cable [meter]
VFD1A5ME43ANNAA VFD1A5ME43AFNAA VFD1A5ME43ANSAA VFD1A5ME43AFSAA	1.8	35	50	50	90
VFD2A7ME43ANNAA VFD2A7ME43AFNAA VFD2A7ME43ANSAA VFD2A7ME43AFSAA	3				
VFD4A2ME43ANNAA VFD4A2ME43AFNAA VFD4A2ME43ANSAA VFD4A2ME43AFSAA	4.6				

460V_Three-Phase Models	Normal Duty Rated Current [Arms]	Without an AC Output Reactor		With an AC Output Reactor	
		Shielded Cable [meter]	Non-shielded Cable [meter]	Shielded Cable [meter]	Non-shielded Cable [meter]
VFD5A5ME43ANNAA VFD5A5ME43AFNAA VFD5A5ME43ANSAA VFD5A5ME43AFSAA	6.5	50	75	75	115
VFD9A0ME43ANNAA VFD9A0ME43AFNAA VFD9A0ME43ANSAA VFD9A0ME43AFSAA	10.5				
VFD13AME43ANNAA VFD13AME43AFNAA VFD13AME43ANSAA VFD13AME43AFSAA	15.7				
VFD17AME43ANNAA VFD17AME43AFNAA VFD17AME43ANSAA VFD17AME43AFSAA	20.5	100	150	150	225

Table 7-31

7-5 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. Delta provides two types of zero phase reactors to solve interference problems.

1. A. Casing with mechanical fixed part
   Used for the zero phase reactor at the main input / motor output. It withstands large current load and is used for high frequencies. You can get higher impedance by increasing the number of turns.

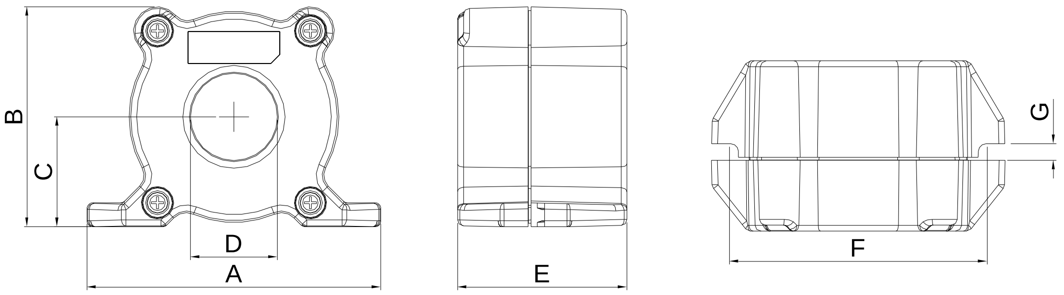


Figure 7-16

Unit: mm

Model	A	B	C	D	E	F	G(Ø)	To use with
RF008X00A	99	73	36.5	29	56.5	86	5.5	Motor cable

Table 7-32

2. B. Casing without mechanical fixed part
   Adopts nanocrystalline core developed by VAC, and has high initial permeability, high saturation induction density, low iron loss and perfect temperature characteristic. If the zero phase reactor does not need to be fixed mechanically, use this solution.

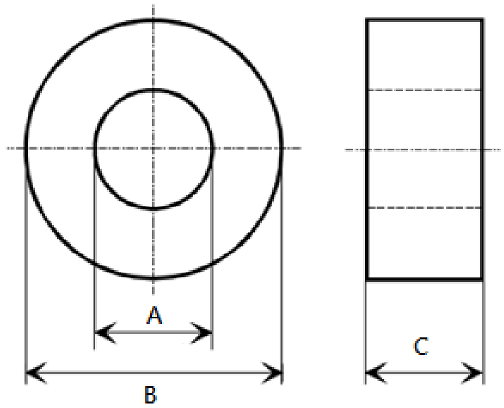


Figure 7-17

Unit: mm

Model	A	B	C	To use w/
T60006L2040W453	22.5	43.1	18.5	Motor cable
T60006L2050W565	36.3	53.5	23.4	Motor cable
T60004L2016W620	10.7	17.8	8.0	Signal cable
T60004L2025W622	17.5	27.3	12.3	Signal cable

Table 7-33

7-5-1 Installation method

During installation, pass the cable through at least one zero phase reactor. Use a suitable cable type (pressure endurance, current endurance, insulation class, and wire gauge) 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 and power cable through the zero phase reactor. With longer motor cables the zero-phase reactor can effectively reduce interference at the motor output. Moreover, pay extra attention to the large leakage current due to long cable length. This may cause temperature rise in the zero phase reactor. Install the zero phase reactor as close to the output of the drive as possible. Figure 7-16 shows the installation diagram for a single turn zero phase reactor. If the wire diameter allows several turns, Figure 7-17 shows the installation of a multi-turn zero phase reactor. The more turns, the better the noise suppression effect.

Single turn wiring installation

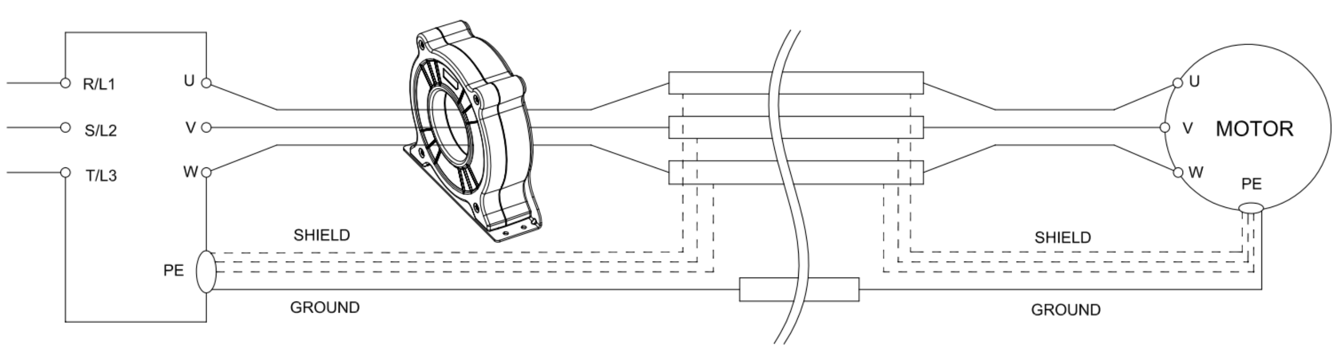


Figure 7-18

Multi-turn wiring installation

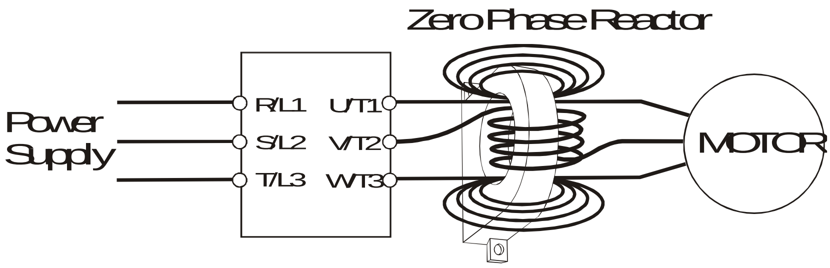


Figure 7-19

7-5-2 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 drive. 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. For example: 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 a zero phase reactor

Zero Phase Reactor Model No.	Max. Wire Gauge or LUG Width	Max. Wire Gauge AWG (1Cx3)		Max. Wire Gauge AWG (4Cx1)	
		75ºC	90ºC	75ºC	75ºC
RF008X00A	13MM	3AWG	1AWG	3AWG	1AWG
T60006L2040W453	11MM	9AWG	4AWG	6AWG	6AWG
T60006L2050W565	16MM	1AWG	2/0AWG	1AWG	1/0AWG

Table 7-34

7-5-3 Zero Phase Reactor for Signal Cable

To solve interference problems between signal cables and electrical equipment, install a zero phase reactor on the signal cable. Refer to the table below for models and dimensions. Installing a zero phase reactor on the signal cable at the source of the interference suppresses the interference and noise between signal cables.

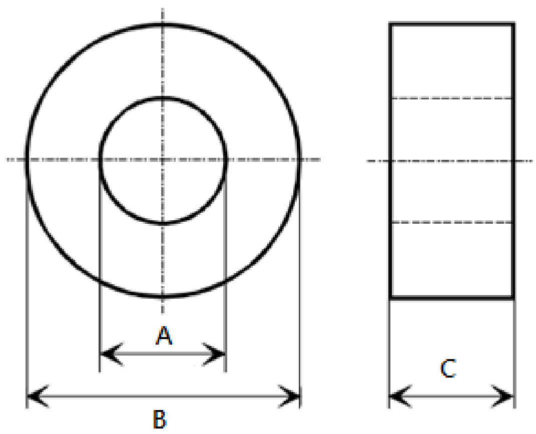


Figure 7-20

Unit: mm

Model	A	B	C
T60004L2016W620	10.7	17.8	8.0
T60004L2025W622	17.5	27.3	12.3

Table 7-35

7-6 EMC Filter

Use EMC filters to enhance the EMC performance for the environment and machines and to comply with EMC regulations, further reducing EMC problems. If you purchase a motor drive without a built-in EMC filter, it is recommended that you select the EMC filters as shown below.

Frame	Models	Input Current (A)	Filter Model #	Zero Phase Reactor Model No.		Conducted emission				Radiated emission		
						C1-motor cable length-30m			C2-motor cable length-100m	C2-motor cable length-100m		
						Position to install a zero phase reactor						
				DELTA	VAC®	*1	*2	*3	N/A	*1	*2	*3
A	VFD0A8ME11ANNAA VFD0A8ME11ANSAA	3.7	EMF11AM21A	RF008X00A	T60006L2040W453				NA			
	VFD1A6ME11ANNAA VFD1A6ME11ANSAA	6.8							NA			
	VFD2A5ME11ANNAA VFD2A5ME11ANSAA	10.1							NA			
	VFD0A8ME21ANNAA VFD0A8ME21ANSAA	3.2							NA			
	VFD1A6ME21ANNAA VFD1A6ME21ANSAA	3.8					✓	✓	NA		✓	✓
	VFD2A8ME21ANNAA VFD2A8ME21ANSAA	6.7					✓	✓	NA		✓	✓
	VFD0A8ME23ANNAA VFD0A8ME23ANSAA	1.2	EMF10AM23A				✓	✓	NA		✓	✓
	VFD1A6ME23ANNAA VFD1A6ME23ANSAA	2.2					✓	✓	NA		✓	✓
	VFD2A8ME23ANNAA VFD2A8ME23ANSAA	3.8					✓	✓	NA		✓	✓
	VFD4A8ME23ANNAA VFD4A8ME23ANSAA	6					✓	✓	NA		✓	✓
	VFD1A5ME43ANNAA VFD1A5ME43ANSAA	2.5	EMF6A0M43A					✓	NA			✓
	VFD2A7ME43ANNAA VFD2A7ME43ANSAA	4.2						✓	NA			✓
B	VFD4A8ME21ANNAA VFD4A8ME21ANSAA	10.5	EMF11AM21A				✓	✓	NA		✓	✓
	VFD7A5ME23ANNAA VFD7A5ME23ANSAA	9.6	EMF10AM23A				✓	✓	NA		✓	✓
	VFD4A2ME43ANNAA VFD4A2ME43ANSAA	6.4	EMF6A0M43A					✓	NA			✓
C	VFD4A8ME11ANNAA VFD4A8ME11ANSAA	20.6	EMF27AM21B	RF008X00A	T60006L2040W453				NA			
	VFD11AME21ANNAA VFD11AME21ANSAA	26.3	EMF27AM21B					✓	NA			✓
	VFD7A5ME21ANNAA VFD7A5ME21ANSAA	17.9	EMF27AM21B					✓	NA			✓
	VFD11AME23ANNAA VFD11AME23ANSAA	15	EMF24AM23B				✓	✓	NA		✓	✓
	VFD17AME23ANNAA VFD17AME23ANSAA	23.4	EMF24AM23B				✓	✓	NA		✓	✓
	VFD5A5ME43ANNAA VFD5A5ME43ANSAA	7.2	EMF12AM43B						NA			
	VFD7A3ME43ANNAA VFD7A3ME43ANSAA	8.9	EMF12AM43B				✓	✓	NA		✓	✓
	VFD9A0ME43ANNAA VFD9A0ME43ANSAA	11.6	EMF12AM43B				✓	✓	NA		✓	✓
D	VFD25AME23ANNAA VFD25AME23ANSAA	32.4	EMF33AM23B	RF008X00A	T60006L2050W565	✓	✓		NA	✓	✓	
	VFD13AME43ANNAA VFD13AME43ANSAA	17.3	EMF23AM43B			✓	✓	✓	NA	✓	✓	✓
	VFD17AME43ANNAA VFD17AME43ANSAA	22.6	EMF23AM43B			✓	✓	✓	NA	✓	✓	✓

Table 7-36

Zero phase reactor installation position diagram:

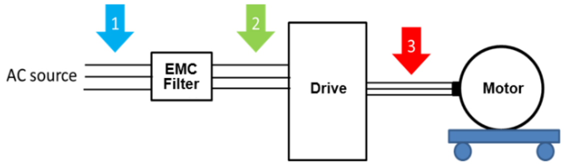


Figure 7-21

*1 Install at the cable between the power supply and the EMC filter

*2 Install at the cable between the EMC filter and the drive

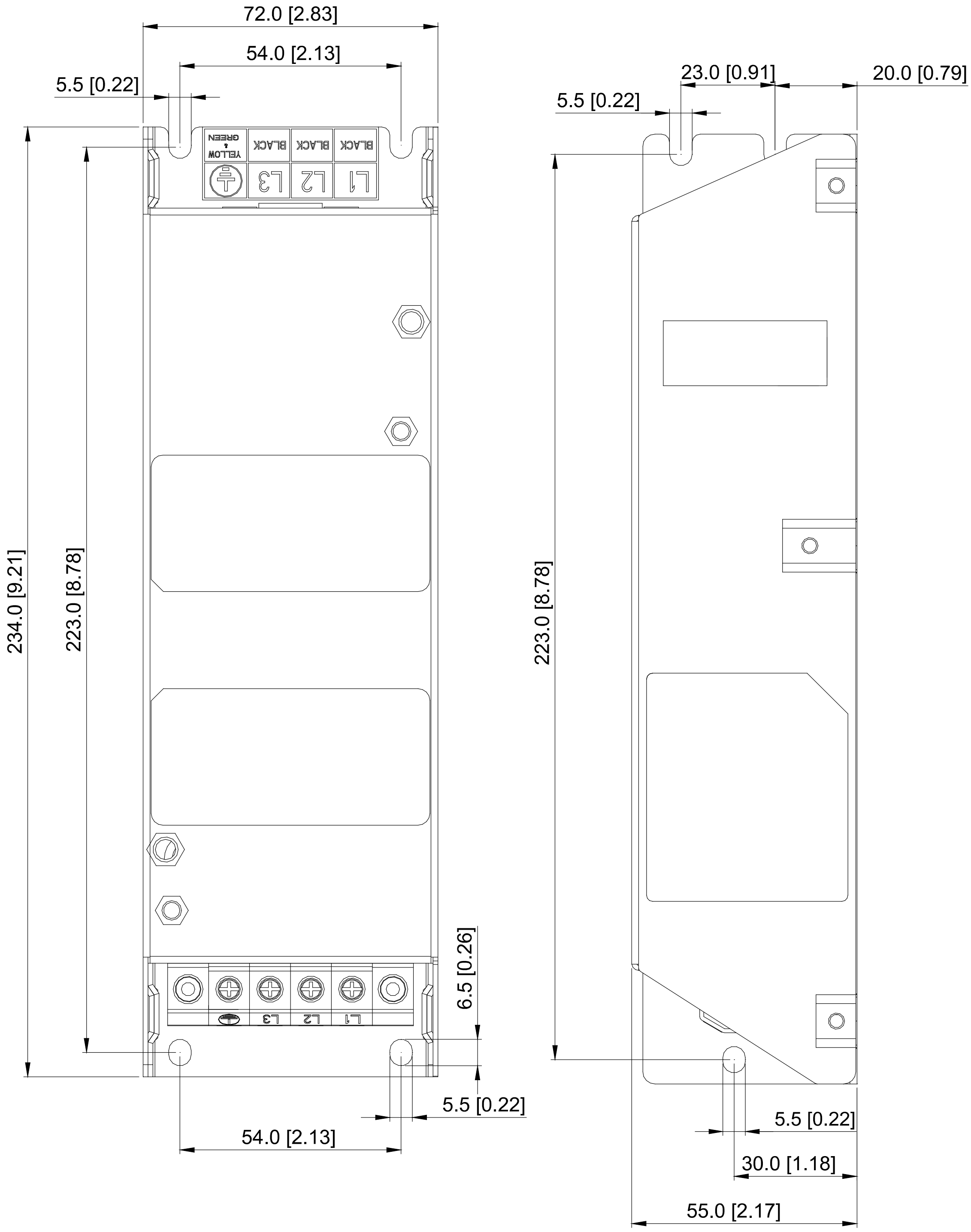
*3 Install at the cable between the drive and the motor

Filter Dimension

EMF11AM21A; EMF10AM23A; EMF6A0M43A

Screw Spec.	Torque
M5 * 2	16–20 kg-cm / [13.9–17.3 lb-in.] / [1.56–1.96 Nm]
M4 * 2	14–16 kg-cm / [12.2–13.8 lb-in.] / [1.38–1.56 Nm]

Table 7-37



Unit: mm (inch)

Figure 7-22

EMF27AM21B; EMF24AM23B;
EMF33AM23B; EMF12AM43B;
EMF23AM43B; EMF6A0M63B;
EMF16AM63B

Screw	Torque
M5 * 4	16–20 kg-cm / [13.9–17.3 lb-in.] / [1.56–1.96 Nm]

Table 7-38

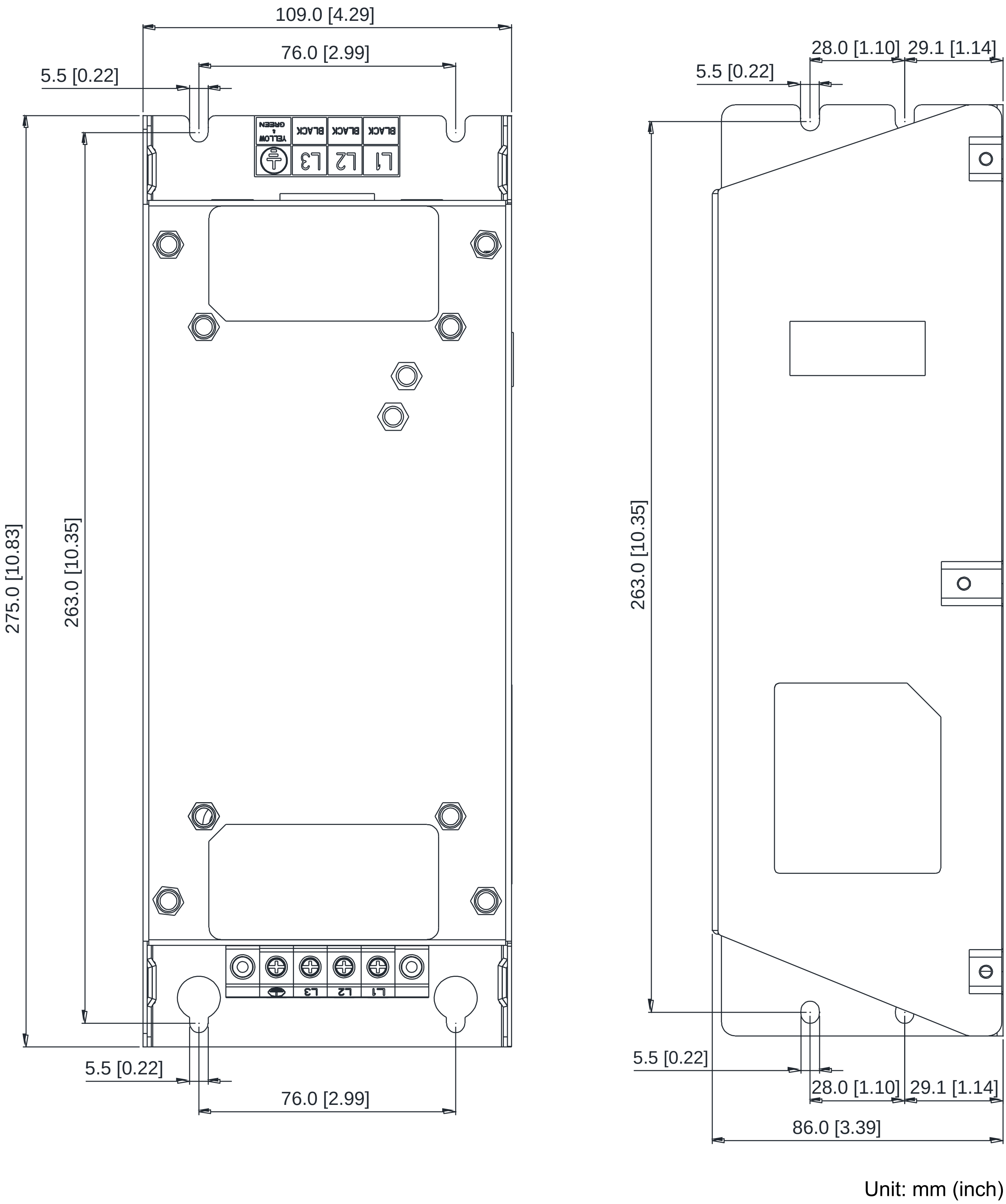


Figure 7-23

The table below is the maximum shielded cable length for drive models with built-in EMC filters. You can choose the corresponding shielded cable length according to the required noise emission and electromagnetic interference class.

<table>
<tr><th colspan="2">Drive Models with Built-in EMC Filters</th><th rowspan="2">Rated Current (HD)</th><th colspan="2">Compliance with EMC (IEC 61800-3) Class C3</th><th colspan="2">Compliance with EMC (IEC 61800-3) Class C2</th></tr>
<tr><th>Frame</th><th>Models</th><th>Shielded Cable Length</th><th>Fc</th><th>Shielded Cable Length</th><th>Fc</th></tr>
<tr><td rowspan="7">B</td><td>VFD0A8ME21AFSAA</td><td>0.8</td><td rowspan="13">30 m</td><td rowspan="13">4 kHz</td><td rowspan="4">20 m</td><td rowspan="13">4 kHz</td></tr>
<tr><td>VFD1A6ME21AFSAA</td><td>1.6</td></tr>
<tr><td>VFD2A8ME21AFSAA</td><td>2.8</td></tr>
<tr><td>VFD4A8ME21AFSAA</td><td>4.8</td></tr>
<tr><td>VFD1A5ME43AFSAA</td><td>1.5</td><td rowspan="3">-</td></tr>
<tr><td>VFD2A7ME43AFSAA</td><td>2.7</td></tr>
<tr><td>VFD4A2ME43AFSAA</td><td>4.2</td></tr>
<tr><td rowspan="4">C</td><td>VFD7A5ME21AFSAA</td><td>7.5</td><td rowspan="2">20 m</td></tr>
<tr><td>VFD11AME21AFSAA</td><td>11</td></tr>
<tr><td>VFD5A5ME43AFSAA</td><td>5.5</td><td rowspan="4">-</td></tr>
<tr><td>VFD9A0ME43AFSAA</td><td>9</td></tr>
<tr><td rowspan="2">D</td><td>VFD13AME43AFSAA</td><td>13</td></tr>
<tr><td>VFD17AME43AFSAA</td><td>17</td></tr>
</table>

Table 7-39

7-7 EMC Shield Plate

EMC Shield Plate (for use with shielded cable)

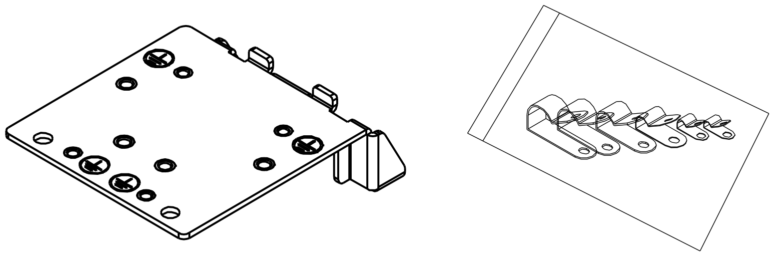
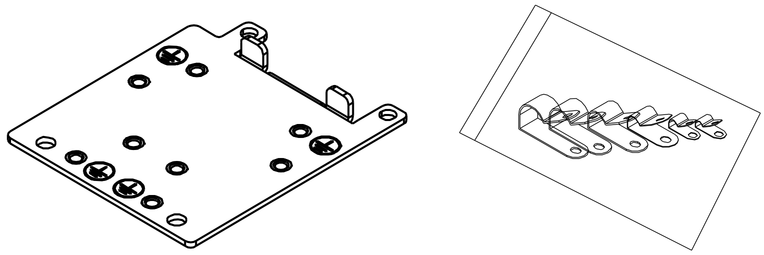
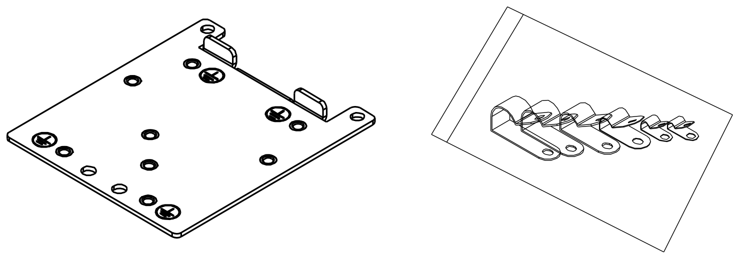
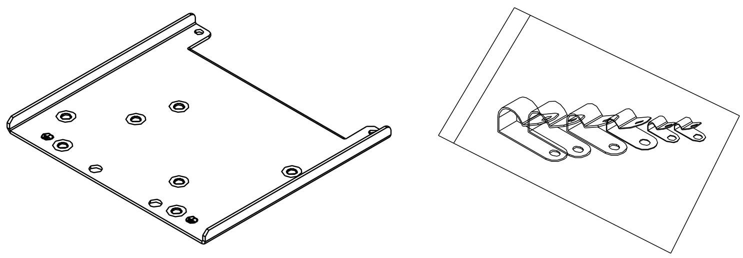
Frame	Models of EMC shield plate	Reference Figures
A	MKM-EPA	 Figure 7-24
B	MKM-EPB	 Figure 7-25
C	MKM-EPC	 Figure 7-26
D	MKM-EPD	 Figure 7-27

Table 7-40

Installation

This example uses Frame A model

1. As shown in the right figure, fix the shield plate on the AC motor drive.

   Torque value:

Frame	Screw	Torque
A	M3.5	6–8 kg-cm / [5.2–6.9 lb-in.] / [0.59–0.78 Nm]
B	M4	6–8 kg-cm / [5.2–6.9 lb-in.] / [0.59–0.78 Nm]
C	M4	6–8 kg-cm / [5.2–6.9 lb-in.] / [0.59–0.78 Nm]
D	M3	4–6 kg-cm / [3.5–5.2 lb-in.] / [0.39–0.59 Nm]

Table 7-41

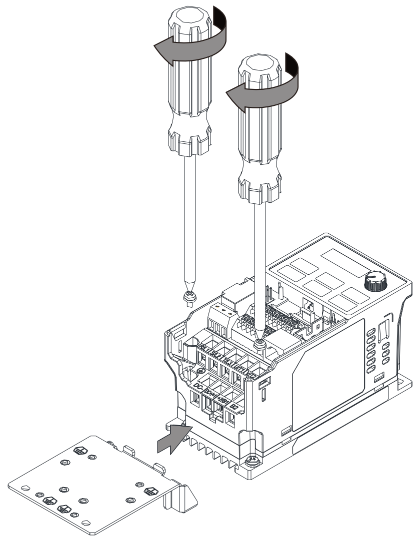


Figure 7-28

2. Select a suitable R-clip according to the wire gauge used, and then fix the R-clip on the shield plate.

Screw	Torque
M4	6–8 kg-cm / [5.2–6.9 lb-in.] / [0.59–0.78 Nm]

Table 7-42

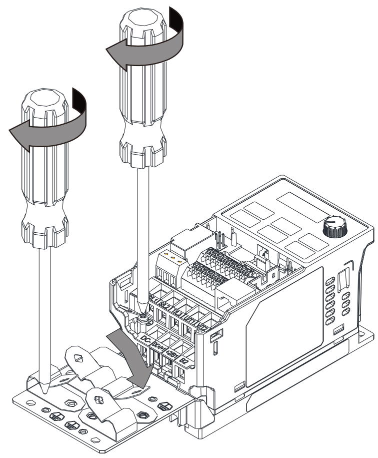


Figure 7-29

Appearance of EMC Shield Plate

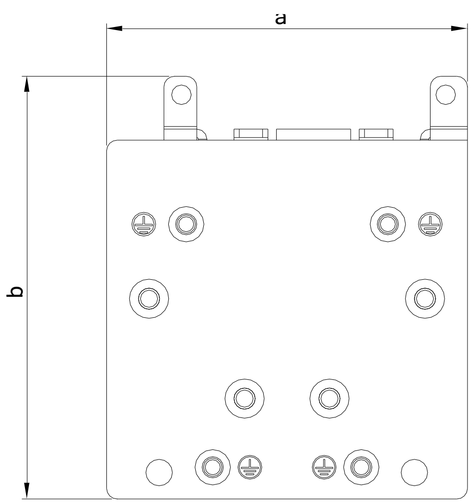


Figure 7-30

Models	Dimensions [mm (inch)]	
	a	b
MKM-EPA	69.3 (2.73)	80.0 (3.15)
MKM-EPB	67.7 (2.67)	79.7 (3.14)
MKM-EPC	78.0 (3.07)	91.0 (3.58)
MKM-EPD	103.4 (4.07)	97.0 (3.82)

Table 7-43

Recommended wiring method

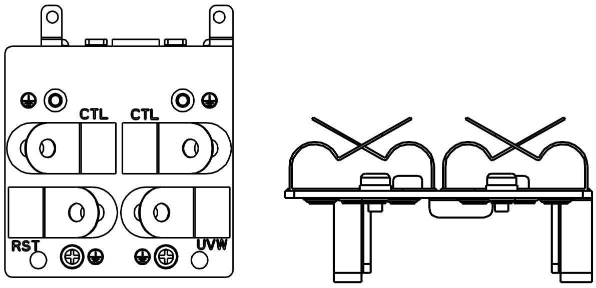
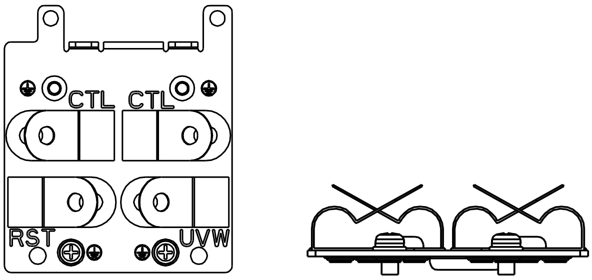
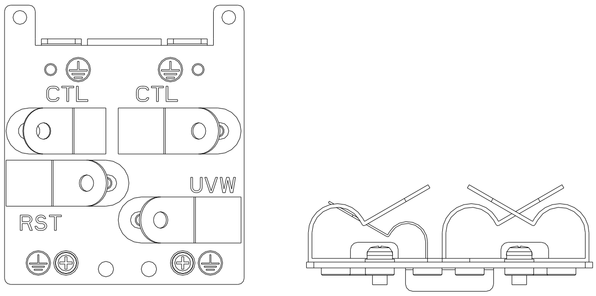
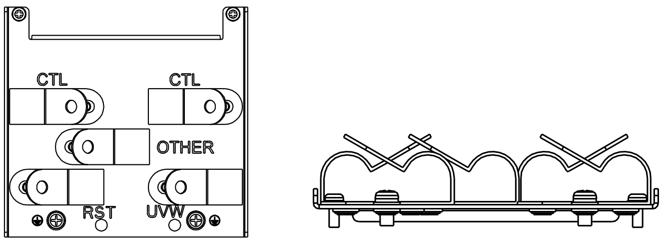
Frame	Models of EMC Shield Plate	Reference Figures
A	MKM-EPA	 Figure 7-31
B	MKM-EPB	 Figure 7-32
C	MKM-EPC	 Figure 7-33
D	MKM-EPD	 Figure 7-34

Table 7-44

7-8 Capacitive Filter

The capacitive filter (CXY101-43A) is a simple filter that supports basic filtering and noise interference reduction.

Installation

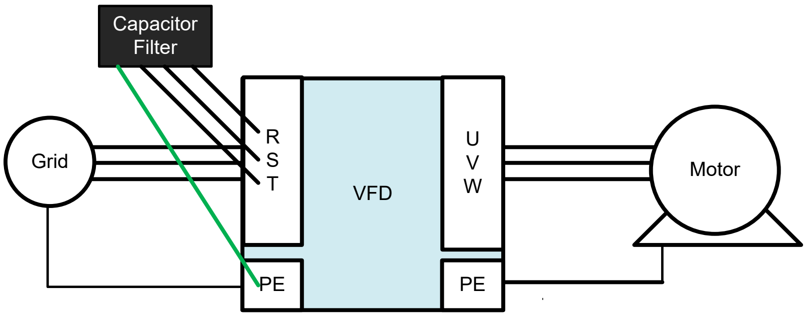


Figure 7-35

Wiring diagram for the capacitive filter and the drive:

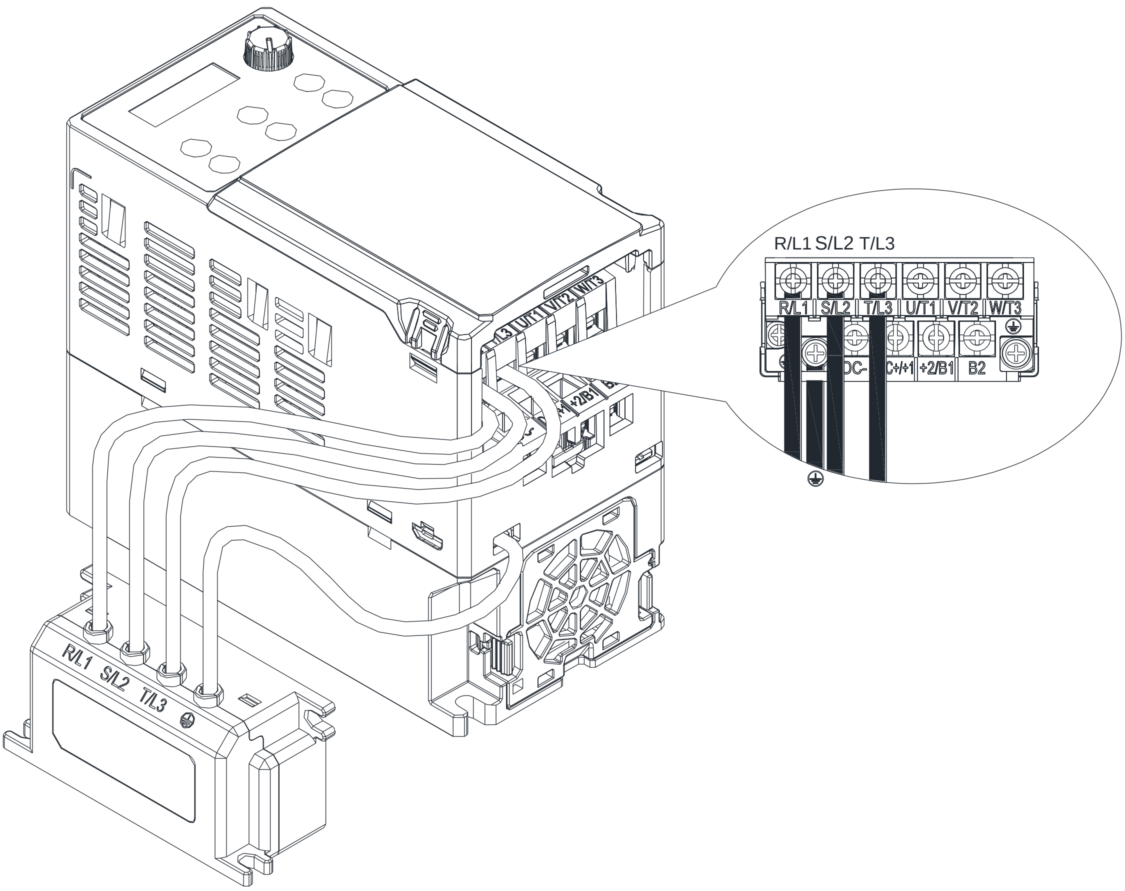


Figure 7-36

Specifications:

Model	Applicable Voltage	Temperature Range	Capacitance
CXY101-43A	110–480 V_{AC}	-40 – +85°C	Cx: 1 μF ± 20 % Cy: 1 μF ± 20 %

Table 7-45

Dimensions:

CXY101-43A

Unit: mm (inch)

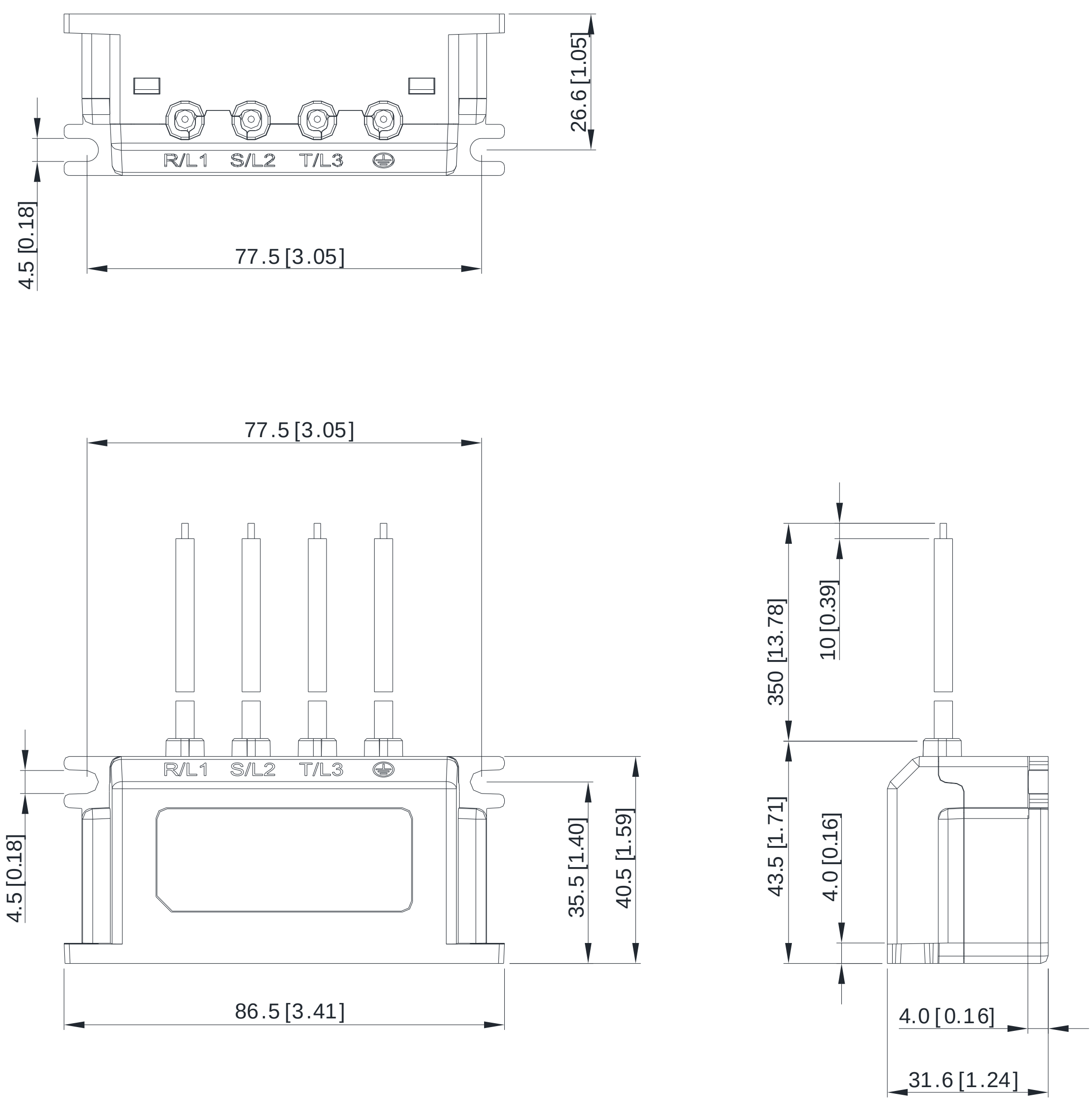


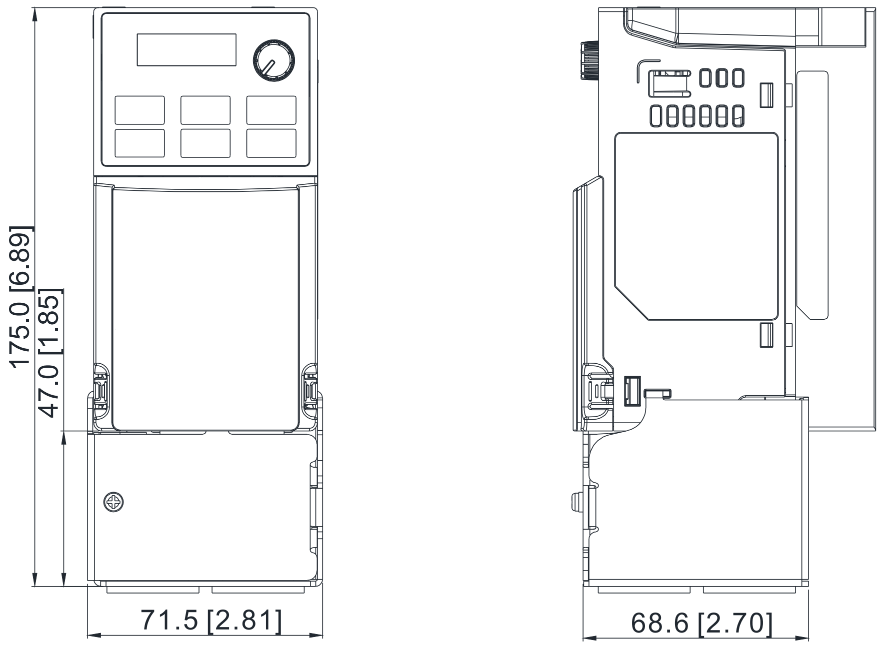
Figure 7-37

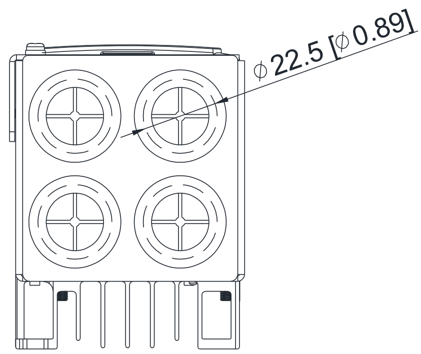
7-9 NEMA 1 / UL Type 1 Kit

Conduit box installation

Frame A (A1, A2)

Conduit box model: MKME-CBA0



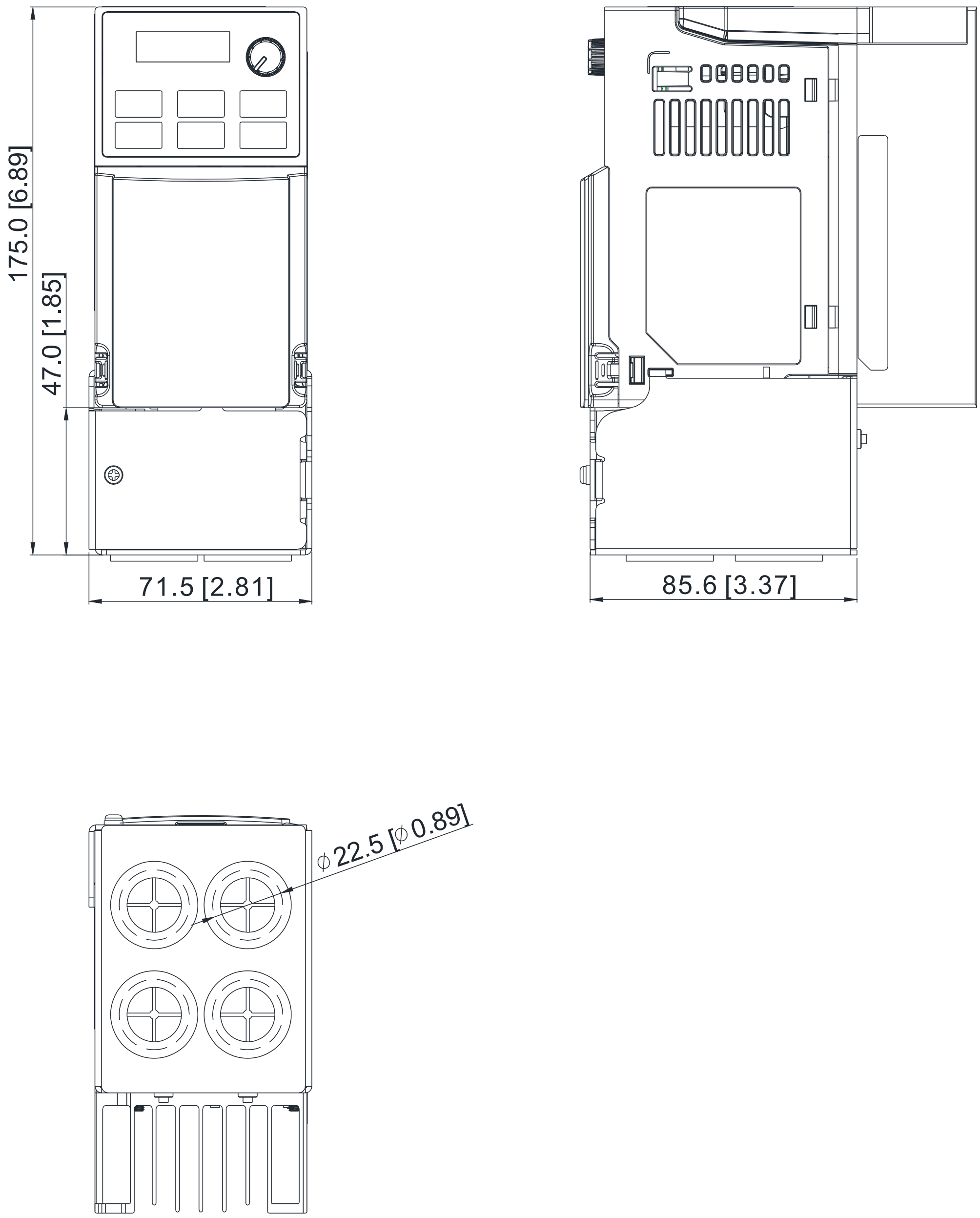


Unit: mm (inch)

Figure 7-38

Frame A (A3–A6)

Conduit box model: MKME-CBA

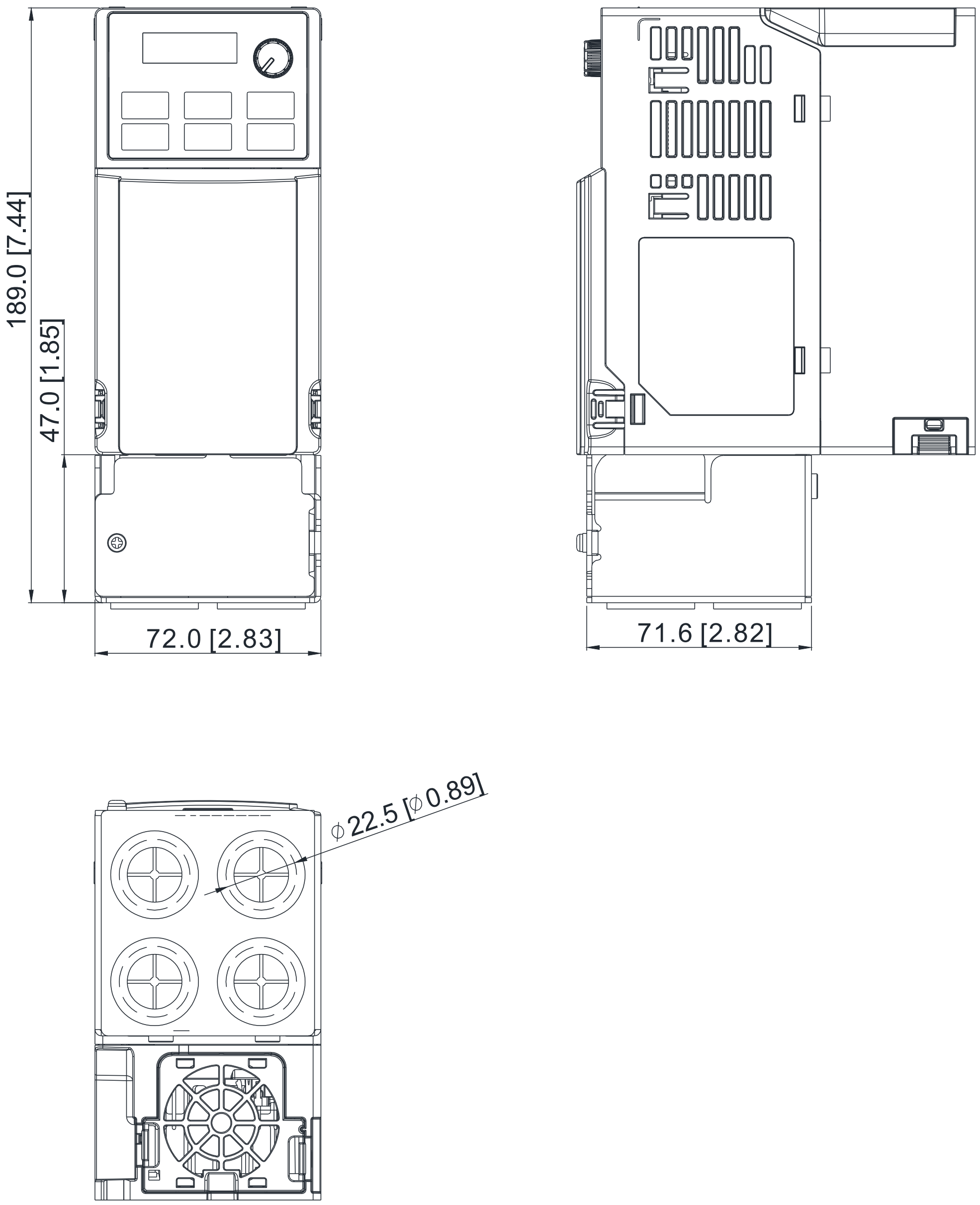


Unit: mm (inch)

Figure 7-39

Frame B

Conduit box model: MKME-CBB

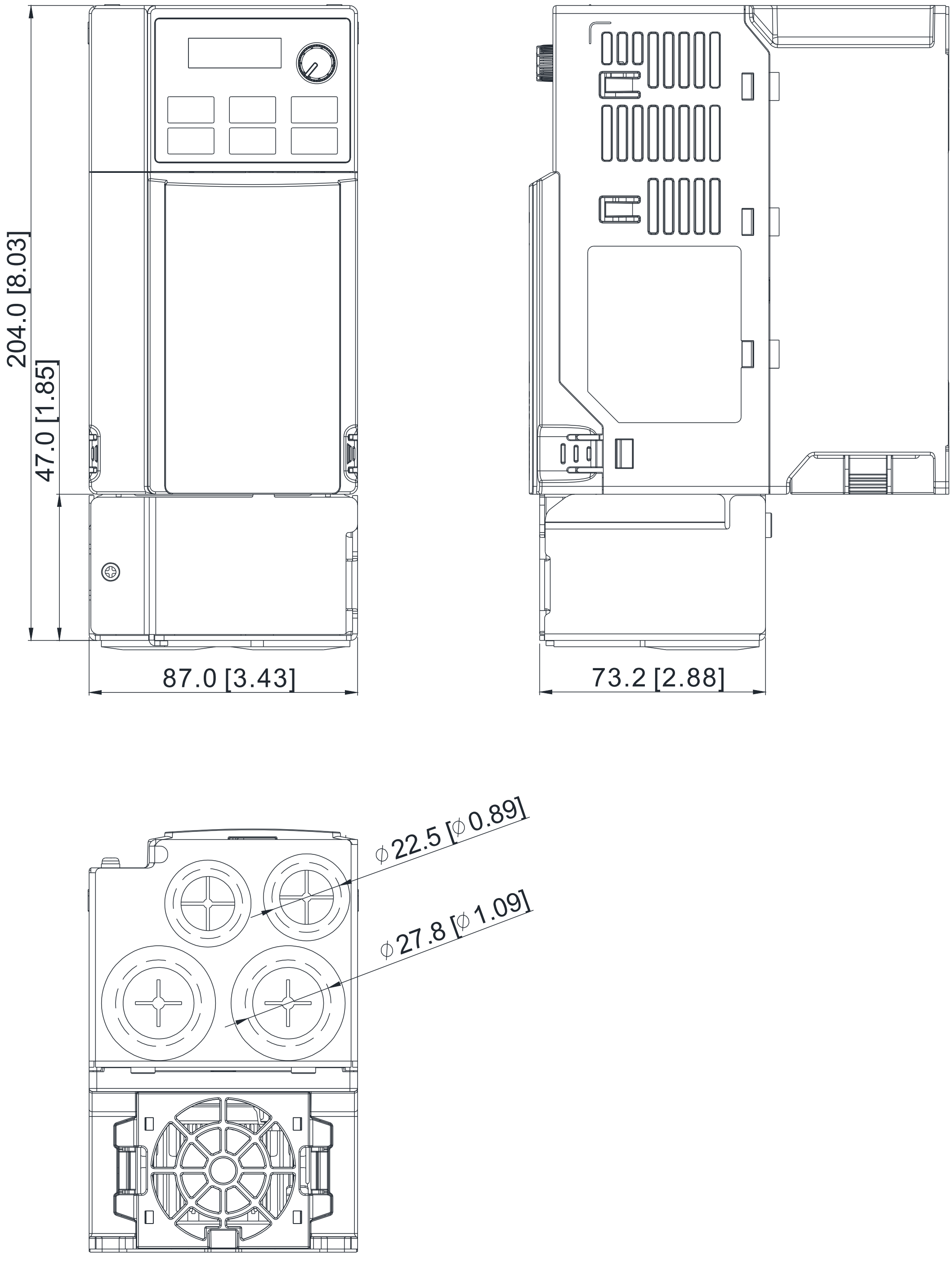


Unit: mm (inch)

Figure 7-40

Frame C

Conduit box model: MKME-CBC

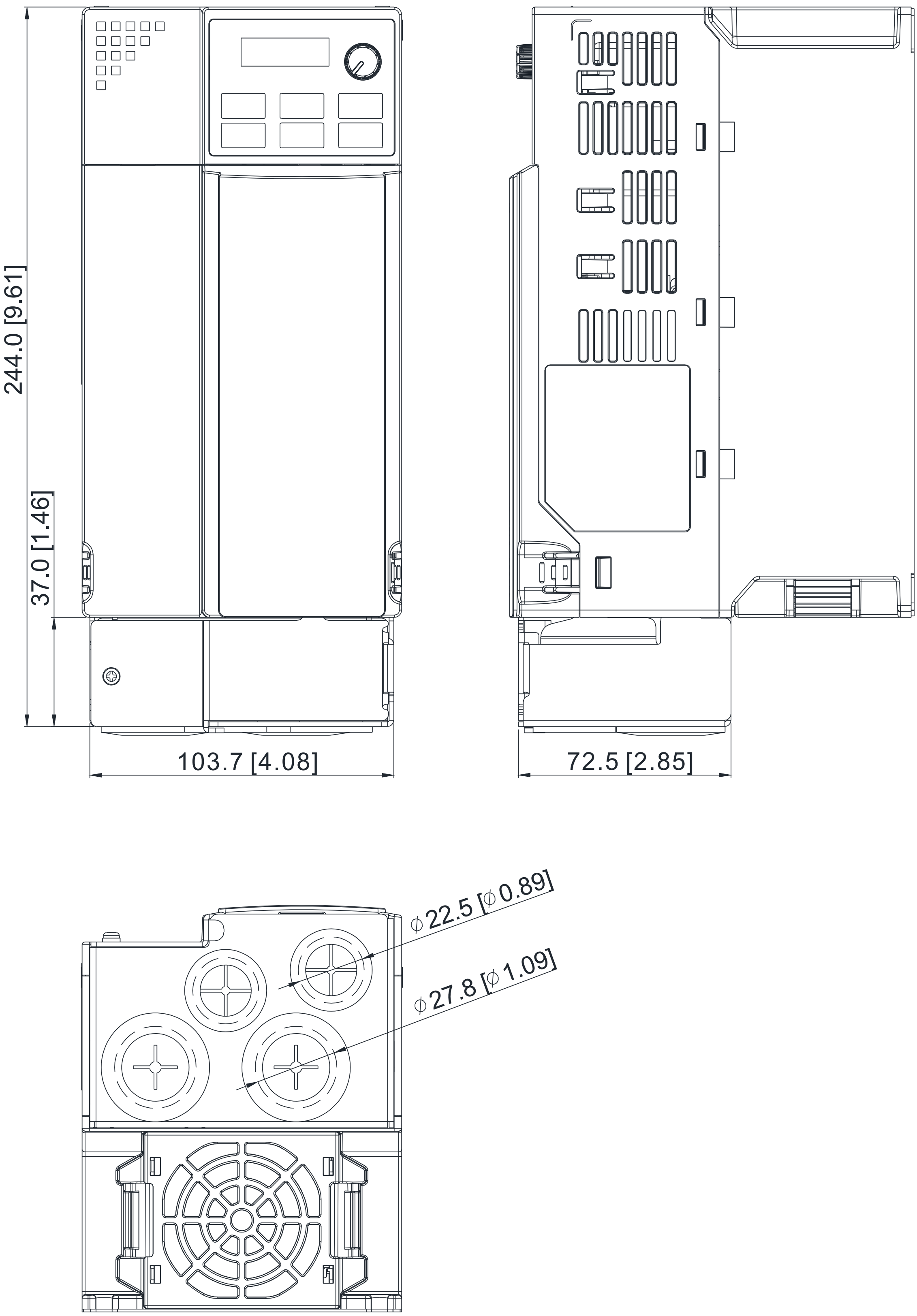


Unit: mm (inch)

Figure 7-41

Frame D

Conduit box model: MKME-CBD



Unit: mm (inch)

Figure 7-42

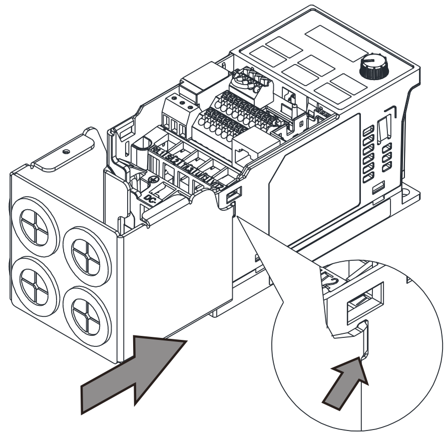
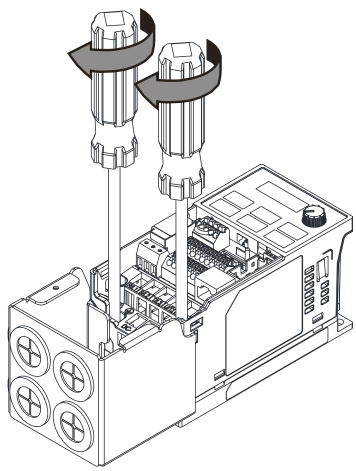
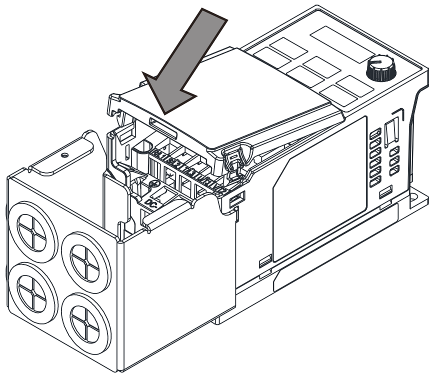
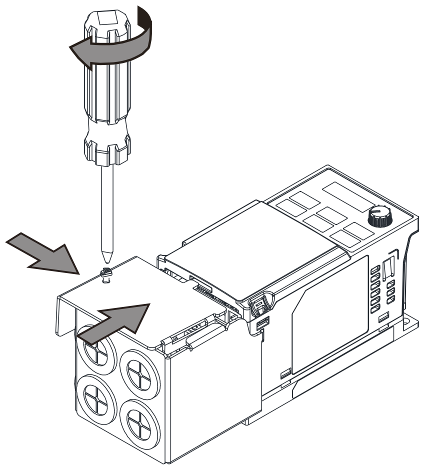
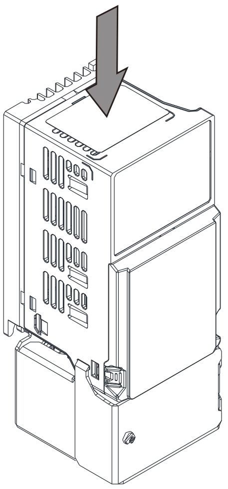
Installation

Recommended screw size and torque value: M3: 4–6 kg-cm / [3.5–5.2 lb-in.] / [0.39–0.59 Nm]

M3.5: 4–6 kg-cm / [3.5–5.2 lb-in.] / [0.39–0.59 Nm]

M4: 6–8 kg-cm / [5.2–6.9 lb-in.] / [0.59–0.78 Nm]

Frame A

1.  Figure 7-43	2.  Figure 7-44
3.  Figure 7-45	4.  Figure 7-46
5.  Figure 7-47	

Frame B–D

1.

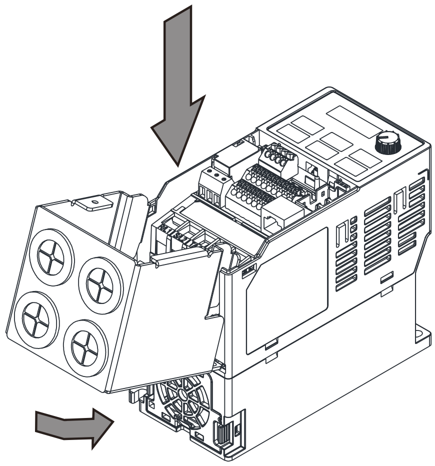


Figure 7-48

2.

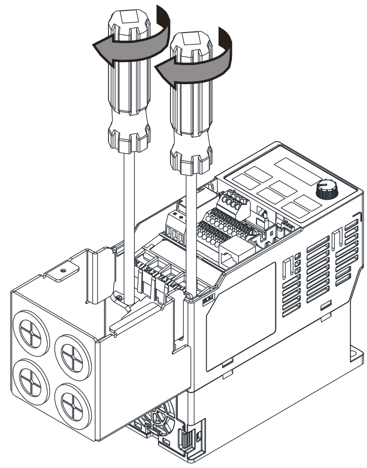


Figure 7-49

3.

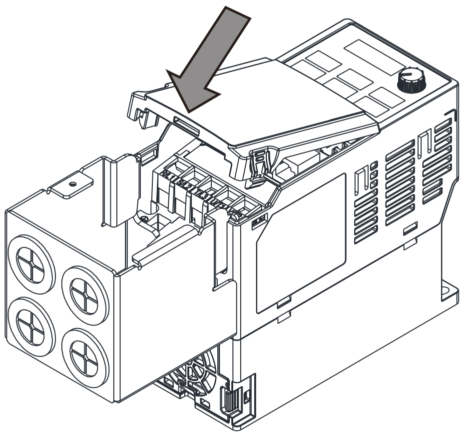


Figure 7-50

4.

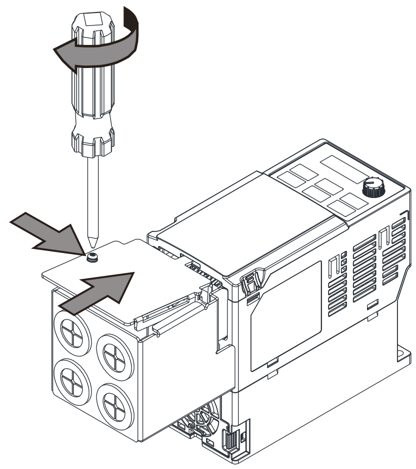


Figure 7-51

5.

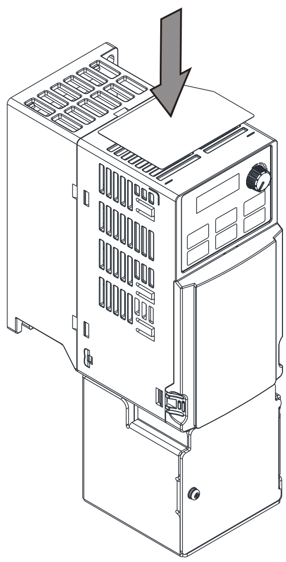


圖7-52

7-10 Fan Kit

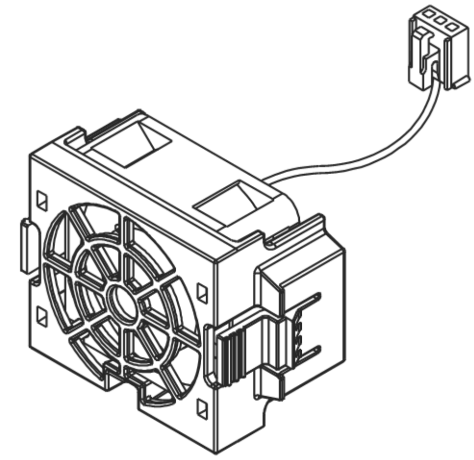
<table>
<tr><th>Frame</th><th>Fan Models</th><th>Reference Figure</th></tr>
<tr><td>A</td><td>MKM-FKMA</td><td rowspan="4">
Figure 7-53</td></tr>
<tr><td>B</td><td>MKM-FKMB</td></tr>
<tr><td>C</td><td>MKM-FKMC</td></tr>
<tr><td>D</td><td>MKM-FKMD</td></tr>
</table>

Table 7-46

Fan Removal

1. As shown in the figure below, press the tabs on both sides of the fan to remove it.

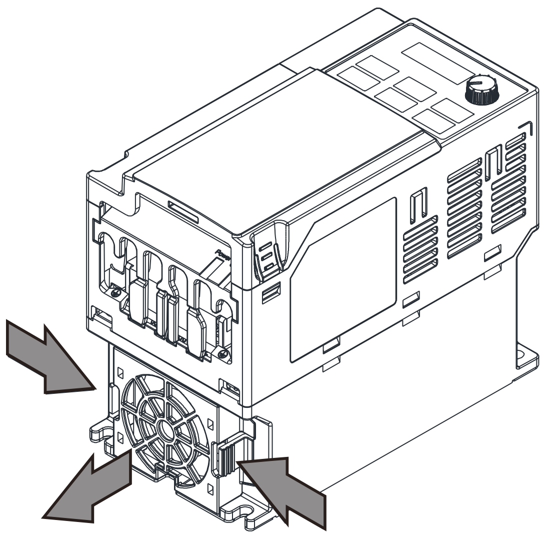


Figure 7-54

2. Disconnect the power cable while removing the fan.

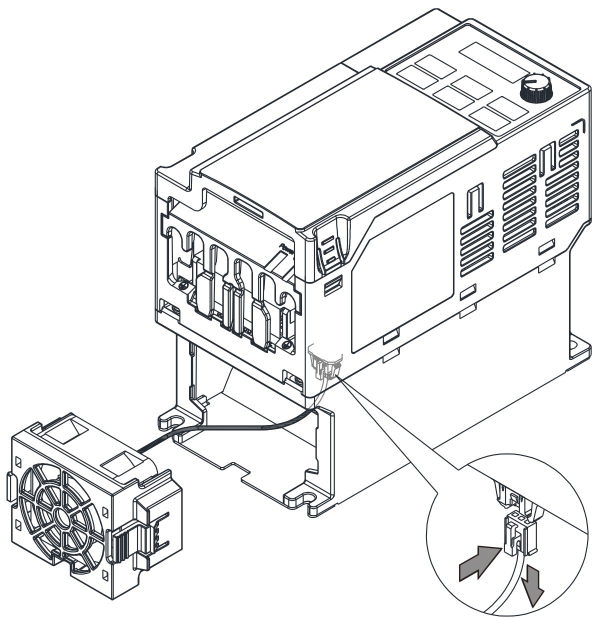


Figure 7-55

7-11 DinRail Mounting

MKM-DRB (Applicable for frame A and frame B)

Screw	Torque
M4*2PCS	8–10 kg-cm [6.9–8.7 lb-in.] [0.78–0.98 Nm]

Table 7-47

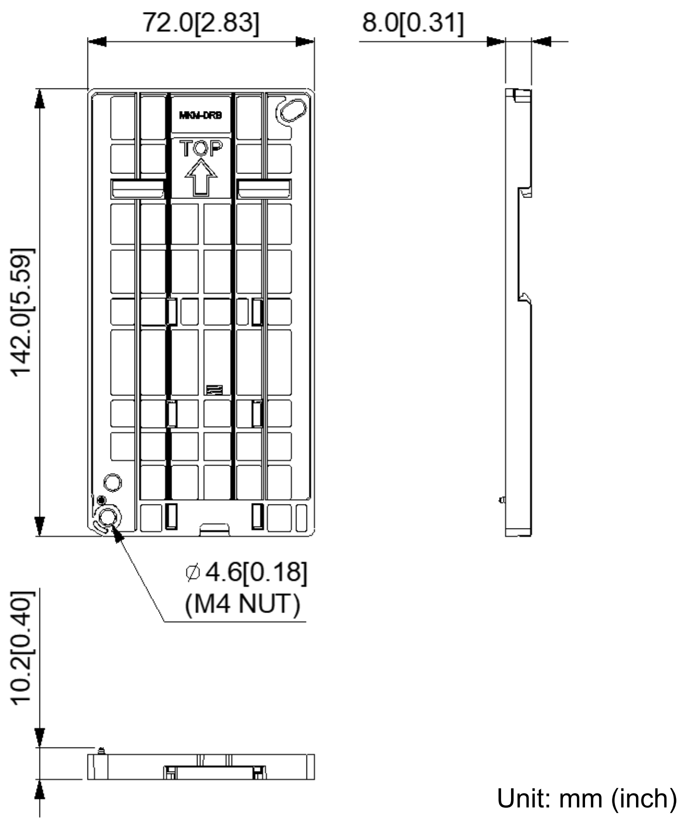


Figure 7-56

MKM-DRC (Applicable for Frame C)

Screw	Torque
M5*4PCS	10–12 kg-cm [8.7–10.4 lb-in.] [0.98–1.18 Nm]

Table 7-48

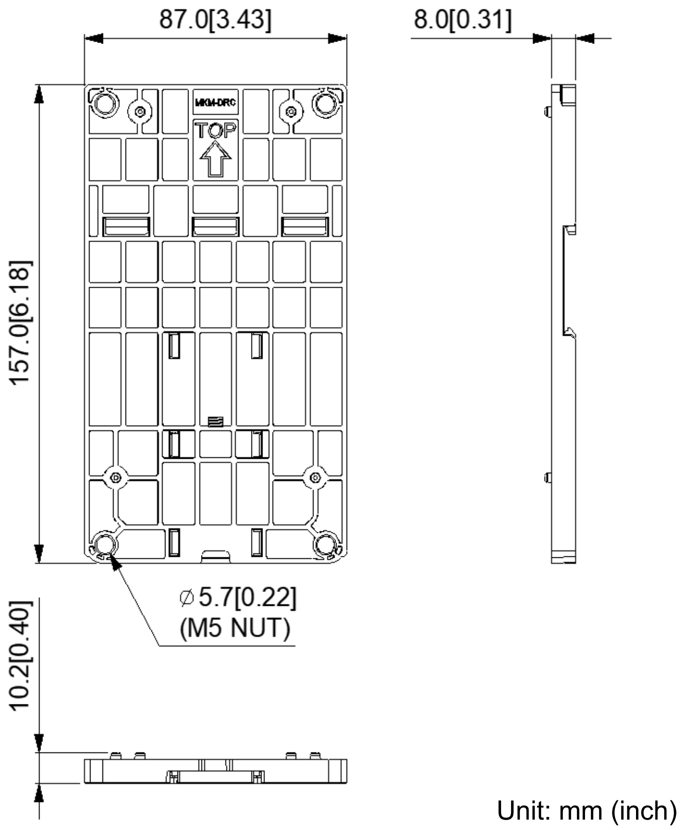


Figure 7-57

Installation

Models	Screw	Torque
MKM-DRB	M4*P0.7*2PCS	8–10 kg-cm / [6.9–8.7 lb-in.] / [0.78–0.98 Nm]
MKM-DRC	M5*P0.8*4PCS	10–12 kg-cm / [8.7–10.4 lb-in.] / [0.98–1.18 Nm]

Table 7-49

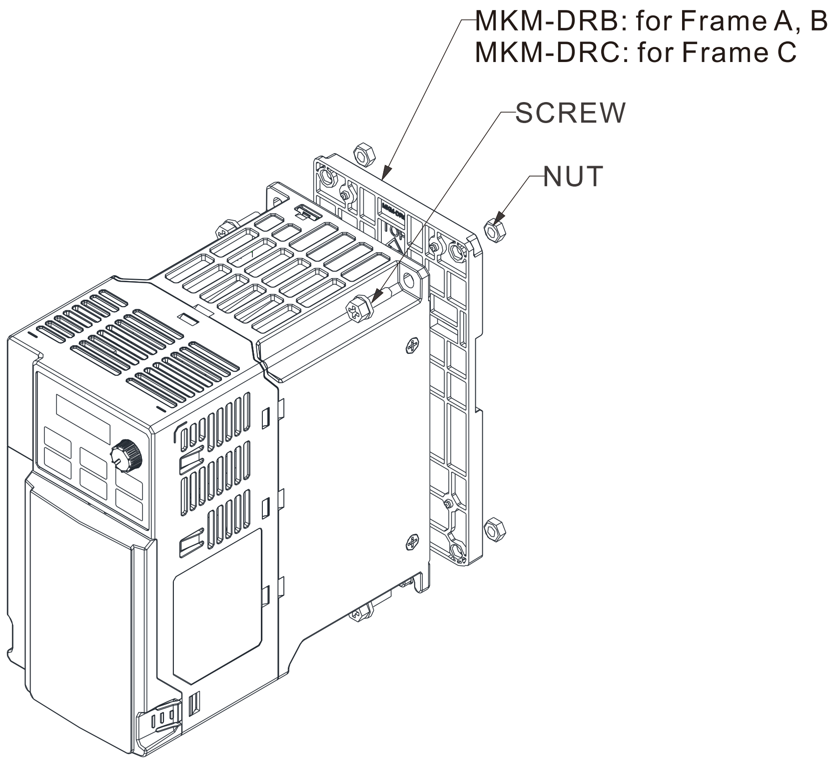


Figure 7-58

7-12 Mounting Adapter Plate

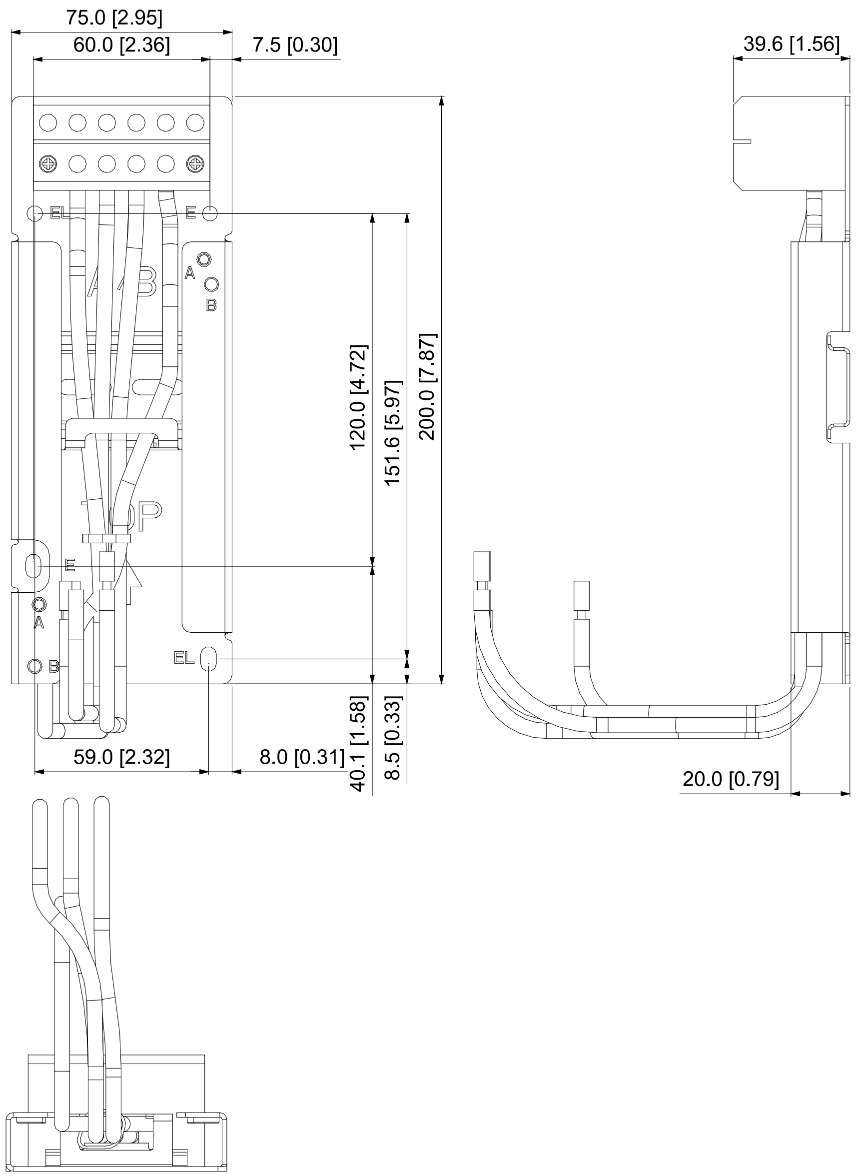
The mounting adapter plate is to change the wiring method for the ME300 / MS300 / MH300 series to provide you a flexible installation. It changes the wiring method from the “bottom-mains input/ bottom-motor output" to the “top-mains input/bottom-motor output" for ME300 / MS300 / MH300. Therefore, you can use the mounting adapter plate to change the drive from VFD-E / VFD-EL series to ME300 / MS300 / MH300 series without changing the original wiring method and fixing hole. The following table shows the correspondences.

Series / Models	ME300 / MS300 / MH300	VFD-E	VFD-EL
MKM-MAPB	Frame A, B	Frame A	Frame A
MKM-MAPC	Frame C	Frame B	Frame B

Table 7-50

MKM-MAPB

Applicable for frame A and frame B



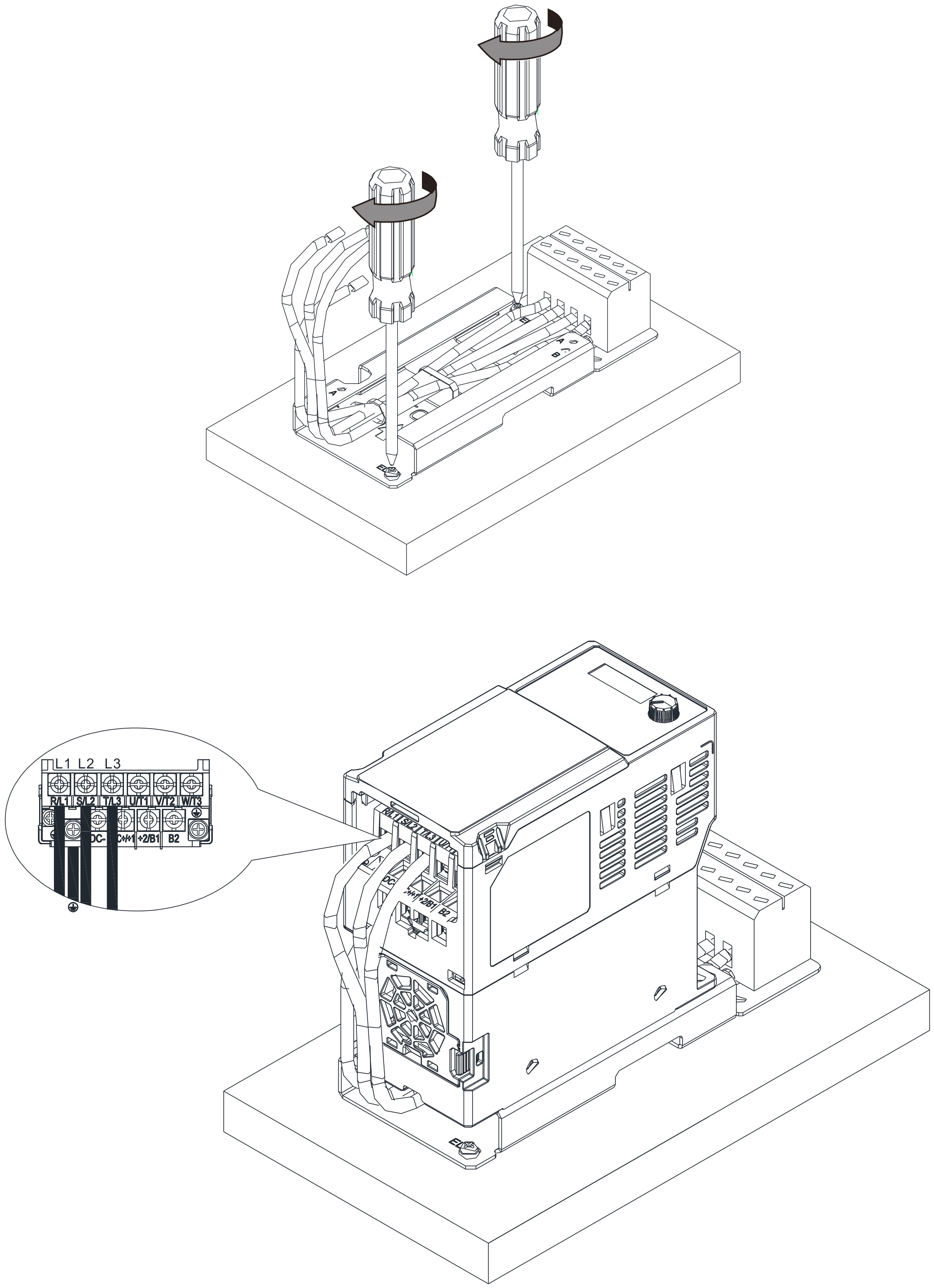
Unit: mm (inch)

Figure 7-59

Installation

Screw	Torque
M4	14–16 kg-cm / [12.4–13.9 lb-in.] / [1.37–1.57 Nm]
M5	16–20 kg-cm / [13.9–17.4 lb-in.] / [1.57–1.96 Nm]

Table 7-51

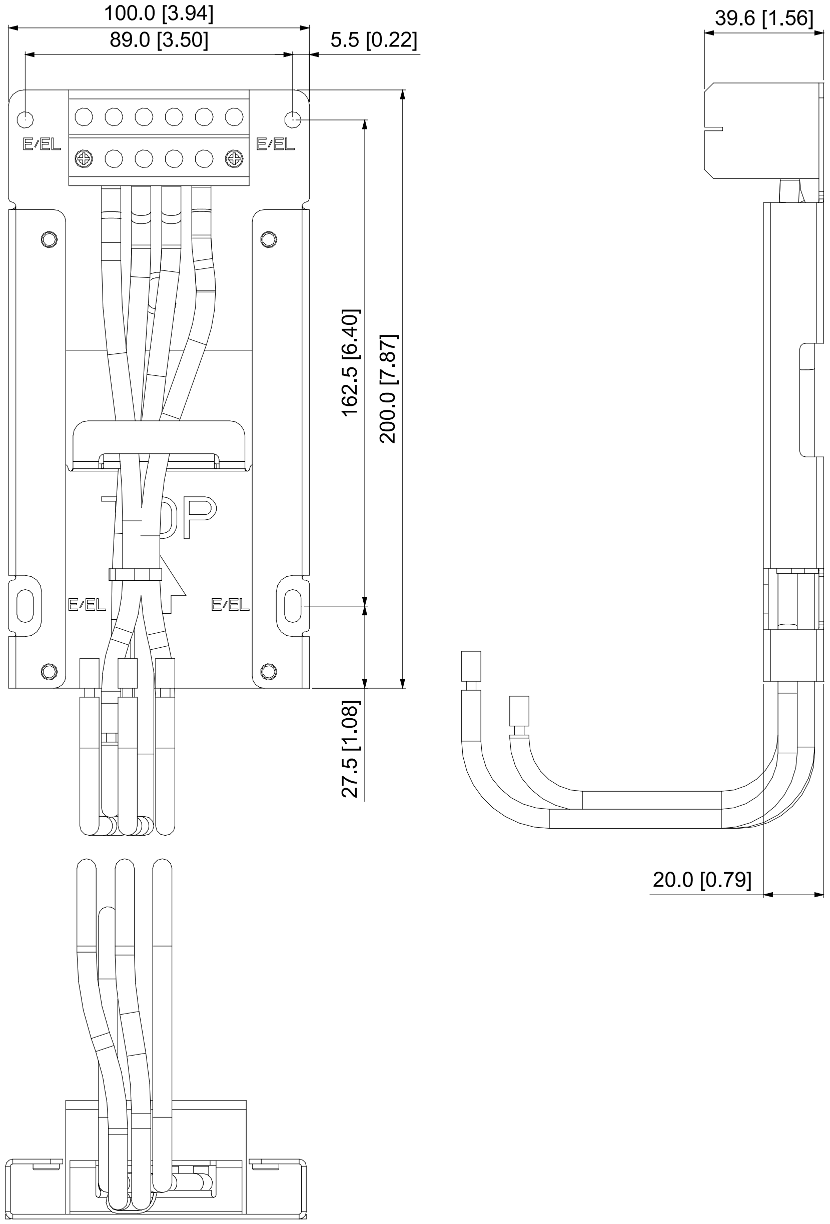


Unit: mm (inch)

Figure 7-60

MKM-MAPC

Applicable for frame C



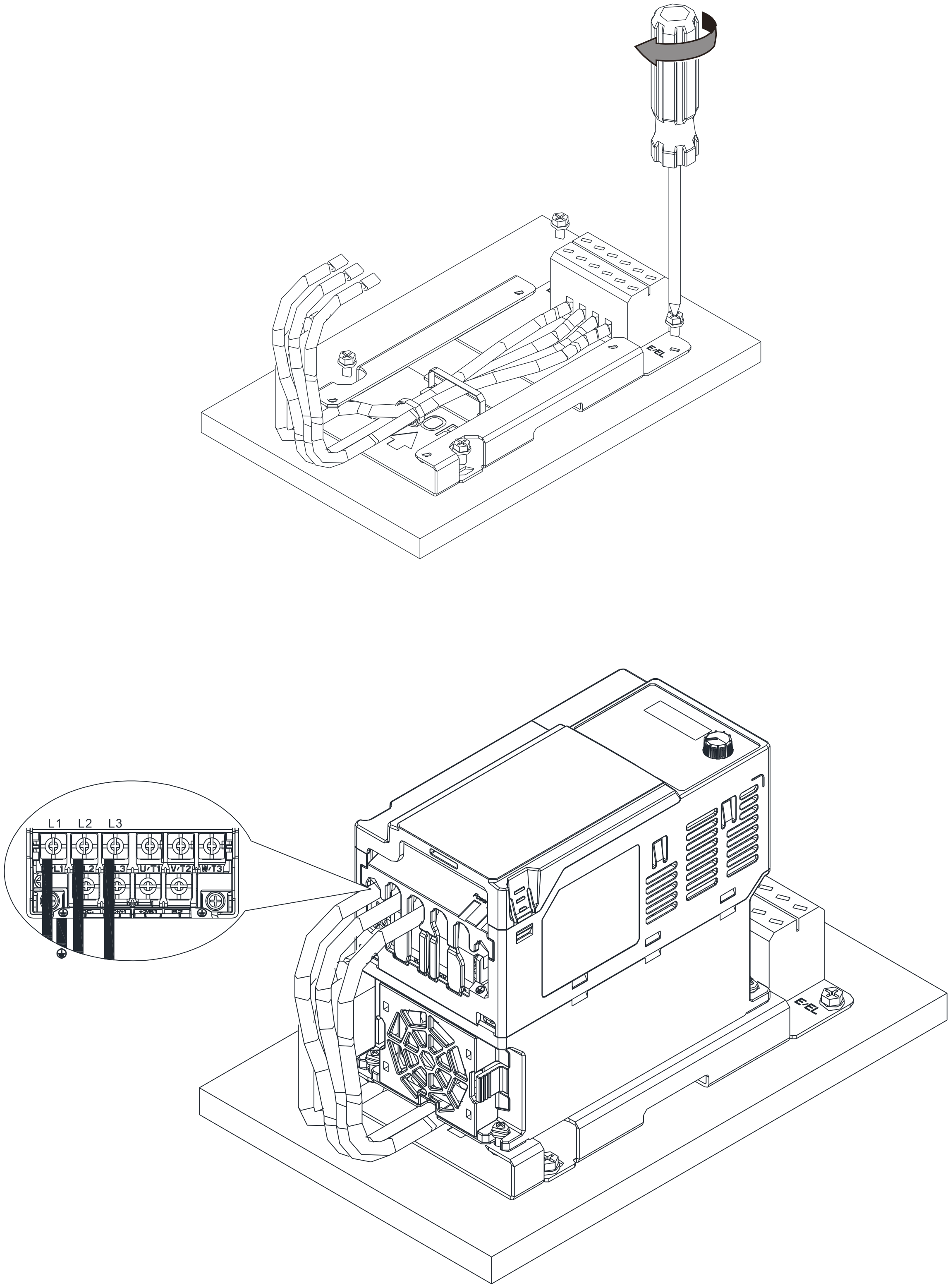
Unit: mm (inch)

Figure 7-61

Installation

Screw	Torque
M4	14–16 kg-cm / [12.4–13.9 lb-in.] / [1.37–1.57 Nm]
M5	16–20 kg-cm / [13.9–17.4 lb-in.] / [1.57–1.96 Nm]

Table 7-52



Unit: mm (inch)

Figure 7-62

7-13 Digital Keypad - KPC-CC01

7-13-1 Introduction

The default communication protocol for ME300 is ASCII 9600, 7, N, 2, whereas the default communication protocol for KPC-CC01 is RTU 19200, 8, N, 2. So you must set the ME300 communication parameters as follows to connect it to KPC-CC01.

- Pr.09-00 Communication Address: Settings = 1
- Pr.09-01 COM1 Transmission Speed (Baud rate): Settings = 19.2 Kbps
- Pr.09-04 COM1 Communication Protocol: Settings = 13: 8N2 (RTU)

KPC-CC01

Communication Interface

RJ45 (socket), RS-485 interface

Communication Protocol

RTU19200, 8, N, 2

Installation Method

- Install the embedded type on the surface of the control box. The front cover is waterproof.
- Buy a MKC-KPPK model for wall mounting or embedded mounting. Its protection level is IP66.
- The maximum RJ45 extension lead is 5 m (16 ft).
- This keypad can only be used on Delta's motor drive C2000, CH2000, CP2000, MS300, MH300 and ME300.

Keypad Function Descriptions

Key	Descriptions
	Start Operation Key 1. Only valid when the source of operation command is the keypad. 2. Operates the AC motor drive by the function setting. The RUN LED will be ON. 3. Can be pressed repeatedly at the stop process.
	STOP key 1. This key has the highest priority when the command is from the keypad. 2. When it receives the STOP command, regardless of whether the AC motor drive is in operation or stop status, the AC motor drive executes the "STOP" command. 3. Use the RESET key to reset the drive after a fault occurs. 4. For the situations cannot reset: a. The trigger conditions to the fault may not been cleared. You can reset the drive after the troubleshooting. b. To check the fault status when starting up, it is necessary to troubleshoot first and then restart the drive.
	Operation Direction Key 1. Only controls the operation direction, NOT the drive activation. FWD: forward, REV: reverse. 2. Refer to the LED descriptions for more details.
	ENTER Key Go to the next menu level. If it's the last level, press ENTER to execute the command.

Key	Descriptions
ESC	To be a "Back to previous menu" function for each sub-menu, press ESC key to go back to the previous page. This also a function to cancel the selection.
MENU	Return to the main menu after pressing MENU key in whichever page. Menu commands: 1. Parameter setting 2. Quick Start 3. Application Selection List 4. Changed List 5. Copy Parameter 6. Fault Record 7. Language Setup 8. Time Setup 9. Keypad Locked 10. PLC Function 11. Copy PLC 12. Display Setup 13. Start-up Menu 14. Main Page 15. PC Link 16. Start Wizard ● ME300 do not support item 2, 8, 10, 11 and16.
< > ^ v	1. Direction: Left / Right / Up / Down 2. In the numeric value setting mode, moves the cursor and changes the numeric value. 3. In the menu/text selection mode, selects an item.
F1 F2 F3 F4	Function Key 1. The functions keys have defaults and can also be user-defined. The defaults for F1 and F4 work with the function list below. For example, F1 is the JOG function, and F4 is a speed setting key for adding/deleting user-defined parameters. 2. Other function keys need to be defined with TPEditor before they can take effect. Download TPEditor software at Delta website. Select TPEditor version 1.60 and later. Refer to the installation instruction for TPEditor in Section 10-3.
HAND	1. Use this key to select HAND mode. In this mode, the drive's parameter settings for frequency command source is Pr.00-30, and that for operation command source is Pr.00-31. 2. Press the HAND key at STOP, then the setting switches to HAND frequency source and HAND operation source. 3. Press HAND key at RUN, and it stops the AC motor drive first (displays AHSP warning), and switches to HAND frequency source and HAND operation source. 4. Successful mode switching for the KPV-CC01 displays HAND mode on the screen.
AUTO	1. The default of the drive is AUTO mode. 2. Use this key to select AUTO mode. In this mode, the drive's parameter settings for frequency command source is Pr.00-20, and that for operation command is Pr.00-21. 3. Press the AUTO key at STOP, then the setting switches to AUTO frequency source and AUTO operation source. 4. Press AUTO key at RUN, and it stops the AC motor drive first (displays AHSP warning), and switches to AUTO frequency source and AUTO operation source. 5. Successful mode switching for the KPV-CC01 displays AUTO mode on the screen.

Table 7-53

NOTE: The defaults for the frequency command and operation command source of HAND / AUTO mode are both from the keypad.

LED Function Descriptions

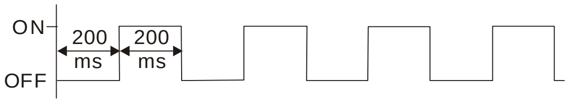
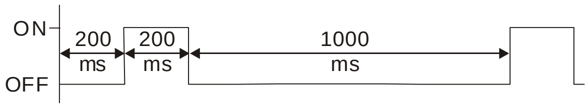
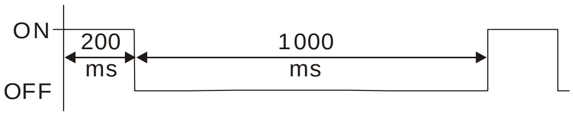
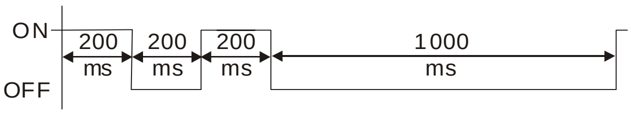
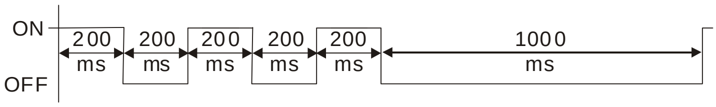
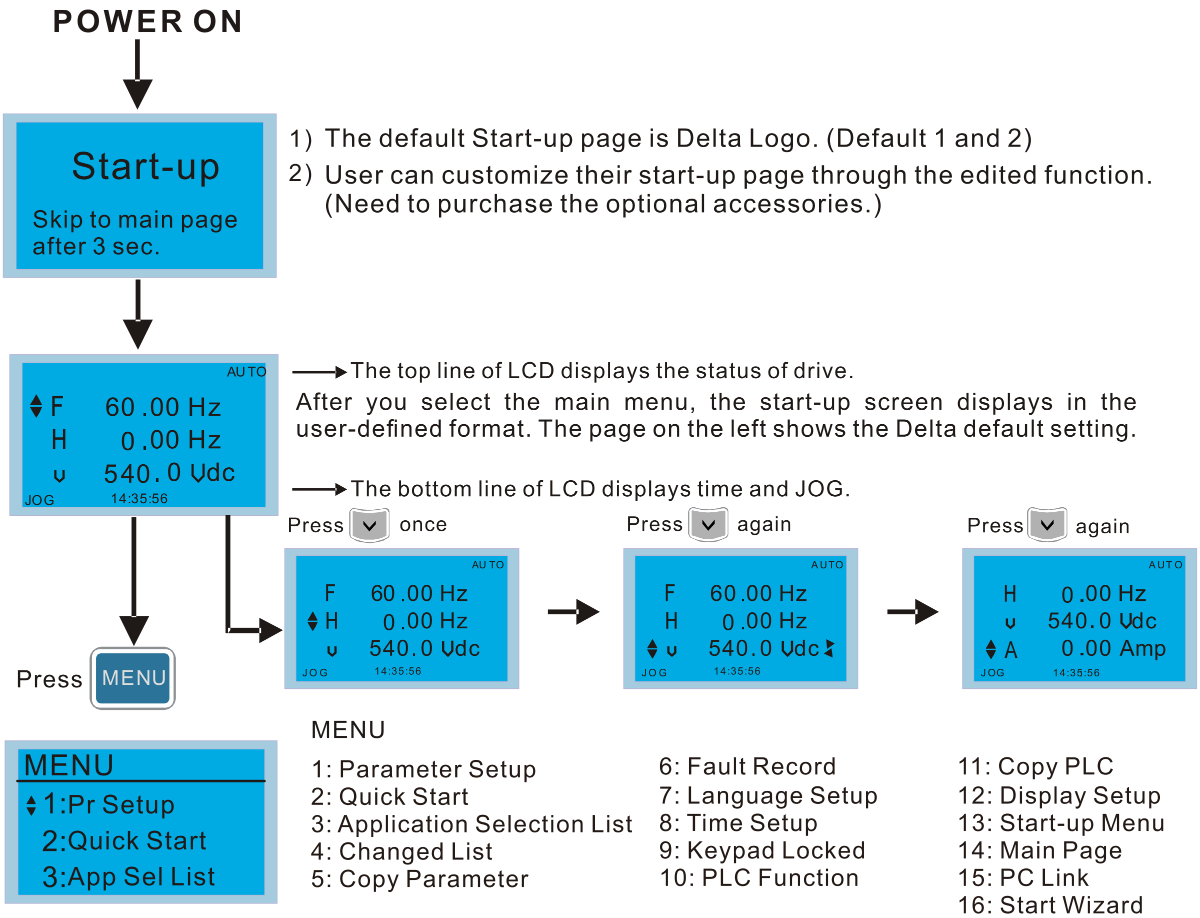
<table>
<tr><th>LED</th><th>Descriptions</th></tr>
<tr><td>
</td><td>The indicator light to show whether the drive executes stop command. Always ON: the drive is stopped.
Flashing: the drive is in standby state.
Always OFF: the drive does not execute stop command.</td></tr>
<tr><td>
</td><td>The indicator light to show the drive’s operation direction.
1. Always ON-Green light: the drive is running forward.
2. Always ON-Red light: the drive is running backward.
3. Flashing: the drive is changing direction.
The indicator light to show the drive’s operation direction in torque mode.
1. Always ON-Green light: when the torque command ≥ 0, and the motor is running forward.
2. Always ON-Red light: when the torque command < 0, and the motor is running backward.
3. Flashing: when the torque command < 0, and the motor is running forward.</td></tr>
<tr><td>CANopen–RUN</td><td>Green RUN light:
<table>
<tr><th>Display</th><th colspan="2">Light ON / OFF Status</th></tr>
<tr><td>OFF</td><td>CANopen at initial</td><td>No lights ON and OFF</td></tr>
<tr><td>Flashing</td><td>CANopen at pre-operation</td><td>
</td></tr>
<tr><td>Single flash</td><td>CANopen at stopped</td><td>
</td></tr>
<tr><td>ON</td><td>CANopen at operation status</td><td>
</td></tr>
</table></td></tr>
<tr><td>CANopen–ERR</td><td>Red ERR light:
<table>
<tr><th>Display</th><th colspan="2">Light ON / OFF Status</th></tr>
<tr><td>OFF</td><td colspan="2">No Error</td></tr>
<tr><td>Single flash</td><td>At least one packet of CANopen is in failure</td><td>
</td></tr>
<tr><td>Double flash</td><td>Node guarding failure or heartbeat message failure</td><td>
</td></tr>
<tr><td>Triple flash</td><td>SYNC failure</td><td>
</td></tr>
<tr><td>ON</td><td>Bus off</td><td>
</td></tr>
</table></td></tr>
</table>

Table 7-54

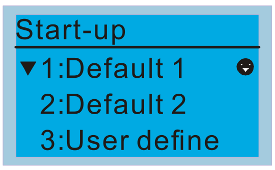
7-13-2 Functions of Digital Keypad KPC-CC01

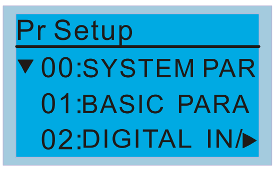


NOTE:

1. Start-up screen displays static images, cannot display dynamic such as information ticker.
2. When powered ON, it displays the start-up screen then the main screen. The main screen displays Delta's default setting F / H / A / U. You can set the display order with Pr.00-03 (Start-up display). When you select the U screen, use the left / right keys to switch between the items, and set the display order for the U screen with Pr.00-04 (User display).

Display Icons





● : present setting

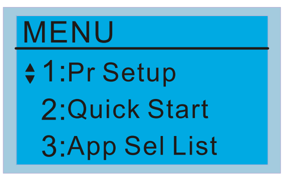
▼ : Scroll down the page for more options

Press ˄ ˅ for more options

► : show complete sentence

Press < > for complete information

Display items



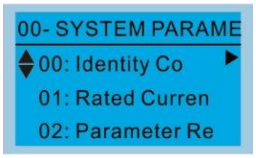
MENU

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

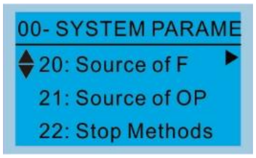
1. Parameter setting

Press ENTER to select.
Press UP / DOWN to select the parameter group.
Once you select a parameter group, press ENTER to go into that group.

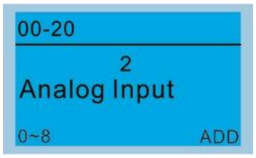
Example: Setup source for the master frequency command.



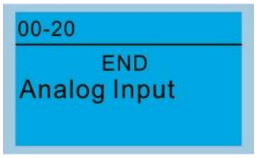
In the Group 00 Motor Drive Parameter, use UP / DOWN keys to select parameter 20: Auto Frequency Command.



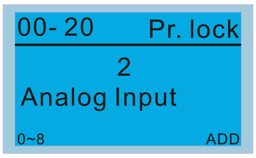
Press ENTER to go to this parameter's setting menu.



Use the UP / DOWN keys to choose a setting.
For example: choose 2 Analogue Input, and then press ENTER key.



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

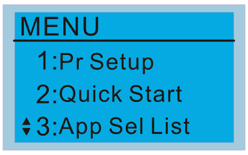


NOTE: When parameter lock / password protection function is enabled, it displays "Pr. lock" on the upper right corner of the keypad. The parameter cannot be written or is protected by the password under this circumstances.

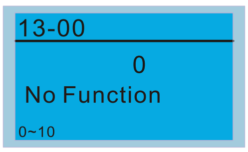
2. Quick Start (ME300 series does not support this function)

3. Application Selection List

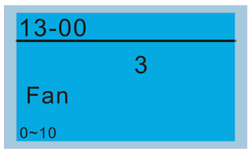
This function enables you to select application and its parameter sets.
Example:
In the menu content, select 3: Application Selection List



Press ENTER to go into the Application Selection List

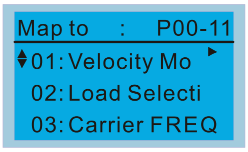


Select Application

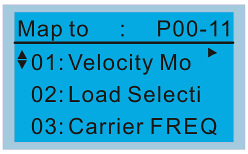


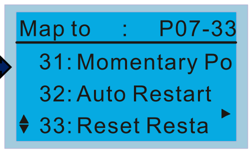
Press ENTER to enter the application selection screen, and the selected application industry is "Fan".

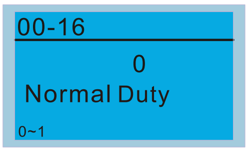
Press ENTER to enter the Fan application screen.

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


Press the Up / Down keys to select the parameter to set.

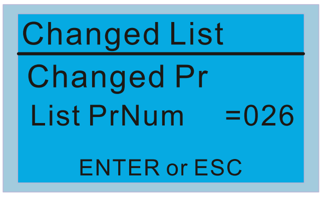




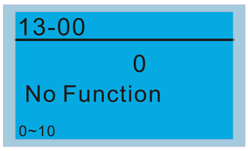


Select 0: Normal duty or 1: Heavy duty according to your needs, and then press ENTER.
</td>
</tr>
</table>

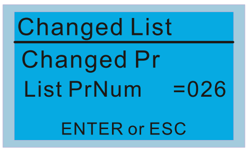
4. Changed List

<table>
<tr>
<td>


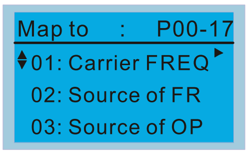
</td>
<td>
This function records the parameters you have changed.
Example:
Set Pr.13-00 Application Selection = 3: Fan



Enter the changed list screen. List PrNum = 026 means that there are 26 parameters that have been changed.



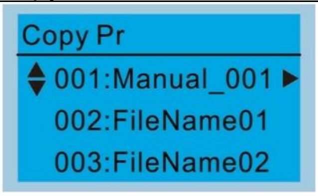
Press ENTER to enter the changed list screen.



Use the Up / Down keys to select the parameters to check or to change. Press ENTER to enter the parameter.

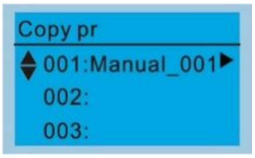
</td>
</tr>
</table>

5. Copy Parameter

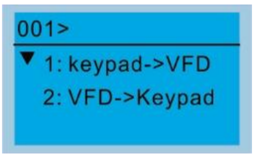


Press ENTER to go to 001–004 content storage

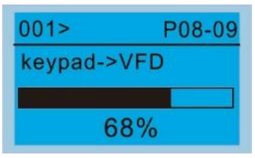
Four groups of parameters are available to copy.
The steps are shown in the example below.
Example: parameter saved in the motor drive.



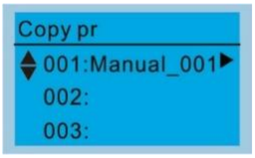
1. Go to Copy Parameter
2. Select the parameter group to copy and press ENTER.



1. Select 1: Keypad→VFD.
2. Press ENTER to go to the “Keypad→VFD” screen.

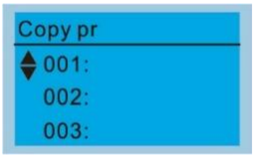


Begin copying parameters until it is done.

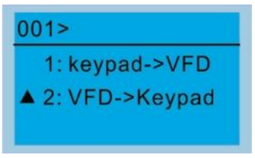


After copying is done, the keypad automatically returns to this screen.

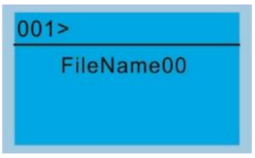
Example: PLC program saved in the keypad.



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



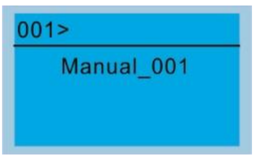
Press ENTER to go to the “VFD→Keypad” screen.



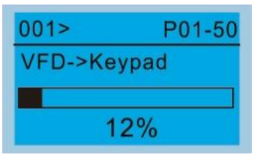
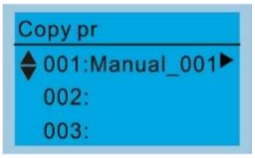
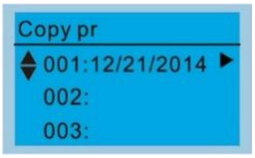
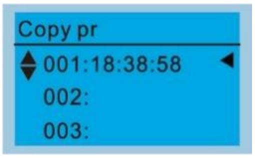
Press the Up / Down keys to select a symbol.
Press the Left / Right keys to move the cursor to select a file name.

String & Symbol Table:

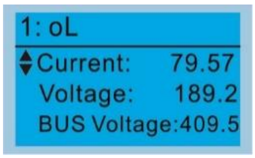
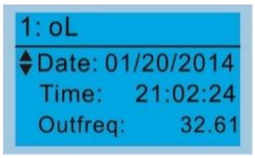
! " # $ % & ' ( ) * + , - . / 0 1 2 3 4 5 6 7 8 9 : ; < = > ? @ A
B C D E F G H I J K L M N O P Q R S T U V W X Y Z [\ ] ^ _ ' a b c d
f g h i j k l m n o p q r s t u v w x y z { | } ~

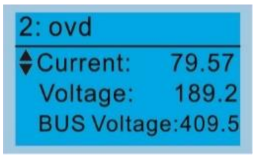


After you confirm the file name, press ENTER.

		Begin copying parameters until it is done.
		After copying is done, the keypad automatically returns to this screen.
		Press the Right key to see the date of the parameters copied.
		Press the Right key to see the time of the parameters copied.

6. Fault Record

 Press ENTER to see an error record's details.	Able to store 6 fault codes (Keypad V1.02 and previous versions) Able to store 30 fault codes (Keypad V1.20 and later version) The most recent 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. Example	
		Press the Up / Down keys to select a fault record. Press ENTER to see the fault record's details.
		Press the Up / Down keys to scroll through a fault record's details such as date, time, frequency, current, voltage, and DC bus voltage.
		Press ESC to return to the Fault Record screen.
		Press the Up / Down keys to select a fault record. Press ENTER to see the fault record's details.



Press the Up / Down keys to scroll through a fault record's details such as date, time, frequency, current, voltage, and DC bus voltage.

NOTE: The AC motor drive actions are recorded and saved to the KPC-CC01. When you remove the KPC-CC01 and connect it to another AC motor drive, the previous fault records are not deleted. The new fault records of the new AC motor drive continue to be added to the KPC-CC01.

7. Language Setup

Press the Up / Down keys to select the language, and then press ENTER.

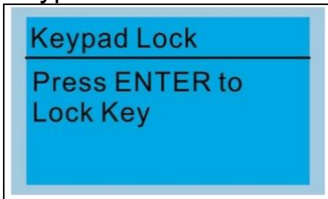
The language setting option is displayed in the language of your choice.

Language setting options:

1. English
2. 繁體中文
3. 简体中文
4. Türkçe (Turkish)
5. Русский (Russian)
6. Español (Spanish)
7. Português (Portuguese)
8. Français (French)
9. Polski (Polish)
10. Deutsch (German)
11. Italiano (Italian)
12. Svenska (Swedish)

8. Time Setup (ME300 series does not support this function)

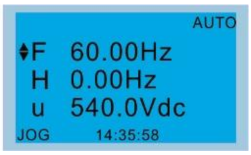
9. Keypad Locked



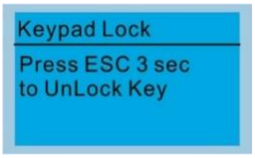
Press ENTER to lock

Lock the keypad

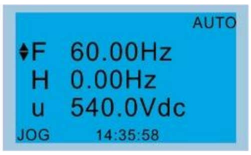
Use this function to lock the keypad. The main screen does not display "keypad locked" when the keypad is locked; however, it displays the message "Press ESC 3 sec to UnLock Key" when you press any key.



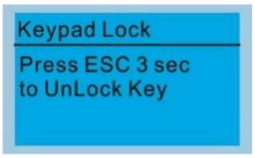
When the keypad is locked, the main screen does not indicate the lock status.



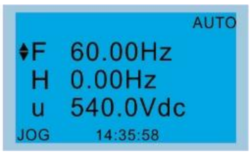
Press any key on the keypad; a message displays as shown on the left.



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



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

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


Press ESC for 3 seconds to unlock the keypad; the keypad returns to this screen.

All keys on the keypad is functional. Turning the power off and on does not lock the keypad.
</td>
</tr>
</table>

10. PLC Function (ME300 series does not support this function)

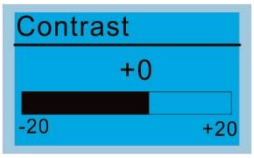
11. Copy PLC (ME300 series does not support this function)

12. Display Setup

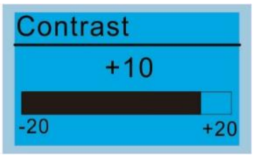
<table>
<tr>
<td>


Press ENTER to go to the setting screen
</td>
<td>

● Contrast

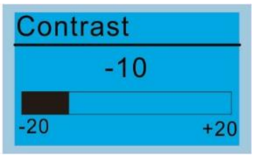


Press the Up / Down keys to adjust the setting value.

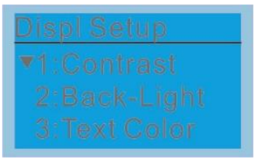


For example, increase Contrast to +10.

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



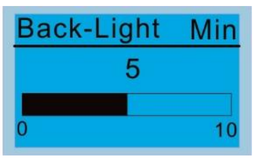
Then press ENTER and decrease the Contrast to -10.



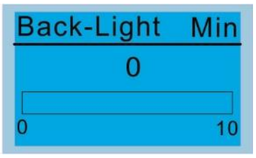
Press ENTER to see screen display after contrast is adjusted to -10.

● 2. Back-Light

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



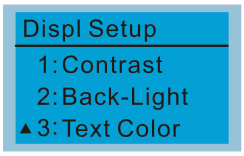
Press the Up / Down keys to adjust the setting value.
</td>
</tr>
</table>



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

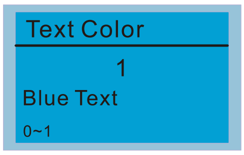
When the setting value is 10 Min, the backlight turns OFF in 10 minutes.

- Text Color



Press ENTER to go to the Text Color Setting screen.

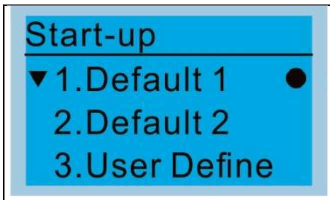
The default value is White Text.



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

The setting value changes to Blue Text.

13. Start-up



- Default 1

DELTA LOGO

- Default 2

DELTA Text

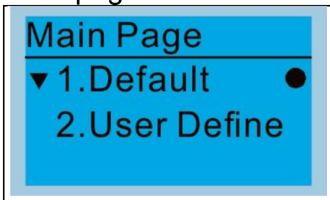
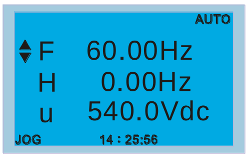
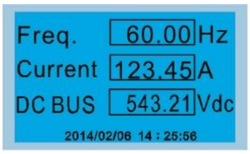
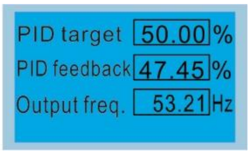
- User-Defined

An optional accessory is required (TPEditor & USB / RS-485 Communication Interface-IFD6530) to design your own start-up screen.

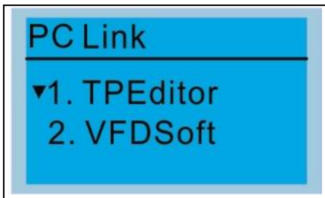
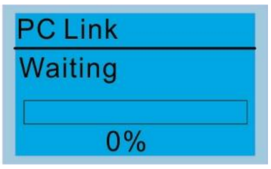
If the editor accessory is not installed, the User Define option displays a blank screen.

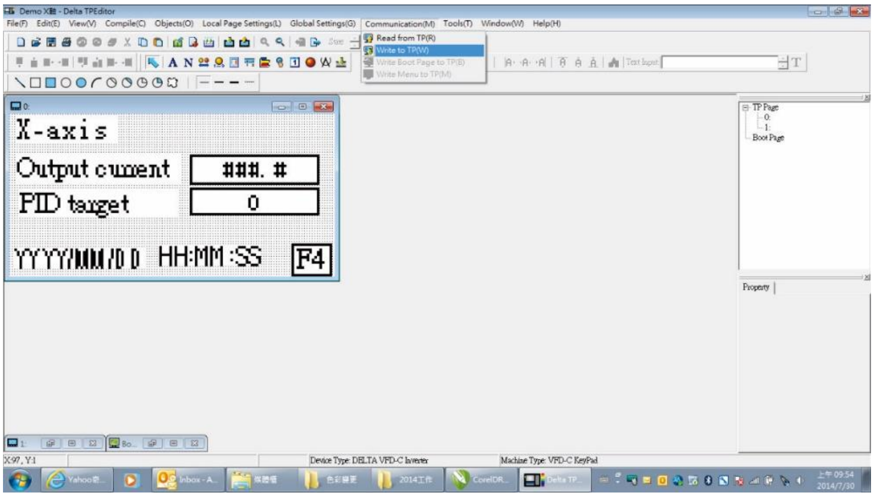
	 USB/RS-485 Communication Interface-IFD6530 Refer to Chapter 07 Optional Accessories for more details. Download TPEditor software at Delta website. Select TPEditor version 1.60 and later. Refer to the installation instruction for TPEditor in Section 7-13-3.

14. Main page

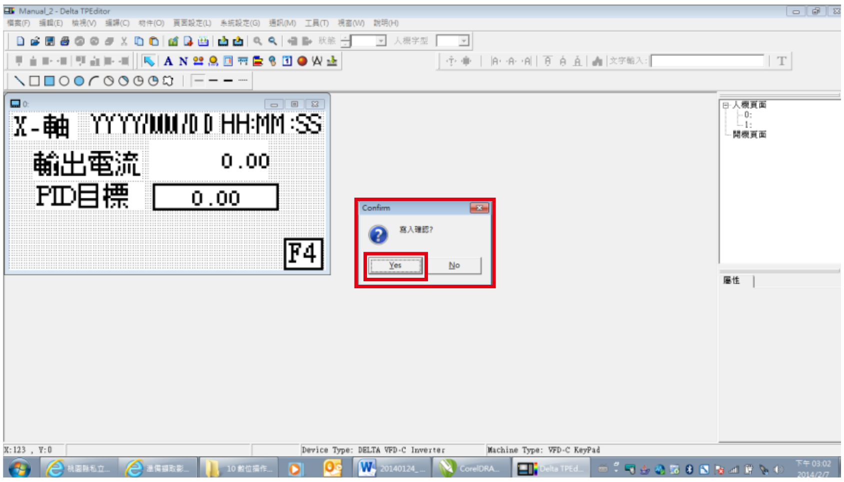
 Default screen and editable screen are available. Press ENTER to go to the setting screen	● Default page  F 60.00Hz >>> H >>> A >>> U (options rotate) ● User-Defined An optional accessory is required (TPEditor & USB / RS-485 Communication Interface-IFD6530) to design your own start-up screen. If the editor accessory is not installed, the User Define option displays a blank screen.   USB/RS-485 Communication Interface-IFD6530 Refer to Chapter 07 Optional Accessories for more details. Download TPEditor software at Delta website. Select TPEditor version 1.60 and later. Refer to the installation instruction for TPEditor in Section 7-13-3.

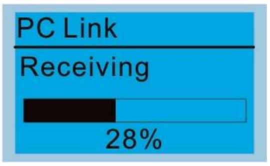
15. PC Link

	1. TPEditor: This function enables you to connect the keypad to a computer then download and edit user-defined screens.  Press ENTER to go to Waiting to connect to PC screen. In TPEditor, from the **Communication** menu, choose **Write to HMI**.

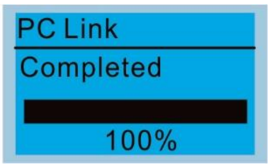


In the **Confirm** message box, click **YES**.





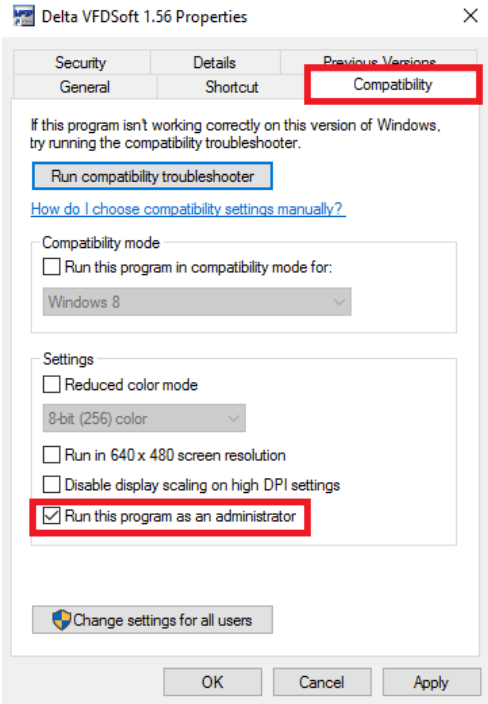
The software starts downloading screens to edit to the KPC-CC01.



Download completed.

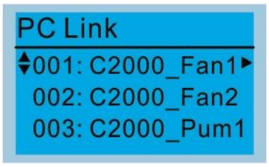
2. VFDSoft: This function enables you to link to the VFDSoft then upload the parameters 1–4 you have saved in the KPC-CC01.

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

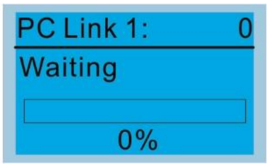


3. Connecting the KPC-CCO1 to a computer

Select 2: VFDSoft, and then press ENTER.

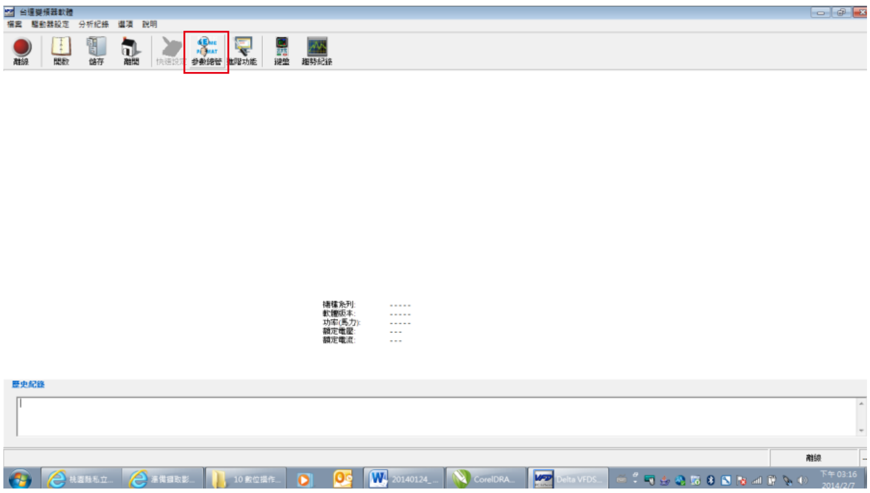


Press the Up / Down keys to select a parameter group to upload to the VFDSoft.

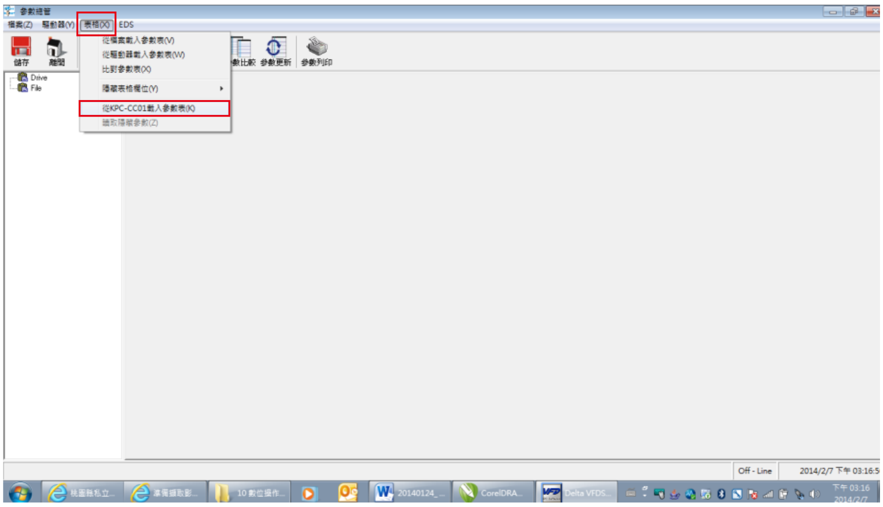


Press ENTER to go to Waiting to connect to PC screen.

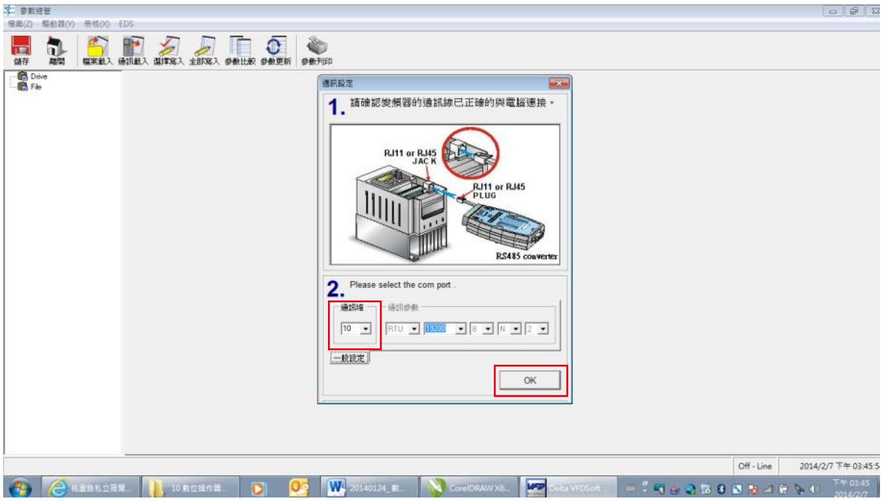
Open VFDSoft and click **Parameter** on the toolbar.

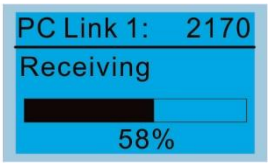


In the Parameter Management, from the **Table** menu, choose **Read from KPC-CC01**.

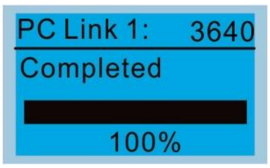


Choose the correct communication port and click OK.





Start to upload parameters to VFDSoft.



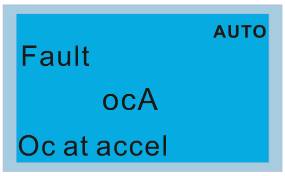
Uploading parameter is completed.

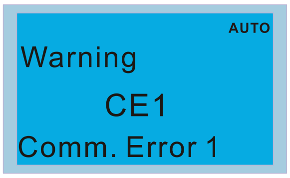
Before using the user-defined start-up screen and user-defined main screen, you must preset the start-up screen and the main screen as user-defined. If you do not download the user-defined screen to the KPC-CC01, the start-up screen and the main screen are blank.

16. Start Wizard (ME300 series does not support this function)

Other displays

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





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

Optional accessory: RJ45 Extension Lead for Digital Keypad

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

Table 7-55

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

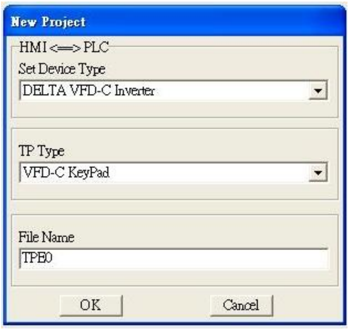
7-13-3 TPEditor Installation Instruction

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.

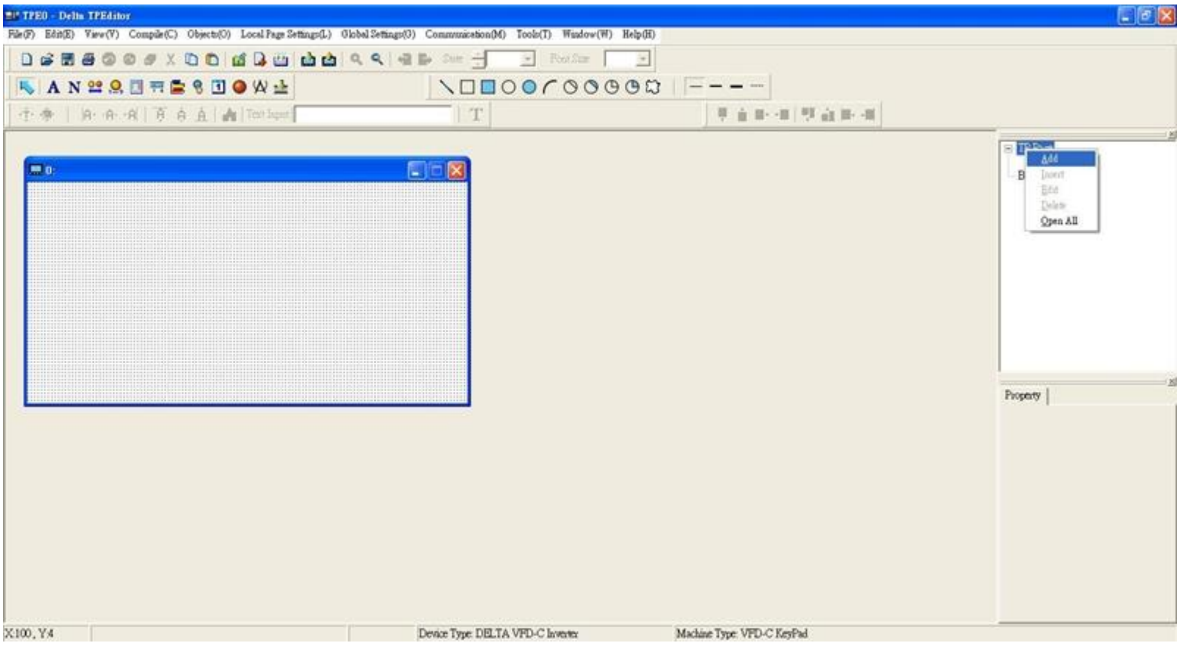
1. TPEditor: Setup & Basic Functions

(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 dialog box, 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**.

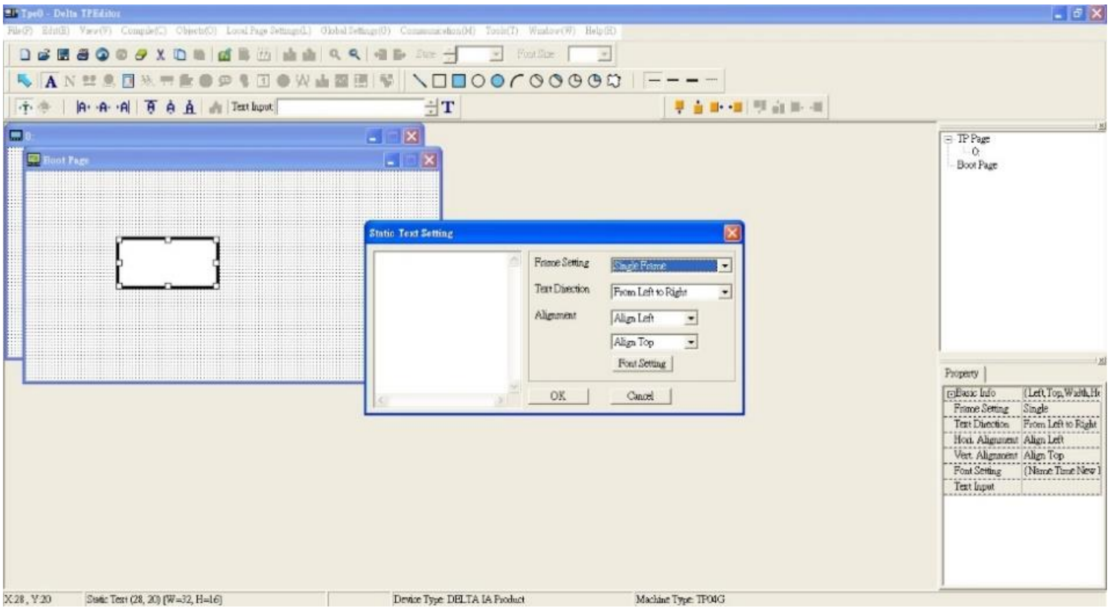


(3) The editor displays the Design window. On the **Edit** menu, click **Add a New Page**. You can also right-click on the TP page in the upper right corner of the Design window and click **Add** to add one more page(s) to edit.



(4) Edit the start-up screen

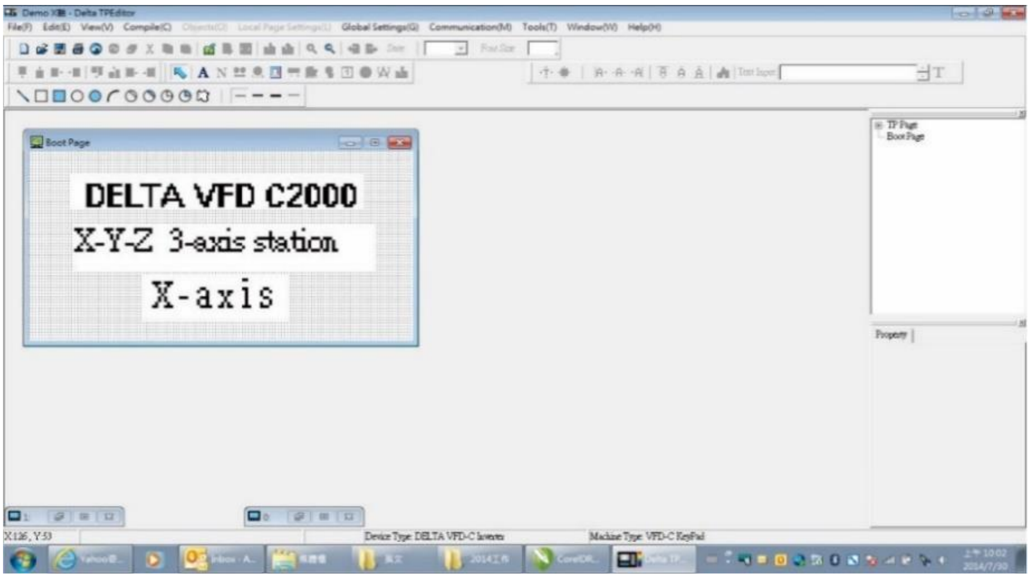
(5) Add static text.  Open a blank page (step 3), then on the toolbar click  . Double-click the blank page to display the **Static Text Setting** dialog box, and then enter the static text.



(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.

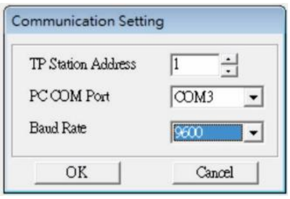
(7) Add a geometric bitmap . There are 11 kinds of geometric bitmaps to choose. Open a new blank page (step 3), then on the toolbar click the geometric bitmap icon that you need . In the page, drag the geometric bitmap and enlarge it to the size that you need.

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

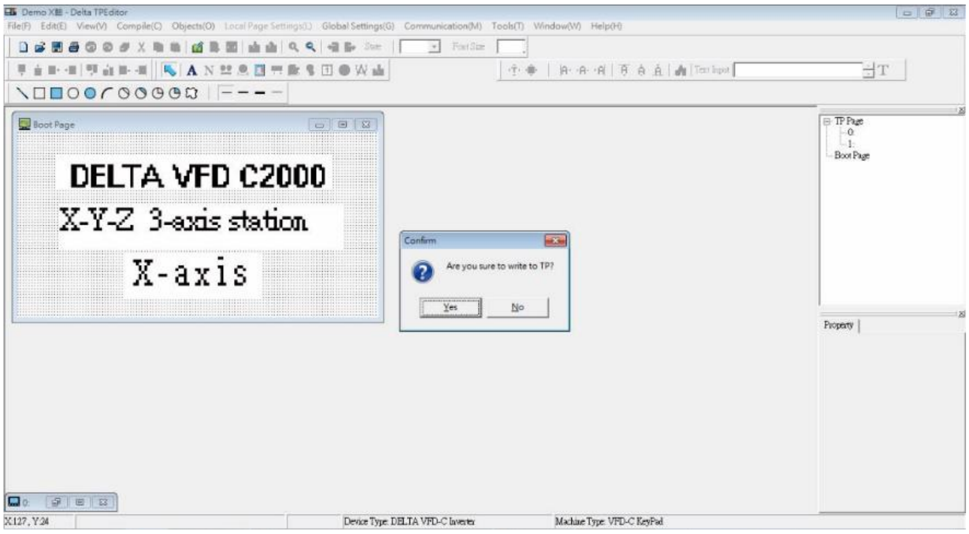


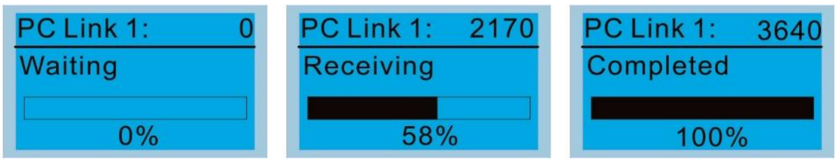
(9) Download the new setting: On the **Tool** menu, click **Communication**. Set up the communication port and speed for the IFD6530. There are three speeds available: 9600 bps, 19200 bps, and 38400 bps.

(10) On the **Communication** menu, click **Input User Defined Keypad Starting Screen**.



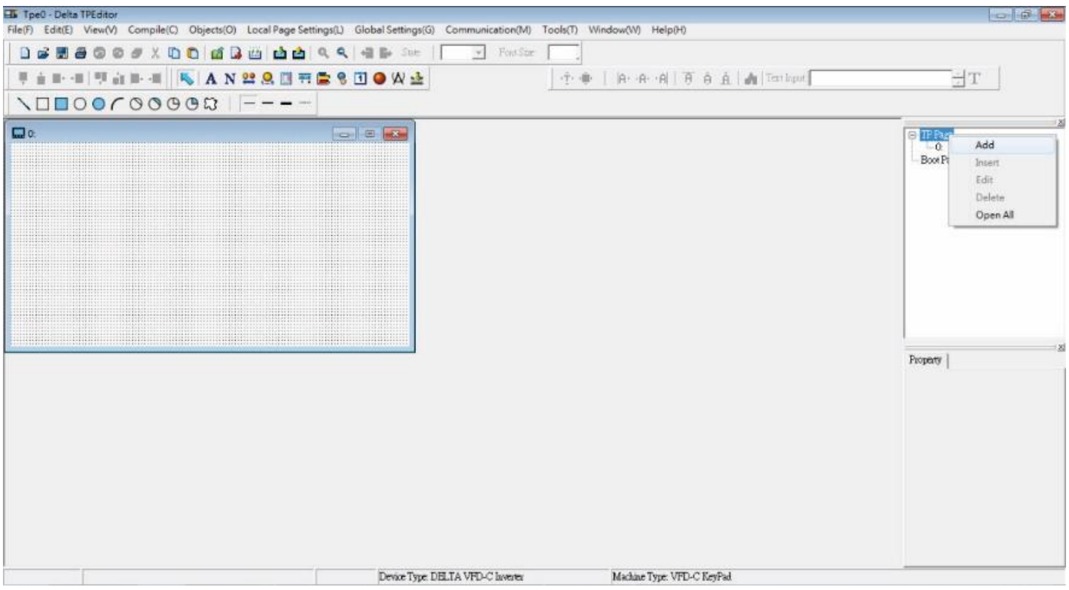
(11) The Editor displays a message asking you to confirm the new setting. Before you click **OK**, on the keypad, go to MENU, select PC LINK, press ENTER and then wait for few seconds. Then click **YES** in the confirmation dialog box to start downloading.



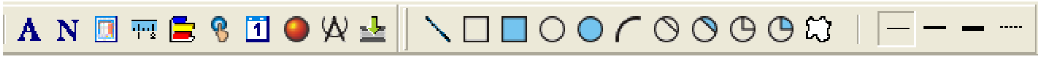


2. Edit the Main Page and Download to the Keypad

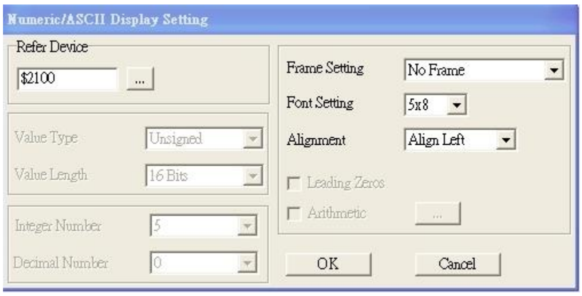
(1) In the Editor, add a page to edit. On the **Edit** menu, click **Add a New Page**. You can also right-click on the TP page in the upper right corner of the Design window and click **Add** to add one more pages to edit. This keypad currently supports up to 256 pages.



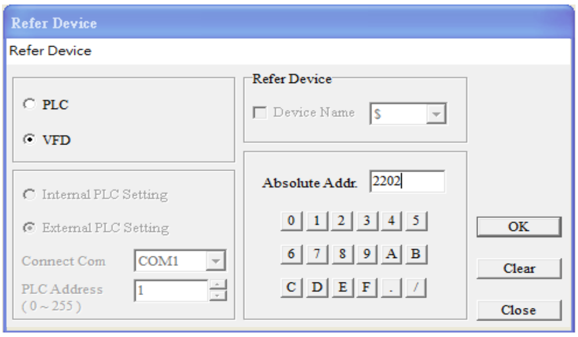
(2) In the bottom right-hand corner of the Editor, click the page number to edit, or on the **View** menu, click **HMI Page** to start editing the main page. As shown in the picture above, the following objects are available. From left to right they are: Static Text, ASCII Display, Static Bitmap, Scale, 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.

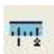


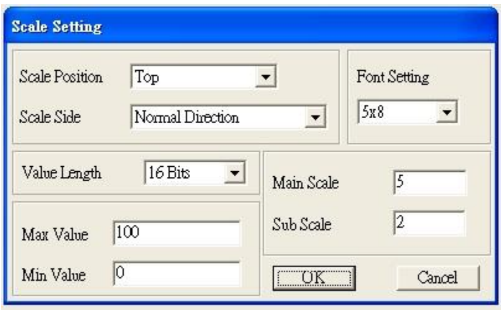
(3) Add a numeric/ASCII display. On the toolbar, click the **Numeric/ASCII** button. In the page, double-click the object to specify the **Refer Device**, **Frame Setting**, **Font Setting** and **Alignment**.



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.



(4) Scale Setting. On the toolbar, 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.



A. **Scale Position**: specifies where to place the scale.

B. **Scale Side**: specifies whether the scale is numbered from smaller numbers to larger numbers or from larger to smaller.

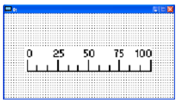
C. **Font Setting**: specifies the font.

D. **Value Length**: specifies 16 bits or 32 bits.

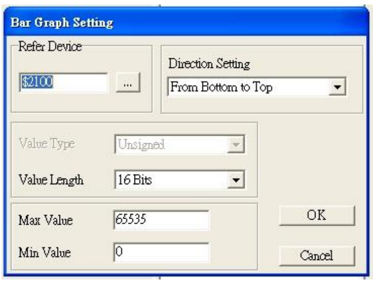
E. **Main Scale & Sub-Scale**: divides the whole scale into equal parts; enter the numbers for the main scale and sub-scale.

F. **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 -40000.

Clicking **OK** creates a scale as in the picture below.



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



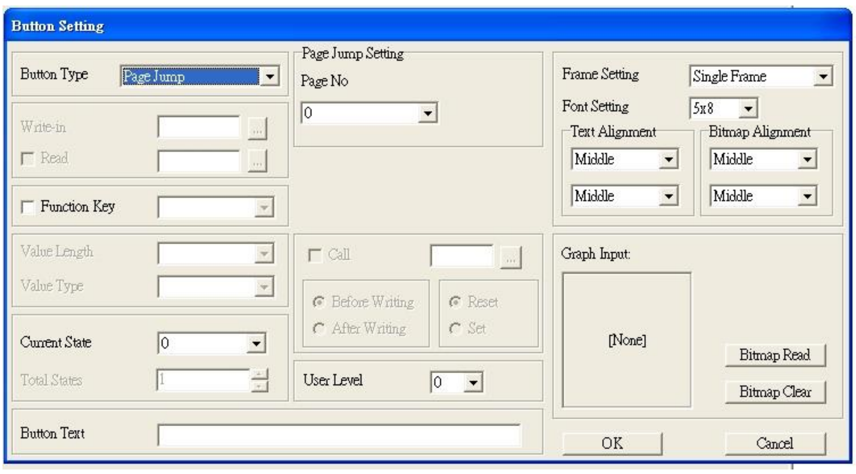
A. **Refer Device:** specifies the VFD communication port.

B. **Direction Setting:** specifies the direction: **From Bottom to Top**, **From Top to Bottom**, **From Left to Right** or **From Right to Left**.

C. **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.

(6) Button: 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** dialog box.

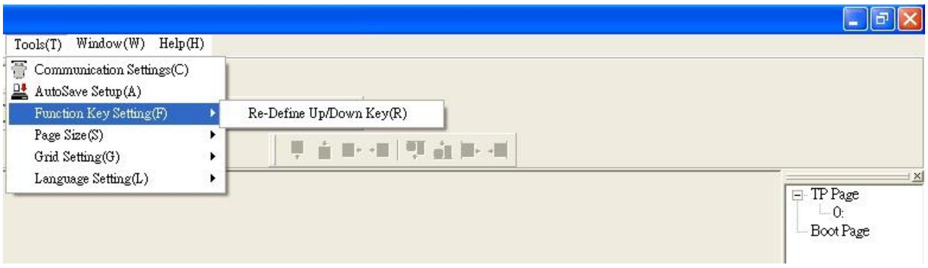


Button Type: specifies the button's functions. Page Jump and Constant Setting are the only functions currently supported.

A. Page Jump Setting

a. Page Jump Setting: in the Button Type list, choose Page Jump to show the Page Jump Setting. Make sure it's more than one main screen in HMI page for selection, and then you can switch the page by this menu. This function supports 0 to 3, four pages in total at present.

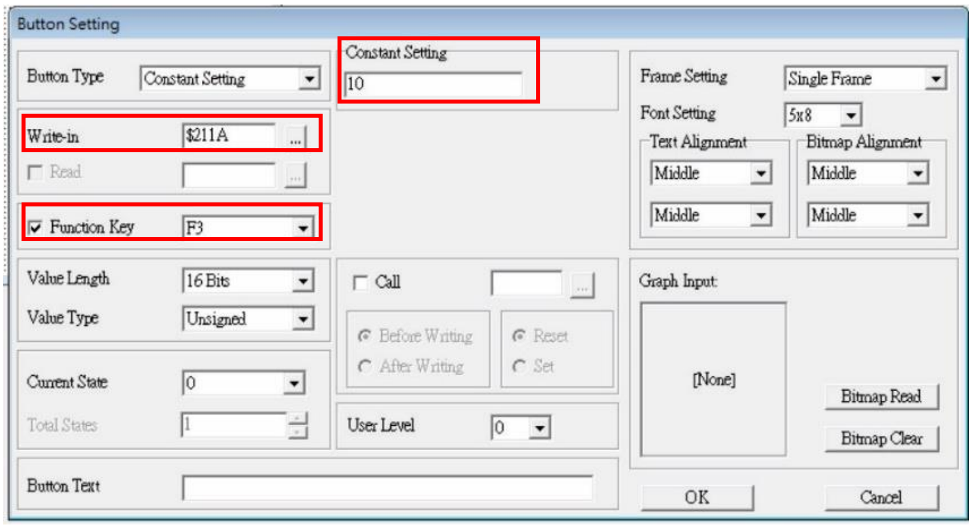
b. Function Key: specifies the functions for the following keys on the KPC-CC01 keypad: F1, F2, F3, F4, Up, Down, Left and Right. Note that the Up and Down keys are locked by TPEditor. You cannot program these two keys. If you want to program Up and Down keys, on the **Tool** menu, click **Function Key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



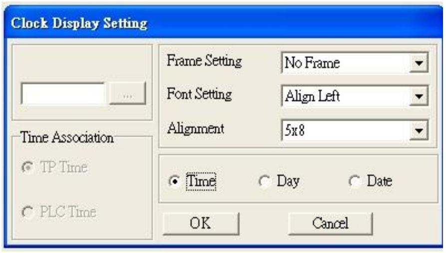
c. Button Text: specifies the text that appears on a button. For example, when you enter Next Page for the button text, that text appears on the button.

B. Constant Setting

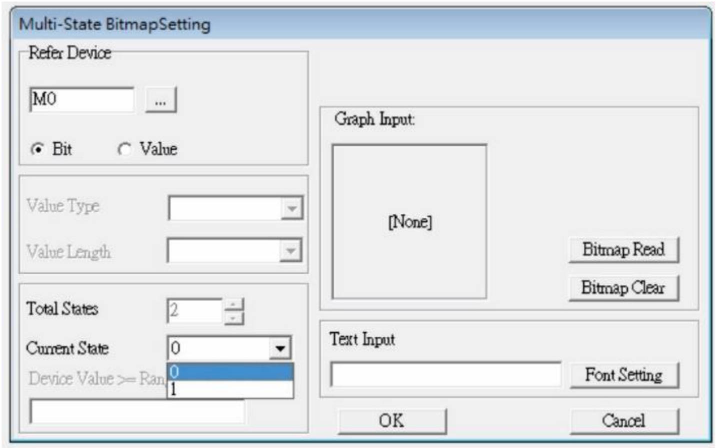
This function specifies the memory address' values for the VFD. When you press the **Function Key**, it writes a value to the memory address specified by the value for **Constant Setting**. You can use this function to initialize a variable.



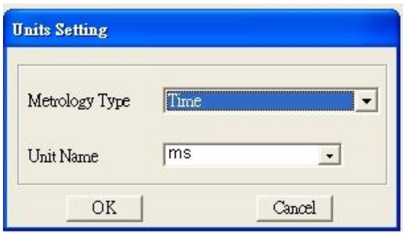
(7) Clock Display Setting: on the toolbar, click  . You can display the time, day, or date on the keypad. Open a new page and click once in that window to add a clock display. Choose to display **Time**, **Day**, or **Date** on the keypad. To adjust time, go to #9 on the keypad's menu. You can also specify the **Frame Setting**, **Font Setting**, and **Alignment**. KPC-CC01 can use Calendar function, but ME300 series does not support it.



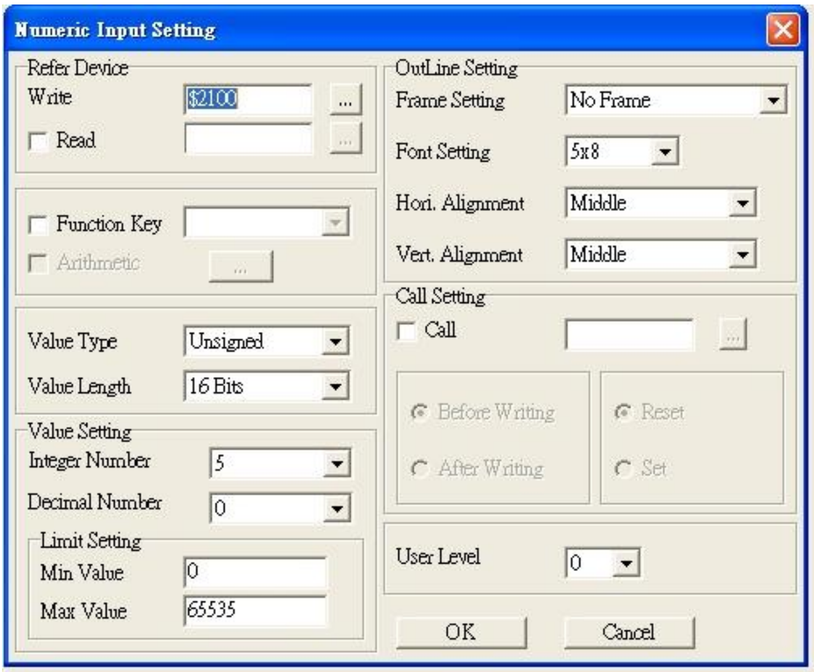
(8) Multi-state bitmap: on the toolbar, click . Open a new page and click once in that window to add a Multi-state bitmap. This object reads a bit's property value from the PLC (ME300 series does not support PLC function). It defines the image or text that appears when this bit is 0 or 1. Set the initial 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 enables you to provide parameters or communication ports (0x22xx) and to input numbers.



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**. The value is given by control board to define it a signed number or an unsigned number. In unsigned number condition, do NOT select signed decimal system and do NOT let the minimum value to be negative, this causes a malfunction that keypad misrecognizes the negative of minimum value is large and positive, and cannot decrease the value by pressing DOWN key.

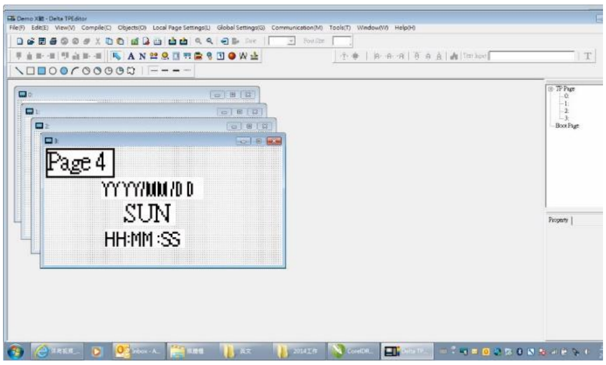
E. **Value Setting**: automatically set by the keypad itself.

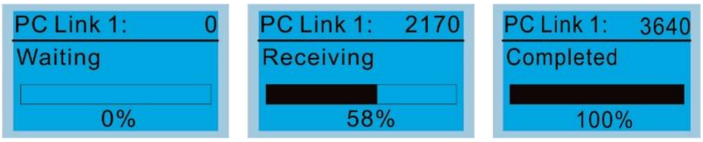
F. **Limit Setting**: specifies the range for the numeric input here.

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 01-44 to verify if you correctly entered the value.

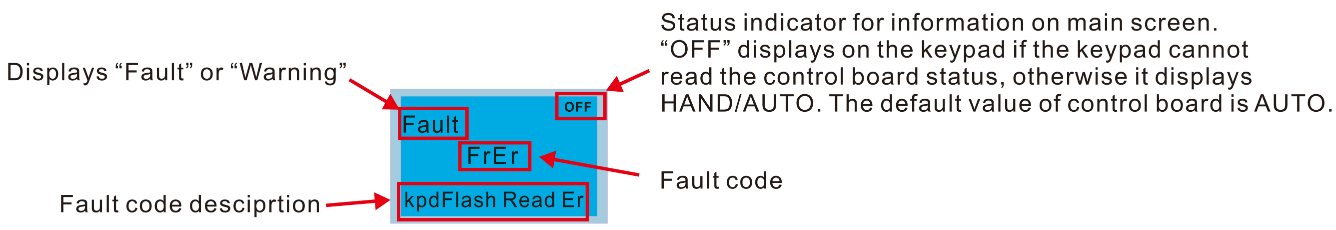
(11) Download the TP page:

Press Up/Down keys on the keypad to select #13 PC Link. 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. 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.

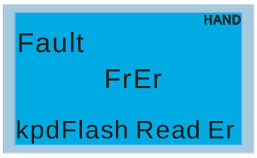
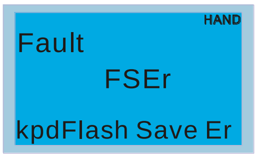
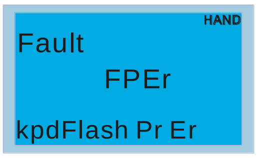
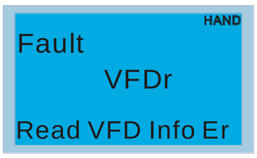

Page 4
YYYY/MM/DD
SUN
HH:MM:SS


PC Link 1: 0
Waiting
0%
PC Link 1: 2170
Receiving
58%
PC Link 1: 3640
Completed
100%

7-13-4 Digital Keypad KPC-CC01 Fault Codes and Descriptions



Fault Codes

Display on LCD Keypad	Fault Name	Descriptions	Corrective Action
	Flash memory read error (FrEr)	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.
	Flash memory save error (FsEr)	Keypad flash memory save error	Error in the keypad’s flash memory. 1. Press RESET to clear the errors. 2. Check for any problem on Flash IC. 3. Shut down the system, wait for ten minutes, and then restart the system. If none of the above solutions works, contact your authorized local dealer for assistance.
	Flash memory parameter error (FPEr)	Keypad flash memory parameter error	Error in the default parameters. It might be caused by a firmware update. 1. Press RESET to clear the errors. 2. Check for any problem on Flash IC. 3. Shut down the system, wait for ten minutes, and then restart the system. If none of the above solutions works, contact your authorized local dealer for assistance.
	Reading AC motor drive data error (VFDr)	Keypad error when reading AC motor drive data	Keypad cannot read any data sent from the VFD. 1. Verify that the keypad is properly connected to the motor drive by a communication cable such as RJ45. 2. Press RESET to clear the errors. 3. Shut down the system, wait for ten minutes, and then restart the system. If none of the above solutions works, contact your local authorized dealer for assistance.

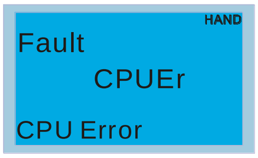
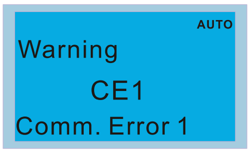
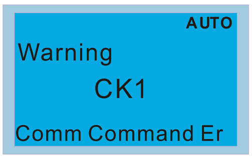
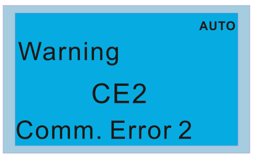
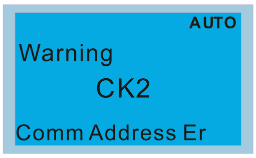
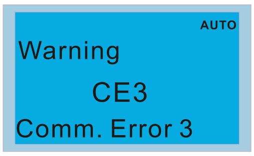
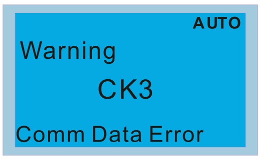
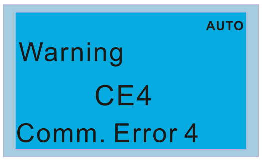
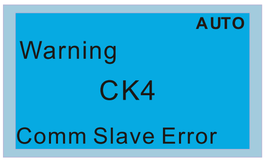
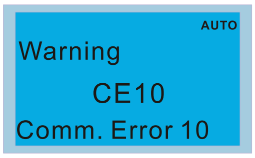
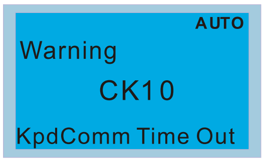
	CPU error (CPUEr)	Keypad CPU error	A serious error in the keypad's CPU. 1. Check for any problem on CPU clock. 2. Check for any problem on Flash IC. 3. Check for any problem on RTC IC. 4. Verify that the communication quality of the RS-485 cable is good. 5. Shut down the system, wait for ten minutes, and then restart the system. If none of the above solutions works, contact your authorized local dealer for assistance.

Table 7-56

Warning Codes

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

Display on LCD Keypad	Warning Name	Descriptions	Corrective Action
	Communication address error (CK2)	Keypad communication data, illegal data address (Keypad autodetect this error and display it)	Keypad does not accept the motor drive's communication command. 1. Remove the keypad and reconnect it. 2. Verify if the Baud rate = 19200 bps, and the Format = RTU8, N, 2 Format = RTU8, N, 2 3. Verify that the keypad is properly connected to the motor drive by a communication cable such as RJ45. If none of the above solutions works, contact your local authorized dealer for assistance.
	Communication error 3 (CE3)	Modbus data value error	Motor drive does not accept the communication data sent from the keypad. 1. Verify that the keypad is properly connected to the motor drive by a communication cable such as RJ45. 2. Press RESET to clear the errors. If none of the above solutions works, contact your local authorized dealer for assistance.
	Communication data error (CK3)	Keypad communication data, illegal data value (Keypad autodetect this error and display it)	Keypad does not accept the motor drive's communication command. 1. Remove the keypad and reconnect it. 2. Verify if the Baud rate = 19200 bps, and the Format = RTU8, N, 2 Format = RTU8, N, 2 3. Verify that the keypad is properly connected to the motor drive by a communication cable such as RJ45. If none of the above solutions works, contact your local authorized dealer for assistance.
	Communication error 4 (CE4)	Modbus slave drive error	Motor drive cannot process the communication command sent from the keypad. 1. Verify that the keypad is properly connected to the motor drive by a communication cable such as RJ45. 2. Press RESET to clear the errors. 3. Shut down the system, wait for ten minutes, and then restart the system. If none of the above solutions works, contact your local authorized dealer for assistance.

Display on LCD Keypad	Warning Name	Descriptions	Corrective Action
	Communication slave error (CK4)	Keypad communication data is written to readonly address (Keypad autodetect this error and display it)	Keypad does not accept the motor drive's communication command. 1. Remove the keypad and reconnect it. 2. Verify if the Baud rate = 19200 bps, and the Format = RTU8, N, 2 Format = RTU8, N, 2 3. Verify that the keypad is properly connected to the motor drive by a communication cable such as RJ45. If none of the above solutions works, contact your local authorized dealer for assistance.
	Communication error 10 (CE10)	Modbus transmission time-out	Motor drive does not respond to the communication command sent from the keypad. 1. Verify that the keypad is properly connected to the motor drive by a communication cable such as RJ45. 2. Press RESET to clear the errors. 3. Shut down the system, wait for ten minutes, and then restart the system. If none of the above solutions works, contact your local authorized dealer for assistance.
	Keypad communication time out (CK10)	Keypad communication data, transmission timeout (Keypad autodetect this error and display it)	Keypad does not accept the motor drive's communication command. 1. Remove the keypad and reconnect it. 2. Verify if the Baud rate = 19200 bps, and the Format = RTU8, N, 2 Format = RTU8, N, 2 3. Verify that the keypad is properly connected to the motor drive by a communication cable such as RJ45. If none of the above solutions works, contact your local authorized dealer for assistance.

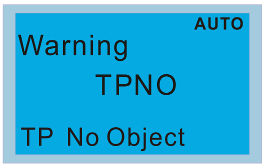
Display on LCD Keypad	Warning Name	Descriptions	Corrective Action
	TP object not defined (TPNO)	Object not supported by TPEditor	Keypad's TPEditor uses an unsupported object. 1. Verify that the TPEditor is not using an unsupported object or setting. Delete unsupported objects and unsupported settings.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

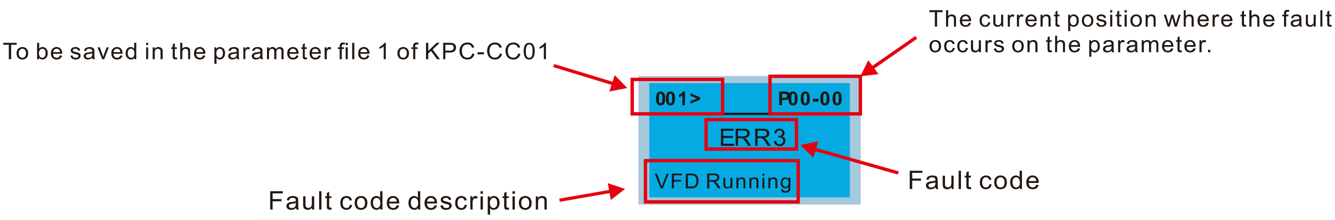
Table 7-57

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

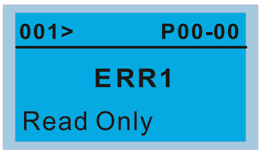
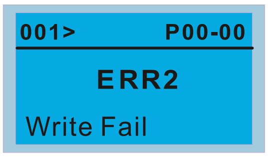
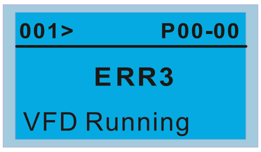
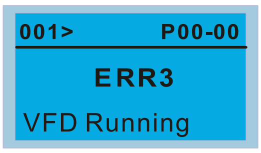
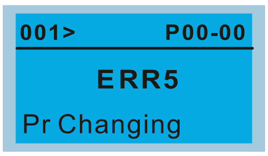
File Copy Setting Fault Description

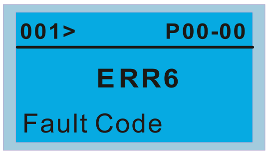
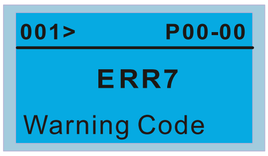
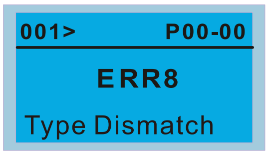
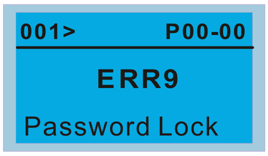
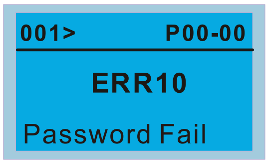
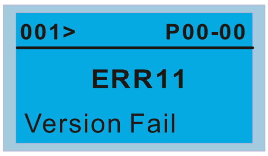
These faults occur when KPC-CC01 cannot perform the command after clicking the ENTER key in the copy function.

Take "Copy Parameter" functions as an example.



Corrective Action

LCD Display *	Fault Name	Descriptions	Corrective Action
	Read only (ERR1)	Parameter and file are read-only	The parameter/file is read-only and cannot be written to. 1. Verify the specification in the user manual. If this solution does not work, contact your local authorized dealer for assistance.
	Write in error (ERR2)	Fail to write parameter and file	An error occurred while writing to a parameter/file. 1. Check for any problem on Flash IC. 2. Shut down the system, wait for ten minutes, and then restart the system. If none of the above solutions works, contact your local authorized dealer for assistance.
	Drive operating (ERR3)	AC motor drive is in operating status	A setting cannot be changed while the motor drive is in operation. 1. Verify that the drive is not in operation. If none of the above solutions works, contact your local authorized dealer for assistance.
	Parameter locked (ERR4)	AC motor drive parameter is locked	A setting cannot be changed because a parameter is locked. 1. Check if the parameter is unlocked. If none of the above solutions works, contact your local authorized dealer for assistance.
	Parameter changing (ERR5)	AC motor drive parameter is changing	A setting cannot be changed because a parameter is being modified. 1. Check if the parameter is not being modified. If none of the above solutions works, contact your local authorized dealer for assistance.

LCD Display *	Fault Name	Descriptions	Corrective Action
	Fault code (ERR6)	Fault code is not cleared	A setting cannot be changed because an error has occurred in the motor drive. 1. Check if the motor drive does not have a fault. If none of the above solutions works, contact your local authorized dealer for assistance.
	Warning Codes (ERR7)	Warning code is not cleared	A setting cannot be changed because of a warning message given to the motor drive. 1. Check if there is a warning message given to the motor drive. If none of the above solutions works, contact your local authorized dealer for assistance.
	File type mismatch (ERR8)	File type mismatch	Data to be copied are not the correct type, so the setting cannot be changed. 1. Check if the products' serial numbers to be copied are in the same category. If none of the above solutions works, contact your local authorized dealer for assistance.
	Password locked (ERR9)	File is locked with password	A setting cannot be changed because some data are locked. 1. Check if the data are unlocked or able to be unlocked. 2. Shut down the system, wait for ten minutes, and then restart the system. If none of the above solutions works, contact your local authorized dealer for assistance.
	Password fail (ERR10)	File password mismatch	A setting cannot be changed because the password is incorrect. 1. Check if the password is correct. 2. Shut down the system, wait for ten minutes, and then restart the system. If none of the above solutions works, contact your local authorized dealer for assistance.
	Version fail (ERR11)	File version mismatch	A setting cannot be changed because the version of the data is incorrect. 1. Check if the version of the data matches the motor drive. If none of the above solutions works, contact your local authorized dealer for assistance.

LCD Display *	Fault Name	Descriptions	Corrective Action
001> P00-00 ERR12 VFD Time Out	VFD Time out (ERR12)	AC motor drive copy function time-out VFD Copy Enable TimeOut	A setting cannot be changed because the data copying time-out expired. 1. Try copying the data again. 2. Check if copying data is authorized. 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.

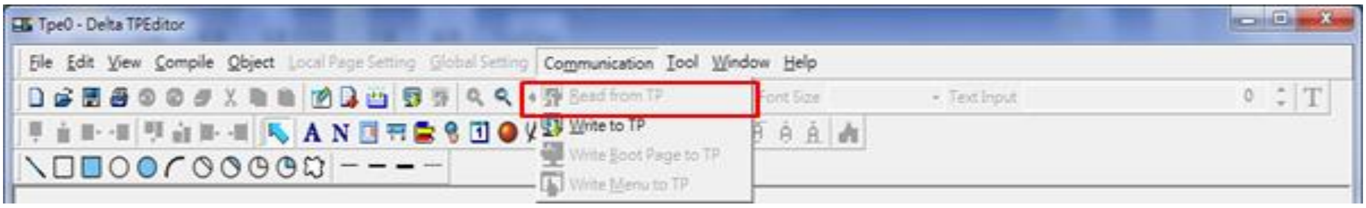
Table 7-58

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

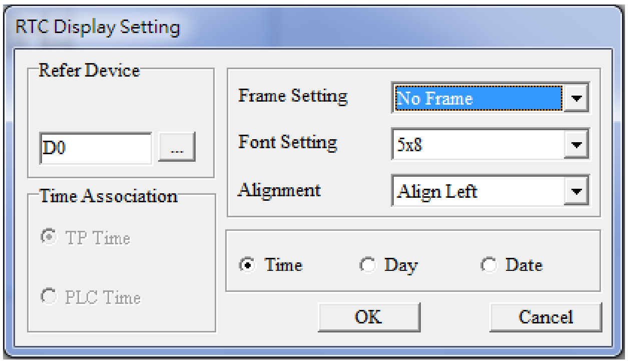
7-13-5 Unsupported Functions when Using TPEditor with the KPC-CC01

1. **Local Page Setting** and **Global Setting** functions are not supported.

2. In the **Communication** menu, **Read from TP** function is not supported.



3. In the **RTC Display Setting**, you cannot change the **Refer Device**.



Chapter 8 Option cards

This series do not support option card installation by customers.

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Chapter 9 Specifications

9-1 115V Models

115V, single-phase

			A			C
Frame			A			C
Model VFD_ _ _ ME11_ _ _AA			0A8	1A6	2A5	4A8
			ANN ANS	ANN ANS	ANN ANS	ANN ANS
Applicable Motor Output (kW)			0.1	0.2	0.4	0.75
Applicable Motor Output (HP)			1/8	1/4	1/2	1
Output	Heavy duty	Rated Output Capacity (kVA)	0.4	0.6	1.0	1.8
		Rated Output Current (A)	0.8	1.6	2.5	4.8
		Carrier Frequency (kHz)	2–15			
	Normal duty	Rated Output Capacity (kVA)	0.4	0.7	1.0	2.1
		Rated Output Current (A)	1.0	1.8	2.7	5.5
		Carrier Frequency (kHz)	2–15			
Input	Rated Input Current (A)	Heavy duty	3.0	6.0	9.4	18
		Normal duty	3.7	6.8	10.1	20.6
	Rated Voltage / Frequency		Single-phase AC 100–120 V (-15%–10%), 50/60 Hz			
	Mains Input Voltage Range (V_{AC})		85–132			
	Mains Frequency Range (Hz)		47–63			
Weight (kg)			0.4	0.4	0.5	1
Cooling Method			Convective cooling		Fan cooling	
EMC Filter			Optional			
IP Rating			IP20			

Table 9-1

NOTE:

1. Default is heavy duty.
2. The value of the carrier frequency is a factory default. Decrease the current value if you need to increase the carrier frequency. Refer to Section 9-6 for details.
3. For shock or impact load applications, select a drive with a larger capacity model.

9-2 230V Models

230V, single-phase

Frame			A	B	A	B	A	B
Model VFD_ _ _ ME21_ _ _AA			0A8		1A6		2A8	
			ANN ANS	AFN AFS	ANN ANS	AFN AFS	ANN ANS	AFN AFS
Applicable Motor Output (kW)			0.1		0.2		0.4	
Applicable Motor Output (HP)			1/8		1/4		1/2	
Output	Heavy duty	Rated Output Capacity (kVA)	0.3		0.6		1.1	
		Rated Output Current (A)	0.8		1.6		2.8	
		Carrier Frequency (kHz)	2–15					
	Normal duty	Rated Output Capacity (kVA)	0.4		0.7		1.2	
		Rated Output Current (A)	1.0		1.8		3.2	
		Carrier Frequency (kHz)	2–15					
Input	Rated Input Current (A)	Heavy duty	2.2		3.4		5.9	
		Normal duty	2.8		3.8		6.7	
	Rated Voltage / Frequency		Single-phase AC 200–240 V (-15%–10%), 50/60 Hz					
	Mains Input Voltage Range (V_{AC})		170–265					
	Mains Frequency Range (Hz)		47–63					
Weight (kg)			0.4	0.9	0.4	0.9	0.5	0.9
Cooling Method			Convective cooling			Fan cooling		
EMC Filter			Optional	Built-in	Optional	Built-in	Optional	Built-in
IP Rating			IP20					

Frame			B		C			
Model VFD_ _ _ ME21_ _ _AA			4A8		7A5		11A	
			ANN ANS	AFN AFS	ANN ANS	AFN AFS	ANN ANS	AFN AFS
Applicable Motor Output (kW)			0.75		1.5		2.2	
Applicable Motor Output (HP)			1		2		3	
Output	Heavy duty	Rated Output Capacity (kVA)	1.8		2.9		4.2	
		Rated Output Current (A)	4.8		7.5		11	
		Carrier Frequency (kHz)	2–15					
	Normal duty	Rated Output Capacity (kVA)	1.9		3.2		4.8	
		Rated Output Current (A)	5		8.5		12.5	
		Carrier Frequency (kHz)	2–15					
Input	Rated Input Current (A)	Heavy duty	10.1		15.8		23.1	
		Normal duty	10.5		17.9		26.3	
	Rated Voltage / Frequency		Single-phase AC 200–240 V (-15%–10%), 50/60 Hz					
	Mains Input Voltage Range (V_{AC})		170–265					
	Mains Frequency Range (Hz)		47–63					
Weight (kg)			0.8	0.9	1	1.5	1	1.5
Cooling Method			Convective cooling		Fan cooling			
EMC Filter			Optional	Built-in	Optional	Built-in	Optional	Built-in
IP Rating			IP20					

Table 9-2

NOTE:

1. Default is heavy duty.
2. The value of the carrier frequency is a factory default. Decrease the current value if you need to increase the carrier frequency. Refer to Section 9-6 Derating for Ambient Temperature and Altitude for details.
3. For shock or impact load applications, select a drive with a larger capacity model.

230V, three-phase

Frame			A				B	C		D
Model VFD_ _ _ ME23_ _ _AA			0A8 ANN ANS	1A6 ANN ANS	2A8 ANN ANS	4A8 ANN ANS	7A5 ANN ANS	11A ANN ANS	17A ANN ANS	25A ANN ANS
Applicable Motor Output (kW)			0.1	0.2	0.4	0.75	1.5	2.2	3.7/4	5.5
Applicable Motor Output (HP)			1/8	1/4	1/2	1	2	3	5	7.5
Output	Heavy duty	Rated Output Capacity (kVA)	0.3	0.6	1.1	1.8	2.9	4.2	6.5	9.5
		Rated Output Current (A)	0.8	1.6	2.8	4.8	7.5	11	17	25
		Carrier Frequency (kHz)	2–15							
	Normal duty	Rated Output Capacity (kVA)	0.4	0.7	1.2	1.9	3.0	4.8	7.4	10.3
		Rated Output Current (A)	1.0	1.8	3.2	5	8.0	12.5	19.5	27
		Carrier Frequency (kHz)	2–15							
Input	Rated Input Current (A)	Heavy duty	2.2	1.9	3.4	5.8	9.0	13.2	20.4	30
		Normal duty	2.8	2.2	3.8	6.0	9.6	15	23.4	32.4
	Rated Voltage / Frequency		Three-phase AC 200–240 V (-15%–10%), 50/60 Hz							
	Mains Input Voltage Range (V_{AC})		170–265							
	Mains Frequency Range (Hz)		47–63							
Weight (kg)			0.4	0.4	0.45	0.6	0.8	1	1	2
Cooling Method			Convective cooling				Fan cooling			
EMC Filter			Optional							
IP Rating			IP20							

Table 9-3

NOTE:

1. Default is heavy duty.
2. The value of the carrier frequency is a factory default. Decrease the current value if you need to increase the carrier frequency. Refer to Section 9-6 Derating for Ambient Temperature and Altitude for details.
3. For shock or impact load applications, select a drive with a larger capacity model.

9-3 460V Models

460V, three-phase

Frame			A	B	A	B	B		C	
Model VFD_ _ _ ME43_ _ _AA			1A5		2A7		4A2		5A5	
			ANN ANS	AFN AFS	ANN ANS	AFN AFS	ANN ANS	AFN AFS	ANN ANS	AFN AFS
Applicable Motor Output (kW)			0.4		0.75		1.5		2.2	
Applicable Motor Output (HP)			1/2		1		2		3	
Output	Heavy duty	Rated Output Capacity (kVA)	1.1		4.2		3.2		4.2	
		Rated Output Current (A)	1.5		2.7		4.2		5.5	
		Carrier Frequency (kHz)	2–15							
	Normal duty	Rated Output Capacity (kVA)	1.4		2.3		3.5		5.0	
		Rated Output Current (A)	1.8		3		4.6		6.5	
		Carrier Frequency (kHz)	2–15							
Input	Rated Input Current (A)	Heavy duty	1.7		3.0		4.6		6.1	
		Normal duty	2.0		3.3		5.1		7.2	
	Rated Voltage / Frequency		Three-phase 380–480 VAC (-15–10%), 50/60 Hz							
	Mains Input Voltage Range (V_{AC})		323–528							
	Mains Frequency Range (Hz)		47–63							
Weight (kg)			0.55	0.9	0.7	0.9	0.8	0.9	1	1.5
Cooling Method			Convective cooling	Fan cooling	Convective cooling	Fan cooling				
EMC Filter			Optional	Built-in	Optional	Built-in	Optional	Built-in	Optional	Built-in
IP Rating			IP20							

Frame			C				D			
Model VFD_ _ _ ME43_ _ _AA			7A3		9A0		13A		17A	
			ANN ANS	AFN AFS	ANN ANS	AFN AFS	ANN ANS	AFN AFS	ANN ANS	AFN AFS
Applicable Motor Output (kW)			3		3.7/4		5.5		7.5	
Applicable Motor Output (HP)			4		5		7.5		10	
Output	Heavy duty	Rated Output Capacity (kVA)	5.6		6.9		9.9		13	
		Rated Output Current (A)	7.3		9		13		17	
		Carrier Frequency (kHz)	2–15							
	Normal duty	Rated Output Capacity (kVA)	6.1		8.0		12		15.6	
		Rated Output Current (A)	8		10.5		15.7		20.5	
		Carrier Frequency (kHz)	2–15							
Input	Rated Input Current (A)	Heavy duty	8.1		9.9		14.3		18.7	
		Normal duty	8.9		11.6		17.3		22.6	
	Rated Voltage / Frequency		Three-phase 380–480 VAC (-15–10%), 50/60 Hz							
	Mains Input Voltage Range (V_{AC})		323–528							
	Mains Frequency Range (Hz)		47–63							
Weight (kg)			1	1.5	1	1.5	2	2.7	2	2.7
Cooling Method			Fan cooling							
EMC Filter			Optional	Built-in	Optional	Built-in	Optional	Built-in	Optional	Built-in
IP Rating			IP20							

Table 9-4

NOTE:

1. Default is heavy duty.
2. The value of the carrier frequency is a factory default. Decrease the current value if you need to increase the carrier frequency. Refer to Section 9-6 Derating for Ambient Temperature and Altitude for details.
3. For shock or impact load applications, select a drive with a larger capacity model.

9-4 General Specifications

<table>
<tr><td rowspan="9">Control Characteristics</td><td>Control Method</td><td>V/F, SVC</td></tr>
<tr><td>Applicable Motor</td><td>IM (Induction Motor), PM motor control (IPM and SPM)</td></tr>
<tr><td>Max. Output Frequency</td><td>0.00–599.00 Hz</td></tr>
<tr><td>Starting Torque *1</td><td>150% / 3 Hz (V/F, SVC for IM, Heavy duty)
100% / (1/20 of motor rated frequency) (SVC control for PM, Heavy duty)</td></tr>
<tr><td>Speed Control Range *1</td><td>1: 50 (V/F, SVC for IM, Heavy duty)
1: 20 (SVC control for PM, Heavy duty)</td></tr>
<tr><td>Overload Capacity</td><td>● Normal duty:
120% of rated current can endure for 1 minute during every 5 minutes
150% of rated current can endure for 3 seconds during every 36 seconds.
● Heavy duty:
150% of rated current can endure for 1 minute during every 5 minutes
200% of rated current can endure for 3 seconds during every 36 seconds.</td></tr>
<tr><td>Frequency Setting Signal</td><td>0–10 V / 4(0)–20 mA
PWM pulse width input, pulse input (10 kHz).</td></tr>
<tr><td>Main Functions</td><td>Multiple motor switches (Two independent motor parameter settings), Fast start-up, Deceleration Energy Back (DEB) function, Fast deceleration function, Master and Auxiliary frequency source selectable, Momentary power loss ride thru, Speed search, Over-torque detection, Torque limit, 16-step speed (main speed included), Accel. / decel. time switch, S-curve accel. / decel., three-wire sequence, JOG frequency, Upper / lower limits for frequency reference, DC injection braking at start and stop, PID control, Positioning function.</td></tr>
<tr><td>Application Macro</td><td>Built-in application parameter groups (selected by industry) and user-defined application parameter groups.</td></tr>
<tr><td rowspan="2">Motor Protection Performance</td><td>Motor Protection</td><td>Over-current, Over-voltage, Over-heating, Phase loss.</td></tr>
<tr><td>Stall Prevention</td><td>Stall prevention during acceleration, deceleration and running (independent settings).</td></tr>
<tr><td colspan="2">Certifications*2</td><td>UL, CE, RCM, RoHS, REACH, KC</td></tr>
<tr><td colspan="2">Safety Standard*2</td><td>TUV (SIL 2)</td></tr>
</table>

Table 9-5

NOTE:

1. Control accuracy may vary depending on the environment, application conditions or different motors. For more information, contact Delta or your local distributors.
2. For information on Certifications and Declaration of Conformity (DoC), visit https://downloadcenter.deltaww.com/en-US/DownloadCenter?v=1&CID=06&itemID=060101&downloadID=ME300&dataType=10&sort_expr=cdate&sort_dir=DESC

9-5 Environment for Operation, Storage and Transportation

<table>
<tr><td colspan="5">DO NOT expose the AC motor drive to a poor environment, such as one with dust, direct sunlight, corrosive/ inflammable gases, humidity, liquids, or excessive vibration. The salt in the air must be less than 0.01 mg/cm^2 every year.</td></tr>
<tr><td rowspan="17">Environment</td><td>Installation Location</td><td colspan="3">IEC 60364-1 / IEC 60664-1 Pollution degree 2, Indoor use only</td></tr>
<tr><td rowspan="6">Surrounding Temperature</td><td rowspan="3">Operation</td><td>IP20/UL Open Type</td><td>-20–50°C
-20~60°C (Derating required)</td></tr>
<tr><td>IP20 installed side by side</td><td>-20–40°C</td></tr>
<tr><td>NEMA 1 / UL Type 1</td><td>-20~50°C (Derating required)</td></tr>
<tr><td>Storage</td><td colspan="2">-40–85°C</td></tr>
<tr><td>Transportation</td><td colspan="2">-20–70°C</td></tr>
<tr><td colspan="3">Non-condensing, non-freezing</td></tr>
<tr><td rowspan="3">Rated Humidity</td><td>Operation</td><td colspan="2">Maximum 90%</td></tr>
<tr><td>Storage / Transportation</td><td colspan="2">Maximum 95%</td></tr>
<tr><td colspan="3">No water condensation</td></tr>
<tr><td rowspan="2">Air Pressure</td><td>Operation</td><td colspan="2">86–106 kPa</td></tr>
<tr><td>Storage / Transportation</td><td colspan="2">70–106 kPa</td></tr>
<tr><td rowspan="4">Pollution Level (IEC60721-3)</td><td>Operation</td><td colspan="2">Class 3C3; Class 3S2</td></tr>
<tr><td>Storage</td><td colspan="2">Class 2C2; Class 2S2</td></tr>
<tr><td>Transportation</td><td colspan="2">Class 1C2; Class 1S2</td></tr>
<tr><td colspan="3">Concentrate prohibited</td></tr>
<tr><td>Altitude</td><td colspan="3"><1000 m (For altitudes > 1000 m, derate to use it.)</td></tr>
<tr><td rowspan="2">Package Drop</td><td>Storage</td><td colspan="3" rowspan="2">ISTA procedure 1A (according to weight) IEC 60068-2-31</td></tr>
<tr><td>Transportation</td></tr>
<tr><td rowspan="2">Vibration</td><td>Operating</td><td colspan="3">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; complies with IEC 60068-2-6.</td></tr>
<tr><td>Non-operating</td><td colspan="3">2.5 G Peak
5 Hz–2 kHz
0.015" Displacement Max.</td></tr>
<tr><td rowspan="2">Impact</td><td>Operating</td><td colspan="3">15 G, 11 ms, in accordance with IEC / EN 60068-2-27</td></tr>
<tr><td>Non-operating</td><td colspan="3">30 G</td></tr>
</table>

Table 9-6

9-6 Operation Noise Level

According to IEC61800-5-1: 2022, operators working in an environment above 70Db must take appropriate hearing protection.

Frame	Model	Noise Level (dB)
A	VFD0A8ME11ANNAA VFD0A8ME11ANSAA	50.8
	VFD1A6ME11ANNAA VFD1A6ME11ANSAA	
	VFD2A5ME11ANNAA VFD2A5ME11ANSAA	
	VFD0A8ME21ANNAA VFD0A8ME21ANSAA	
	VFD1A6ME21ANNAA VFD1A6ME21ANSAA	
	VFD2A8ME21ANNAA VFD2A8ME21ANSAA	
	VFD0A8ME23ANNAA VFD0A8ME23ANSAA	
	VFD1A6ME23ANNAA VFD1A6ME23ANSAA	
	VFD2A8ME23ANNAA VFD2A8ME23ANSAA	
	VFD4A8ME23ANNAA VFD4A8ME23ANSAA	
	VFD1A5ME43ANNAA VFD1A5ME43ANSAA	
	VFD2A7ME43ANNAA VFD2A7ME43ANSAA	
B	VFD0A8ME21AFNAA VFD0A8ME21AFSAA	54.5
	VFD1A6ME21AFNAA VFD1A6ME21AFSAA	
	VFD2A8ME21AFNAA VFD2A8ME21AFSAA	
	VFD4A8ME21AFNAA VFD4A8ME21AFSAA	
	VFD4A8ME21ANNAA VFD4A8ME21ANSAA	
	VFD7A5ME23ANNAA VFD7A5ME23ANSAA	
	VFD4A2ME43ANNAA VFD4A2ME43AFNAA VFD4A2ME43ANSAA VFD4A2ME43AFSAA	
	VFD1A5ME43AFNAA VFD1A5ME43AFSAA	
	VFD2A7ME43AFNAA VFD2A7ME43AFSAA	
C	VFD4A8ME11ANNAA VFD4A8ME11ANSAA	64.3
	VFD7A5ME21ANNAA VFD7A5ME21AFNAA	
	VFD7A5ME21ANSAA VFD7A5ME21AFSAA	
	VFD11AME21ANNAA VFD11AME21AFNAA VFD11AME21ANSAA VFD11AME21AFSAA	
	VFD11AME23ANNAA VFD11AME23ANSAA	
	VFD17AME23ANNAA VFD17AME23ANSAA	
	VFD5A5ME43ANNAA VFD5A5ME43AFNAA VFD5A5ME43ANSAA VFD5A5ME43AFSAA	
	VFD7A3ME43ANNAA VFD7A3ME43AFNAA VFD7A3ME43ANSAA VFD7A3ME43AFSAA	
	VFD9A0ME43ANNAA VFD9A0ME43AFNAA VFD9A0ME43ANSAA VFD9A0ME43AFSAA	
D	VFD25AME23ANNAA VFD25AME23ANSAA	65.8
	VFD13AME43ANNAA VFD13AME43AFNAA VFD13AME43ANSAA VFD13AME43AFSAA	
	VFD17AME43ANNAA VFD17AME43AFNAA VFD17AME43ANSAA VFD17AME43AFSAA	

Table 9-7

9-7 Derating Curve

9-7-1 Derating Curve for Ambient Temperature and Altitude

Protection Level	Operating Environment
IP20/UL Open Type	If the AC motor drive operates at the rated current, the ambient temperature needs to be between -20–50℃ If the temperature is above 50℃, decrease 2.5% of the rated current for every 1℃ increase in temperature. The maximum allowable temperature is 60℃.
NEMA1 / UL Type 1	If the AC motor drive operates at the rated current, the ambient temperature needs to be between -20–40℃. If the temperature is above 40℃, decrease 2.5% of the rated current for every 1℃ increase in temperature. The maximum allowable temperature is 60℃.
High Altitude	If the AC motor drive is installed at an altitude of 0–1000 m, follow normal operation restrictions. For altitudes of 1000–2000 m, decrease the drive's rated current by 1% or lower the temperature by 0.5℃ for every 100 m increase in altitude. The maximum altitude for corner grounded is 2000 m. If installing at an altitude higher than 2000 m is required, contact Delta for more information.

Table 9-8

Ambient Temperature Derating Curve

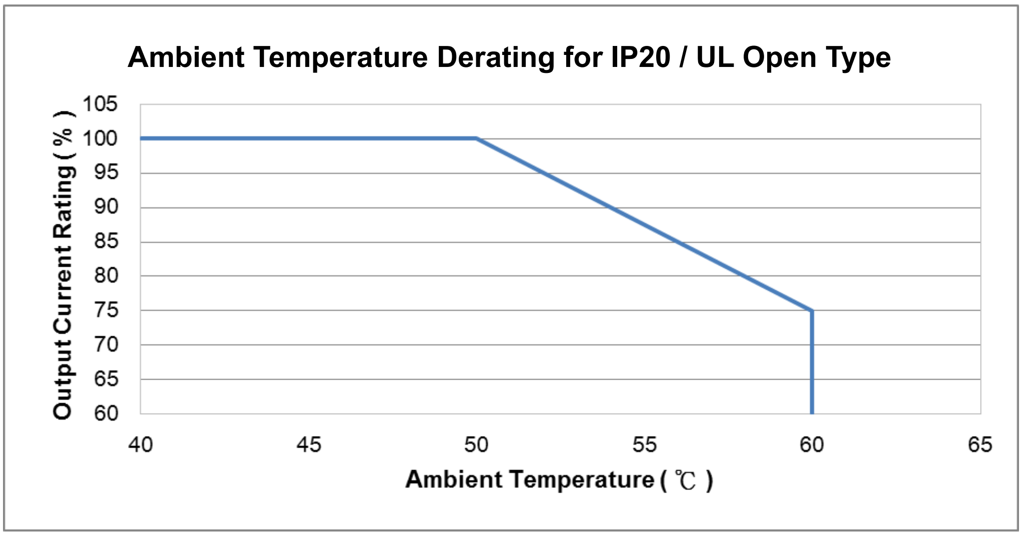

Figure 9-1

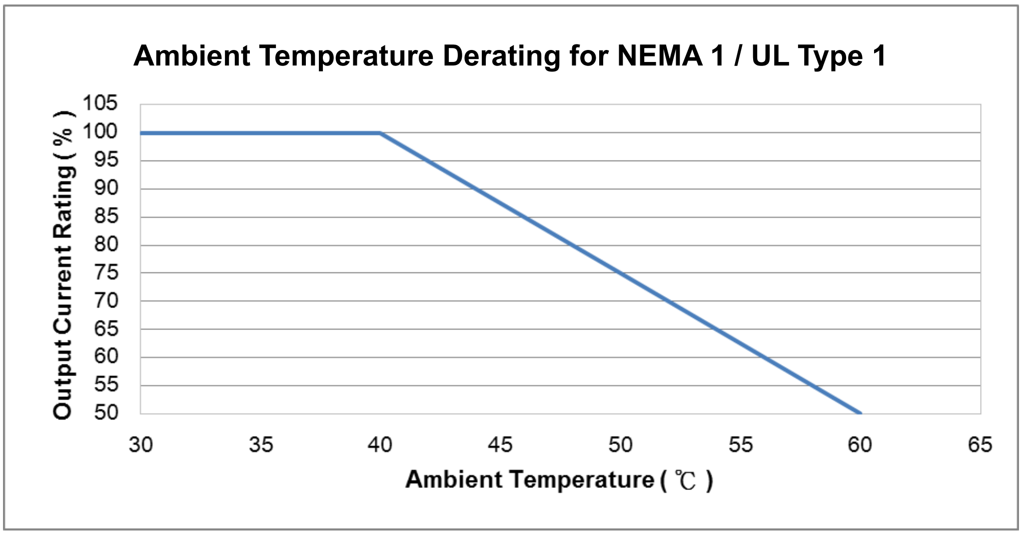

Figure 9-2

For IP20 / UL Open Type

Current derating at ambient temperature				
Ambient temperature		40℃	45℃	50℃
Operating altitude above sea level (m)	0–1000	100%		
	1001–1500	100%		95%
	1501–2000	100%	95%	90%

Table 9-9

For NEMA 1 / UL Type 1

Current derating at ambient temperature				
Ambient temperature		30℃	35℃	40℃
Operating altitude above sea level (m)	0–1000	100%		
	1001–1500	100%		95%
	1501–2000	100%	95%	90%

Table 9-10

Altitude Derating Curve

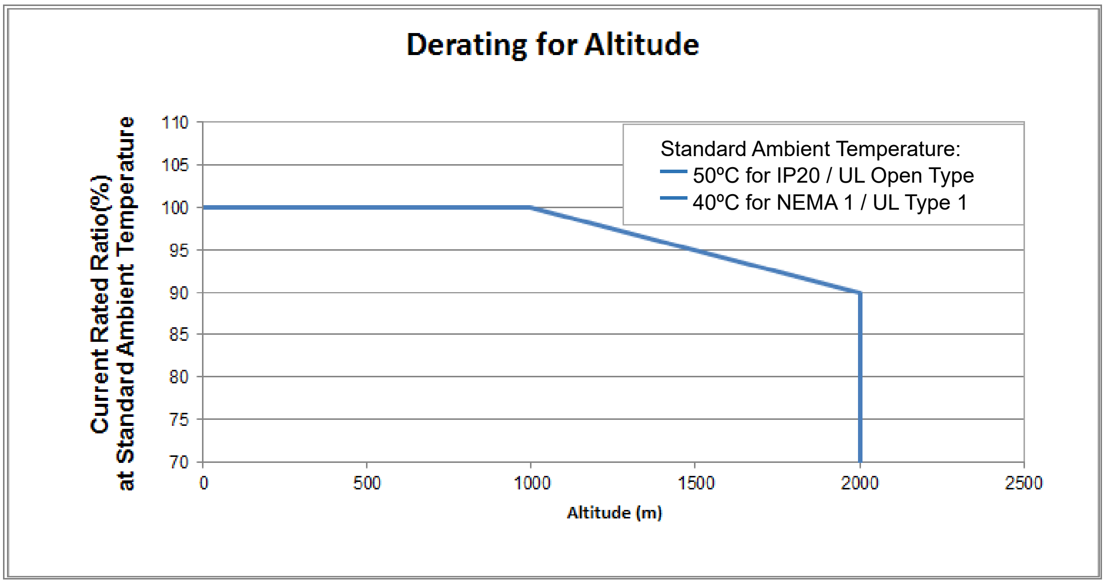

Figure 9-3

9-7-2 Ambient Temperature Derating for Each Installation Method

- Single drive installation

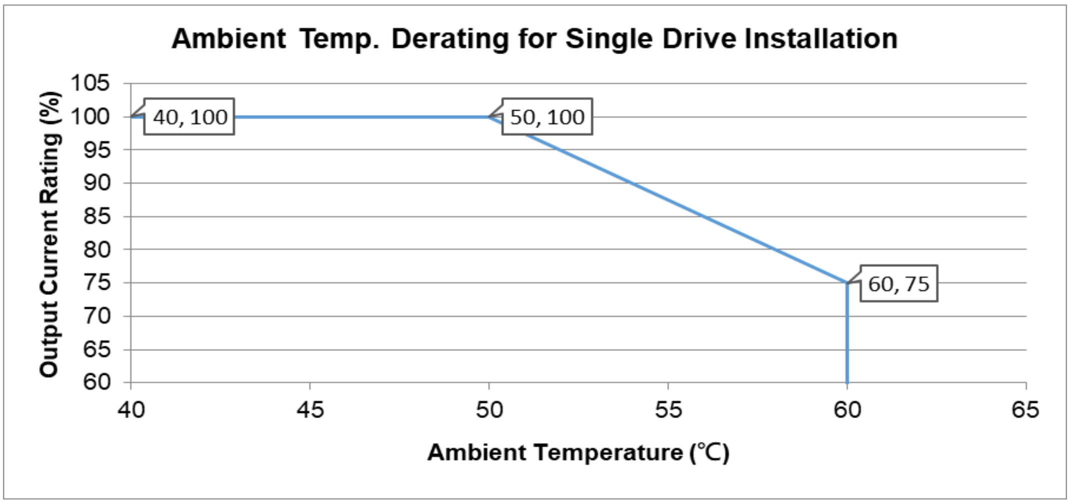

Figure 9-4

- Side-by-side horizontal installation

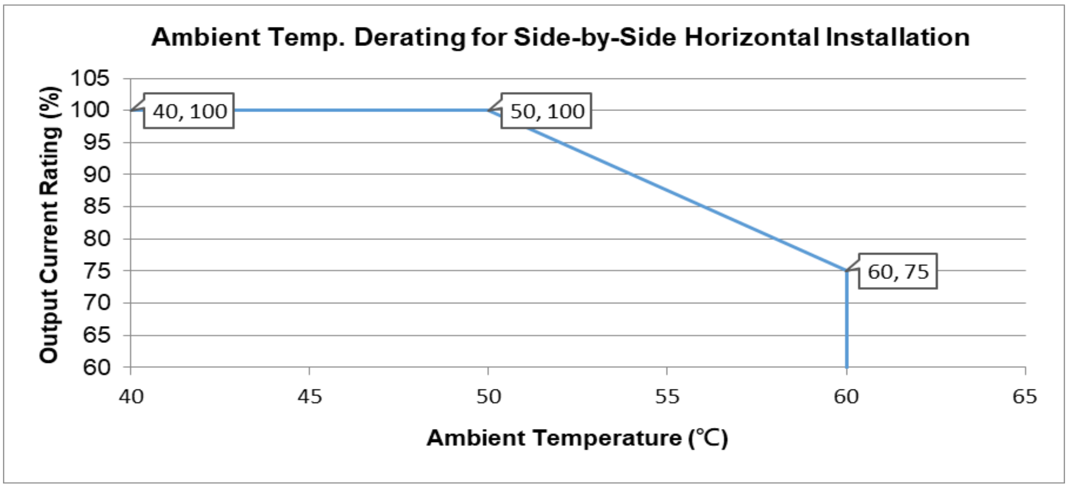

Figure 9-5

- Zero stack installation

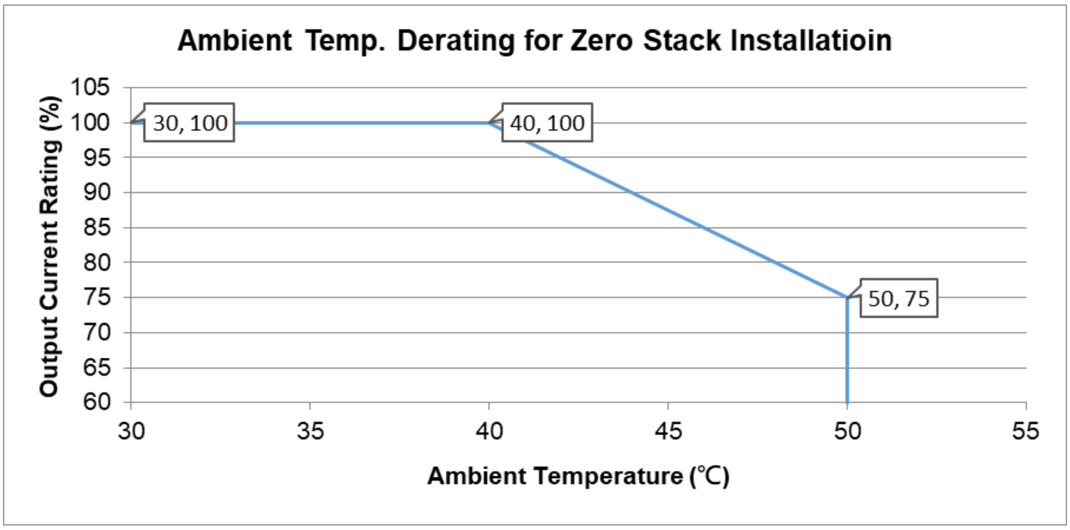

Figure 9-6

9-7-3 Derating Curve for Carrier Frequency

Normal duty (Pr.00-16 = 0)

- Space vector modulation mode (Pr.11-41 = 2)

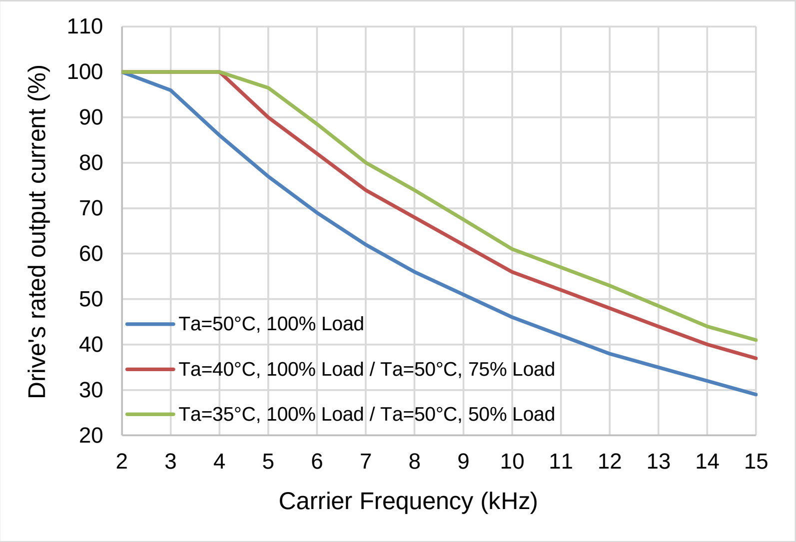

Figure 9-7

The rated output current (unit: %) of SVPWM in different carrier frequencies with normal duty.

Fc (kHz) / Ambient temperature (Ta) 100% Load	2	3	4	5	6	7	8	9	10	11	12	13	14	15
50°C	100	96	86	77	69	62	56	51	46	42	38	35	32	29
40°C	100	100	100	90	82	74	68	62	56	52	48	44	40	37
35°C	100	100	100	96.5	88.5	80	74	67.5	61	57	53	48.5	44	41

Table 9-11

- Two-Phase Modulation Mode (Pr.11-41 = 0)

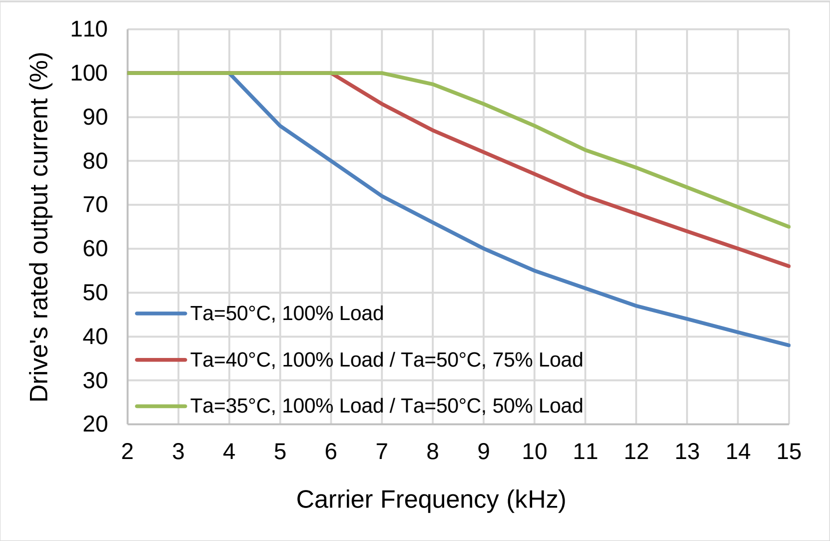

Figure 9-8

The rated output current (unit: %) of DPWM in different carrier frequencies with normal duty.

Fc (kHz) / Ambient temperature (Ta) 100% Load	2	3	4	5	6	7	8	9	10	11	12	13	14	15
50°C	100	100	100	88	80	72	66	60	55	51	47	44	41	38
40°C	100	100	100	100	100	93	87	82	77	72	68	64	60	56
35°C	100	100	100	100	100	100	97.5	93	88	82.5	78.5	74	69.5	65

Table 9-12

Heavy duty (Pr.00-16=1)

- Space Vector Modulation Mode (Pr.11-41 = 2)

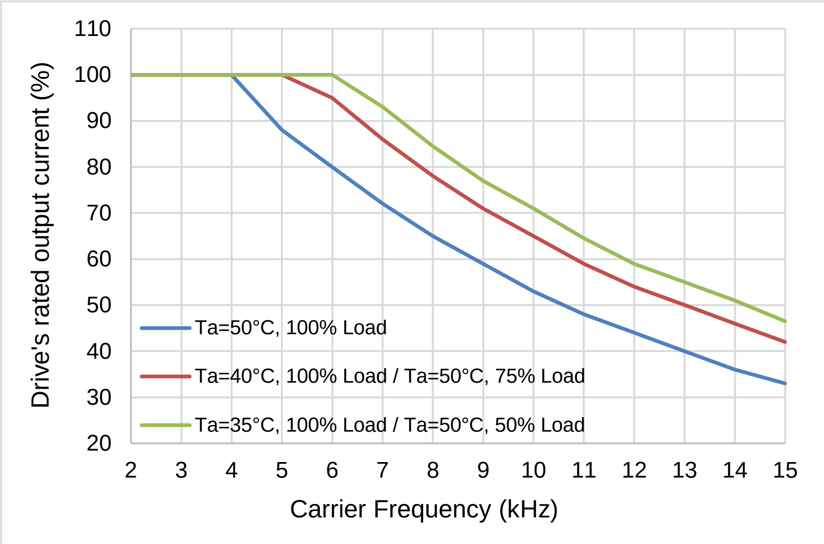

Figure 9-9

The rated output current (unit: %) of SVPWM in different carrier frequencies with heavy duty.

Fc (kHz) / Ambient temperature (Ta) 100% Load	2	3	4	5	6	7	8	9	10	11	12	13	14	15
50°C	100	100	100	88	80	72	65	59	53	48	44	40	36	33
40°C	100	100	100	100	95	86	78	71	65	59	54	50	46	42
35°C	100	100	100	100	100	93	84.5	77	71	64.5	59	55	51	46.5

Table 9-13

- Two-Phase Modulation Mode (Pr.11-41 = 0)

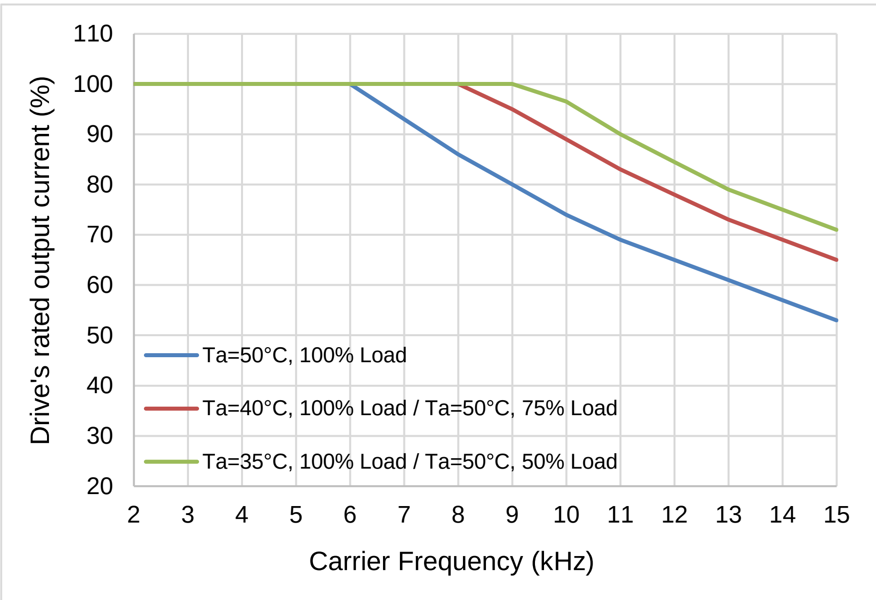

Figure 9-10

The rated output current (unit: %) of DPWM in different carrier frequencies with heavy duty.

Fc (kHz) / Ambient temperature (Ta) 100% Load	2	3	4	5	6	7	8	9	10	11	12	13	14	15
50°C	100	100	100	100	100	93	86	80	74	69	65	61	57	53
40°C	100	100	100	100	100	100	100	95	89	83	78	73	69	65
35°C	100	100	100	100	100	100	100	100	96.5	90	84.5	79	75	71

Table 9-14

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Chapter 10 Digital Keypad

10-1 Appearance of Keypad

Figure 10-1

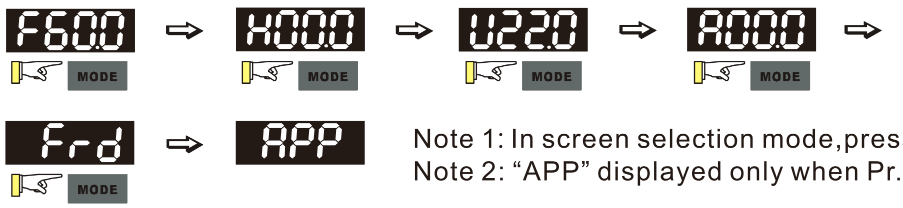
10-2 Descriptions of Keypad Functions

Displayed items	Descriptions
RUN FWD REV **F60.0** STOP PLC	Display the present frequency setting for the drive.
RUN FWD REV **H50.0** STOP PLC	Display the actual output frequency to the motor.
RUN FWD REV **U 18** STOP PLC	Display the user-defined output of a physical quantity. This example uses Pr.00-04=30
RUN FWD REV **A 5.0** STOP PLC	Display the load current.
RUN FWD REV **Frd** STOP PLC	Forward command
RUN FWD REV **rEv** STOP PLC	Reverse command
RUN FWD REV **c 20** STOP PLC	Display the count value.
RUN FWD REV **06.00** STOP PLC	Display a parameter item.
RUN FWD REV **10** STOP PLC	Display a parameter value.
RUN FWD REV **EF** STOP PLC	Display an external fault.
RUN FWD REV **End** STOP PLC	Display “End” for approximately one second if the data has been accepted and automatically stored in the register.
RUN FWD REV **Err** STOP PLC	Display if the setting data is not accepted or data value exceeds the allowed range.

Table 10-1

Keypad Operation Process

1. Main Page Selection

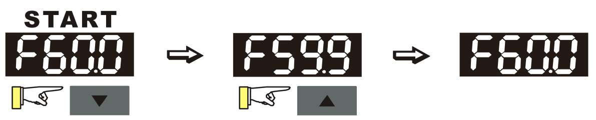


Note 1: In screen selection mode, press ENTER to set parameter
Note 2: “APP” displayed only when Pr.13-00≠0

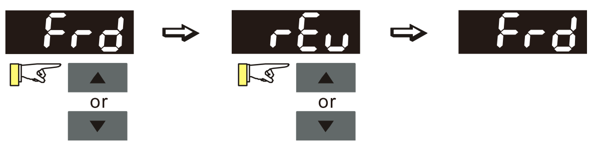
Setting parameters

Note: In the parameter setting mode, you can press MODE to return to the selection mode.

To shift data



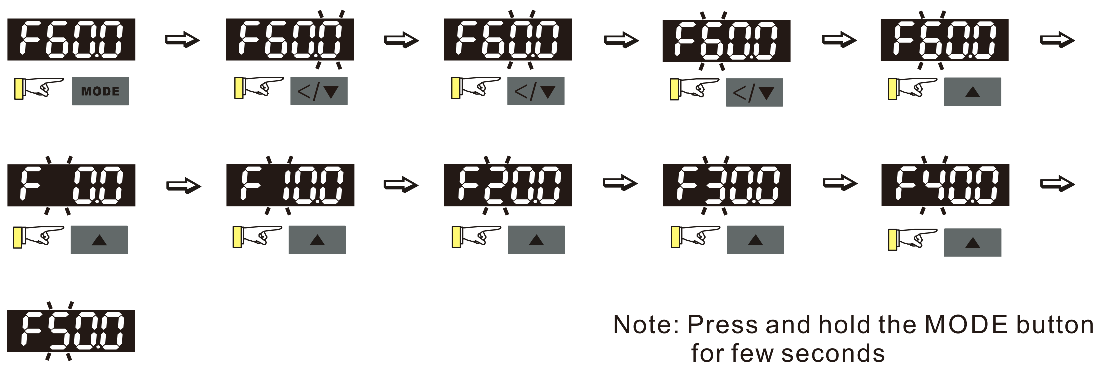
Setting direction (When the operation source is the digital keypad.)



2. F Page (Frequency command setting page)

General mode 1

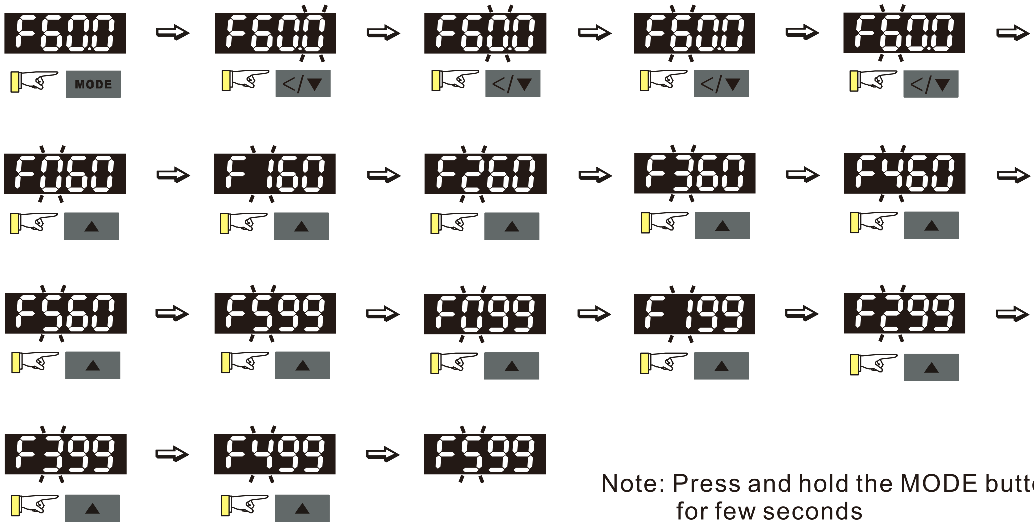
(The maximum operation frequency Pr.01-00 is in two decimal places. The example uses Pr.01-00 = 60.00 Hz.)



Note: Press and hold the MODE button for few seconds

General mode 2

(The maximum operation frequency Pr.01-00 is in three decimal places. The example uses Pr.01-00 = 599.0 Hz.)



Note: Press and hold the MODE button for few seconds

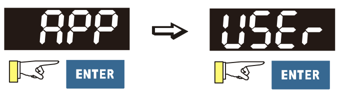
3. Application Macro Selection Page

Once enabled, the Application Marco Selection page displays “APP”. If Pr.13-00 = 0, the APP page does not display.

The description of Pr.13-00 setting is as follows:

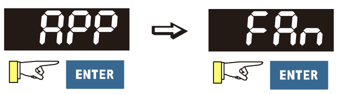
Pr.13-00 = 0 specifies the application selection is inactive and does not show on the display.

Pr.13-00 = 1 specifies a user-defined application, and the keypad displays “USEr”.



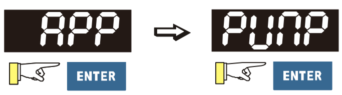
⇨ User-defined parameters display in sequence ⇨ parameters setting

Pr.13-00 = 3 specifies the Fan application, and the keypad displays “FAn”.



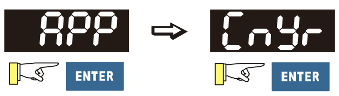
⇨ Industrial application displays in sequence ⇨ parameters setting

Pr.13-00 = 4 specifies the Pump application, and the keypad displays “PUMP”.



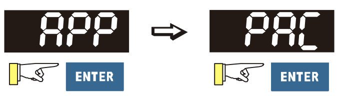
⇨ Industrial application displays in sequence ⇨ parameters setting

Pr.13-00 = 5 specifies the Conveyor application, and the keypad displays “CnYr”.



⇨ Industrial application displays in sequence ⇨ parameters setting

Pr.13-00 = 7 specifies the Packing application, and the keypad displays “PAC”.



⇨ Industrial application displays in sequence ⇨ parameters setting

When Pr.13-00 is not 0, the corresponding parameters appear in the APP page according to the setting for Pr.13-00. In each selected application, you can view the parameters by pressing the digital dial button. If Pr.13-00 = 1 and you do not set any parameters in Pr.13-01–Pr.13-50, you cannot enter the sub-layer of the USER page. The parameter settings in the APP page are the same as those in other parameter groups: rotate and then press the digital dial to select and set the parameter's value.

Follow the process below to set the user-defined application macro parameters (Pr.13-00=1).

Set Pr.13-00=1 to enable the user-defined application selection.

→ Set Pr.13-01–Pr.13-50 user-defined parameters orderly.

→ After finishing setting, press MODE to display the APP page, and then press the frequency knob to display the USEr page. Press the frequency knob again to display the user-defined parameters.

↓ Use frequency knob to select user-defined parameters, and press frequency knob to check the setting.

← To change a user-defined parameter, return to Pr.13-01–Pr.13-50 to modify the setting value.

← To remove a user-defined parameter, return to Pr.13-01–Pr.13-50 and set the parameters as 0.00 from the last defined parameter in sequence.

(1) Go to Parameter Group 13 to set the application macro functions. The application macro function is enabled when Pr.13-00 ≠ 0.

(2) Set Pr.13-00 = 1 to enable the user-defined applications.

(3) Use Pr.13-01–Pr.13-50 to set the user-defined parameters orderly according to your requirement. The default setting 0-00 means there is no user-defined parameter. Press ENTER to set the corresponding parameters for Pr.13-01– Pr.13-50.

(4) The setting method of user-defined parameters is the same as that for non-user-defined parameters. You can use Up and Down keys or left shift key to speed up the settings.

NOTE: You must set Pr.13-01, Pr.13-02, Pr.13-03, ...in order, otherwise the display shows "Err".

(5) If you want to change parameters which have been set before, you have to go back to Pr.13-01–13-50.

(6) If you want to remove unnecessary parameters after setting parameters, you must start to remove from the last parameter, that is, if you originally set 5 user-defined parameters Pr.13-01, Pr.13-02...Pr.13-05, to remove Pr. 13-02, it needs to be removed in sequence from Pr.13-05, Pr.13-04, and Pr.13-03.

(7) After finishing the setting, return to the APP page, and then press ENTER. The display shows "USEr". After you press ENTER again, the parameter you just set appears.

Follow the process below to set the industry-specific application macro parameters.

Set Pr.13-00 = 3, 4, 5 or 7 (3, 4, 5 and 7 represent different industries).

→ After selecting your application, press MODE to return to the APP page. Then, press frequency knob to enter into the industry-specific short name page. Pressing ENTER again displays the application macro parameters for the industry.

→ Use frequency knob to select industrial application parameters, and press frequency knob to check and set the parameters.

4. Parameter setting

(1) Unsigned parameter (Parameter setting range ≥ 0; for example, Pr.01-00)

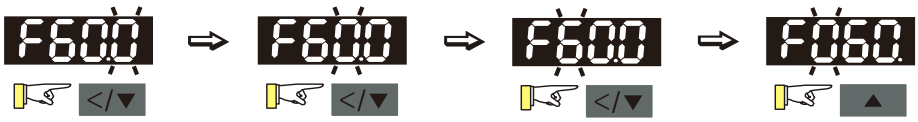
A. Without using the left shift key: Use Up and Left/Down key to select and adjust the parameters. Then, press ENTER to start the parameter settings.

B. Using the left shift key: Long press MODE for two seconds until the last digit of the parameter value starts to blink. Increase the value by pressing the Up key. The value goes back to 0 after 9.

C. Press left/down key to shift the blinking cursor one digit to the left, and increase the value by pressing the Up key.

D. After you finish setting the parameter, the left shift key function is not disabled automatically until you disable it manually by pressing MODE for two seconds.

Example: The default of Pr.01-00 is 60.0. Long pressing MODE for two seconds enables the left shift function. The process for pressing the Left / Down key shows as follows:



The upper limit for Pr.01-00 is 599.0. If you set a value greater than 599.0, “Err” appears after you press ENTER, and then the keypad shows the upper limit (599.0) for a second to remind you of the incorrect setting. The setting value remains as the original set value (default is 60.0, which means the setting value is not changed), and the cursor returns to the last digit.

(2) Minus-signed parameter setting status 1

(The parameter value is one decimal place or no decimal point, the range can be < 0; e.g. Pr.03-03)

A. Without using the left shift key: Use Up and Left/Down key to select and adjust the parameters. Then, press ENTER to start the parameter settings.

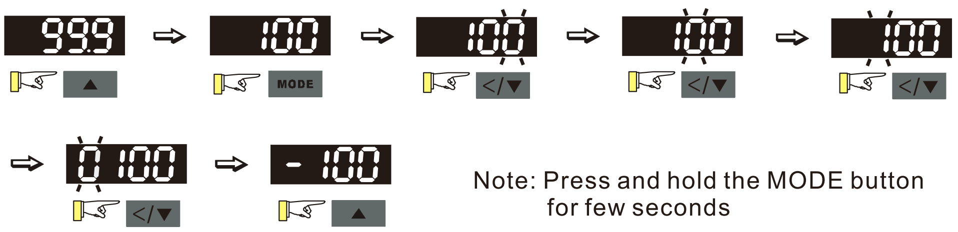
B. Using the left shift key: Long press MODE for two seconds until the last digit of the parameter value starts to blink. Increase the value by pressing the Up key. The value goes back to 0 after 9.

C. Press the left / down key to shift the blinking cursor one digit to the left, and increase the value by pressing the Up key. When you shift to the first digit and press the Up key, the digit “0” changes to “-” (minus).

D. After you finish setting the parameter, the left shift key function is not disabled automatically until you disable it manually by pressing MODE for two seconds.

E. For parameter values with three digits and one decimal place (Pr.03-03, -100–100.00%), the display only shows three digits.

Example: The default of Pr.03-03 is 0.0. Long pressing MODE for two seconds enables the left shift function. The process for pressing the Left / Down key shows as follows:



The upper limit for Pr.03-03 is 100.0 and lower limit is -100.0. If you set a value greater than 100.0 or less than -100.0, “Err” appears after you press ENTER, and then the keypad shows the upper limit (100.0) or lower limit (-100.0) for a second to remind you of the incorrect setting. The setting value remains as the original set value, and the cursor returns to the last digit.

10-3 Reference Table for the Seven-Segment Digital Keypad LED Display

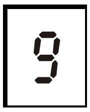
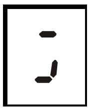
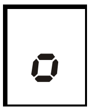
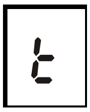
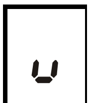
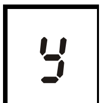
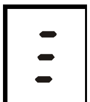
Number	0	1	2	3	4	5	6	7	8	9
7-Segment Display										
Letter	A	a	B	b	C	c	D	d	E	e
7-Segment Display		—	—				—			—
Letter	F	f	G	g	H	h	I	i	J	j
7-Segment Display		—		—			—			
Letter	K	k	L	l	M	m	N	n	O	o
7-Segment Display		—		—	—	—	—		—	
Letter	P	p	Q	q	R	r	S	s	T	t
7-Segment Display		—	—		—			—	—	
Letter	U	u	V	v	W	w	X	x	Y	y
7-Segment Display			—		—	—	—	—		—
Letter	Z	z								
7-Segment Display		—								

Table 10-2

Chapter 11 Summary of Parameter Settings

00 Drive Parameters

01 Basic Parameters

02 Digital Input / Output Parameters

03 Analog Input / Output Parameters

04 Multi-Step Speed Parameters

05 Motor Parameters

06 Protection Parameters (1)

07 Special Parameters

08 High-function PID Parameters

09 Communication Parameters

10 Speed Feedback Control Parameters

11 Advanced Parameters

12 Function Parameters

13 Industry Application Parameters

14 Protection Parameters (2)

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

Note:

1. ↗ You can set this parameter during operation.
2. Refer to chapter 12 for the details of parameters.
3. The following are abbreviations for different types of motors:
   - IM: Induction motor
   - PM: Permanent magnet synchronous AC motor
   - IPM: Interior permanent magnet synchronous AC motor
   - SPM: Surface permanent magnet synchronous AC motor
   - SynRM: Synchronous reluctance motor

00 Drive Parameters

Pr.	Parameter Name	Settings	Default
00-00	AC Motor Drive Identity Code	101: 115 V, 1 Phase, 0.125 HP 102: 115 V, 1 Phase, 0.25 HP 103: 115 V, 1 Phase, 0.5 HP 104: 115 V, 1 Phase, 1 HP 301: 230 V, 1 Phase, 0.125 HP 302: 230 V, 1 Phase, 0.25 HP 303: 230 V, 1 Phase, 0.5 HP 304: 230 V, 1 Phase, 1 HP 305: 230 V, 1 Phase, 2 HP 306: 230 V, 1 Phase, 3 HP 201: 230 V, 3 Phase, 0.125 HP 202: 230 V, 3 Phase, 0.25 HP 203: 230 V, 3 Phase, 0.5 HP 204: 230 V, 3 Phase, 1 HP 205: 230 V, 3 Phase, 2 HP 206: 230 V, 3 Phase, 3 HP 207: 230 V, 3 Phase, 5 HP 208: 230 V, 3 Phase, 7.5 HP 209: 230 V, 3 Phase, 10 HP 210: 230 V, 3 Phase, 15 HP 211: 230 V, 3 Phase, 20 HP 403: 460 V, 3 Phase, 0.5 HP 404: 460 V, 3 Phase, 1 HP 405: 460 V, 3 Phase, 2 HP 406: 460 V, 3 Phase, 3 HP 407: 460 V, 3 Phase, 5 HP 408: 460 V, 3 Phase, 7.5 HP	Read only

Pr.	Parameter Name	Settings	Default
		409: 460 V, 3 Phase, 10 HP 410: 460 V, 3 Phase, 15 HP 411: 460 V, 3 Phase, 20 HP 412: 460 V, 3 Phase, 25 HP 413: 460 V, 3 Phase, 30 HP 482: 460 V, 3 Phase, 4 HP	
00-01	AC Motor Drive Rated Current Display	Display by models	Read only
00-02	Parameter Reset	0: No Function 1: Write protection for parameters 5: Return kWh displays to 0 8: Keypad does not respond 9: Reset all parameters to defaults (base frequency is 50 Hz) 10: Reset all parameters to defaults (base frequency is 60 Hz) 11: Reset all parameters to defaults with base frequency at 50 Hz (save the user-defined parameter values of Pr.13-01–Pr.13-50) 12: Reset all parameters to defaults with base frequency at 60 Hz (save the user-defined parameter values of Pr.13-01–Pr.13-50)	0
00-03	Start-up Display	0: F (frequency command) 1: H (output frequency) 2: U (user-defined) see Pr.00-04 3: A (output current)	0
00-04	Content of Multi-function Display (User-Defined)	0: Display output current from the drive to the motor (A) (Unit: Amp) 1: Display counter value (c) (Unit: CNT) 2: Display the drive's actual output frequency (H.) (Unit: Hz) 3: Display the drive's DC bus voltage (v) (Unit: V_{DC}) 4: Display the drive's output voltage (E) (Unit: V_{AC}) 5: Display the drive's output power angle (n) (Unit: deg) 6: Display the drive's output power (P) (Unit: kW) 7: Display the motor speed (r) (Unit: rpm) 10: Display PID feedback (b) (Unit: %)	3

	Pr.	Parameter Name	Settings	Default
			11: Display AVI analog input terminal signal (1.) (Unit: %) 12: Display ACI analog input terminal signal (2.) (Unit: %) 14: Display the drive's IGBT temperature (i.) (Unit: ºC) 16: The digital input status (ON / OFF) (i) 17: The digital output status (ON / OFF) (o) 18: Display multi-step speed (S) 19: The corresponding CPU digital input pin status (d) 20: The corresponding CPU digital output pin status (0.) 25: Overload count (0.00–100.00%) (o.) (Unit: %) 26: Ground Fault GFF (G.) (Unit: %) 27: DC bus voltage ripple (r.) (Unit: V_{DC}) 30: Display the output of User-defined (U) 31: Display Pr.00-05 user gain (K) 35: Control mode display: 0= Speed control mode (SPD) 36: Present operating carrier frequency of the drive (J.) (Unit: Hz) 38: AC motor drive status (6.) 41: kWh display (J) (Unit: kWh) 42: PID target value (h.) (Unit: %) 43: PID compensation (o.) (Unit: %) 44: PID output frequency (b.) (Unit: Hz) 46: Auxiliary frequency value (U.) (Unit: Hz) 47: Master frequency value (A.) (Unit: Hz) 48: Frequency value after addition and subtraction of master and auxiliary frequency (L.) (Unit: Hz) 60: Display the setting value and the feedback of PID control 61: Display the content of the running program (1 = tt)	
✐	00-05	Coefficient Gain in Actual Output Frequency	0.00–160.00	1.00
	00-06	Firmware Version	Read only	Read only

Pr.	Parameter Name	Settings	Default
00-07	Parameter Protection Password Input	0–65535 0–4 (number of failed password attempts)	0
00-08	Parameter Protection Password Setting	0–65535 0: No password protection or password is entered correctly (Pr.00-07) 1: Password has been set	0
00-10	Control Mode	0: Speed Control mode	0
00-11	Speed Control Mode	0: IM V/F (Induction Motor V/F Control) 2: IM/PM SVC (Induction Motor / Permanent Magnet Synchronous AC Motor Space Vector Control)	0
00-16	Duty Selection	0: Normal duty 1: Heavy duty	1
00-17	Carrier Frequency	Normal duty: 2–15 kHz Heavy duty: 2–15 kHz	4 4
00-20	Frequency Command Source (AUTO, REMOTE)	0: Digital keypad 1: RS-485 communication input 2: External analog input (Refer to Pr.03-00) 3: External UP / DOWN terminal (multi-function input terminals) 4: Pulse input without direction command (refer to Pr.10-16 without considering direction) 7: Frequency knob on the digital keypad 9: PID controller (use with Pr.08-65 = 1) **Note:** HOA (Hand-Off-Auto) function is valid only when you use with MO function setting 42 and 56 or with KPC-CC01 (optional).	0
00-21	Operation Command Source (AUTO, REMOTE)	0: Digital keypad 1: External terminals 2: RS-485 communication input **Note:** HOA (Hand-Off-Auto) function is valid only when you use with MO function setting 42 and 56 or with KPC-CC01 (optional).	0
00-22	Stop Method	0: Ramp to stop 1: Coast to stop 2: Motor stops with simple positioning method	0
00-23	Motor Direction Control	0: Enable forward / reverse 1: Disable reverse 2: Disable forward	0

Pr.	Parameter Name	Settings	Default
00-24	Digital Operator (Keypad) Frequency Command Memory	Read only	Read only
00-25	User-Defined Characteristics	bit 0–3: user-defined decimal places 0000h-0000b: no decimal place 0001h-0001b: one decimal place 0002h-0010b: two decimal places 0003h-0011b: three decimal places bit 4–15: user-defined unit 000xh: Hz 001xh: rpm 002xh: % 003xh: kg 004xh: m/s 005xh: kW 006xh: HP 007xh: ppm 008xh: 1/m 009xh: kg/s 00Axh: kg/m 00Bxh: kg/h 00Cxh: lb/s 00Dxh: lb/m 00Exh: lb/h 00Fxh: ft/s 010xh: ft/m 011xh: m 012xh: ft 013xh: degC 014xh: degF 015xh: mbar 016xh: bar 017xh: Pa 018xh: kPa 019xh: mWG 01Axh: inWG 01Bxh: ftWG 01Cxh: psi 01Dxh: atm 01Exh: L/s	0

Pr.	Parameter Name	Settings	Default
		01Fxh: L/m 020xh: L/h 021xh: m3/s 022xh: m3/h 023xh: GPM 024xh: CFM xxxxh: Hz	
00-26	Maximum User-Defined Value	0: Disabled ● 0–65535 (when Pr.00-25 is set to no decimal place) ● 0.0–6553.5 (when Pr.00-25 is set to one decimal place) ● 0.00–655.35 (when Pr.00-25 is set to two decimal places) ● 0.000–65.535 (when Pr.00-25 is set to three decimal places)	0
00-27	User-Defined Value	Read only	Read only
00-29	LOCAL / REMOTE Selection	0: Standard HOA function 1: When switching between local and remote, the drive stops. 2: When switching between local and remote, the drive runs with REMOTE settings for frequency and operating status. 3: When switching between local and remote, the drive runs with LOCAL settings for frequency and operating status. 4: When switching between local and remote, the drive runs with LOCAL settings when switched to Local and runs with REMOTE settings when switched to Remote for frequency and operating status.	0
00-30	Master frequency command source (HAND, LOCAL)	0: Digital keypad 1: RS-485 communication input 2: External analog input (Refer to Pr.03-00) 3: External UP / DOWN terminal (multi-function input terminals) 4: Pulse input without direction command (refer to Pr.10-16 without considering direction) 7: Frequency knob on the digital keypad 9: PID controller	0

Pr.	Parameter Name	Settings	Default
		Note: HOA (Hand-Off-Auto) function is valid only when you use with MO function setting 41 and 56 or with KPC-CC01 (optional).	
00-31	Operation command source (HAND, LOCAL)	0: Digital keypad 1: External terminals 2: RS-485 communication input **Note:** HOA (Hand-Off-Auto) function is valid only when you use with MO function setting 41 and 56 or with KPC-CC01 (optional).	0
✓ 00-32	Digital Keypad STOP Function	0: STOP key disabled 1: STOP key enabled	0
00-33	RPWM Mode Selection	0: Disabled 1: RPWM mode 1 2: RPWM mode 2 3: RPWM mode 3	0
✓ 00-34	RPWM carrier frequency variation	0.0–4.0 kHz ● Pr.00-17 = 4 kHz, 8 kHz: the setting range is 0.0–2.0 kHz ● Pr.00-17 = 5–7 kHz: the setting range is 0.0–4.0 kHz	0
00-35	Auxiliary Frequency Source	0: Master and auxiliary frequency function disabled 1: Digital keypad 2: RS-485 communication input 3: Analog input 4: External UP/DOWN key input (multi-function input terminals) 7: Frequency knob on the digital keypad	0
00-36	Master and Auxiliary Frequency Command Selection	0: Master + auxiliary frequency 1: Master - auxiliary frequency 2: Auxiliary - master frequency	0
00-47	Output Phase Order Selection	0: Standard 1: Exchange the rotation direction	0
✓ 00-48	Display Filter Time (Current)	0.001–65.535 sec.	0.100
✓ 00-49	Display Filter Time (Keypad)	0.001–65.535 sec.	0.100
00-50	Software Version (Date)	Read only	Read only

01 Basic Parameters

	Pr.	Parameter Name	Settings	Default
	01-00	Motor 1 Maximum Operation Frequency	0.00–599.00 Hz	60.00 / 50.00
	01-01	Motor 1 Rated / Base Frequency	0.00–599.00 Hz	60.00 / 50.00
	01-02	Motor 1 Rated / Base Voltage	115V / 230V models: 0.0–255.0 V 460V models: 0.0–510.0 V	220.0 440.0
	01-03	Motor 1 Mid-Point Frequency 1	0.00–599.00 Hz	3.00
✓	01-04	Mid-Point Voltage 1 of Motor 1	115V / 230V models: 0.0–240.0 V 460V models: 0.0–480.0 V	11.0 22.0
	01-05	Motor 1 Mid-Point Frequency 2	0.00–599.00 Hz	1.50
✓	01-06	Mid-Point Voltage 1 of Motor 2	115V / 230V models: 0.0–240.0 V 460V models: 0.0–480.0 V	5.0 10.0
	01-07	Motor 1 Minimum Output Frequency	0.00–599.00 Hz	0.50
✓	01-08	Motor 1 Minimum Output Voltage	115V / 230V models: 0.0–240.0 V 460V models: 0.0–480.0 V	1.0 2.0
	01-09	Start-up Frequency	0.00–599.00 Hz	0.50
✓	01-10	Output Frequency Upper Limit	0.00–599.00 Hz	599.00
✓	01-11	Output Frequency Lower Limit	0.00–599.00 Hz	0.00
✓	01-12	Acceleration Time 1	Pr.01-45 = 0: 0.00–600.00 sec. Pr.01-45 = 1: 0.0–6000.0 sec.	10.00
✓	01-13	Deceleration Time 1	Pr.01-45 = 0: 0.00–600.00 sec. Pr.01-45 = 1: 0.0–6000.0 sec.	10.00
✓	01-14	Acceleration Time 2	Pr.01-45 = 0: 0.00–600.00 sec. Pr.01-45 = 1: 0.0–6000.0 sec.	10.00
✓	01-15	Deceleration Time 2	Pr.01-45 = 0: 0.00–600.00 sec. Pr.01-45 = 1: 0.0–6000.0 sec.	10.00
✓	01-16	Acceleration Time 3	Pr.01-45 = 0: 0.00–600.00 sec. Pr.01-45 = 1: 0.0–6000.0 sec.	10.00
✓	01-17	Deceleration Time 3	Pr.01-45 = 0: 0.00–600.00 sec. Pr.01-45 = 1: 0.0–6000.0 sec.	10.00
✓	01-18	Acceleration Time 4	Pr.01-45 = 0: 0.00–600.00 sec. Pr.01-45 = 1: 0.0–6000.0 sec.	10.00
✓	01-19	Deceleration Time 4	Pr.01-45 = 0: 0.00–600.00 sec. Pr.01-45 = 1: 0.0–6000.0 sec.	10.00

	Pr.	Parameter Name	Settings	Default
〆	01-20	JOG Acceleration Time	Pr.01-45 = 0: 0.00–600.00 sec. Pr.01-45 = 1: 0.0–6000.0 sec.	10.00
〆	01-21	JOG Deceleration Time	Pr.01-45 = 0: 0.00–600.00 sec. Pr.01-45 = 1: 0.0–6000.0 sec.	10.00
〆	01-22	JOG Frequency	0.00–599.00 Hz	6.00
〆	01-23	Switch Frequency between First and Fourth Accel./Decel.	0.00–599.00 Hz	0.00
〆	01-24	S-Curve for Acceleration Begin Time 1	Pr.01-45 = 0: 0.00–25.00 sec. Pr.01-45 = 1: 0.0–250.0 sec.	0.20
〆	01-25	S-Curve for Acceleration Arrival Time 2	Pr.01-45 = 0: 0.00–25.00 sec. Pr.01-45 = 1: 0.0–250.0 sec.	0.20
〆	01-26	S-Curve for Deceleration Begin Time 1	Pr.01-45 = 0: 0.00–25.00 sec. Pr.01-45 = 1: 0.0–250.0 sec.	0.20
〆	01-27	S-Curve for Deceleration Arrival Time 2	Pr.01-45 = 0: 0.00–25.00 sec. Pr.01-45 = 1: 0.0–250.0 sec.	0.20
	01-28	Skip Frequency 1 (Upper Limit)	0.00–599.00 Hz	0.00
	01-29	Skip Frequency 1 (Lower Limit)	0.00–599.00 Hz	0.00
	01-30	Skip Frequency 2 (Upper Limit)	0.00–599.00 Hz	0.00
	01-31	Skip Frequency 2 (Lower Limit)	0.00–599.00 Hz	0.00
	01-32	Skip Frequency 3 (Upper Limit)	0.00–599.00 Hz	0.00
	01-33	Skip Frequency 3 (Lower Limit)	0.00–599.00 Hz	0.00
	01-34	Zero-Speed Mode	0: Output waiting 1: Zero-speed operation 2: Fmin (refer to Pr.01-07, Pr.01-41)	0
	01-35	Motor 2 Rated / Base Frequency	0.00–599.00 Hz	60.00 / 50.00
	01-36	Motor 2 Rated / Base Voltage	115V / 230V models: 0.0–255.0 V 460V models: 0.0–510.0 V	220.0 440.0
	01-37	Motor 2 Mid-Point Frequency 1	0.00–599.00 Hz	3.00
〆	01-38	Mid-Point Voltage 2 of Motor 1	115V / 230V models: 0.0–240.0 V 460V models: 0.0–480.0 V	11.0 22.0

	Pr.	Parameter Name	Settings	Default
	01-39	Motor 2 Mid-Point Frequency 2	0.00–599.00 Hz	0.50
✎	01-40	Mid-Point Voltage 2 of Motor 2	115V / 230V models: 0.0–240.0 V 460V models: 0.0–480.0 V	2.0 4.0
	01-41	Motor 2 Minimum Output Frequency	0.00–599.00 Hz	0.00
✎	01-42	Motor 2 Minimum Output Voltage	115V / 230V models: 0.0–240.0 V 460V models: 0.0–480.0 V	0.0 0.0
	01-43	V/F Curve Selection	0: V/F curve determined by Pr.01-00–01-08 1: V/F curve to the power of 1.5 2: V/F curve to the power of 2	0
✎	01-44	Auto-acceleration and Auto-deceleration Setting	0: Linear acceleration and deceleration 1: Auto-acceleration and linear deceleration 2: Linear acceleration and auto-deceleration 3: Auto-acceleration and auto-deceleration 4: Stall prevention by auto-acceleration and auto-deceleration (limited by Pr.01-12–01-21)O	0
	01-45	Time Unit for Acceleration / Deceleration and S-Curve	0: Unit 0.01 sec. 1: Unit 0.1 sec.	0
	01-49	Regenerative Energy Restriction Control Method	0: Disabled 1: Over voltage energy restriction 2: Traction energy control (TEC) 3: Electromagnetic energy traction control	0
	01-52	Motor 2 Maximum Operation Frequency	0.00–599.00 Hz	60.00 / 50.00

02 Digital Input / Output Parameters

<table>
<tr><th>Pr.</th><th>Parameter Name</th><th>Settings</th><th>Default</th></tr>
<tr><td>02-00</td><td>Two-wire / Three-wire Operation Control</td><td>0: Disabled
1: Two-wire mode 1, power ON for operation control (M1: FWD / STOP, M2: REV / STOP)
2: Two-wire mode 2, power on for operation control (M1: RUN / STOP, M2: REV / FWD)
3: Three-wire, power on for operation control (M1: RUN, M2: REV / FWD, M3: STOP)
4: Two-wire mode 1, Quick Start (M1: FWD / STOP, M2: REV / STOP)
5: Two-wire mode 2, Quick Start (M1: RUN / STOP, M2: REV / FWD)
6: Three-wire, Quick Start (M1: RUN, M2: REV / FWD, M3: STOP)
<u>IMPORTANT</u>
1. In the Quick Start function, the output remains ready for operation. The drive responds to the Start command immediately.
2. When using Quick Start function, the output terminals UVW are with driving voltages in order to output and respond immediately if a Start command is given. Do NOT touch the terminals or modify the motor wiring to prevent electric shocks.</td><td>1</td></tr>
<tr><td>02-01</td><td>Multi-function Input Command 1 (MI1)</td><td rowspan="6">0: No Function
1: Multi-step speed command 1
2: Multi-step speed command 2
3: Multi-step speed command 3
4: Multi-step speed command 4
5: Reset
6: JOG operation [by external control or KPC-CC01 (optional)]
7: Acceleration / deceleration speed inhibit
8: 1st and 2nd acceleration / deceleration time selection
9: 3rd and 4th acceleration / deceleration time selection
10: External Fault (EF) input (Pr.07-20)
11: Base Block (B.B.) input from external
12: Output stop
13: Cancel the setting of auto-acceleration / auto-deceleration time</td><td>0</td></tr>
<tr><td>02-02</td><td>Multi-function Input Command 2 (MI2)</td><td>0</td></tr>
<tr><td>02-03</td><td>Multi-function Input Command 3 (MI3)</td><td>1</td></tr>
<tr><td>02-04</td><td>Multi-function Input Command 4 (MI4)</td><td>2</td></tr>
<tr><td>02-05</td><td>Multi-Function Input Command 5 (MI5)</td><td>3</td></tr>
<tr><td></td><td></td><td></td></tr>
</table>

Pr.	Parameter Name	Settings	Default
		15: Rotating speed command from AVI 18: Force to stop (Pr.07-20) 19: Frequency up command 20: Frequency down command 21: PID function disabled 22: Clear the counter 23: Input the counter value 24: FWD JOG command 25: REV JOG command 28: Emergency stop (EF1) 29: Signal confirmation for Y-connection 30: Signal confirmation for -connection 38: Disable writing EEPROM function 40: Force coasting to stop 41: HAND switch 42: AUTO switch 49: Enable drive 50: Slave dEb action to execute 56：Local / Remote selection 58: Enable fire mode (with RUN command) 59: Enable fire mode (without RUN command) 69: Enable preheating function 70: Force auxiliary frequency to be 0 71: Disable PID function, force PID output to be 0 72: Disable PID function, retain the output value before disabled 73: Force PID integral gain to be 0, disable integral 74: Reverse PID feedback 77: PLC program running 78: PLC program phase completed 79: PLC program completed 80: PLC operation paused 83: Multi-motor (IM) selection bit 0 94: Programmable AUTO RUN 95: Pausing AUTO RUN 97: Multi-pump switch by HAND / AUTO mode 98: Simple positioning stop by forward limit 99: Simple positioning stop by reverse limit	

<table>
<tr><th>Pr.</th><th>Parameter Name</th><th>Settings</th><th>Default</th></tr>
<tr><td>02-09</td><td>External Terminals UP / DOWN Key Mode</td><td>0: According to acceleration / deceleration time
1: Constant speed (Pr.02-10)
2: Pulse signal (Pr.02-10)
3: Curve
4: Steps (Pr.02-10)</td><td>0</td></tr>
<tr><td>02-10</td><td>Acceleration / Deceleration Speed of External Terminal UP / DOWN Keys</td><td>0.001–1.000 Hz / ms</td><td>0.001</td></tr>
<tr><td>02-11</td><td>Multi-Function Input Response Time</td><td>0.000–30.000 sec.</td><td>0.005</td></tr>
<tr><td>02-12</td><td>Multi-Function Input Mode Selection</td><td>0–65535</td><td>0</td></tr>
<tr><td>02-13</td><td>Multi-Function Output 1 (RY1)</td><td rowspan="3">0: No Function
1: Indication during RUN
2: Operation speed reached
3: Desired frequency reached 1 (Pr.02-22)
4: Desired frequency reached 2 (Pr.02-24)
5: Zero speed (Frequency command)
6: Zero speed including STOP (Frequency command)
7: Over-torque 1 (Pr.06-06–06-08)
8: Over-torque 2 (Pr.06-09–06-11)
9: Drive is ready
10: Low voltage warning (Lv) (Pr.06-00)
11: Malfunction indication
13: Overheat warning (Pr.06-15)
14: Software brake signal indication (Pr.07-00)
15: PID feedback error (Pr.08-13, 08-14)
16: Slip error (oSL)
17: Count value reached, does not return to 0 (Pr.02-20)
18: Count value reached, return to 0 (Pr.02-19)
19: Base Block (B.B.) input interrupted from the outside
20: Warning output
21: Over-voltage
22: Over-current stall prevention
23: Over-voltage stall prevention
24: Operation mode
25: Forward command</td><td>11</td></tr>
<tr><td>02-16</td><td>Multi-Function Output 2 (MO1)</td><td>0</td></tr>
<tr><td></td><td></td><td></td></tr>
</table>

	Pr.	Parameter Name	Settings	Default
			26: Reverse command 29: Output when frequency ≥ Pr.02-34 30: Output when frequency < Pr.02-34 31: Y-connection for the motor coil 32: Δ-connection for the motor coil 33: Zero speed (actual output frequency) 34: Zero speed including STOP (actual output frequency) 35: Error output selection 1 (Pr.06-23) 36: Error output selection 2 (Pr.06-24) 37: Error output selection 3 (Pr.06-25) 38: Error output selection 4 (Pr.06-26) 40: Speed reached (including STOP) 42: Crane function 43: Actual motor speed detection 44: Low current output (use with Pr.06-71–Pr.06-73) 45: UVW output electromagnetic valve switch 46: Master dEb output 51: Analog output control for RS-485 interface 53: Fire mode indication 67: Analog input level reached 69: Indication of preheating operation 75: Forward RUN status 76: Reverse RUN status 77: Program running 78: One program step completed 79: Program running completed 80: Program running paused 81: Indication of multi-pump system error (only Master)	
✔	02-18	Multi-function Output Direction	0000h–FFFFh (0: N.O.; 1: N.C.)	0000h
✔	02-19	Terminal Counting Value Reached (returns to 0)	0–65500	0
✔	02-20	Preliminary Counting Value Reached (does not return to 0)	0–65500	0
✔	02-22	Desired Frequency Reached 1	0.00–599.00 Hz	60.00 / 50.00

	Pr.	Parameter Name	Settings	Default
✓	02-23	The Width of the Desired Frequency Reached 1	0.00–599.00 Hz	2.00
✓	02-24	Desired Frequency Reached 2	0.00–599.00 Hz	60.00 / 50.00
✓	02-25	The Width of the Desired Frequency Reached 2	0.00–599.00 Hz	2.00
✓	02-34	Output Frequency Setting for Multi-Function Output Terminal	0.00–599.00 Hz–	0.00
✓	02-35	External Operation Control Selection after Reset and Reboot	0: Disabled 1: Drive runs if the RUN command remains after reset or reboot.	0
✓	02-47	Motor Zero-Speed Level	0–65535 rpm	0
	02-50	Display the Status of Multi-Function Input Terminal	Monitor the status of the Multi-Function Input Terminal	Read only
	02-51	Display the Status of Multi-Function Output Terminal	Monitor the status of the Multi-Function Output Terminal	Read only
	02-54	Display the Frequency Command Executed by External Terminal	0.00–599.00 Hz (Read only)	Read only
	02-58	Multi-function Output Terminal (Function 42): Brake Frequency Check Point	0.00–599.00 Hz	0.00
✓	02-72	Preheating DC current level	0–100%	0
✓	02-73	Preheating DC Current Duty Cycle	0–100%	0
✓	02-81	EF Activates when the Terminal Count Value Reached	0: Terminal count value reached, no EF displays (continues to operate) 1: Terminal count value reached, EF activates	0
✓	02-82	Initial Frequency Command (F) Mode after Stop	0: Use current Frequency command 1: Use zero Frequency command 2: Refer to Pr.02-83 to set up	0
✓	02-83	Initial Frequency Command (F) Setting after Stop	0.00–599.0 Hz	60.00

03 Analog Input / Output Parameters

Pr.	Parameter Name	Settings	Default
03-00	AI1 Analog Input Selection	0: No Function 1: Frequency command 4: PID target value 5: PID feedback signal 6: Thermistor (PTC) input value 11: PT100 thermistor input value 12: Auxiliary frequency input 13: PID compensation value	1
03-03	Analog Input Bias (AVI)	-100.0–100.0%	0
03-04	Analog Input Bias (ACI)	-100.0–100.0%	0
03-07	Positive / Negative Bias Mode (AVI)	0: No bias 1: Lower than or equal to bias 2: Greater than or equal to bias 3: The absolute value of the bias voltage while serving as the center 4: Bias serves as the center	0
03-08	Positive / Negative Bias Mode (ACI)		
03-10	Reverse Setting when Analog Signal Input is Negative Frequency	0: Negative frequency input is not allowed. The digital keypad or external terminal controls the forward and reverse direction. 1: Negative frequency input is allowed. Positive frequency = run in a forward direction; negative frequency = run in a reverse direction. The digital keypad or external terminal control cannot change the running direction.	0
03-11	Analog Input Gain (AVI)	-500.0–500.0%	100.0
03-12	Analog Input Gain (ACI)	-500.0–500.0%	100.0
03-15	Analog Input Filter Time (AVI)	0.00–20.00 sec.	0.01
03-16	Analog Input Filter Time (ACI)	0.00–20.00 sec.	0.01
03-19	Signal Loss Selection for the Analog Input 4–20 mA	0: Disabled 1: Continue operation at the last frequency 2: Decelerate to 0 Hz 3: Stop immediately and display "ACE"	0
03-20	AFM Analog Output Selection	0: Output frequency (Hz) 1: Frequency command (Hz) 2: Motor speed (Hz) 3: Output current (rms) 4: Output voltage 5: DC bus voltage	0

	Pr.	Parameter Name	Settings	Default
			6: Power factor 7: Power 9: AVI 12: Iq current command 13: Iq feedback value 14: Id current command 15: Id feedback value 16: Vq-axis voltage command 17: Vd-axis voltage command 21: RS-485 analog output 23: Constant voltage output	
✓	03-21	AFM Analog Output Gain	0.0–500.0%	100.0
✓	03-22	AFM Analog Output in REV Direction	0: Absolute value in output voltage 1: Reverse output 0 V; forward output 0–10 V 2: Reverse output 5-0 V; forward output 5–10 V	0
✓	03-27	AFM Output Bias	-100.00–100.00%	0.00
✓	03-28	AI Terminal Input Selection	0: 0–10 V (Pr.03-63–Pr.03-68 are valid) 1: 0–10 V (Pr.03-57–Pr.03-62 are valid) 2: 4–10 V (Pr.03-57–Pr.03-62 are valid)	0
✓	03-32	AFM DC Output Setting Level	0.00–100.00%	0.00
✓	03-35	AFM Output Filter Time	0.00–20.00 sec.	0.01
✓	03-39	VR Input Selection	0: Disabled 1: Frequency command	1
✓	03-40	VR Input Bias	-100.0–100.0%	0.0
✓	03-41	VR Positive / Negative Bias	0: No bias 1: Lower than or equal to bias 2: Greater than or equal to bias 3: The absolute value of the bias voltage while serving as the center 4: Bias serves as the center	0
✓	03-42	VR Gain	-500.0–500.0%	100.0
✓	03-43	VR Filter Time	0.00–2.00 sec.	0.01
✓	03-44	Multi-function Output (MO) by AI Level Source	0: AVI 1: ACI	0
✓	03-45	AI Upper Level	-100.00–100.00%	50.00
✓	03-46	AI Lower Level	-100.00–100.00%	10.00
✓	03-50	Analog Input Curve Selection	0: Normal curve 1: Three-point curve of AVI (& AI10) 2: Three-point curve of ACI (& AI11)	0

	Pr.	Parameter Name	Settings	Default
𝓝	03-57	ACI Lowest Point	Pr.03-28 = 1, 0.00–10.00 V Pr.03-28 =1, 0.00–20.00 mA	4.00
𝓝	03-58	ACI Proportional Lowest Point	0.00–100.00%	0.00
𝓝	03-59	ACI Mid-point	Pr.03-28 = 1, 0.00–10.00 V Pr.03-28 =1, 0.00–20.00 mA	12.00
𝓝	03-60	ACI Proportional Mid-point	0.00–100.00%	50.00
𝓝	03-61	ACI Highest Point	Pr.03-28 = 1, 0.00–10.00 V Pr.03-28 =1, 0.00–20.00 mA	20.00
𝓝	03-62	ACI Proportional Highest Point	0.00–100.00%	100.00
𝓝	03-63	AVI voltage lowest point	0.00–10.00 V	0.00
𝓝	03-64	AVI Proportional Lowest Point	-100.00–100.00%	0.00
𝓝	03-65	AVI Voltage Mid-Point	0.00–10.00 V	5.00
𝓝	03-66	AVI Proportional Mid-Point	-100.00–100.00%	50.00
𝓝	03-67	AVI Voltage Highest Point	0.00–10.00 V	10.00
𝓝	03-68	AVI Proportional Highest Point	-100.00–100.00%	100.00

04 Multi-Step Speed Parameters

	Pr.	Parameter Name	Settings	Default
✓	04-00	1st Step Speed Frequency	0.00–599.00 Hz	0.00
✓	04-01	2nd Step Speed Frequency	0.00–599.00 Hz	0.00
✓	04-02	3rd Step Speed Frequency	0.00–599.00 Hz	0.00
✓	04-03	4th Step Speed Frequency	0.00–599.00 Hz	0.00
✓	04-04	5th Step Speed Frequency	0.00–599.00 Hz	0.00
✓	04-05	6th Step Speed Frequency	0.00–599.00 Hz	0.00
✓	04-06	7th Step Speed Frequency	0.00–599.00 Hz	0.00
✓	04-07	8th Step Speed Frequency	0.00–599.00 Hz	0.00
✓	04-08	9th Step Speed Frequency	0.00–599.00 Hz	0.00
✓	04-09	10th Step Speed Frequency	0.00–599.00 Hz	0.00
✓	04-10	11th Step Speed Frequency	0.00–599.00 Hz	0.00
✓	04-11	12th Step Speed Frequency	0.00–599.00 Hz	0.00
✓	04-12	13th Step Speed Frequency	0.00–599.00 Hz	0.00
✓	04-13	14th Step Speed Frequency	0.00–599.00 Hz	0.00
✓	04-14	15th Step Speed Frequency	0.00–599.00 Hz	0.00
	04-68	Flaying Catch Retry Time	0–65535 sec.	0
	04-69	Magnetization Time	0–65535	0

05 Motor Parameters

	Pr.	Parameter Name	Settings	Default
	05-00	Motor Parameter Auto-tuning	0: Disabled 1: Dynamic test for induction motor (IM) 2: Static test for induction motor (IM) 5: Rolling auto-tuning for PM (IPM / SPM) 13: High frequency stall test for PM synchronous motor	0
	05-01	Full-Load Current for Induction Motor 1 (A)	10–120% of the drive's rated current	Depend on the model power
〃	05-02	Rated Power for Induction Motor 1 (kW)	0.00–655.35 kW	Depend on the model power
〃	05-03	Rated Speed for Induction Motor 1 (rpm)	0–xxxxx rpm (Depend on the motor's number of poles) 1710 (60 Hz 4 poles); 1410 (50 Hz 4 poles)	Depend on the motor's number of poles
	05-04	Number of Poles for Induction Motor 1	2–20	4
	05-05	No-load Current for Induction Motor 1 (A)	0.00–Pr.05-01 default	Depend on the model power
	05-06	Stator Resistance (Rs) for Induction Motor 1	0.000–65.535 Ω	Depend on the model power
	05-07	Rotor Resistance (Rr) for Induction Motor 1	0.000–65.535 Ω	0.000
	05-08	Magnetizing Inductance (Lm) for Induction Motor 1	0.0–6553.5 mH	0.0
	05-09	Stator Inductance (Lx) for Induction Motor 1	0.0–6553.5 mH	0.0
	05-13	Full-Load Current for Induction Motor 2 (A)	10–120% of the drive's rated current	Depend on the model power
〃	05-14	Rated Power for Induction Motor 2 (kW)	0.00–655.35 kW	Depend on the model power
〃	05-15	Rated Speed for Induction Motor 2 (rpm)	0–xxxxx rpm (Depend on the motor's number of poles) 1710 (60 Hz 4 poles); 1410 (50 Hz 4 poles)	Depend on the motor's number of poles
	05-16	Number of Poles for Induction Motor 2	2–20	4

Pr.	Parameter Name	Settings	Default
05-17	No-load Current for Induction Motor 2 (A)	0.00–Pr.05-13 default	Depend on the model power
05-18	Stator Resistance (Rs) for Induction Motor 2	0.000–65.535 Ω	Depend on the model power
05-19	Rotor Resistance (Rr) for Induction Motor 2	0.000–65.535 Ω	0.000
05-20	Magnetizing Inductance (Lm) for Induction Motor 2	0.0–6553.5 mH	0.0
05-21	Stator Inductance (Lx) for Induction Motor 2	0.0–6553.5 mH	0.0
05-22	Multi-Motor (Induction) Selection	1: Motor 1 2: Motor 2	1
05-23	Frequency for Y-Connection / Δ-Connection Switch for an Induction Motor	0.00–599.00 Hz	60.00
05-24	Y-Connection / Δ-Connection Switch for an Induction Motor	0: Disabled 1: Enabled	0
05-25	Delay Time for Y-Connection / Δ-Connection Switch for an Induction Motor	0.000–60.000 sec.	0.200
05-26	Accumulated Watt-Millisecond for a Running Motor (W-msec.)	Read only	0.0
05-27	Accumulated Watt-Second for a Running Motor (W-sec.)	Read only	0.0
05-28	Accumulated Watt-Hour for a Running Motor (Wh)	Read only	0.0
05-29	Accumulated Kilowatt-Hour for a Running Motor (kWh)	Read only	0.0
05-30	Accumulated Megawatt-Hour for a Running Motor (MWh)	Read only	0.0
05-31	Accumulated Motor Operation Time (minutes)	0–1439	0
05-32	Accumulated Motor Operation Time (days)	0–65535	0

Pr.	Parameter Name	Settings	Default
05-33	Induction Motor (IM) or Permanent Magnet Synchronous AC Motor Selection	0: IM (Induction motor) 1: SPM (Surface permanent magnet synchronous AC motor) 2: IPM (Interior permanent magnet synchronous AC motor)	0
05-34	Full-Load Current for a Permanent Magnet Synchronous AC Motor	0–120% of the drive's rated current	Depend on the model power
05-35	Rated Power for a Permanent Magnet Synchronous AC Motor	0.00–655.35 kW	Depend on the motor power
05-36	Rated Speed for a Permanent Magnet Synchronous AC Motor	0–65535 rpm	2000
05-37	Number of Poles for a Permanent Magnet Synchronous AC Motor	0–65535	10
05-39	Stator Resistance for a Permanent Magnet Synchronous AC Motor	0.000–65.535 Ω	0.000
05-40	Permanent Magnet Synchronous AC Motor Ld	0.00–655.35 mH	0.00
05-41	Permanent Magnet Synchronous AC Motor Lq	0.00–655.35 mH	0.00
05-43	Ke Parameter of a Permanent Magnet Synchronous AC Motor	0–65535 (Unit: V/krpm)	0

06 Protection Parameters (1)

	Pr.	Parameter Name	Settings	Default
〆	06-00	Low Voltage Level	115V / 230V models: 150.0–220.0 V_{DC} 460V models: 300.0–440.0 V_{DC}	180.0 360.0
〆	06-01	Over-Voltage Stall Prevention	0: Disabled 115V / 230V models: 0.0–390.0 V_{DC} 460V models: 0.0–780.0 V_{DC}	380.0 760.0
〆	06-02	Selection for Over-voltage Stall Prevention	0: Traditional over-voltage stall prevention 1: Smart over-voltage stall prevention	0
〆	06-03	Over-Current Stall Prevention during Acceleration	Normal duty: 0–150% (100% corresponds to the rated current of the drive) Heavy load: 0–200% (100% corresponds to the rated current of the drive)	120 180
〆	06-04	Over-Current Stall Prevention during Operation	Normal duty: 0–150% (100% corresponds to the rated current of the drive) Heavy load: 0–200% (100% corresponds to the rated current of the drive)	120 180
〆	06-05	Acceleration / Deceleration Time Selection for Stall Prevention at Constant Speed	0: By current acceleration / deceleration time 1: By the first acceleration / deceleration time 2: By the second acceleration / deceleration time 3: By the third acceleration / deceleration time 4: By the fourth acceleration / deceleration time 5: By auto-acceleration / auto-deceleration	0
〆	06-06	Over-Torque Detection Selection (Motor 1)	0: Disabled 1: Continue operation after over-torque detection during constant speed operation 2: Stop after over-torque detection during constant speed operation 3: Continue operation after over-torque detection during RUN 4: Stop after over-torque detection during RUN	0
〆	06-07	Over-torque detection level (motor 1)	10–250% (100% corresponds to the rated current of the drive)	120
〆	06-08	Over-torque Detection Time (Motor 1)	0.1–60.0 sec.	0.1
〆	06-09	Over-Torque Detection Selection (Motor 2)	0: Disabled 1: Continue operation after over-torque detection during constant speed operation 2: Stop after over-torque detection during constant speed operation	0

Pr.	Parameter Name	Settings	Default
		3: Continue operation after over-torque detection during RUN 4: Stop after over-torque detection during RUN	
06-10	Over-torque detection level (motor 2)	10–250% (100% corresponds to the rated current of the drive)	120
06-11	Over-torque Detection Time (Motor 2)	0.1–60.0 sec.	0.1
06-13	Electronic Thermal Relay Selection 1 (Motor 1)	0: Inverter motor (with external forced cooling) 1: Standard motor (motor with fan on the shaft) 2: Disabled	2
06-14	Electronic Thermal Relay Action Time 1 (Motor 1)	30.0–600.0 sec.	60.0
06-15	Temperature Level Overheat (OH) Warning	0.0–110.0°C	Depend on the model power
06-16	Stall Prevention Limit Level	0–100% (Refer to Pr.06-03–Pr.06-04)	100
06-17	Fault Record 1	0: No fault record	0
06-18	Fault Record 2	Over-current during acceleration (ocA)	0
06-19	Fault Record 3	2: Over-current during deceleration (ocd)	0
06-20	Fault Record 4	3: Over-current during steady operation (ocn)	0
06-21	Fault Record 5	Ground fault (GFF)	0
06-22	Fault Record 6	6: Over-current at stop (ocS)	0
	Fault Record 7 (Pr.14-70)	7: Over-voltage during acceleration (ovA) 8: Over-voltage during deceleration (ovd)	
	Fault Record 8 (Pr.14-71)	9: Over-voltage during constant speed (ovn) 10: Over-voltage at stop (ovS)	
	Fault Record 9 (Pr.14-72)	11: Low-voltage during acceleration (LvA) 12: Low-voltage during deceleration (Lvd)	
	Fault Record 10 (Pr.14-73)	13: Low-voltage at constant speed (Lvn) 14: Low-voltage at stop (LvS)	
		15: Phase loss protection (orP) 16: IGBT overheating (oH1) 18: IGBT temperature detection failure (tH1o) 21: Over load (oL) 22: Electronics thermal relay 1 protection (EoL1) 23: Electronics thermal relay 2 protection (EoL2) 24: Motor overheating PTC / PT100 (oH3) 26: Over torque 1 (ot1) 27: Over torque 2 (ot2) 28: Under current (uC)	

Pr.	Parameter Name	Settings	Default
		31: EEPROM read error (cF2) 33: U-phase error (cd1) 34: V-phase error (cd2) 35: W-phase error (cd3) 36: cc hardware error (Hd0) 37: oc hardware error (Hd1) 40: Auto-tuning error (AUE) 41: PID loss ACI (AFE) 48: ACI loss (ACE) 49: External fault (EF) 50: Emergency stop (EF1) 51: External base block (bb) 52: Enter wrong password three times and locked (Pcod) 54: Illegal command (CE1) 55: Illegal data address (CE2) 56: Illegal data value (CE3) 57: Data is written to read-only address (CE4) 58: Modbus transmission time-out (CE10) 61: Y-connection / Δ-connection switch error (ydc) 62: Deceleration energy backup error (dEb) 63: Over slip error (oSL) 72: STO Loss 1 (STL1) (for STO models only) 76: STO (STO) (for STO models only) 77: STO Loss 2 (STL2) (for STO models only) 78: STO Loss 3 (STL3) (for STO models only) 79: U-phase over-current before run (Aoc) 80: V-phase over-current before run (boc) 81: W-phase over-current before run (coc) 82: Output phase loss U phase (oPL1) 83: Output phase loss V phase (oPL2) 84: Output phase loss W phase (oPL3) 87: Low frequency overload protection (oL3) 89: Rotor position detection error (roPd) 140: oc hardware error (Hd6) 141: GFF occurs before run (b4GFF) 142: Auto-tuning error 1 (AuE1) 143: Auto-tuning error 1 (AuE2) 144: Auto-tuning error 1 (AuE3) 149: Total resistance measurement fault (AUE5)	

	Pr.	Parameter Name	Settings	Default
			150: No-load current I_0 measurement fault (AUE6) 151: dq axis inductance measurement fault (AUE7) 152: High frequency injection measurement fault (AUE8) 157: Pump PID feedback error (dEv)	
✓	06-23	Fault Output Option 1	0–65535 (refer to bit table for fault code)	0
✓	06-24	Fault Output Option 2	0–65535 (refer to bit table for fault code)	0
✓	06-25	Fault Output Option 3	0–65535 (refer to bit table for fault code)	0
✓	06-26	Fault Output Option 4	0–65535 (refer to bit table for fault code)	0
✓	06-27	Electronic Thermal Relay Selection 2 (Motor 2)	0: Inverter motor (with external forced cooling) 1: Standard motor (motor with fan on the shaft) 2: Disabled	2
✓	06-28	Electronic Thermal Relay Action Time 2 (Motor 2)	30.0–600.0 sec.	60.0
✓	06-29	PTC Detection Selection	0: Warn and continue operation 1: Fault and ramp to stop 2: Fault and coast to stop 3: No warning	0
✓	06-30	PTC Level	0.0–100.0%	50.0
	06-31	Frequency Command at Malfunction	0.00–599.00 Hz	Read only
	06-32	Output Frequency at Malfunction	0.00–599.00 Hz	Read only
	06-33	Output Voltage at Malfunction	0.0–6553.5 V	Read only
	06-34	DC bus Voltage at Malfunction	0.0–6553.5 V	Read only
	06-35	Output Current at Malfunction	0.00–655.35 Amps	Read only
	06-36	IGBT Temperature at Malfunction	-3276.7–3276.7 °C	Read only
	06-38	Motor Speed at Malfunction	-32767–32767 rpm	Read only
	06-39	Torque Command at Malfunction	-32767–32767%	Read only
	06-40	Status of the Multi-function Input Terminal at Malfunction	0000h–FFFFh	Read only
	06-41	Status of the Multi-function Output Terminal at Malfunction	0000h–FFFFh	Read only

	Pr.	Parameter Name	Settings	Default
	06-42	Drive Status at Malfunction	0000h–FFFFh	Read only
✓	06-44	STO Latch Function (for STO models only)	bit0: STO Latch auto reset (0: OFF / 1: ON) bit1: STO Latch indication shielding (0: OFF / 1: ON)	0
✓	06-45	Output Phase Loss Detection Action (OPHL)	0: Warn and continue operation 1: Fault and ramp to stop 2: Fault and coast to stop 3: No warning	3
✓	06-46	Detection Time for Output Phase Loss	0.000–65.535 sec.	0.500
✓	06-47	Current Detection Level for Output Phase Loss	0.00–100.00%	1.00
✓	06-48	DC Brake Time for Output Phase Loss	0.000–65.535 sec.	0.000
✓	06-49	LvX Set Function	bit0: LvX auto reset (0: OFF / 1: ON) bit1: LvX indication shielding (0: OFF / 1: ON)	0
✓	06-53	Input Phase Loss Detection Action (OrP)	0: Fault and ramp to stop 1: Fault and coast to stop	0
✓	06-55	Derating Protection	0: Constant rated current and limit carrier frequency by load current and temperature 1: Constant carrier frequency and limit load current by setting carrier frequency 2: Constant rated current (same as setting 0), but close current limit	0
✓	06-56	PT100 Voltage Level 1	0.000–10.000 V	5.000
✓	06-57	PT100 Voltage Level 2	0.000–10.000 V	7.000
✓	06-58	PT100 Level 1 Frequency Protection	0.00–599.00 Hz	0.00
✓	06-59	PT100 Activation Level 1 Protection Frequency Delay Time	0–6000 sec.	60
✓	06-60	Software Detection GFF Current Level	0.0–6553.5%	60.0
✓	06-61	Software Detection GFF Filter Time	0.00–655.35 sec.	0.10
	06-63	Operation Time of Fault Record 1 (Days)	0–65535 days	Read only
	06-64	Operation Time of Fault Record 1 (Minutes)	0–1439 min.	Read only
	06-65	Operation Time of Fault	0–65535 days	Read only

	Pr.	Parameter Name	Settings	Default
		Record 2 (Days)		
	06-66	Operation Time of Fault Record 2 (Minutes)	0–1439 min.	Read only
	06-67	Operation Time of Fault Record 3 (Days)	0–65535 days	Read only
	06-68	Operation Time of Fault Record 3 (Minutes)	0–1439 min.	Read only
	06-69	Operation Time of Fault Record 4 (Days)	0–65535 days	Read only
	06-70	Operation Time of Fault Record 4 (Minutes)	0–1439 min.	Read only
〆	06-71	Low Current Setting Level	0.0–100.0%	0.0
〆	06-72	Low Current Detection Time	0.00–360.00 sec.	0.00
〆	06-73	Low Current Action	0: No Function 1: Fault and coast to stop 2: Fault and ramp to stop by the 2nd deceleration time 3: Warn and continue operation	0
	06-80	Fire Mode	0: Disabled 1: Forward (counterclockwise) operation 2: Reverse (clockwise) operation	0
〆	06-81	Operating Frequency in Fire Mode	0.00–599.00 Hz	60.00
	06-88	Operation Times in Fire Mode	0–65535 times	Read only
	06-90	Operation Time of Fault Record 5 (Days)	0–65535 days	Read only
	06-91	Operation Time of Fault Record 5 (Minutes)	0–1439 min.	Read only
	06-92	Operation Time of Fault Record 6 (Days)	0–65535 days	Read only
	06-93	Operation Time of Fault Record 6 (Minutes)	0–1439 min.	Read only

07 Special Parameters

Pr.	Parameter Name	Settings	Default
07-00	Software Brake Chopper Action Level	115V / 230V models: 350.0–450.0 V_{DC} 460V models: 700.0–900.0 V_{DC}	370.0 740.0
07-01	DC Brake Current Level	0–100%	0
07-02	DC Brake Time at Start-up	0.0–60.0 sec.	0.0
07-03	DC Brake Time at STOP	0.0–60.0 sec.	0.0
07-04	DC Brake Frequency at STOP	0.00–599.00 Hz	0.00
07-05	Voltage Increasing Gain	0–1000%	100
07-06	Restart after Momentary Power Loss	0: Stop operation 1: Speed tracking by the speed before the power loss 2: Speed tracking by the minimum output frequency	0
07-07	Allowed Power Loss Duration	0.0–20.0 sec.	2.0
07-08	Base Block Time	0.0–60.0 sec.	0.5
07-09	Current Limit of Speed Tracking	20–200%	100
07-10	Restart after Fault Action	0: Stop operation 1: Speed tracking by current speed 2: Speed tracking by the minimum output frequency	0
07-11	Number of Times of Restart after Fault	0–10	0
07-12	Speed Tracking during Start-up	0: Disabled 1: Speed tracking by the maximum output frequency 2: Speed tracking by the motor frequency at start-up 3: Speed tracking by the minimum output frequency	0
07-13	dEb Function Selection	0: Disabled 1: dEb with auto-acceleration / auto-deceleration, the drive does not output the frequency after the power is restored. 2: dEb with auto-acceleration / auto-deceleration, the drive outputs the frequency after the power is restored.	0
07-15	Dwell Time at Acceleration	0.00–600.00 sec.	0.00

	Pr.	Parameter Name	Settings	Default
𝓝	07-16	Dwell Frequency at Acceleration	0.00–599.00 Hz	0.00
𝓝	07-17	Dwell Time at Deceleration	0.00–600.00 sec.	0.00
𝓝	07-18	Dwell Frequency at Deceleration	0.00–599.00 Hz	0.00
𝓝	07-19	Fan Cooling Control	0: Fan is always ON 1: Fan is OFF after the AC motor drive stops for one minute. 2: Fan is ON when the AC motor drive runs, fan is OFF when the AC motor drive stops. 3: Fan turns ON when the temperature (IGBT) reaches around 60 ºC . 5: Fan turns ON / OFF when the AC motor drive runs / stops and stays in Stand By mode at zero speed	3
𝓝	07-20	Emergency Stop (EF) & Force to Stop Selection	0: Coast to stop 1: Stop by the first deceleration time 2: Stop by the second deceleration time 3: Stop by the third deceleration time 4: Stop by the fourth deceleration time 5: System deceleration 6: Automatic deceleration	0
𝓝	07-21	Automatic Energy-saving Setting	0: Disabled 1: Enabled	0
𝓝	07-23	Automatic Voltage Regulation (AVR) Function	0: Enable AVR 1: Disable AVR 2: Disable AVR during deceleration	0
𝓝	07-24	Torque Command Filter Time	0.001–10.000 sec.	0.050
𝓝	07-25	Slip Compensation Filter Time	0.001–10.000 sec.	0.100
𝓝	07-26	Torque Compensation Gain	IM: 0–10 (when Pr.05-33 = 0) PM: 0–5000 (when Pr.05-33 = 1 or 2)	1
𝓝	07-27	Slip Compensation Gain	0.00–10.00	0.00 (Default value is 1.00 in SVC mode)
𝓝	07-29	Slip Deviation Level	0.0–100.0% 0: No detection	0
𝓝	07-30	Over-slip Deviation Detection Time	0.0–10.0 sec.	1.0

	Pr.	Parameter Name	Settings	Default
↯	07-31	Over-slip Deviation Treatment	0: Warn and continue operation 1: Fault and ramp to stop 2: Fault and coast to stop 3: No warning	0
↯	07-32	Motor Oscillation Compensation Factor	0–10000	1000
↯	07-33	Auto-Restart Interval of Fault	0.0–6000.0 sec.	60.0
	07-38	PMSVC Voltage Feed Forward Gain	0.50–2.00	1.00
↯	07-62	dEb Gain (Kp)	0–65535	8000
↯	07-63	dEb Gain (Ki)	0–65535	150
↯	07-71	Torque Compensation Gain (Motor 2)	IM: 0–10 (when Pr.05-33 = 0) PM: 0–5000 (when Pr.05-33 = 1 or 2)	1
↯	07-72	Slip Compensation Gain (Motor 2)	0.00–10.00	0.00 (Default value is 1.00 in SVC mode)

08 High-function PID Parameters

	Pr.	Parameter Name	Settings	Default
✔	08-00	Terminal Selection of PID Feedback	0: Disabled 1: Negative PID feedback: by analog input (Pr.03-00) 4: Positive PID feedback: by analog input (Pr.03-00) 7: Negative PID feedback: by communication protocols 8: Positive PID feedback: by communication protocols	0
✔	08-01	Proportional gain (P)	0.0–100.0 (when Pr.08-23 bit1 = 0) 0.00–100.0 (when Pr.08-23 bit1 = 1)	1.00
✔	08-02	Integral Time (I)	0.00–100.00 sec.	1.00
✔	08-03	Differential Time (D)	0.00–1.00 sec.	0.00
✔	08-04	Upper Limit of Integral Control	0.0–100.0%	100.0
✔	08-05	PID Output Command Limit (Positive Limit)	0.0–100.0%	100.0
✔	08-06	PID Feedback Value by Communication Protocol	-200.00–200.00%	0.00
✔	08-07	PID Delay Time	0.0–2.5 sec.	0.0
✔	08-08	Feedback Signal Detection Time	0.0–3600.0 sec.	0.0
✔	08-09	Feedback Signal Fault Treatment	0: Warn and continue operation 1: Fault and ramp to stop 2: Fault and coast to stop 3: Warn and operate at last frequency	0
✔	08-10	Sleep Level	0.00–599.00 Hz / 0.00–200.00%	0.00
✔	08-11	Wake-Up Level	0.00–599.00 Hz / 0.00–200.00%	0.00
✔	08-12	Sleep Delay Time	0.0–6000.0 sec.	0.0
✔	08-13	PID Feedback Signal Error Deviation Level	1.0–50.0%	10.0
✔	08-14	PID Feedback Signal Error Deviation Detection Time	0.1–300.0 sec.	5.0
✔	08-15	PID Feedback Signal Filter Time	0.1–300.0 sec.	5.0
✔	08-16	PID Compensation Selection	0: Parameter setting 1: Analog input	0
✔	08-17	PID Compensation	-100.0–100.0%	0

Pr.	Parameter Name	Settings	Default
08-18	Sleep Mode Function Setting	0: Refer to PID output command 1: Refer to PID feedback signal	0
08-19	Wake-Up Integral Limit	0.0–200.0%	50.0
08-20	PID Mode Selection	0: Serial connection 1: Parallel connection	0
08-21	Enable PID to Change the Operation Direction	0: Operation direction cannot be changed 1: Operation direction can be changed	0
08-22	Wake-up Delay Time	0.00–600.00 sec.	0.00
08-23	PID Control Flag	● bit 0 = 1: PID running in reverse follows the setting for Pr.00-23. ● bit 0 = 0, PID running in reverse refers to PID's calculated value. ● bit 1 = 1, two decimal places for PID Kp ● bit 1 = 0, one decimal place for PID Kp	2
08-26	PID Output Command Limit (Reverse Limit)	0.0–100.0%	100.0
08-27	Acceleration / Deceleration Time for PID Command	0.00–655.35 sec.	0.00
08-31	Proportional Gain 2	0.00–100.00	1.00
08-32	Integral Time 2	0.00–100.00 sec.	1.00
08-33	Differential Time 2	0.00–1.00 sec.	0.00
08-61	Feedback of PID Physical Quantity Value	1.0–99.9	99.9
08-62	Treatment of the Erroneous PID Feedback Level	0: Warn and continue operation (no treatment) 1: Fault and coast to stop 2: Fault and ramp to stop 3: Ramp to stop and restart after time set at Pr.08-63 (Without displaying fault and warning) 4: Ramp to stop and restart after time set at Pr.08-63. The number of times of restart depends on the setting for Pr.08-64.	0
08-63	Delay Time for Restart of Erroneous PID Deviation Level	1–9999 sec.	60
08-64	Number of Times of Restart after PID Error	0–1000 times	0
08-65	PID Target Value Source	0: Frequency command (Pr.00-20, Pr.00-30) 1: Pr.08-66 setting 2 (RS-485 communication input) 3: External analog input (Refer to Pr.03-00)	0

Pr.	Parameter Name	Settings	Default
		4: CANopen communication card 6: Communication card (CANopen card not included) 7: Frequency knob on digital keypad	
08-66	PID Target Value Setting	-100.00–100.00%	50.00
08-67	Master and Auxiliary Reverse Running Cutoff Frequency	0.0–100.0%	10.0
08-68	PID Deviation Limit	0.00–100.00%	0.00
08-69	Integral Separation Level	0.00–100.00%	0.00
08-70	Smart Start-up Level	0.00–100.00%	5.00
08-71	Smart Start-up Frequency Command	0.00–599.00 Hz	0.00
08-72	Smart Start-up Acceleration Time	0.00–600.00 sec.	3.00
08-75	PID2 Parameter Switch Condition	0: No switching 1: Auto-switch based on the output frequency 2: Auto-switch based on the deviation	0
08-76	PID2 Parameter Switch Deviation 1	0.00–Pr.08-77 %	10.00
08-77	PID2 Parameter Switch Deviation 2	Pr.08-76–100.00%	40.00
08-78	Allowed Reverse Running Time after Start-Up	0.0–6553.5 sec.	0.0

09 Communication Parameters

	Pr.	Parameter Name	Settings	Default
✓	09-00	Modbus Communication Address	1–254	1
✓	09-01	Modbus Transmission Speed	4.8–38.4 Kbps	9.6
✓	09-02	Modbus Transmission Fault Treatment	0: Warn and continue operation 1: Fault and ramp to stop 2: Fault and coast to stop 3: No warning, no fault, and continue operation	3
✓	09-03	Modbus Time-out Detection	0.0–100.0 sec.	0.0
✓	09-04	Modbus Communication Protocol	1: 7, N, 2 (ASCII) 2: 7, E, 1 (ASCII) 3: 7, O, 1 (ASCII) 4: 7, E, 2 (ASCII) 5: 7, O, 2 (ASCII) 6: 8, N, 1 (ASCII) 7: 8, N, 2 (ASCII) 8: 8, E, 1 (ASCII) 9: 8, O, 1 (ASCII) 10: 8, E, 2 (ASCII) 11: 8, O, 2 (ASCII) 12: 8, N, 1 (RTU) 13: 8, N, 2 (RTU) 14: 8, E, 1 (RTU) 15: 8, O, 1 (RTU) 16: 8, E, 2 (RTU) 17: 8, O 2 (RTU)	1
✓	09-09	Communication Response Delay Time	0.0–200.0 ms	2.0
	09-10	Communication Main Frequency	0.00–599.00 Hz	60.00
✓	09-11	Block Transfer 1	0–65535	0
✓	09-12	Block Transfer 2	0–65535	0
✓	09-13	Block Transfer 3	0–65535	0
✓	09-14	Block Transfer 4	0–65535	0
✓	09-15	Block Transfer 5	0–65535	0
✓	09-16	Block Transfer 6	0–65535	0
✓	09-17	Block Transfer 7	0–65535	0
✓	09-18	Block Transfer 8	0–65535	0
✓	09-19	Block Transfer 9	0–65535	0
✓	09-20	Block Transfer 10	0–65535	0

Pr.	Parameter Name	Settings	Default
09-21	Block Transfer 11	0–65535	0
09-22	Block Transfer 12	0–65535	0
09-23	Block Transfer 13	0–65535	0
09-24	Block Transfer 14	0–65535	0
09-25	Block Transfer 15	0–65535	0
09-26	Block Transfer 16	0–65535	0
09-30	Communication Decoding Method	0: Decoding method 1 1: Decoding method 2	1
09-31	COM1 internal communication protocol	0: Modbus 485 -21: Pump Master -22: Pump Slave 1 -23: Pump Slave 2 -24: Pump Slave 3	0

10 Speed Feedback Control Parameters

	Pr.	Parameter Name	Settings	Default
✓	10-16	Pulse Input Type Setting	0: Disabled 5: Unidirectional pulse input 6: PWM signal input	0
✓	10-29	Upper Limit of Frequency Deviation	0.00–200.00 Hz	20.00
✓	10-31	I/F Mode, Current Command	0–150% rated current of the motor	40
✓	10-32	PM FOC Sensorless Speed Estimator Bandwidth	0.00–600.00 Hz	5.00
✓	10-34	PM Sensorless Speed Estimator Low-pass Filter Gain	0.00–655.35	1.00
✓	10-42	Initial Angle Detection Pulse Value	0.0–3.0	1.0
✓	10-49	Zero Voltage Time during Start-up	00.000–60.000 sec.	00.000
✓	10-51	Injection Frequency	0–1200 Hz	500
✓	10-52	Injection Magnitude	115V / 230V models: 100.0 V 460V models: 200.0 V **Note:** The setting range varies depending on the voltage.	15.0 30.0
✓	10-53	Angle Detection Method	0: Disabled 1: Force attracting the rotor to zero degrees 2: High frequency injection 3: Pulse injection	0

11 Advanced Parameters

Pr.	Parameter Name	Settings	Default
11-00	System Control	bit 3: Dead time compensation closed bit 7: Save or do not save the frequency	0
11-41	PWM Mode Selection	0: Two-phase modulation mode 2: Space vector modulation mode	2
11-42	System Control Flag	0000–FFFFh	0000

12 Function Parameters

	Pr.	Parameter Name	Settings	Default
✓	12-00	Set point deviation level	0–100%	0
✓	12-01	Detection Time of Set Point Deviation Level	1–9999 sec.	10
✓	12-02	Offset Level of Water Leakage	0–50%	0
✓	12-03	Water Leakage Change Detection	0: Disabled 0–100%	0
✓	12-04	Time Setting for Water Leakage Change	0: Disabled 0.1–10.0 sec.	0.5
	12-05	Multi-Pump Control Mode	0: Disabled 1: Fixed time circulation (alternative operation) 2: Fixed quantity control (multi-pump operating at constant pressure)	0
✓	12-07	Multi-Pump's Fixed Time Circulation Period	1–65535 minutes	60
✓	12-08	Frequency to Start Switching Pumps	0.00 Hz–FMAX (Pr.01-00)	60.00
✓	12-09	Time Detected When Pump Reaches the Starting Frequency	0.0–3600.0 sec.	1.0
✓	12-10	Frequency to Stop Switching Pumps	0.00 Hz–FMAX (Pr.01-00)	48.00
✓	12-11	Time Detected When Pump Reaches the Stopping Frequency	0.0–3600.0 sec.	1.0
✓	12-12	Pump's frequency at time-out (disconnection)	0.00 Hz–FMAX (Pr.01-00)	0.00
	12-13	Pump's Error Treatment	bit 0: During the operation, whether to switch to an alternative pump when operating pump error occurs 0: Stop all pumps' action 1: Switch to an alternative pump bit 1: During the operation, stop or standby after resetting from error 0: Standby after resetting 1: Stop after resetting bit 2: Before the operation, whether the system runs or stops if the pump has an error 0: The system can not operate	1

	Pr.	Parameter Name	Settings	Default
			1: The system selects another pump to operate	
	12-14	Selection of pump start-up sequence	0: According to the serial numbers of the pumps 1: According to the operating time	1
✓	12-15	Running Time of Multi-Pump under Alternative Operation	0.0–360.0 sec.	60.0
✓	12-20	Simple Positioning Stop Frequency 0	0.00–599.00 Hz	0.00
✓	12-21	Simple Positioning Stop Frequency 1	0.00–599.00 Hz	5.00
✓	12-22	Simple Positioning Stop Frequency 2	0.00–599.00 Hz	10.00
✓	12-23	Simple Positioning Stop Frequency 3	0.00–599.00 Hz	20.00
✓	12-24	Simple Positioning Stop Frequency 4	0.00–599.00 Hz	30.00
✓	12-25	Simple Positioning Stop Frequency 5	0.00–599.00 Hz	40.00
✓	12-26	Simple Positioning Stop Frequency 6	0.00–599.00 Hz	50.00
✓	12-27	Simple Positioning Stop Frequency 7	0.00–599.00 Hz	60.00
✓	12-28	Delay Time of Simple Positioning Stop 0	0.00–600.00 sec.	0.00
✓	12-29	Delay Time of Simple Positioning Stop 1	0.00–600.00 sec.	0.00
✓	12-30	Delay Time of Simple Positioning Stop 2	0.00–600.00 sec.	0.00
✓	12-31	Delay Time of Simple Positioning Stop 3	0.00–600.00 sec.	0.00
✓	12-32	Delay Time of Simple Positioning Stop 4	0.00–600.00 sec.	0.00
✓	12-33	Delay Time of Simple Positioning Stop 5	0.00–600.00 sec.	0.00
✓	12-34	Delay Time of Simple Positioning Stop 6	0.00–600.00 sec.	0.00
✓	12-35	Delay Time of Simple Positioning Stop 7	0.00–600.00 sec.	0.00
	12-40	Automatic Operation Mode	0: Disabled 1: Automatically operate one cycle and stop	0

Pr.	Parameter Name	Settings	Default
		2: Automatically operate cycles 3: Automatically operate one cycle and stop (with STOP interval) 4: Automatically operate cycles (with STOP intervals) 5: Disable automatic operation, but the direction setting at multi-step speed 1 to 7 are effective	
12-41	PLC Program Running Direction Mode	bit 0–bit 7 (0: FWD RUN, 1: REV RUN) bit 0: Direction of auto-operation's main speed bit 1: Direction of the first speed for Pr.04-00 bit 2: Direction of the second speed for Pr.04-01 bit 3: Direction of the second speed for Pr.04-02 bit 4: Direction of the second speed for Pr.04-03 bit 5: Direction of the second speed for Pr.04-04 bit 6: Direction of the second speed for Pr.04-05 bit 7: Direction of the second speed for Pr.04-06	0
12-42	Master Speed Operating Time Setting	0–65500 sec.	0
12-43	1st Speed Operating Time Setting	0–65500 sec.	0
12-44	2nd Speed Operating Time Setting	0–65500 sec.	0
12-45	3rd Speed Operating Time Setting	0–65500 sec.	0
12-46	4th Speed Operating Time Setting	0–65500 sec.	0
12-47	5th Speed Operating Time Setting	0–65500 sec.	0
12-48	6th Speed Operating Time Setting	0–65500 sec.	0
12-49	7th Speed Operating Time Setting	0–65500 sec.	0
12-51	Average PWM Signal	1–100 times	1
12-52	PWM Signal Period	1–2000 ms	1

13 Industry Application Parameters

Pr.	Parameter Name	Settings	Default
13-00	Industry-specific Parameter Application	00: Disabled 01: User-defined 03: Fan 04: Pump 05: Conveyor 07: Packing 10: Logistics 11: Tension PID 12: Tension PID + master / auxiliary frequency	00
13-01 – 13-50	Application parameter (user-defined)		

14 Protection Parameters (2)

Pr.	Parameter Name	Settings	Default
14-50	Output Frequency at Malfunction 2	0.00–599.00 Hz	Read only
14-51	DC bus Voltage at Malfunction 2	0.0–6553.5 V	Read only
14-52	Output Current at Malfunction 2	0.00–655.35 Amps	Read only
14-53	IGBT Temperature at Malfunction 2	-3276.7–3276.7ºC	Read only
14-54	Output Frequency at Malfunction 3	0.00–599.00 Hz	Read only
14-55	DC bus Voltage at Malfunction 3	0.0–6553.5 V	Read only
14-56	Output Current at Malfunction 3	0.00–655.35 Amps	Read only
14-57	IGBT Temperature at Malfunction 3	-3276.7–3276.7ºC	Read only
14-58	Output Frequency at Malfunction 4	0.00–599.00 Hz	Read only
14-59	DC bus Voltage at Malfunction 4	0.0–6553.5 V	Read only
14-60	Output Current at Malfunction 4	0.00–655.35 Amps	Read only
14-61	IGBT Temperature at Malfunction 4	-3276.7–3276.7ºC	Read only
14-62	Output Frequency at Malfunction 5	0.00–599.00 Hz	Read only
14-63	DC bus Voltage at Malfunction 5	0.0–6553.5 V	Read only
14-64	Output Current at Malfunction 5	0.00–655.35 Amps	Read only
14-65	IGBT Temperature at Malfunction 5	-3276.7–3276.7ºC	Read only
14-66	Output Frequency at Malfunction 6	0.00–599.00 Hz	Read only
14-67	DC bus Voltage at Malfunction 6	0.0–6553.5 V	Read only
14-68	Output Current at Malfunction 6	0.00–655.35 Amps	Read only

Pr.	Parameter Name	Settings	Default
14-69	IGBT Temperature at Malfunction 6	-3276.7–3276.7ºC	Read only
14-70	Fault Record 7	Refer to fault record Pr.06-17–06-22	0
14-71	Fault Record 8	Refer to fault record Pr.06-17–06-22	0
14-72	Fault Record 9	Refer to fault record Pr.06-17–06-22	0
14-73	Fault Record 10	Refer to fault record Pr.06-17–06-22	0

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Chapter 12 Descriptions of Parameter Settings

12-1 Descriptions of Parameter Settings

00 Drive Parameters

✓ You can set this parameter during operation.

00-00	AC Motor Drive Identity Code

Default: Read only

Settings Read only

00-01	AC Motor Drive Rated Current Display

Default: Read only

Settings Read only

- Pr.00-00 displays the AC motor drive identity code. Use the following specification table to check if Pr.00-01 setting is the rated current of the AC motor drive. Pr.00-01 corresponds to the identity code of Pr.00-00.
- The default is the rated current for heavy duty. Set Pr.00-16 = 0 to display the rated current for normal duty.

Models	115V Models - Single-phase				230V Models - Single-phase					
Frame	A		B	C	A/B			B	C	
Power (kW)	0.1	0.2	0.4	0.75	0.1	0.2	0.4	0.75	1.5	2.2
Power (HP)	0.125	0.25	0.5	1	0.125	0.25	0.5	1	2	3
Identity Code	101	102	103	104	301	302	303	304	305	306
Rated Current for Heavy Duty	0.8	1.6	2.5	4.8	0.8	1.6	2.8	4.8	7.5	11
Rated Current for Normal Duty	1	1.8	2.7	5.5	1	1.8	3.2	5	8.5	12.5

230V models - Three-phase											
Frame	A				B	C		D	E		F
Power (kW)	0.1	0.2	0.4	0.75	1.5	2.2	3.7/4	5.5	7.5	11	15
Power (HP)	0.125	0.25	0.5	1	2	3	5	7.5	10	15	20
Identity Code	201	202	203	204	205	206	207	208	209	210	211
Rated Current for Heavy Duty	0.8	1.6	2.8	4.8	7.5	11	17	25	33	49	65
Rated Current for Normal Duty	1	1.8	3.2	5	8	12.5	19.5	27	36	51	69

460V models - Three-phase												
Frame	A / B		B	C			D		E		F	
Power (kW)	0.4	0.75	1.5	2.2	3	3.7/4	5.5	7.5	11	15	18.5	22
Power (HP)	0.5	1	2	3	4	5	7.5	10	15	20	25	30
Identity Code	403	404	405	406	482	407	408	409	410	411	412	413
Rated Current for Heavy Duty	1.5	2.7	4.2	5.5	7.3	9	13	17	25	32	38	45
Rated Current for Normal Duty	1.8	3	4.6	6.5	8	10.5	15.7	20.5	28	36	41.5	49

00-02 Parameter Reset

Default: 0

Settings 0: No Function
1: Write protection for parameters
5: Return kWh displays to 0
8: Keypad does not respond
9: Reset all parameters to defaults (base frequency is 50 Hz)
10: Reset all parameters to defaults (base frequency is 60 Hz)
11: Reset all parameters to defaults with base frequency at 50 Hz (save the user-defined parameter values of Pr.13-01–Pr.13-50)
12: Reset all parameters to defaults with base frequency at 60 Hz (save the user-defined parameter values of Pr.13-01–Pr.13-50)

- 1: All parameters are read only except Pr.00-02, Pr.00-07, and Pr.00-08. Set Pr.00-02 to 0 before changing other parameter settings.
- 5: You can return the kWh displayed value to 0 even during drive operation.For example, you can set Pr.05-26–Pr.05-30 to 0.
- 8: RUN key on the keypad is invalid; the rest of the keys work normally. Set Pr.02-00 to 0 to unlock the setting.
- 9 or 10: Reset all parameters to defaults. If you have set a password (Pr.00-08), unlock the password (Pr.00-07) to clear the password you have set before you reset all parameters.
- For settings of 9, 10, 11 and 12, you must reboot the motor drive after you finish the setting.

✓ 00-03 Start-up Display

Default: 0

Settings 0: F (frequency command)
1: H (output frequency)
2: U (user-defined) see Pr.00-04
3: A (output current)

- Determines the start-up display page after power is applied to the drive. The user-defined contents display according to the Pr.00-04 settings.

✓ 00-04 Content of Multi-Function Display (User-Defined)

Default: 3

Settings 0: Display output current from the drive to the motor (A) (Unit: Amps)
1: Display counter value (c) (Unit: CNT)
2: Display the drive's actual output frequency (H.) (Unit: Hz)
3: Display the drive's DC bus voltage (v) (Unit: V_{DC})
4: Display the drive's output voltage (E) (Unit: V_{AC})
5: Display the drive's output power angle (n) (Unit: deg)
6: Display the drive's output power (P) (Unit: kW)
7: Display the motor speed (r) (Unit: rpm)
10: Display PID feedback (b) (Unit: %)

11: Display AVI analog input terminal signal (1.) (Unit: %)
12: Display ACI analog input terminal signal (2.) (Unit: %)
14: Display the drive's IGBT temperature (i.) (Unit: ºC)
16: The digital input status (ON / OFF) (i)
17: The digital output status (ON / OFF) (o)
18: Display multi-step speed (S)
19: The corresponding CPU digital input pin status (d)
20: The corresponding CPU digital output pin status (0.)
25: Overload count (0.00–100.00%) (o.) (Unit: %)
26: Ground Fault GFF (G.) (Unit: %)
27: DC bus voltage ripple (r.) (Unit: V_{DC})
30: Display the output of User-defined (U)
31: Display Pr.00-05 user gain (K)
35: Control mode display:
 0 = Speed control mode (SPD)
36: Present operating carrier frequency of the drive (J.) (Unit: Hz)
38: Display the drive status (6.) (See Explanation 5)
41: kWh display (J) (Unit: kWh)
42: PID target value (h.) (Unit: %)
43: PID compensation (o.) (Unit: %)
44: PID output frequency (b.) (Unit: Hz)
46: Auxiliary frequency value (U.) (Unit: Hz)
47: Master frequency value (A.) (Unit: Hz)
48: Frequency value after addition and subtraction of master and auxiliary frequency (L.) (Unit: Hz)
60: Display the setting value and the feedback of PID control
61: Display the content of the running program (1 = tt)

Explanation 1

- It can also display negative values when setting analog input bias (Pr.03-03–03-10). Example: Assume that AI1 input voltage is 0 V, Pr.03-03 is 10.0%, Pr.03-07 is 4 (Bias serves as the center).

Explanation 2

Example: If MI1 and MI5 are ON, the following table shows the status of the terminals.

Normally opened contact (N.O.): (0: OFF, 1: ON)

Terminal	MI5	MI4	MI3	MI2	MI1
Status	1	0	0	0	1

- The value is 0000 0000 0001 0001 in binary system. And converts to 0011H in hexadecimal system. When Pr.00-04 is set to 16 or 19, the u page on the keypad displays 0011h.
- The setting 16 is the ON / OFF status of digital input according to Pr.02-12 setting and the setting 19 is the corresponding CPU pin ON / OFF status of the digital input.
- When MI1 / MI2 default setting is two-wire / three-wire operation control (Pr.02-00 ≠ 0), and MI3 is set to three-wire, it is not affected by Pr.02-12.

- You can set 16 to monitor the digital input ON / OFF status, and then set 19 to check if the circuit is normal.

Explanation 3

Example: Assume that RY: Pr.02-13 is set to 9 (Drive is ready).

After powering the drive ON, if there is no other abnormal status, the contact is close. The display status is shown below.

Normally opened contact (N.O.):

Terminal	MO1	RY1
Status	0	1

- If Pr.00-04 is set to 17 or 20, it displays in hexadecimal "0001h" with LED u page is ON in the keypad.
- The setting 17 is the ON / OFF status of digital output according to Pr.02-18 setting and the setting 20 is the corresponding CPU pin ON / OFF status of the digital output.
- You can set 17 to monitor the digital output ON / OFF status, and then set 20 to check if the circuit is normal.

Explanation 4

- Setting value 25: when displayed value reaches 100.00%, the drive shows "oL" as an overload warning.

Explanation 5

- Setting value 38:

bit 0: The drive is running forward.
bit 1: The drive is running backward.
bit 2: The drive is ready.
bit 3: Errors occurred on the drive.
bit 4: The drive is running.
bit 5: Warnings occurred on the drive.

✓ 00-05 Coefficient Gain in Actual Output Frequency

Default: 1.00

Settings 0.00–160.00

📖 Set the user-defined unit coefficient gain. Set Pr.00-04 = 31 to display the calculation result on the screen (calculation = output frequency x Pr.00-05).

00-06 Firmware Version

Default: Read only

Settings Read only

✓ 00-07 Parameter Protection Password Input

Default: 0

Settings 0–65535

Display 0–4 (number of failed password attempts)

📖 This parameter allows you to enter your password (which is set in Pr.00-08) to unlock the parameter protection and to make changes to the parameter.

📖 To avoid problems in the future, be sure to write down the password after you set this parameter.

📖 Pr.00-07 and Pr.00-08 are used to prevent personnel from setting other parameters by accident.

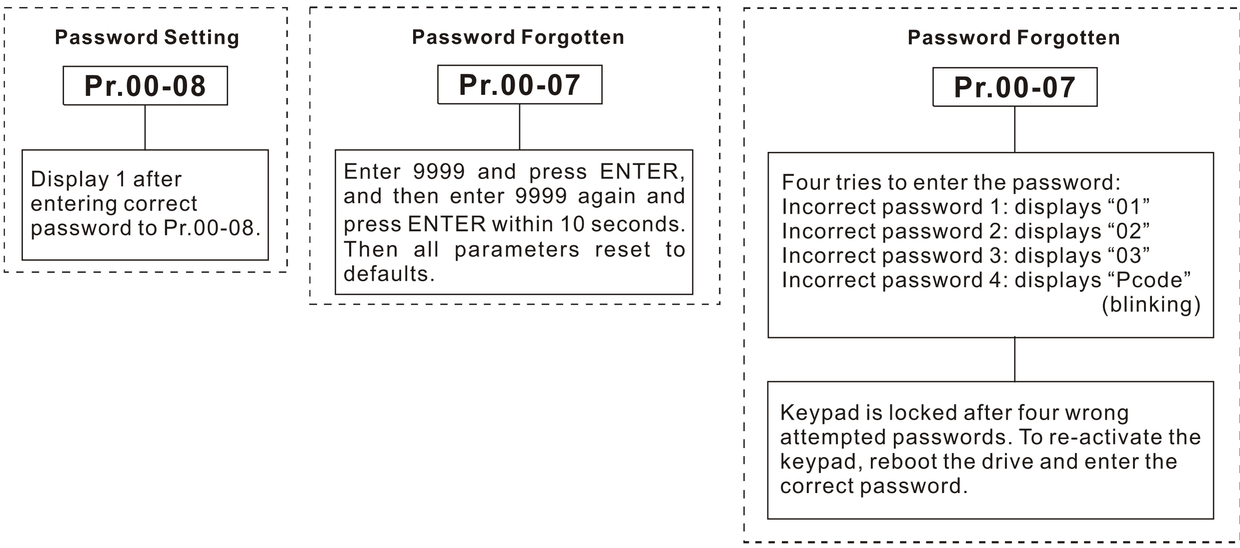
- If you forget the password, clear the password setting by entering 9999 and pressing the ENTER key, then enter 9999 again and press ENTER within 10 seconds. After decoding, all the settings return to default.
- When setting is under password protection, all the parameters read 0, except Pr.00-08.

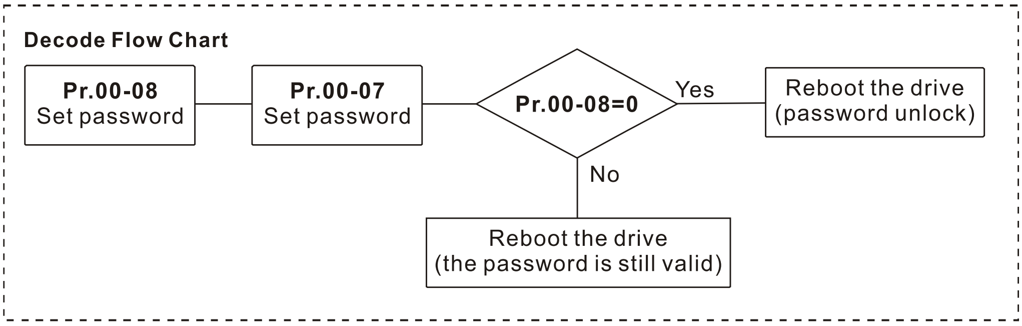
00-08 Parameter Protection Password Setting

Default: 0

Settings	0–65535
Display	0: No password protection or password is entered correctly (Pr.00-07)
	1: Password has been set

- This parameter is for setting the password protection. Password can be set directly the first time. After you set the password, the value of Pr.00-08 is 1, which means password protection is activated. At this time, if you want to change any of the parameter settings, you must enter the correct password in Pr.00-07 to deactivate the password temporarily, and this would make Pr.00-08 become 0. After you finish setting the parameters, reboot the motor drive and the password is activated again.
- Entering the correct password in Pr.00-07 only temporarily deactivates the password. To permanently deactivate password protection, set Pr.00-08 to 0 manually. Otherwise, password protection is always reactivated after you reboot the motor drive.
- The keypad copy function works only when the password protection is deactivated (temporarily or permanently), and the password set in Pr.00-08 cannot be copied to the keypad. So when copying parameters from the keypad to the motor drive, set the password manually again in the motor drive to activate password protection.





00-10 Control Mode

Default: 0

Settings 0: Speed Control mode

📖 Determine the control mode of the AC motor drive.

00-11 Speed Control Mode

Default: 0

Settings 0: IMVF (IM V/F control)

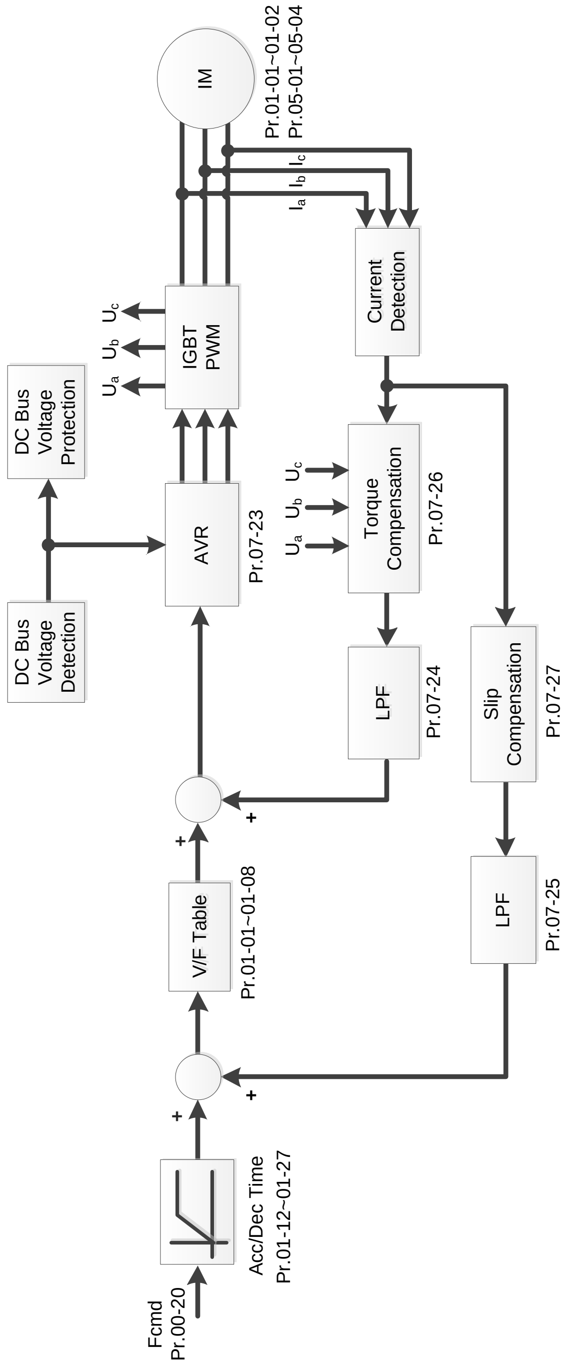
2: IM/PM SVC (Induction Motor / Permanent Magnet Synchronous AC Motor Space Vector Control)

📖 Determine the control mode of the AC motor drive.

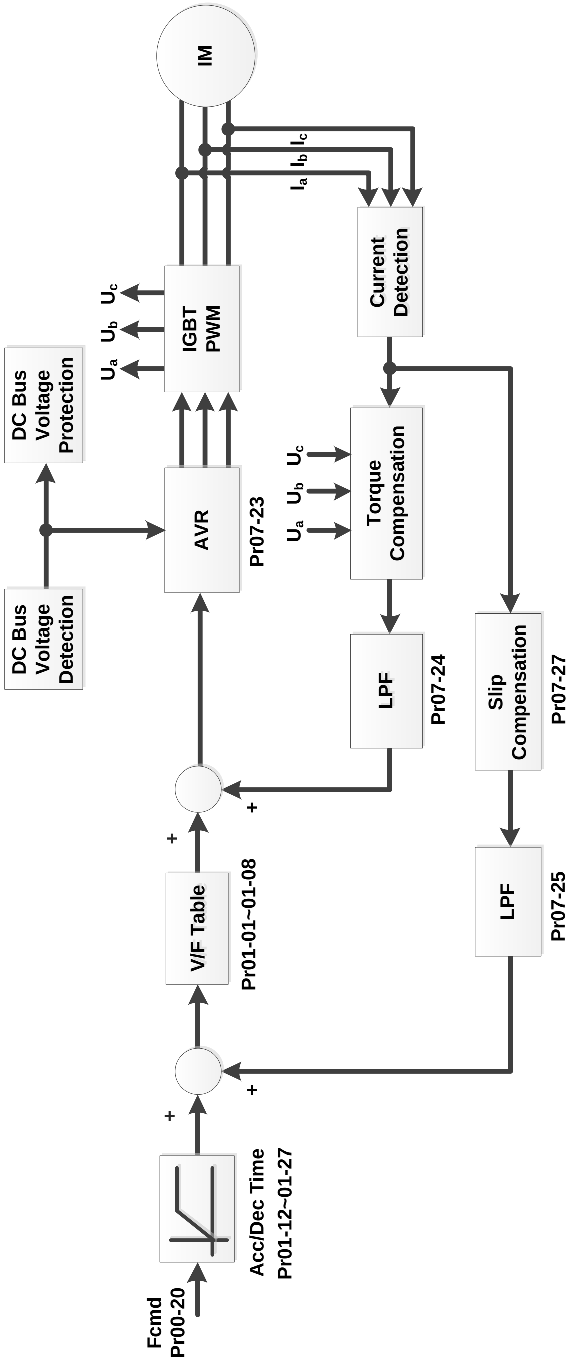
0: IM V/F control: you can set the proportion of V/F as required and control multiple motors simultaneously.

2: IM/PM space vector control: gets the optimal control by auto-tuning the motor parameters.

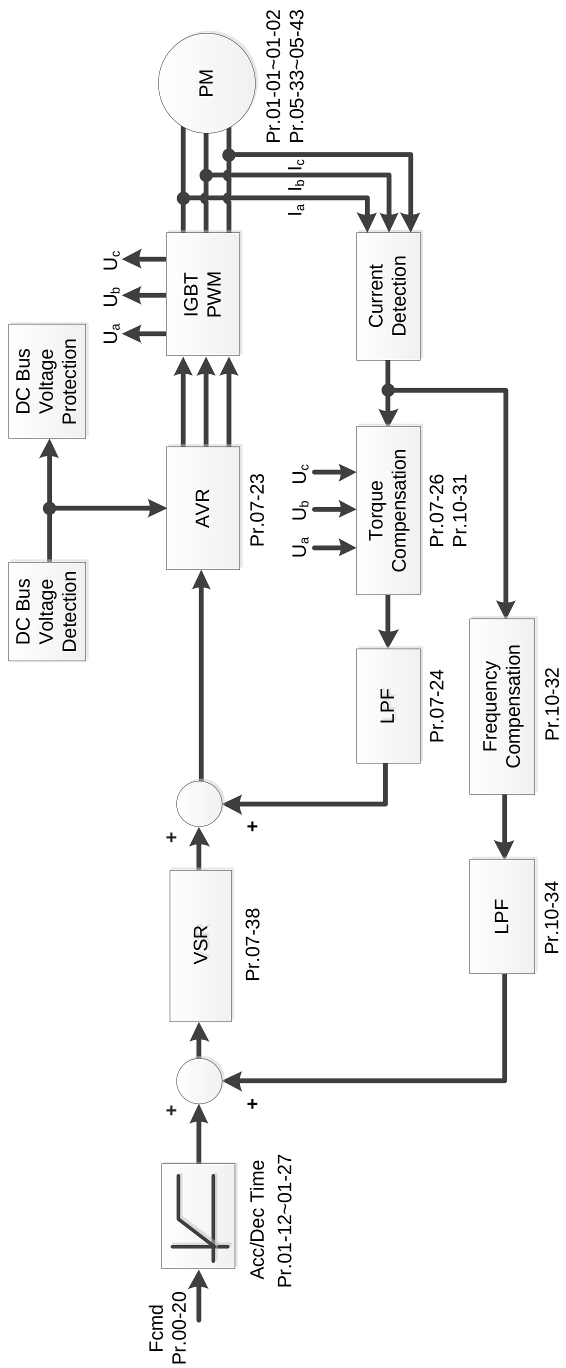
📖 When Pr.00-10 = 0 and you set Pr.00-11 to 0, the V/F control diagram is as follows:



📖 When Pr.00-10 = 0 and you set Pr.00-11 to 2, the sensorless vector control diagram is as follows:
IM Space Vector Control (IMSVC)



PM Space Vector Control (PMSVC)



00-16 Load Selection

Default: 1

Settings 0: Normal duty

1: Heavy duty

- Normal duty: overload rated output current 150% in 3 seconds. (120%, 1 minute). Refer to Pr.00-17 for the setting for the carrier frequency. Refer to Chapter 9 Specifications or Pr.00-01 for the rated current.
- Heavy duty: overload rated output current 200% in 3 seconds. (150%,1 minute) Refer to Pr.00-17 for the setting for the carrier frequency. Refer to Chapter 9 Specifications or Pr.00-01 for the rated current.

- Pr.00-01 varies with the setting value of Pr.00-16. The default value and maximum of Pr.06-03 and Pr.06-04 also vary with the setting value of Pr.00-16.
- In normal duty, the default setting of Pr.06-03 and Pr.06-04 is 120%, and the maximum is 150%.
- In heavy duty, the default setting of Pr.06-03 and Pr.06-04 is 180%, and the maximum is 200%.

00-17 Carrier Frequency

Default: 4 / 4

Settings Normal load: 2–15 kHz

Heavy load: 2–15 kHz

- Determine the PWM carrier frequency for the AC motor drive.

Models	230V		460V	
Models	1–15 HP [0.75–11 kW]	20–30 HP [15–22 kW]	1–20 HP [0.75–15 kW]	25–40 HP [18.5–55 kW]
Settings	2–15 kHz			
Normal Duty Default	4 kHz			
Heavy Duty Default	4 kHz			

- From the table, you see that the PWM carrier frequency has significant influences on the electromagnetic noise, the AC motor drive heat dissipation, and the motor acoustic noise. Therefore, if the surrounding noise is greater than the motor noise, lower the carrier frequency to reduce the temperature rise. Although the motor has quiet operation in the higher carrier frequency, consider the entire wiring and interference.
- When the carrier frequency is higher than the default, decrease the carrier frequency to protect the drive. Refer to Pr.06-55 for the related setting and details.

00-20 Master Frequency Command Source (AUTO, REMOTE)

Default: 0

Settings 0: Digital keypad

1: RS-485 communication input

2: External analog input (Refer to Pr.03-00)

3: External UP / DOWN terminal (multi-function input terminals)

4: Pulse input without direction command (refer to Pr.10-16 without considering direction)

7: Frequency knob on the digital keypad

9: PID controller (use with Pr.08-65 = 1)

Note: HOA (Hand-Off-Auto) function is valid only when you use with MO function setting 42 and 56 or with KPC-CC01 (optional).

- Determine the master frequency source in the “AUTO, REMOTE “mode. The default is AUTO mode.
- You can switch the AUTO, REMOTE mode with the keypad KPC-CC01 (optional) or the multi-function input terminal (MI) to set the master frequency source.
- It returns to AUTO or REMOTE mode whenever you cycle the power. If you use a multi-function input terminal to switch between HAND (LOCAL) and AUTO (REMOTE) mode, the highest priority is the multi-function input terminal.
- The pulse of Pr.00-20 = 4 (Pulse input without direction command) is input by MI5.

- When Pr.00-20 = 9, Pr.08-65 automatically set as 1 at the same time. Pr.08-65 needs to be set as 0 for changing back to other values.
- When Pr.00-20 = 7, set Pr.03-40 = 50% and Pr.03-41 (VR Positive / Negative Bias) = 4 (Bias serves as the center). If you need to reverse the setting, set Pr.03-10 = 1.

00-21 Operation Command Source (AUTO, REMOTE)

Default: 0

Settings 0: Digital keypad

1: External terminals

2: RS-485 communication input

Note: HOA (Hand-Off-Auto) function is valid only when you use with MO function setting 42 and 56 or with KPC-CC01 (optional).

- Determine the operation frequency source in the "AUTO, REMOTE" mode.
- In the HOA mode, if the multi-function input terminal (MI) function setting 41 and 42 are OFF, the drive does not receive any operation command and JOG is invalid.

00-22 Stop Method

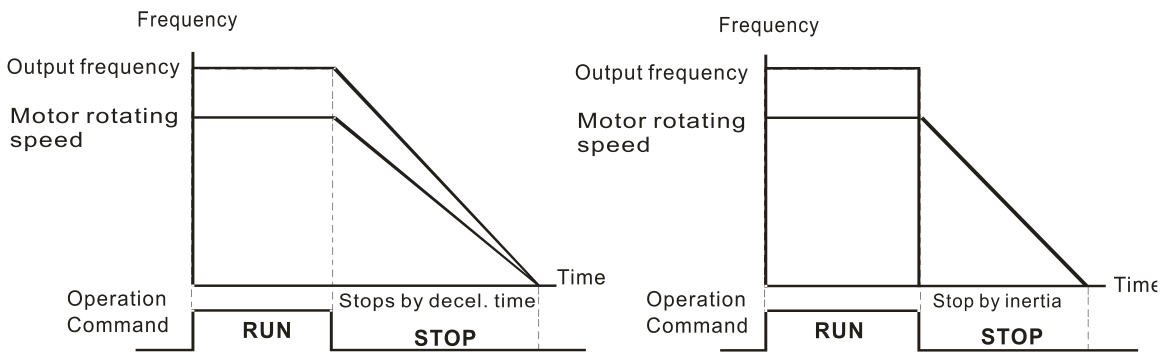
Default: 0

Settings 0: Ramp to stop

1: Coast to stop

2: Motor stops with simple positioning method

- Determine how the motor is stopped when the drive receives the Stop command.



Ramp to Stop and Coast to Stop

1. Ramp to stop: According to the set deceleration time, the AC motor drive decelerates to 0 Hz or the minimum output frequency (Pr.01-07), and then stop.
2. Coast to stop: According to the load inertia, the AC motor drive stops output immediately, and the motor coasts to stop.
   - Use "ramp to stop" for the safety of personnel or to prevent material from being wasted in applications where the motor must stop immediately after the drive stops. You must set the deceleration time accordingly.
   - If idling is allowed or the load inertia is large, use "coast to stop".
     For example, blowers, punching machines and pumps.
3. Motor stops by simple positioning: use with the functions for Pr.12-20–12-35.

00-23 Motor Direction Control

Default: 0

Settings 0: Enable forward / reverse
1: Disable reverse
2: Disable forward

Enable the motor to run in the forward and reverse direction. You can use it to prevent a motor from running in a direction that would cause injury or damage to the equipment, especially when only one running direction is allowed for the motor load.

00-24 Digital Operator (Keypad) Frequency Command Memory

Default: Read only

Settings Read only

If the keypad is the frequency command source, when Lv or fault occurs, this parameter stores the current frequency command.

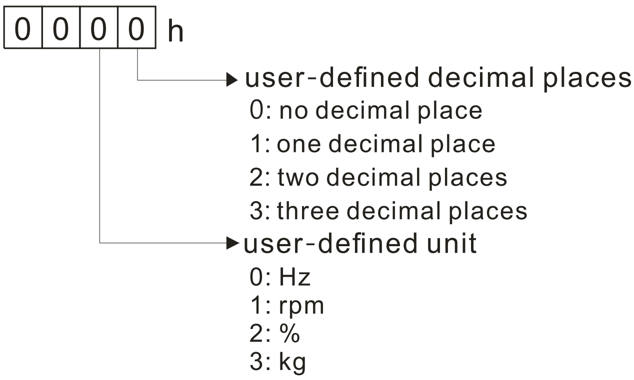
00-25 User-Defined Characteristics

Default: 0

Settings bit 0–3: user-defined decimal places
0000h-0000b: no decimal place
0001h-0001b: one decimal place
0002h-0010b: two decimal places
0003h-0011b: three decimal places
bit 4–15: user-defined unit
000xh: Hz
001xh: rpm
002xh: %
003xh: kg
004xh: m/s
005xh: kW
006xh: HP
007xh: ppm
008xh: 1/m
009xh: kg/s
00Axh: kg/m
00Bxh: kg/h
00Cxh: lb/s
00Dxh: lb/m
00Exh: lb/h
00Fxh: ft/s
010xh: ft/m
011xh: m
012xh: ft

013xh: degC
014xh: degF
015xh: mbar
016xh: bar
017xh: Pa
018xh: kPa
01Axh: inWG
01Bxh: ftWG
01Cxh: psi
01Dxh: atm
01Exh: L/s
01Fxh: L/m
020xh: L/h
021xh: m3/s
022xh: m3/h
023xh: GPM
024xh: CFM
xxxxh: Hz

- bit 0~3: The displayed units for the control frequency F page and user-defined (Pr.00-04 = d10, PID feedback), and the displayed number of decimal places for Pr.00-26 (support up to three decimal places).
- bit 4~15: The displayed units for the control frequency F page, user-defined (Pr.00-04 = 10, PID feedback) and Pr.00-26.



- You must convert the setting value to decimal when using the keypad to set parameters.
  Example: Assume that the user-defined unit is inWG and user-defined decimal place is the third decimal point.
  According to the information above, the corresponding unit to inWG is 01Axh (x is the set decimal point), and the corresponding unit to the third decimal place is 0003h, then inWG and the third decimal point displayed in hexadecimal is 01A3h, that is 419 in decimal value. Thus, set Pr.00-25 = 419 to complete the setting.

00-26 Maximum User-Defined Value

Default: 0

Settings 0: Disabled
0–65535 (when Pr.00-25 is set to no decimal place)
0.0–6553.5 (when Pr.00-25 is set to one decimal place)
0.00–655.35 (when Pr.00-25 is set to two decimal places)
0.000–65.535 (when Pr.00-25 is set to three decimal places)

- When Pr.00-26 is NOT set to 0, the user-defined value is enabled. After selecting the displayed unit and number of decimal places with Pr.00-25, the setting value of Pr.00-26 corresponds to Pr.01-00 (drive's maximum operating frequency).

Example: When the frequency set in Pr.01-00 = 60.00 Hz, the maximum user-defined value for Pr.00-26 is 100.0%. This also means that Pr.00-25 is set at 33 (0021h) to select % as the unit.

Note: Set Pr.00-25 before using Pr.00-26. After you finish setting, when Pr.00-26 is not 0, the displayed unit on the keypad shows correctly according to Pr.00-25 settings.

00-27 User-Defined Value

Default: Read only

Settings Read only

- Pr.00-27 displays the user-defined value when Pr.00-26 is not 0.

00-29 LOCAL / REMOTE Selection

Default: 0

Settings 0: Standard HOA function
1: When switching between local and remote, the drive stops.
2: When switching between local and remote, the drive runs with REMOTE settings for frequency and operating status.
3: When switching between local and remote, the drive runs with LOCAL settings for frequency and operating status.
4: When switching between local and remote, the drive runs with LOCAL settings when switched to Local and runs with REMOTE settings when switched to Remote for frequency and operating status.

- The default for Pr.00-29 is 0, that is, the standard HOA (Hand-Off-Auto) function. Set the AUTO and HAND frequency and operation source with Pr.00-20, 00-21 and Pr.00-30, 00-31. The external terminal function (MI) = 56 for LOC / REM mode selection is disabled when Pr.00-29=0.
- If Pr.00-29 is not set to 0, the top right corner of digital keypad KPC-CC01 (optional) displays LOC or REM. Set the REMOTE and LOCAL frequency and operation source with Pr.00-20, 00-21 and Pr.00-30, 00-31.

  Set the multi-function input terminal (MI) = 56 to set the LOC / REM selection. The AUTO key on the KPC-CC01 (optional) is the REMOTE function; the HAND key is the LOCAL function.
- If Pr.00-29 is not set to 0, the AUTO / HAND keys are disabled. In this case, the external terminal (MI) setting = 56 (local / remote selection) has the highest command priority.

00-30 Master Frequency Command Source (HAND, LOCAL)

Default: 0

Settings 0: Digital keypad
1: RS-485 communication input
2: External analog input (Refer to Pr.03-00)
3: External UP / DOWN terminal (multi-function input terminals)
4: Pulse input without direction command (refer to Pr.10-16 without considering direction)
7: Frequency knob on digital keypad
9: PID controller
Note: HOA (Hand-Off-Auto) function is valid only when you use with MO function setting 41 and 56 or with KPC-CC01 (optional).

- Determine the master frequency source in the "HAND, LOCAL" mode.
- You can switch the HAND, LOCAL mode with the keypad KPC-CC01 (optional) or the multi-function input terminal (MI) to set the master frequency source.
- It returns to AUTO or REMOTE mode whenever you cycle the power. If you use a multi-function input terminal to switch between HAND (LOCAL) and AUTO (REMOTE) mode, the highest priority is the multi-function input terminal.
- The pulse of Pr.00-30 = 4 (Pulse input without direction command) is input by MI5.
- When Pr.00-30 = 9, Pr.08-65 automatically set as 1 at the same time. Pr.08-65 needs to be set as 0 for changing back to other values.

00-31 Operation Command Source (HAND, LOCAL)

Default: 0

Settings 0: Digital keypad
1: External terminals
2: RS-485 communication input
Note: HOA (Hand-Off-Auto) function is valid only when you use with MO function setting 41 and 56 or with KPC-CC01 (optional).

- Determine the operation frequency source in the "HAND, LOCAL" mode.
- In the HOA mode, if the multi-function input terminal (MI) function setting 41 and 42 are OFF, the drive does not receive any operation command and JOG is invalid.

✓ 00-32 Digital Keypad STOP Function

Default: 0

Settings 0: STOP key disabled
1: STOP key enabled

- Valid when the operation command source is not the digital keypad (Pr.00-21≠ 0).
When Pr.00-21 = 0, the STOP key on the digital keypad is not affected by this parameter.

00-33 RPWM Mode Selection

Default: 0

Settings 0: Disabled
1: RPWM mode 1
2: RPWM mode 2
3: RPWM mode 3

- Different control modes for Pr.00-33:

Motor	Induction Motor (IM)		Permanent Magnet Synchronous Motor (PM)
Control Mode	VF	SVC	SVC
0: RPWM mode 1	✓	✓	✓
1: RPWM mode 2	✓	✓	✓
2: RPWM mode 3	✓	✓	✓

- When RPWM function is enabled, the carrier waves are randomly distributed based on carrier frequency setting (Pr.00-17).
- The RPWM function is applicable to all control modes.
- Once RPWM function is enabled, reduce the shrill sounds focused on a specific range of high audio frequency, and the audio frequency produced by the running motor changes accordingly (usually from shrill to deep).
- The AC motor drive supports three kinds of RPWM modes for different applications. Each mode corresponds to different frequency distribution, electromagnetic noise distribution, and audio frequency.
- The settings for Pr.00-17 (Carrier Frequency) vary with enabling or disabling RPWM

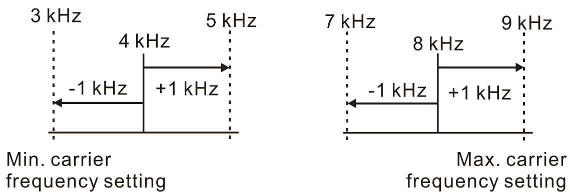
00-34 RPWM carrier frequency variation

Default: 0

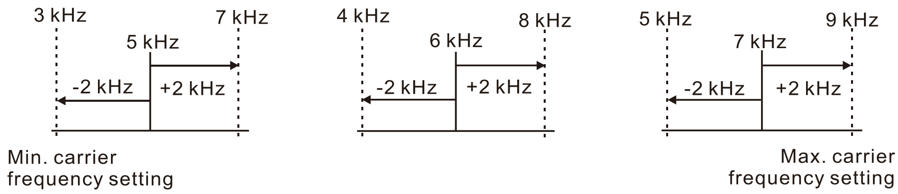
Settings 0.0–4.0 kHz
Pr.00-17 = 4 kHz, 8 kHz: the setting range is 0.0–2.0 kHz
Pr.00-17 = 5–7 kHz: the setting range is 0.0–4.0 kHz

- When RPWM function is enabled, the lowest carrier frequency can be set in Pr.00-17 is 3 kHz, and the highest is 9 kHz.
- Pr.00-34 is valid only when RPWM function is activating (Pr.00-33 ≠ 0).
- Example: When the carrier wave (Pr.00-17) is 4 kHz, activate RPWM function (Pr.00-33 = 1, 2, or 3), and the RPWM range (Pr.00-34) is 2.0 kHz, the output carrier wave is based on 4 kHz, the random frequency range is +/1 kHz, thus the carrier wave changes randomly within 3 kHz to 5 kHz.
- When the RPWM function is enabled and Pr.00-17 = 4 or 8 kHz, the setting range for Pr.00-34 is 0.0–2.0 kHz.

  The maximum setting value of Pr.00-34 can be 2.0 kHz (+/-1 kHz). The carrier frequency range to change is as the figure shown below:



- When the RPWM function is enabled and Pr.00-17 = 5, 6, or 7 kHz, the setting range for Pr.00-34 is 0.0–4.0 kHz.
  The maximum setting value of Pr.00-34 can be 4.0 kHz (+/-2 kHz). The carrier frequency range to change is as the figure shown below:



00-35 Auxiliary Frequency Source

Default: 0

Settings 0: Master and auxiliary frequency function disabled
1: Digital keypad
2: RS-485 communication input
3: Analog input
4: External UP/DOWN key input (multi-function input terminals)
7: Frequency knob on the digital keypad

00-36 Master and Auxiliary Frequency Command Selection

Default: 0

Settings 0: Master + auxiliary frequency
1: Master - auxiliary frequency
2: Auxiliary - master frequency

- Master and auxiliary frequency command sets the master frequency source according to Pr.00-20, and sets the auxiliary frequency source according to Pr.00-35. This parameter determines the addition and subtraction of the master and auxiliary frequency.
- When Pr.00-36 = 0, 1, 2, the control command comes after adding or subtracting the master / auxiliary frequency and the acceleration and deceleration (including S-curve).
- If the value is negative after adding or subtracting the master / auxiliary frequency, Pr.03-10 determines whether to change the running direction.
- If you set the master frequency source (Pr.00-20 = 0) or the auxiliary frequency source (Pr.00-35 = 1) using the keypad, the F page of the keypad displays the setting frequency that you can use to set the master frequency or the auxiliary frequency. If the master frequency source or the auxiliary frequency source is NOT set by the keypad (Pr.00-20 ≠ 0 and Pr.00-35 ≠ 1), the F page of the keypad displays the value after adding or subtracting the master / auxiliary frequency.
- When setting the master frequency source and auxiliary frequency source, Pr.00-35 cannot be set to the same value as Pr.00-20 or Pr.00-30.
- When using the master and auxiliary frequency function, and the value after master and auxiliary frequency are added or subtracted is positive, the output frequency is limited by Pr.01-00 (Maximum operation frequency); if the value is negative, the output frequency is limited by Pr.08-67 (Master and auxiliary reverse running cutoff frequency).

00-47 Output Phase Order Selection

Default: 0

Settings 0: Standard

1: Exchange the rotation direction

- Without changing the wiring and light indicator, this parameter can be used to change the rotation direction from forward to reverse or from reverse to forward.
- When using this parameter with Pr.00-23 (Motor Direction Control), Pr.00-23 has priority over Pr.00-47.

00-48 Display Filter Time (Current)

Default: 0.100

Settings 0.001–65.535 sec.

- Minimize the current fluctuation displayed by the digital keypad.

00-49 Display Filter Time (Keypad)

Default: 0.100

Settings 0.001–65.535 sec.

- Minimize the value fluctuation displayed by the digital keypad.

00-50 Software Version (Date)

Default: Read only

Settings Read only

- Display the current drive software version by date.

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01 Basic Parameters

✓ You can set this parameter during operation.

01-00 Motor 1 Maximum Operation Frequency

01-52 Motor 2 Maximum Operation Frequency

Default: 60.00 / 50.00

Settings 0.00–599.00 Hz

- Determines the AC motor drive's maximum operation frequency.
  All the AC motor drive frequency command sources (analog inputs 0–10 V, 4–20 mA, 0–20 mA, ±10 V) are scaled to correspond to the output frequency range.

01-01 Motor 1 Rated / Base Frequency

01-35 Motor 2 Rated / Base Frequency

Default: 60.00 / 50.00

Settings 0.00–599.00 Hz

- Set this parameter according to the motor's rated frequency on the motor nameplate. If the motor's rated frequency is 60 Hz, set this parameter to 60. If the motor's rated frequency is 50 Hz, set this parameter to 50.

01-02 Motor 1 Rated / Base Voltage

01-36 Motor 2 Rated / Base Voltage

Default: 220.0 / 440.0

Settings 115V / 230V models: 0.0–255.0 V
460V models: 0.0–510.0 V

- Set this parameter according to the rated voltage on the motor nameplate. If the motor's rated voltage is 220 V, set this parameter to 220.0. If the motor's rated voltage 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 Motor 1 Mid-Point Frequency 1

Default: 3.00

Settings 0.00–599.00 Hz

✓ **01-04** Motor 1 Mid-Point Output Voltage 1

Default: 11.0 / 22.0

Settings 115V / 230V models: 0.0–255.0 V
460V models: 0.0–480.0 V

01-37 Motor 2 Mid-Point Frequency 1

Default: 3.00

Settings 0.00–599.00 Hz

✎ 01-38 Motor 2 Mid-Point Output Voltage 1

Default: 11.0 / 22.0

Settings 115V / 230V models: 0.0–240.0 V
460V models: 0.0–480.0 V

01-05 Motor 1 Mid-Point Frequency 2

Default: 1.50

Settings 0.00–599.00 Hz

✎ 01-06 Motor 1 Mid-Point Output Voltage 2

Default: 5.0 / 10.0

Settings 115V / 230V models: 0.0–240.0 V
460V models: 0.0–480.0 V

01-39 Motor 2 Mid-Point Frequency 2

Default: 0.50

Settings 0.00–599.00 Hz

✎ 01-40 Motor 2 Mid-Point Output Voltage 2

Default: 2.0 / 4.0

Settings 115V / 230V models: 0.0–240.0 V
460V models: 0.0–480.0 V

01-07 Motor 1 Minimum Output Frequency

Default: 0.50

Settings 0.00–599.00 Hz

✎ 01-08 Motor 1 Minimum Output Voltage

Default: 1.0 / 2.0

Settings 115V / 230V models: 0.0–240.0 V
460V models: 0.0–480.0 V

01-41 Motor 2 Minimum Output Frequency

Default: 0.00

Settings 0.00–599.00 Hz

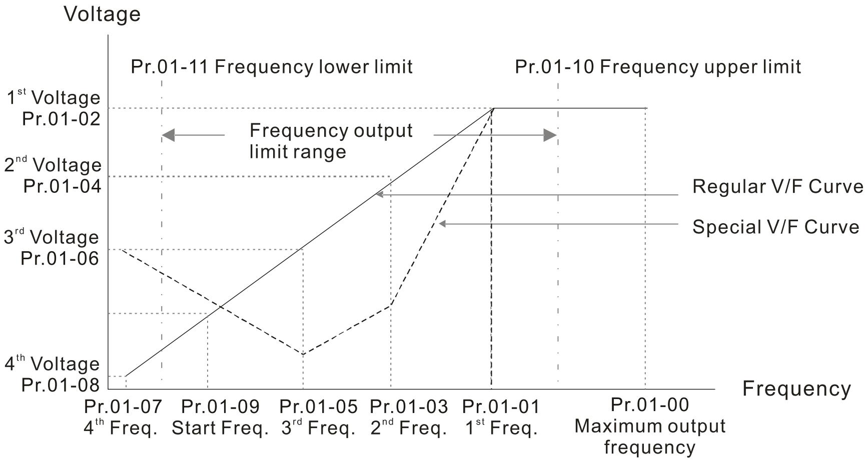
✎ 01-42 Motor 2 Minimum Output Voltage

Default: 0.0 / 0.0

Settings 115V / 230V models: 0.0–240.0 V
460V models: 0.0–480.0 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.
- 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 the over-current protection. Therefore, use low voltage at low frequency to prevent motor damage or drive error.
- The diagram below shows the V/F curve for motor 1. You can use the same V/F curve for motor 2.

For multi-motor selections, refer to the multi-function input terminal (Pr.02-01–Pr.02-05) settings 83.

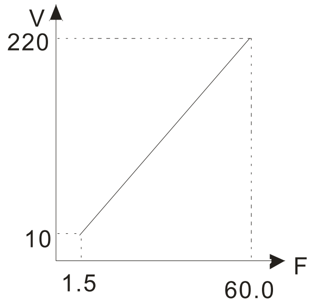


V/F Curve

Common settings for the V/F curve:

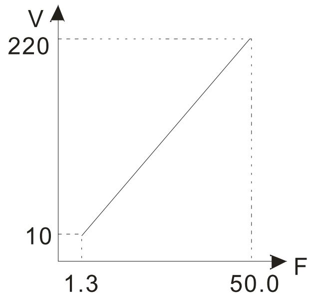
(1) General purpose

Motor spec. 60Hz



Pr.	Setting
01-00	60.0
01-01	60.0
01-02	220.0
01-03 01-05	1.50
01-04 01-06	10.0
01-07	1.50
01-08	10.0

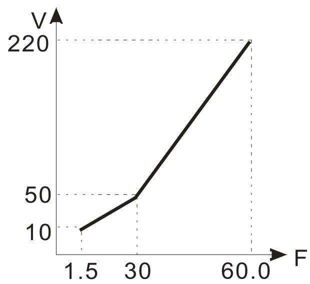
Motor spec. 50Hz



Pr.	Setting
01-00	50.0
01-01	50.0
01-02	220.0
01-03 01-05	1.30
01-04 01-06	10.0
01-07	1.30
01-08	10.0

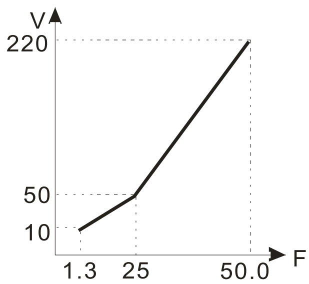
(2) For fan and hydraulic machinery

Motor spec. 60Hz



Pr.	Setting
01-00	60.0
01-01	60.0
01-02	220.0
01-03 01-05	30.0
01-04 01-06	50.0
01-07	1.50
01-08	10.0

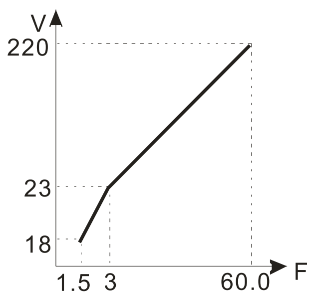
Motor spec. 50Hz



Pr.	Setting
01-00	50.0
01-01	50.0
01-02	220.0
01-03 01-05	25.0
01-04 01-06	50.0
01-07	1.30
01-08	10.0

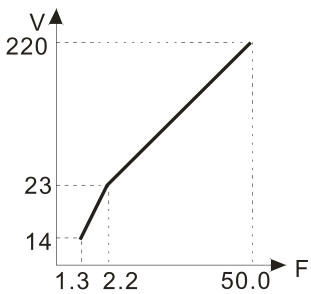
(3) High starting torque

Motor spec. 60Hz



Pr.	Setting
01-00	60.0
01-01	60.0
01-02	220.0
01-03 01-05	3.00
01-04 01-06	23.0
01-07	1.50
01-08	18.0

Motor spec. 50Hz



Pr.	Setting
01-00	50.0
01-01	50.0
01-02	220.0
01-03 01-05	2.20
01-04 01-06	23.0
01-07	1.30
01-08	14.0

01-09 Start-up Frequency

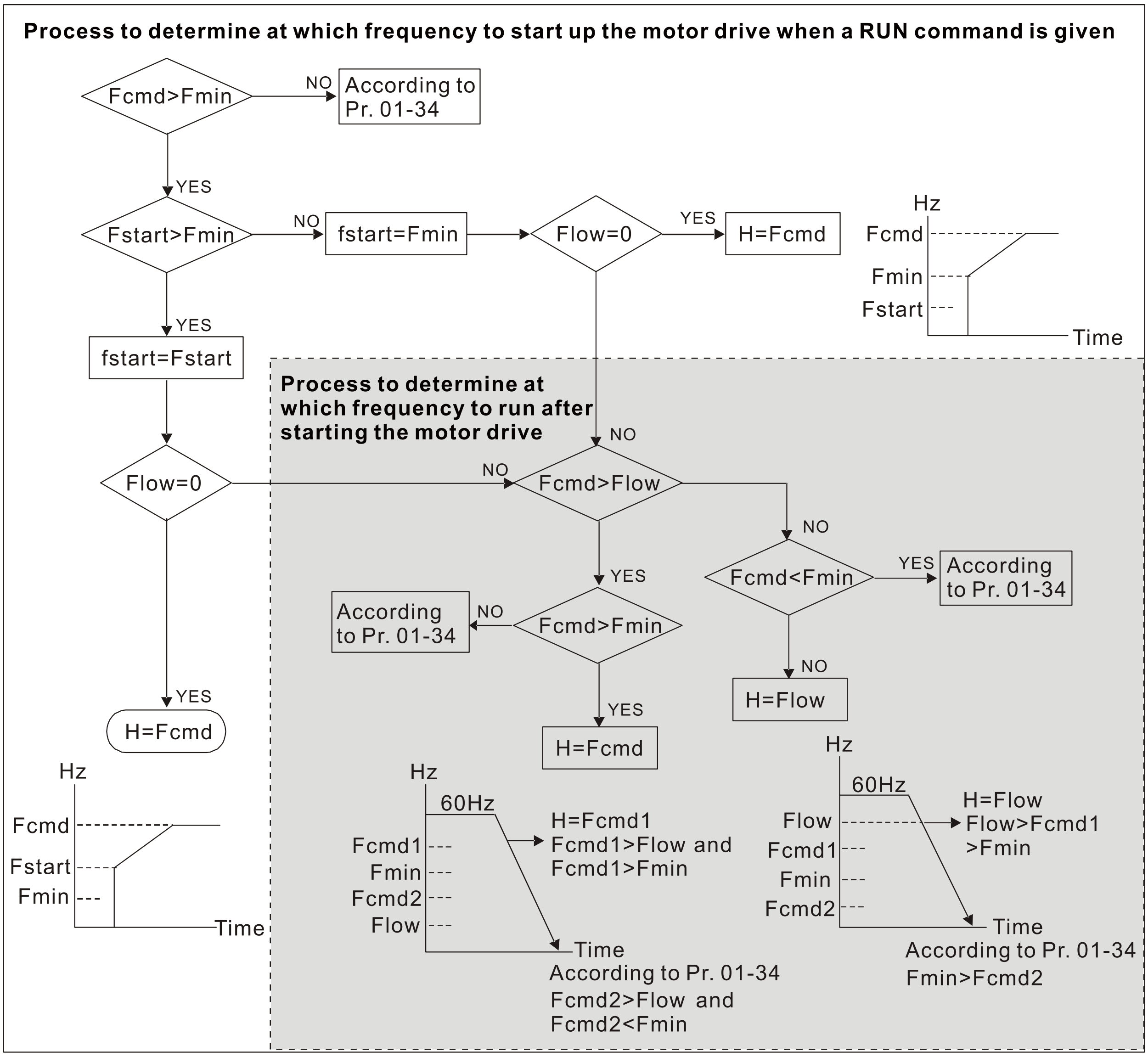
Default: 0.50

Settings 0.00–599.00 Hz

📖 When the starting frequency (Pr.01-09) is larger than the Minimum Output Frequency of Motor 1 (Pr.01-07), the drive's frequency output starts from the starting frequency (Pr.01-09) until reaching the F command.

Refer to the following diagram for details.

- Fcmd = Frequency command
- Fstart = Start-up frequency (Pr.01-09)
- fstart = actual start-up frequency of the drive
- Fmin = 4th output frequency setting (Pr.01-07 / Pr.01-41)
- Flow = output frequency lower limit (Pr.01-11)



📖 When Fcmd > Fmin and Fcmd < Fstart: If Flow < Fcmd, the drive runs directly with Fcmd. If Flow ≥ Fcmd, the drive runs with Fcmd, and then rises to Flow according to acceleration time.

📖 The drive's output frequency goes directly to 0 when decelerating to Fmin.

01-10 Output Frequency Upper Limit

Default: 599.00

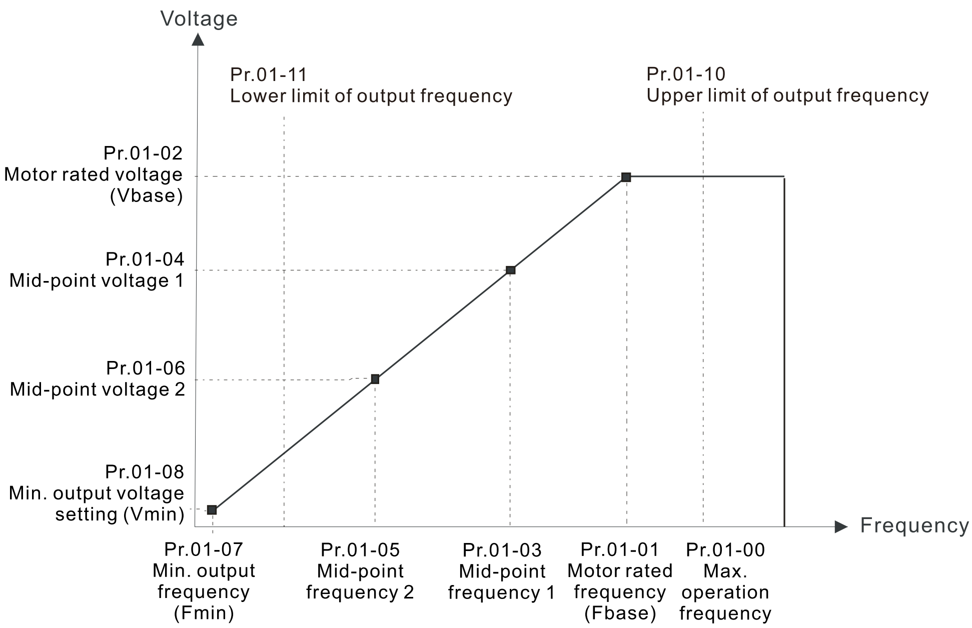
Settings 0.00–599.00 Hz

01-11 Output Frequency Lower Limit

Default: 0.00

Settings 0.0–599.00 Hz

- If the output frequency setting is higher than the upper limit (Pr.01-10), the drive runs with the upper limit frequency. If the output frequency setting is lower than the lower limit (Pr.01-11) but higher than the minimum output frequency (Pr.01-07), the drive runs with the lower limit frequency. Set the upper limit frequency > the lower limit frequency (Pr.01-10 setting value must be > Pr.01-11 setting value).
- If the PID control is enabled for the drive, the drive's output frequency may exceed the frequency command but is still limited by this setting.
- Related parameters: Pr.01-00 Motor 1 Maximum Operation Frequency, Pr.01-11 Output Frequency Lower Limit.



- When the drive starts, it operates according to the V/F curve and accelerates from the minimum output frequency (Pr.01-07) to the setting frequency. It is not limited by the lower output frequency settings.
- Use the output frequency upper and lower limit settings to prevent operator misuse, overheating caused by the motor's operating at a too low frequency, or mechanical wear due to a too high speed.
- If the frequency upper limit setting is 50 Hz and the frequency setting is 60 Hz, the operating frequency is 50 Hz.
- If the frequency lower limit setting is 10 Hz and the minimum output frequency setting (Pr.01-07) is 1.5 Hz, then the drive operates at 10 Hz when the frequency command is higher than Pr.01-07 but lower than 10 Hz. If the frequency command is lower than Pr.01-07, the drive does not output and enter the ready state.

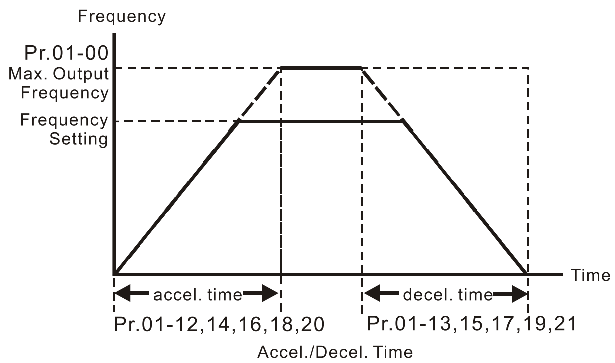
⌁	**01-12**	Acceleration Time 1
⌁	**01-13**	Deceleration Time 1
⌁	**01-14**	Acceleration Time 2
⌁	**01-15**	Deceleration Time 2
⌁	**01-16**	Acceleration Time 3
⌁	**01-17**	Deceleration Time 3
⌁	**01-18**	Acceleration Time 4
⌁	**01-19**	Deceleration Time 4
⌁	**01-20**	JOG Acceleration Time
⌁	**01-21**	JOG Deceleration Time

Default: 10.00

Settings Pr.01-45 = 0: 0.00–600.00 sec.

Pr.01-45 = 1: 0.0–6000.0 sec.

- The acceleration time determines the time required for the AC motor drive to ramp from 0.00 Hz to the maximum operation frequency (Pr.01-00). The deceleration time determines the time required for the AC motor drive to decelerate from the maximum operation frequency (Pr.01-00) down to 0.00 Hz.
- The acceleration and deceleration time are invalid when using Pr.01-44 Auto-acceleration and Auto-deceleration Setting.
- 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.
- With the enabled torque limits and stall prevention functions, the actual acceleration and deceleration time are longer than the above action time.
- Note that set the acceleration and deceleration time too short may trigger the drive's protection function (Pr.06-03 Over-current Stall Prevention during Acceleration or Pr.06-01 Over-voltage Stall Prevention), and the actual acceleration and deceleration time are longer than this setting.
- Note that setting the acceleration time too short may cause motor damage or trigger drive protection due to over-current during the drive's acceleration.
- Note that setting the deceleration time too short may cause motor damage or trigger drive protection due to over-current during the drive's deceleration or over-voltage.
- Use suitable brake resistors (refer to Chapter 07 Optional Accessories) to decelerate in a short time and prevent over-voltage.
- When you enable Pr.01-24–Pr.01-27 (S-curve acceleration and deceleration begin and arrival time), the actual acceleration and deceleration time are longer than the setting.



01-22 JOG Frequency

Default: 6.00

Settings 0.00–599.00 Hz

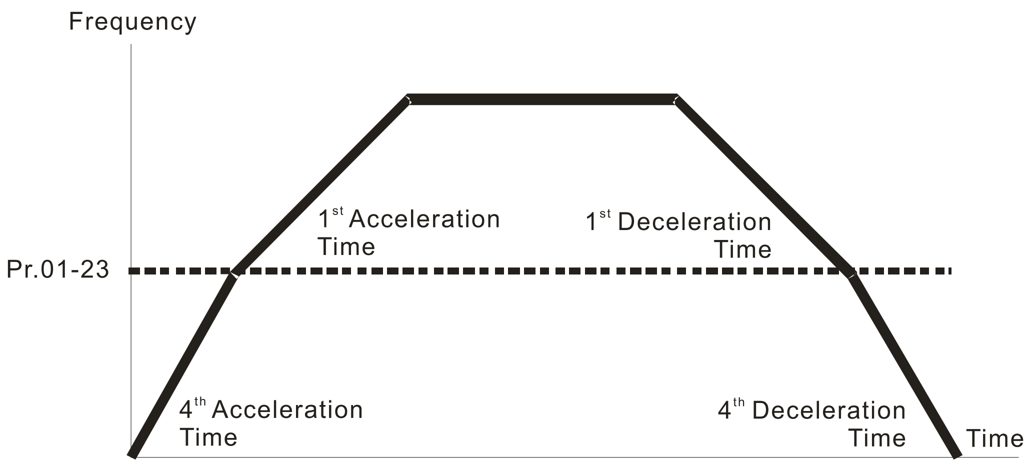
- You can use both the external terminal JOG and F1 key on the optional keypad KPC-CC01 (optional) to set the JOG function. When the JOG command is ON, the AC motor drive accelerates from 0 Hz to the JOG frequency (Pr.01-22). When the JOG command is OFF, the AC motor drive decelerates from the JOG frequency to stop. The JOG acceleration and deceleration time (Pr.01-20, Pr.01-21) are the time to accelerate from 0.0 Hz to the JOG frequency (Pr.01-22). You cannot execute the JOG command when the AC motor drive is running. When the JOG command is executing, other operation commands are invalid.

01-23 First / fourth acceleration and deceleration frequency

Default: 0.00

Settings 0.00–599.00 Hz

- This function does not require the external terminal switching function; it switches the acceleration and deceleration time automatically according to the Pr.01-23 setting. If you set the external terminal, the external terminal has priority over Pr.01-23.
- Use this parameter to set the switch frequency between acceleration and deceleration slope.
  The First / Fourth Accel. / Decel. slope is calculated by the Max. Operation Frequency (Pr.01-00) / acceleration / deceleration time.
  Example: When the Max. Operation Frequency (Pr.01-00) = 80 Hz, and Switch Frequency between First and Fourth Accel. / Decel. (Pr.01-23) = 40 Hz:
  - If Acceleration Time 1 (Pr.01-12) = 10 sec., Acceleration Time 4 (Pr.01-18) = 6 sec., then the acceleration time is 3 sec. for 0–40 Hz and 5 sec. for 40–80 Hz.
  - If Deceleration Time 1 (Pr.01-13) = 8 sec., Deceleration Time 4 (Pr.01-19) = 2 sec., then the deceleration time is 4 sec. for 80–40 Hz and 1 sec. for 40–0 Hz.



1st/4th Acceleration/Deceleration Frequency Switching

01-24 S-Curve for Acceleration Begin Time 1

01-25 S-Curve for Acceleration Arrival Time 2

01-26 S-Curve for Deceleration Begin Time 1

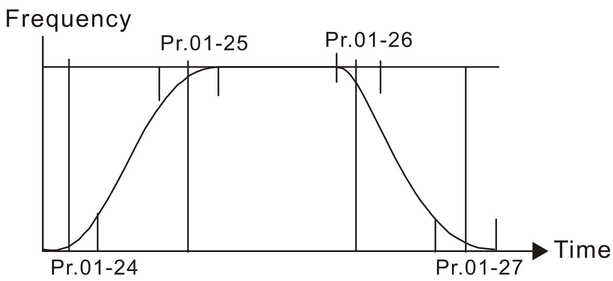
✎ 01-27 S-Curve for Deceleration Arrival Time 2

Default: 0.20

Settings Pr.01-45 = 0: 0.00–25.00 sec.

Pr.01-45 = 1: 0.0–250.0 sec.

- 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 drive produces a different acceleration and deceleration curve according to the acceleration and deceleration time.
- The S-curve function is invalid when you set the acceleration and deceleration time to 0.
- When Pr.01-12, 01-14, 01-16, 01-18 ≥ Pr.01-24 and Pr.01-25,
  the actual acceleration time = Pr.01-12, 01-14, 01-16, 01-18 + (Pr.01-24 + Pr.01-25) ÷ 2
  When Pr.01-13, 01-15, 01-17, 01-19 ≥ Pr.01-26 and Pr.01-27,
- the actual deceleration time = Pr.01-13, 01-15, 01-17, 01-19 + (Pr.01-26 + Pr.01-27) ÷ 2

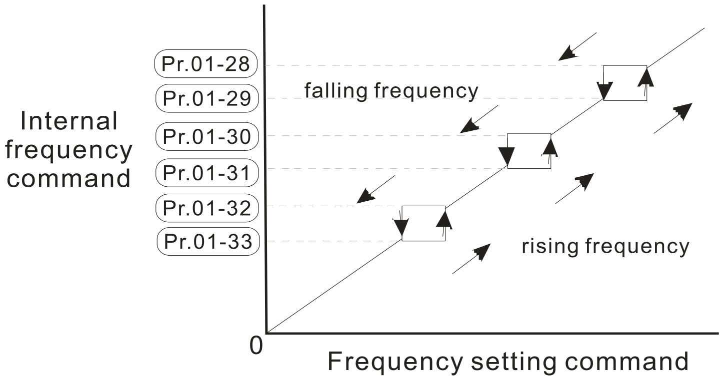


01-28 Skip Frequency 1 (Upper Limit)
01-29 Skip Frequency 1 (Lower Limit)
01-30 Skip Frequency 2 (Upper Limit)
01-31 Skip Frequency 2 (Lower Limit)
01-32 Skip Frequency 3 (Upper Limit)
01-33 Skip Frequency 3 (Lower Limit)

Default: 0.00

Settings 0.00–599.00 Hz

- Sets the AC motor drive's skip frequency. The drive's frequency setting skips these frequency ranges. However, the frequency output is continuous. There are no limits for these six parameters and you can combine them. Pr.01-28 does not need to be greater than Pr.01-29; Pr.01-30 does not need to be greater than Pr.01-31; Pr.01-32 does not need to be greater than Pr.01-33. You can set Pr.01-28–01-33 as you required. There is no size distinction among these six parameters.
- These parameters set the skip frequency ranges for the AC motor drive. You can use this function to avoid frequencies that cause mechanical resonance. The skip frequencies are useful when a motor has resonance vibration at a specific frequency bandwidth. Skipping this frequency avoids the vibration. There are three frequency skip zones available.
- You can set the Frequency command (F) within the range of skip frequencies. Then the output frequency (H) is limited to the lower limit of skip frequency ranges.
- During acceleration and deceleration, the output frequency still passes through the skip frequency ranges.



01-34 Zero-Speed Mode

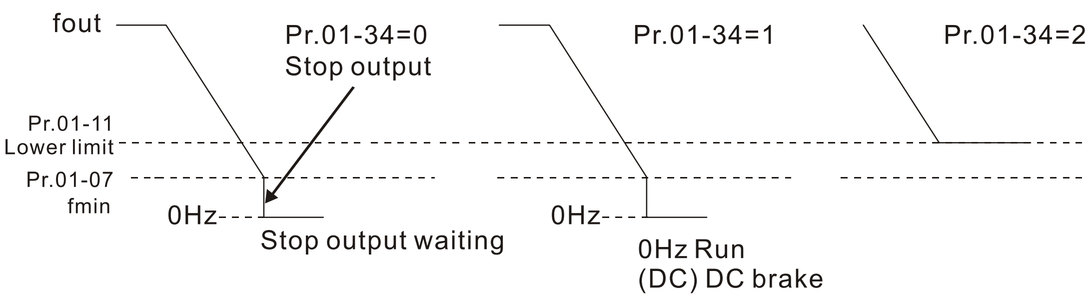
Default: 0

Settings 0: Output waiting
1: Zero-speed operation
2: Fmin (refer to Pr.01-07, Pr.01-41)

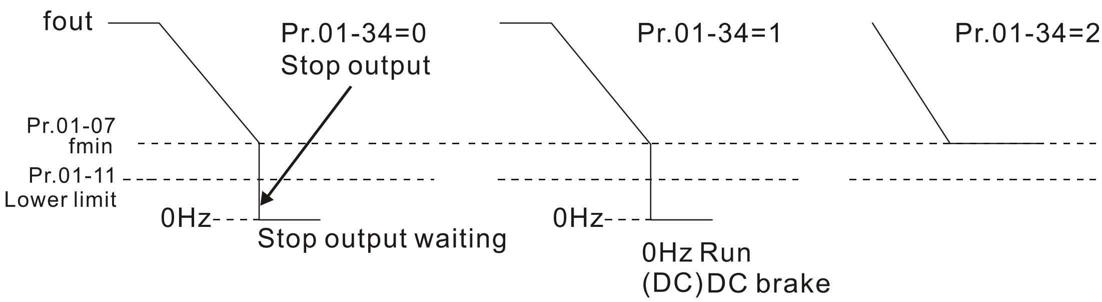
- When the drive's Frequency command is lower than Fmin (Pr.01-07 and Pr.01-41), the drive operates according to this parameter.
- 0: the AC motor drive is in waiting mode without voltage output from terminals U, V, W.
- 1: the drive executes the DC brake by Vmin (Pr.01-08 and Pr.01-42) in V/F mode.
- 2: the AC motor drive runs using Fmin (Pr.01-07 and Pr.01-41) and Vmin (Pr.01-08 and Pr.01-42) in V/F, SVC modes.

In V/F and SVC modes:

- Pr.01-11 lower limit > Pr.01-07 Fmin



- Pr.01-00 lower limit < Pr.01-07 Fmin



01-43 V/F Curve selection

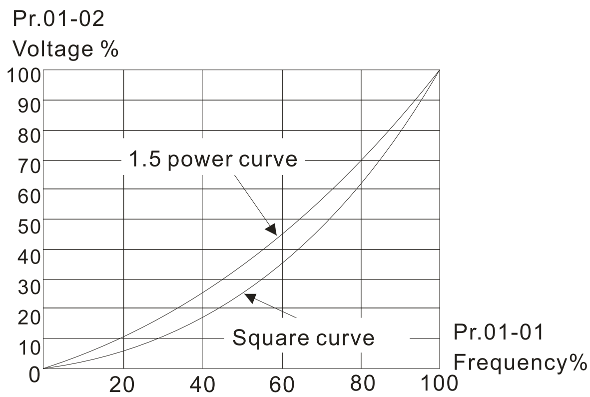
Default: 0

Settings 0: V/F curve determined by Pr.01-00–01-08

1: V/F curve to the power of 1.5

2: V/F curve to the power of 2

- When setting to 0, refer to Pr.01-01–01-08 for the motor 1 V/F curve. For motor 2, refer to Pr.01-35–01-42.
- When setting to 1 or 2, the second and third voltage frequency settings are invalid.
- If the load of the motor is a variable torque load (torque is in direct proportion to the rotating speed, such as the load of a fan or a pump), the load torque is low at low rotating speed. You can decrease the input voltage appropriately to make the magnetic field of the input current smaller and reduce flux loss and iron loss for the motor to increase efficiency.
- When you set the V/F curve to high power, it has lower torque at low frequency, and the drive is not suitable for rapid acceleration and deceleration. Do NOT use this parameter for rapid acceleration and deceleration.



01-44 Auto-acceleration and Auto-deceleration Setting

Default: 0

Settings 0: Linear acceleration and deceleration

1: Auto-acceleration and linear deceleration

2: Linear acceleration and auto-deceleration

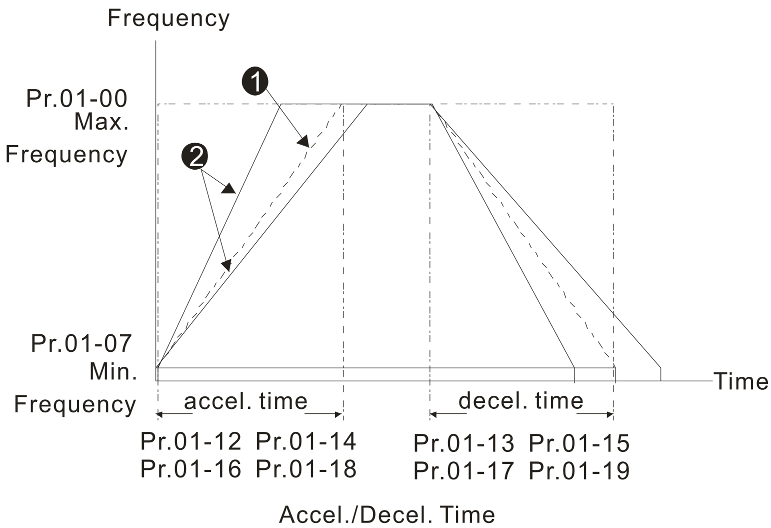
3: Auto-acceleration and auto-deceleration

4: Stall prevention by auto-acceleration and auto-deceleration (limited by Pr.01-12–01-21)

- 0 (linear acceleration and linear deceleration):
  the drive accelerates and decelerates according to the setting for Pr.01-12–01-19.
- 1 or 2 (auto/linear acceleration and auto/linear deceleration):
  the drive reduces the mechanical vibration and prevents the complicated auto-tuning processes. It does not stall during acceleration and has no need for a brake resistor. It does not stall during acceleration and does not need a brake resistor during deceleration to stop. It can also improve operation efficiency and save energy.

📖 3 (auto-acceleration and auto-deceleration):
the drive auto-detects the load torque and accelerates from the fastest acceleration time and smoothest start current to the setting frequency. During deceleration, the drive automatically determines the loaded regenerative energy to steadily and smoothly stop the motor in the fastest deceleration time.

📖 4 (stall prevention by auto-acceleration and auto-deceleration (limited by Pr.01-12–01-21)):
if the acceleration and deceleration is within a reasonable range, the drive accelerates and decelerates according to Pr.01-12–01-19. If the acceleration and deceleration time is too short, the actual acceleration and deceleration time are greater than the acceleration and deceleration time settings.



❶ Optimize the acceleration / deceleration time when Pr.01-44 is set to 0

❷ Optimize the acceleration / deceleration time which load needs actually when Pr.01-44 is set to 3.

01-45 Time Unit for Acceleration and Deceleration and S-Curve

Default: 0

Settings 0: Unit 0.01 sec.
1: Unit 0.1 sec.

01-49 Regenerative Energy Restriction Control Method

Default: 0

Settings 0: Disabled
1: Over voltage energy restriction
2: Traction energy control (TEC)
3: Electromagnetic energy traction control

📖 0: decelerate or stop in accordance with the original deceleration setting.

📖 The actual deceleration time of the motor is longer than the deceleration time setting because of the over-voltage stall prevention.

📖 1: during deceleration, the drive controls the motor according to the setting for Pr.06-01 and the recovery voltage of the DC bus. The controller starts when the DC bus voltage reaches 95% of Pr.06-01. When Pr.06-01 is set to 0, the drive controls the motor according to the operating voltage and the recovery voltage of the DC bus. This method decelerates according to the setting for the deceleration time. The fastest actual deceleration time is not less than the deceleration time setting.

📖 2: during deceleration, the drive controls the motor according to the setting for Pr.06-01 and the DC bus voltage. The controller starts when the DC bus voltage reaches 95% of Pr.06-01, auto-tunes the output frequency and the output voltage to accelerate the consumption of the regenerative energy according to the drive's capability, and the deceleration time is the result of the drive's auto-tuning. Use this setting when over-voltage occurs due to unexpected deceleration time. Use this function with Pr.06-02 = 1 can achieve a smoother and faster deceleration.

📖 3: during operation (acceleration / steady speed / deceleration), the drive adjusts the output voltage according to the amount of regenerative energy and consumes the regenerative energy timely to reduce the risk of over-voltage. The voltage incremental slope can be adjusted through Pr.07-05.

02 Digital Input / Output Parameters

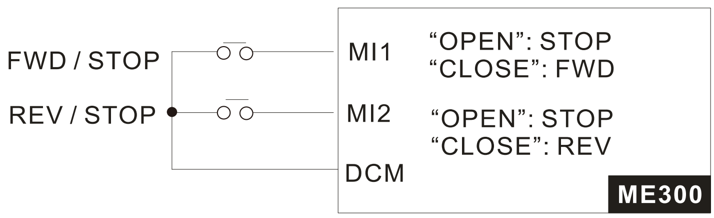
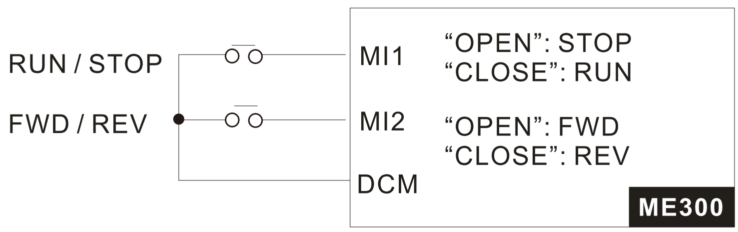
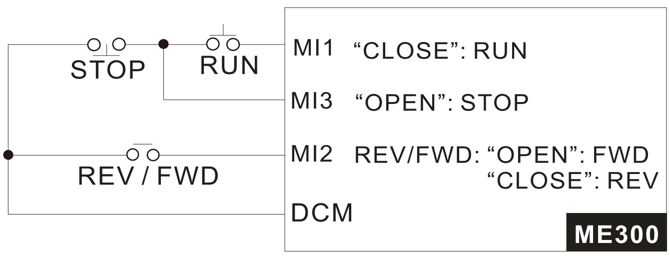
〆 You can set this parameter during operation.

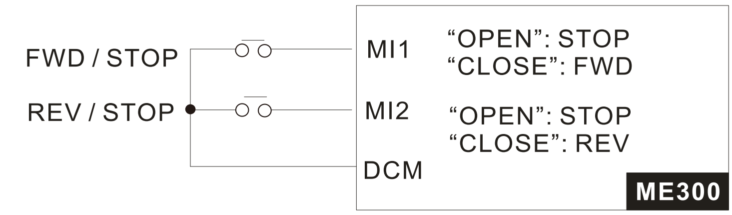
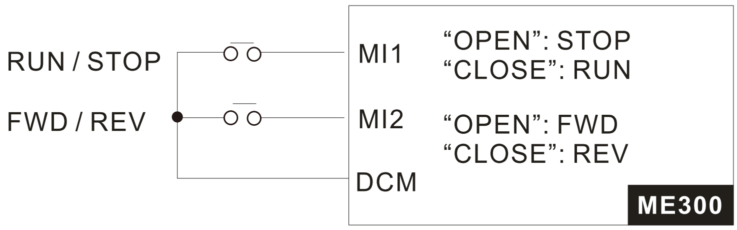
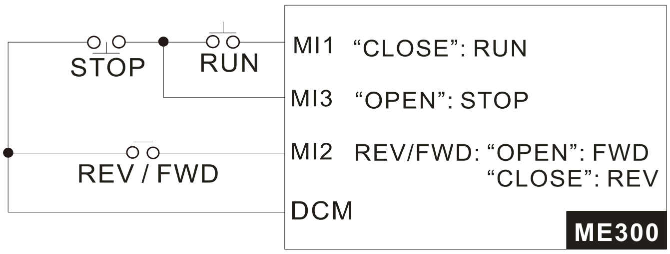
02-00 Two-wire / Three-wire Operation Control

Default: 1

Settings 0: Disabled
1: Two-wire mode 1, power ON for operation control
(M1: FWD / STOP, M2: REV / STOP)
2: Two-wire mode 2, power ON for operation control
(M1: RUN / STOP, M2: REV / FWD)
3: Three-wire, power ON for operation control
(M1: RUN, M2: REV / FWD, M3: STOP)
4: Two-wire mode 1, Quick Start
(M1: FWD / STOP, M2: REV / STOP)
5: Two-wire mode 2, Quick Start
(M1: RUN / STOP, M2: REV / FWD)
6: Three-wire, Quick Start
(M1: RUN, M2: REV / FWD, M3: STOP)

- In the Quick Start function, the output remains ready for operation. The drive responds to the Start command immediately.
- When using Quick Start function, the output terminals UVW are with driving voltages in order to output and respond immediately if a Start command is given. Do NOT touch the terminals or modify the motor wiring to prevent electric shocks.
- This parameter sets the configuration of the external drive operation control and the Quick Start function. There are six different control modes listed in the following table.

Pr.02-00	External Terminal Control Circuits
Setting value: 1 Two-wire operation control FWD / STOP REV / STOP	
Setting value: 2 Two-wire operation control RUN / STOP REV / FWD	
Setting value: 3 Three-wire operation control	

Pr.02-00	External Terminal Control Circuits
Setting value: 4 Two-wire operation control Quick Start	
Setting value: 5 Two-wire operation control Quick Start	
Setting value: 6 Three-wire operation control Quick Start	

02-01 Multi-Function Input Command 1 (MI1)
02-02 Multi-Function Input Command 2 (MI2)

Default: 0

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

Default: 1

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

Default: 2

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

Default: 3

Settings

0: No Function

1: Multi-step speed command 1

2: Multi-step speed command 2

3: Multi-step speed command 3

4: Multi-step speed command 4

5: Reset

6: JOG operation [by external control or KPC-CC01 (optional)]

7: Acceleration / deceleration speed inhibit

8: 1st and 2nd acceleration / deceleration time selection

9: 3rd and 4th acceleration / deceleration time selection

10: External Fault (EF) input (Pr.07-20)

11: Base Block (B.B.) input interrupted from the outside

12: Output stop

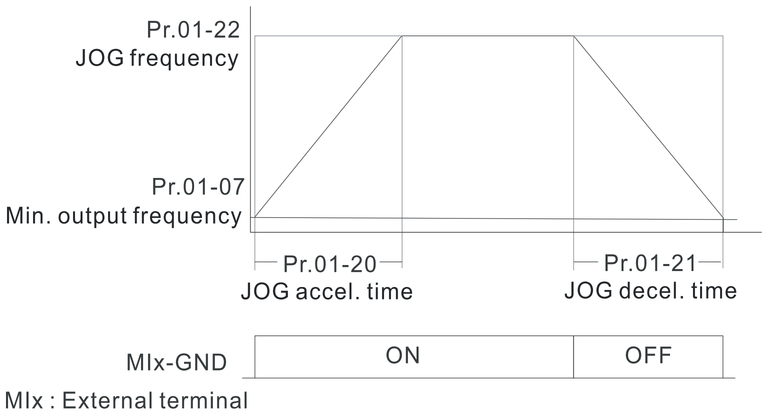
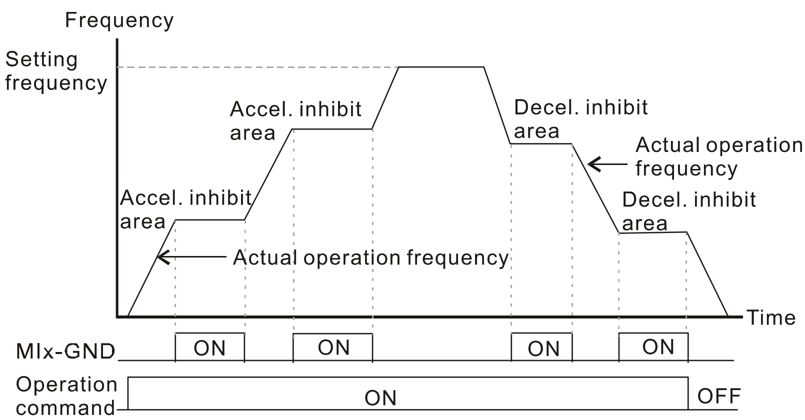
13: Cancel the setting of auto-acceleration / auto-deceleration time
15: Rotating speed command from AVI
18: Force to stop (Pr.07-20)
19: Frequency up command
20: Frequency down command
21: PID function disabled
22: Clear the counter
23: Input the counter value (MI4)
24: FWD JOG command
25: REV JOG command
28: Emergency stop (EF1)
29: Signal confirmation for Y-connection
30: Signal confirmation for   -connection
38: Disable writing EEPROM function
40: Force coasting to stop
41: HAND switch
42: AUTO switch
49: Enable drive
50: Slave dEb action to execute
56：Local / Remote selection
58: Enable fire mode (with RUN command)
59: Enable fire mode (without RUN command)
69: Enable preheating function
70: Force auxiliary frequency return to 0
71: Disable PID function, force PID output return to 0
72: Disable PID function, retain the output value before disabled
73: Force PID integral gain return to 0, disable integral
74: Reverse PID feedback
77: Program running
78: One program step completed
79: Program running completed
80: Program running paused
83: Multi-motor (IM) selection bit 0
94: Programmable AUTO RUN
95: Pausing AUTO RUN
97: Multi-pump switch by HAND / AUTO mode
98: Simple positioning stop by forward limit
99: Simple positioning stop by reverse limit

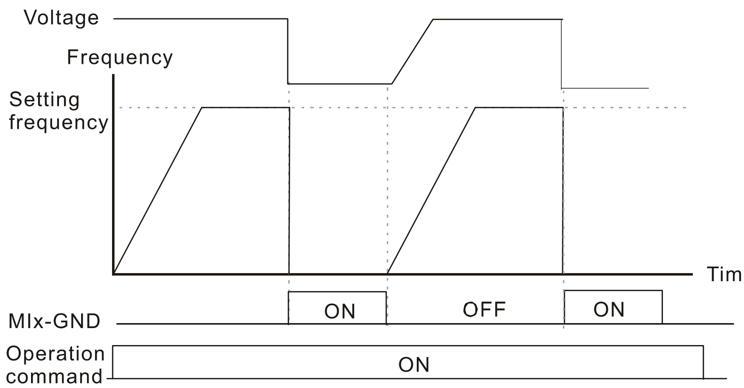
- This parameter selects the functions for each multi-function terminal.
- When Pr.02-00 = 0, you can set multi-function options with multi-function input terminals MI1, MI2.
- When Pr.02-00 ≠ 0, the multi-function input terminals MI1, MI2 work in accordance with the setting values for Pr.02-00.

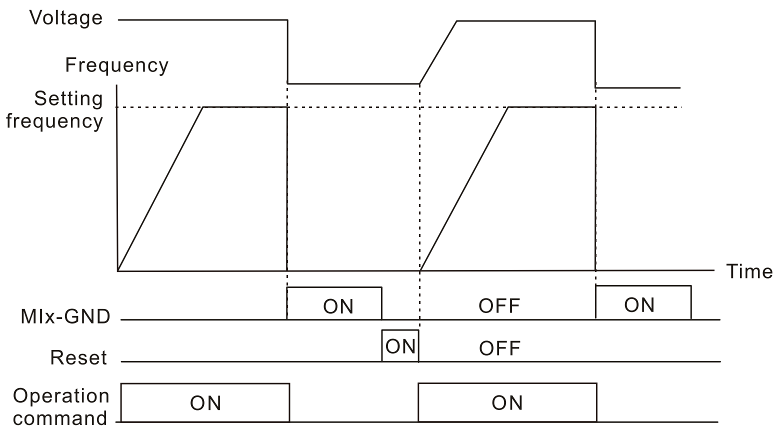
Example: If Pr.02-00 = 1: multi-function input terminal MI1 = FWD / STOP, MI2 = REV / STOP.
If Pr.02-00 = 2: multi-function input terminal MI1 = RUN / STOP, MI2 = FWD / REV.

- When multi-function input terminal MI5 = 0, MI5 is designated as a pulse input terminal.
- If Pr.02-00 is set to three-wire operation control, terminal MI3 is for the STOP contact. The function set previously for this terminal is automatically invalid.

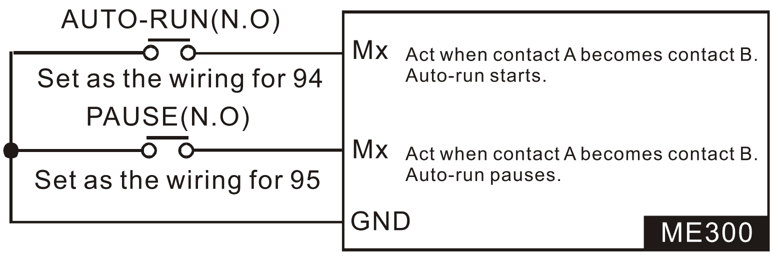
Summary of function settings (Take the normally open contact (N.O.) for example, ON: contact is closed, OFF: contact is open)

<table>
<tr><th>Setting</th><th>Functions</th><th>Descriptions</th></tr>
<tr><td>0</td><td>No function</td><td></td></tr>
<tr><td>1</td><td>Multi-step speed command 1</td><td rowspan="4">You can set 15 steps speed with the digital status of these four terminals. The 15 steps speed plus the main speed support a total of 16 speeds to be operated (refer to Parameter Group 04 Multi-step Speed Parameters).</td></tr>
<tr><td>2</td><td>Multi-step speed command 2</td></tr>
<tr><td>3</td><td>Multi-step speed command 3</td></tr>
<tr><td>4</td><td>Multi-step speed command 4</td></tr>
<tr><td>5</td><td>Reset</td><td>Use this terminal to reset the drive after clearing a drive fault.</td></tr>
<tr><td>6</td><td>JOG operation</td><td>This function is valid when the source of the operation command is the external terminals.
The JOG operation executes when the drive stops completely. While running, you can still change the operation direction, and the STOP key on the keypad* and the STOP command from communications are valid. Once the external terminal receives the OFF command, the motor stops in the JOG deceleration time. Refer to Pr.01-20–01-22 for details.
*: This function is valid when Pr.00-32 = 1.

</td></tr>
<tr><td>7</td><td>Acceleration / deceleration speed inhibit</td><td>When you enable this function, the drive stops acceleration or deceleration immediately. After you disable this function, the AC motor drive starts to accelerate or decelerate from the inhibit point.

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

Setting	Functions	Descriptions
8	1st and 2nd acceleration / deceleration time selection	You can select the acceleration and deceleration time of the drive with this function, or from the digital status of the terminals; there are four acceleration and deceleration selections.
9	3rd and 4th acceleration / deceleration time selection	
10	External Fault (EF) input	For external fault input. The drive decelerates according to the Pr.07-20 setting, and the keypad shows "EF" (it shows the fault record when an external fault occurs). It does not run again until the cause of external abnormality disappears (terminal state is restored) and reset.
11	B.B. inputs from external (B.B.: Base Block)	ON: the output of the drive stops immediately. The motor is in free run and the keypad displays the B.B. signal. Refer to Pr.07-08 for details.
12	Output stop	ON: the output of the drive stops immediately, and the motor is in free run status. The drive is in output waiting status until the switch is turned to OFF, and then the drive restarts and runs to the current setting frequency. 
13	Cancel the setting of auto-acceleration / auto-deceleration time	Set Pr.01-44 to be one of the 01–04 setting modes before using this function. When this function is enabled, the OFF state of the contact is auto mode, and the ON state of the contact is linear acceleration / deceleration.
15	Rotating speed command from AVI	ON: force the source of the drive's frequency to be AVI. (If the rotating speed commands are set to AVI and ACI at the same time, the priority is AVI > ACI.)
18	Force to stop (Pr.07-20)	ON: the drive ramps to a stop according to the Pr.07-20 setting.
19	Frequency up command	ON: the frequency of the drive increases or decreases by one unit. If this function remains ON continuously, the frequency increases or decreases according to Pr.02-09 / Pr.02-10. The Frequency command returns to zero when the drive stops and the displayed frequency is 0.00 Hz. If you select Pr.11-00, bit 7 = 1, the frequency is not saved.
20	Frequency down command	
21	PID function disabled	ON: the PID function is disabled.
22	Clear the counter	ON: the current counter value is cleared and displays 0. The drive counts up when this function is disabled.
23	Input the counter value (MI4)	ON: the counter value increases by one. Use the function with Pr.02-19.
24	FWD JOG command	This function is valid when the source of the operation command is the external terminals. ON: the drive executes forward JOG.

<table>
<tr><th>Setting</th><th>Functions</th><th>Descriptions</th></tr>
<tr><td>25</td><td>REV JOG command</td><td>This function is valid when the source of the operation command is the external terminals.
ON: the drive executes reverse JOG.</td></tr>
<tr><td>28</td><td>Emergency stop (EF1)</td><td>ON: the output of the drive stops immediately, and display “EF1” on the keypad. The motor is free running, and it does not run again until the cause of external abnormality disappears (terminal state is restored) and reset. (EF: External Fault)

</td></tr>
<tr><td>29</td><td>Signal confirmation for Y-connection</td><td>When the control mode is V/F, ON: the drive operates by the first V/F.</td></tr>
<tr><td>30</td><td>Signal confirmation for Δ-connection</td><td>When the control mode is V/F, ON: the drive operates by the second V/F.</td></tr>
<tr><td>38</td><td>Disable writing EEPROM function
(parameter memory is disabled)</td><td>ON: writing to EEPROM is disabled. (The changed parameters are invalid after powering OFF.)</td></tr>
<tr><td>40</td><td>Force coasting to stop</td><td>ON: during operation, the motor coasts to stop.</td></tr>
<tr><td>41</td><td>HAND switch</td><td rowspan="2">● When the MI terminal switches to OFF, it executes a STOP command. Therefore, if the MI terminal switches to OFF during operation, the drive stops.
● Use the optional keypad KPC-CC01 to switch between HAND and AUTO. The drive stops first, and then switches to HAND or AUTO status.
● The optional digital keypad KPC-CC01 displays the current status of the drive (HAND / OFF / AUTO).
<table>
<tr><th></th><th>bit 1</th><th>bit 0</th></tr>
<tr><td>OFF</td><td>0</td><td>0</td></tr>
<tr><td>AUTO</td><td>0</td><td>1</td></tr>
<tr><td>HAND</td><td>1</td><td>0</td></tr>
<tr><td>OFF</td><td>1</td><td>1</td></tr>
</table></td></tr>
<tr><td>42</td><td>AUTO switch</td></tr>
<tr><td>49</td><td>Enable drive</td><td>When the drive is enabled, the RUN command is valid. When the drive is disabled, the RUN command is invalid. When the drive is operating, the motor coasts to stop. This function varies with MO = 45.</td></tr>
<tr><td>50</td><td>Master dEb input</td><td>Enter the message setting in this parameter when the master triggers dEb. This ensures that the slave also triggers dEb, then the master and slave stop simultaneously.</td></tr>
</table>

<table>
<tr><th>Setting</th><th>Functions</th><th>Descriptions</th></tr>
<tr><td>56</td><td>Local / Remote selection</td><td>Need to use Pr.00-29 to select for LOCAL / REMOTE mode (refer to Pr.00-29 for more information). When Pr.00-29 is not 0, the digital keypad KPC-CC01 (optional) displays the LOC / REM status.
<table>
<tr><th></th><th>bit 0</th></tr>
<tr><td>REM</td><td>0</td></tr>
<tr><td>LOC</td><td>1</td></tr>
</table></td></tr>
<tr><td>58</td><td>Enable fire mode
(with RUN command)</td><td>When fire occurs, enable this terminal to make the drive enter the fire mode to force the drive to run. If the drive is in stop status, enable this terminal to make the drive enter the fire mode to force the drive to run according to Pr.06-80 settings. (Refer to Pr.06-80, 06-81, 06-88 for details)</td></tr>
<tr><td>59</td><td>Enable fire mode
(without RUN command)</td><td>When fire occurs, enable this terminal to make the drive enter the fire mode.
If the drive is in stop status, enable this terminal to make the drive enter the fire mode, but the drive does not run.
If the drive is in running status, enable this terminal to run the drive according to Pr.06-80 settings. (Refer to Pr.06-80, 06-81, 06-88 for details)</td></tr>
<tr><td>69</td><td>Enable preheating function</td><td>When you set MI = 69, MI determines the preheating function whether is enabled or disabled.</td></tr>
<tr><td>70</td><td>Force auxiliary frequency to be 0</td><td>Forces the auxiliary frequency to return to zero when using this function. PID keeps operating if PID is the master frequency. When Pr.00-35 ≠ 0, the master and auxiliary frequencies are enabled, and then use terminal to make the function valid to force the auxiliary frequency to be 0.</td></tr>
<tr><td>71</td><td>Disable PID function, force PID output to be 0</td><td>When the master and auxiliary frequencies are enabled and using PID function, ON: PID does not operate, returns the integral value to 0, and forces the PID output to return to 0.</td></tr>
<tr><td>72</td><td>Disable PID function, retain the output value before disabled</td><td>When the master and auxiliary frequencies are enabled, and the PID function is enabled, ON: PID does not operate, and its output value remains the same as the value before it was disabled.</td></tr>
<tr><td>73</td><td>Force PID integral gain to be 0, disable integral</td><td>ON: PID continues to operate, disables the integral control, and returns the integral value to 0.</td></tr>
<tr><td>74</td><td>Reverse PID feedback</td><td>ON: PID negative feedback becomes positive feedback, or PID positive feedback becomes negative feedback.</td></tr>
<tr><td>77</td><td>Program running</td><td>This contact is CLOSED when the drive executes PLC auto running.</td></tr>
<tr><td>78</td><td>One program step completed</td><td>This contact is CLOSED 0.5 seconds for each phase completed when the drive executes PLC auto running.</td></tr>
<tr><td>79</td><td>Program running completed</td><td>This contact is CLOSED 0.5 seconds for all phases completed when the drive executes PLC auto running.</td></tr>
<tr><td>80</td><td>Program running paused</td><td>This contact is CLOSED when the drive executes PLC auto running and the external pause auto operation terminal is activated.</td></tr>
</table>

<table>
<tr><th>Setting</th><th>Functions</th><th>Descriptions</th></tr>
<tr><td>83</td><td>Multi-motor (IM) selection bit 0</td><td>ON: parameters can be changed. Example: MI1 = 83
<table>
<tr><th rowspan="2">MI1</th><th rowspan="2">Motor Selection</th><th colspan="2">Related Motor Parameter</th></tr>
<tr><th>Maximum operation frequency</th><th>V/F Curve Parameters</th></tr>
<tr><td>OFF</td><td>Motor 1</td><td>Pr.01-00</td><td>Pr.01-01–01-08</td></tr>
<tr><td>ON</td><td>Motor 2</td><td>Pr.01-52</td><td>Pr.01-35–01-42</td></tr>
</table></td></tr>
<tr><td>94</td><td>Programmable AUTO RUN</td><td rowspan="2">

When the functional terminals for programmable auto-run enable, the output frequency of the AC motor drive operates automatically according to the settings for multi-step speed. You can pause the terminals to temporarily stop the running program during operation. The program resumes running after the pausing finishes.</td></tr>
<tr><td>95</td><td>Pausing AUTO RUN</td></tr>
<tr><td>97</td><td>Multi-pump switch by HAND / AUTO mode</td><td>Use this terminal to switch between Hand / Auto mode.</td></tr>
<tr><td>98</td><td>Simple positioning stop by forward limit</td><td>If the motor receives this signal while running forward, it stops running forward.</td></tr>
<tr><td>99</td><td>Simple positioning stop by reverse limit</td><td>If the motor receives this signal while running reverse, it stops running reverse.</td></tr>
</table>

02-09 External Terminals UP / DOWN Key Mode

Default: 0

Settings 0: According to acceleration / deceleration time

1: Constant speed (Pr.02-10)

2: Pulse signal (Pr.02-10)

3: Curve

4: Steps (Pr.02-10)

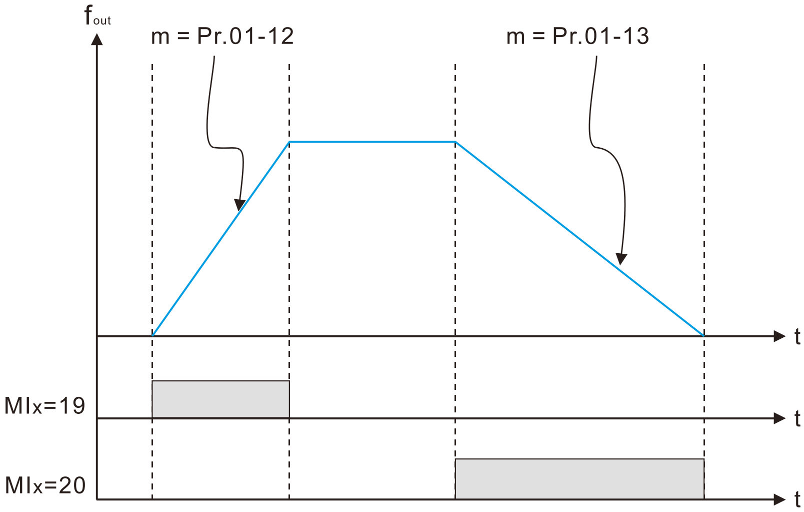
02-10 Acceleration / Deceleration Speed of External Terminal UP / DOWN Keys

Default: 0.001

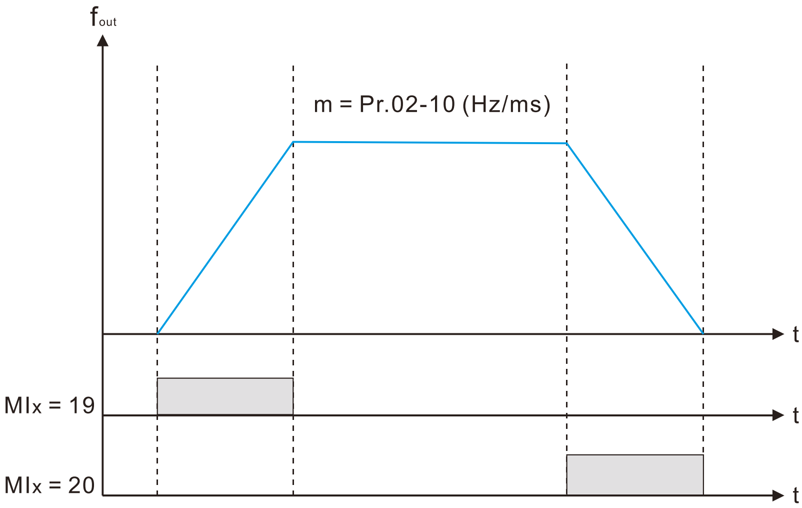
Settings 0.001–1.000 Hz / ms

- When multi-function input terminals are 19 (Frequency up command) and 20 (Frequency down command), the frequency commands increase and decrease according to Pr.02-09 and Pr.02-10.
- When Pr.11-00 bit 7 = 1, the frequency is not saved. The Frequency command returns to zero when the drive stops, and the displayed frequency is 0.00 Hz. At this time, increase or decrease the Frequency command (F) by using the UP or DOWN key is valid when the drive is running.

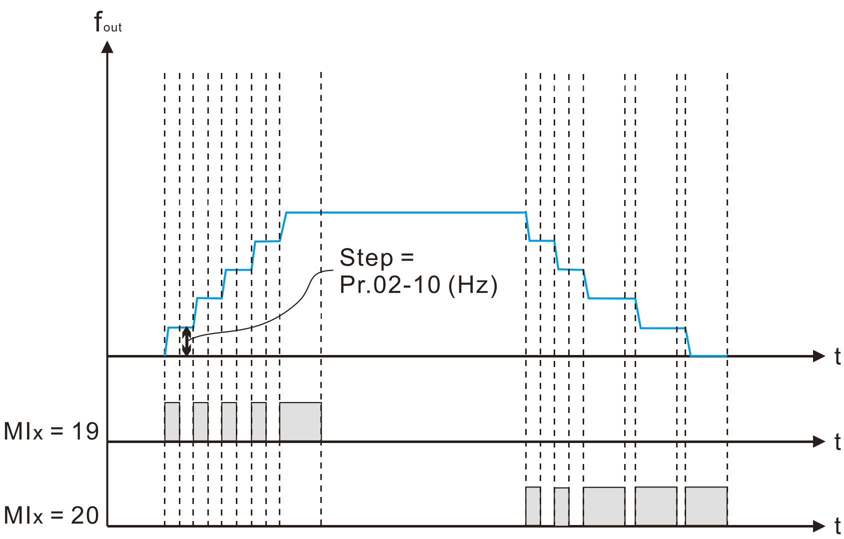
📖 When Pr.02-09 is set to 0: The increasing or decreasing Frequency command (F) operates according to the setting for acceleration or deceleration time (refer to Pr.01-12–01–19).



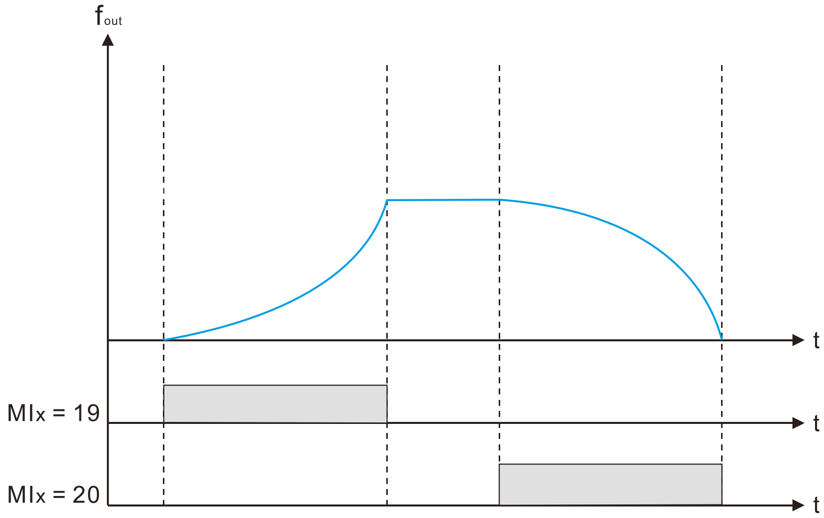
📖 When Pr.02-09 is set to 1: The increasing or decreasing Frequency command (F) operates according to the setting of Pr.02-10 (0.01–1.000 Hz/ms).



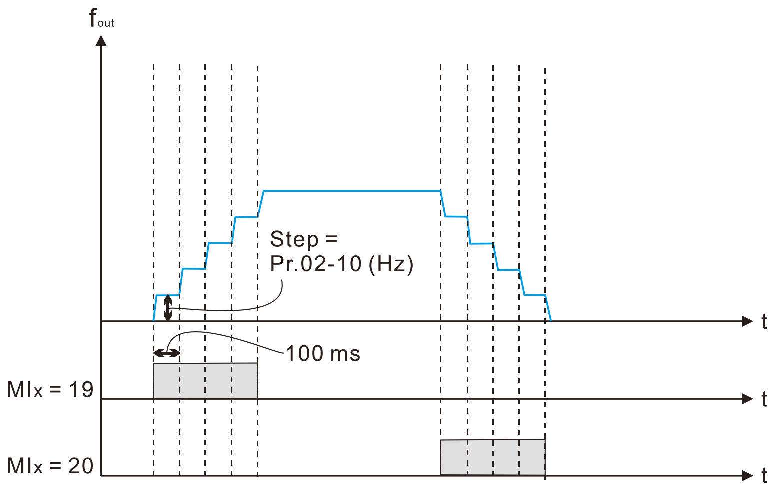
📖 When Pr.02-09 is set to 2: The increasing or decreasing Frequency command (F) operates according to the pulse of Pr.02-10.



- When Pr.02-09 is set to 3: The increasing or decreasing Frequency command (F) operates according to the exponential curve.



- When Pr.02-09 is set to 4: The increasing or decreasing Frequency command (F) operates according to the setting of Pr.02-10 for every 100 ms.



02-11 Multi-Function Input Response Time

Default: 0.005

Settings 0.000–30.000 sec.

- Use this parameter to set the response time of the digital input terminals MI1–MI5.
- This function is to delay and confirm the digital input terminal signal. The time for delay is also the time for confirmation. The confirmation prevents interference that could cause error in the input to the digital terminals. But in the meanwhile, it delays the response time though confirmation improves accuracy.

02-12 Multi-Function Input Mode Selection

Default: 0

Settings 0–65535

- The parameter setting is in decimal.
- This parameter sets the status of the multi-function input signal (0: normally open; 1: normally closed) and it is not affected by the status of SINK / SOURCE.

- bit 0–bit 4 correspond to MI1–MI5.
- The default for bit 0 (MI1) is FWD terminal, and the default for bit 1 (MI2) is REV terminal. If the MI1 and MI2 are not used as two-wire / three-wire control method, set Pr.02-00 = 0. Then set this parameter according to the functional requirements of terminals MI1 and MI2 (refer to Pr.02-01 and Pr.02-02).
- You can change the terminal ON / OFF status through communications.
  For example: MI3 is set to 1 (multi-step speed command 1) and MI4 is set to 2 (multi-step speed command 2).
  Then the forward + second step speed command = $1001_2 = 9_{10}$.
  As long as Pr.02-12 = 9 is set through communications, there is no need to wire any multi- function terminals to run forward with the second step speed.

bit 4	bit 3	bit 2	bit 1	bit 0
MI5	MI4	MI3	MI2	MI1

- Use Pr.11-42 bit 1 to select whether FWD / REV terminal is controlled by Pr.02-12 bit 0 and bit 1.

02-13 Multi-Function Output 1 (RY1)

Default: 11

02-16 Multi-Function Output 2 (MO1)

Default: 0

Settings
0: No Function
1: Indication during RUN
2: Operation speed reached
3: Desired frequency reached 1 (Pr.02-22)
4: Desired frequency reached 2 (Pr.02-24)
5: Zero speed (Frequency command)
6: Zero speed including STOP (Frequency command)
7: Over-torque 1 (Pr.06-06–06-08)
8: Over-torque 2 (Pr.06-09–06-11)
9: Drive is ready
10: Low voltage warning (Lv) (Pr.06-00)
11: Malfunction indication
13: Overheat warning (Pr.06-15)
14: Software brake signal indication (Pr.07-00)
15: PID feedback error (Pr.08-13, 08-14)
16: Slip error (oSL)
17: Count value reached, does not return to 0 (Pr.02-20)
18: Count value reached, return to 0 (Pr.02-19)
19: External interrupt B.B. input (Base Block)
20: Warning output
21: Over-voltage
22: Over-current stall prevention

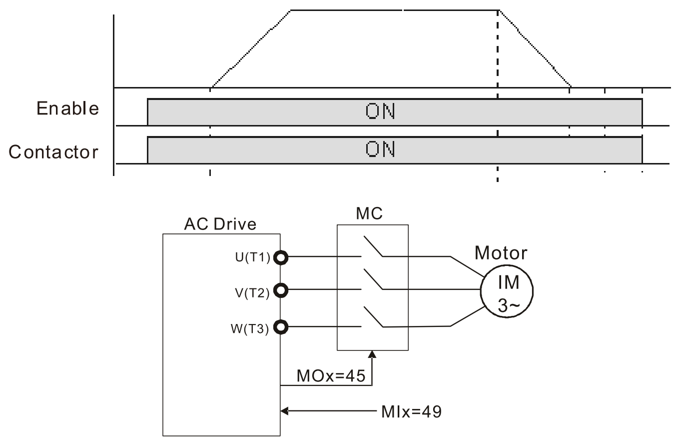
23: Over-voltage stall prevention
24: Operation mode
25: Forward command
26: Reverse command
29: Output when frequency ≥ Pr.02-34
30: Output when frequency < Pr.02-34
31: Y-connection for the motor coil
32: Δ-connection for the motor coil
33: Zero speed (actual output frequency)
34: Zero speed including STOP (output frequency)
35: Error output selection 1 (Pr.06-23)
36: Error output selection 2 (Pr.06-24)
37: Error output selection 3 (Pr.06-25)
38: Error output selection 4 (Pr.06-26)
40: Speed reached (including STOP)
42: Crane function
43: Actual motor speed detection
44: Low current output (use with Pr.06-71–Pr.06-73)
45: UVW output electromagnetic valve switch
46: Master dEb output
51: Analog output control for RS-485 interface
53: Fire mode indication
67: Analog input level reached
69: Indication of preheating operation
75: Forward RUN status
76: Reverse RUN status
77: Program running
78: One program step completed
79: Program running completed
80: Program running paused
81: Indication of multi-pump system error (only Master)

📖 This parameter selects the functions for each multi-function terminal.

Summary of function settings (Take the normally open contact (N.O.) for example, ON: contact is closed, OFF: contact is open)

Setting	Functions	Descriptions
0	No function	Output terminal with no function
1	Indication during RUN	Activates when the drive is not in STOP.
2	Operation speed reached	Activates when output frequency of drive reaches to the setting frequency.
3	Desired frequency reached 1 (Pr.02-22)	Activates when the desired frequency (Pr.02-22) is reached.
4	Desired frequency reached 2 (Pr.02-24)	Activate when the desired frequency (Pr.02-24) is reached.

Setting	Functions	Descriptions
5	Zero speed (Frequency command)	Activate when Frequency command = 0. (the drive must be in RUN status)
6	Zero speed including STOP (Frequency command)	Activate when Frequency command = 0 or stopped.
7	Over-torque 1	Activate when the drive detects over-torque. Pr.06-07 sets the over-torque detection level, and Pr.06-08 sets the over-torque detection time. (Refer to Pr.06-06–06-08)
8	Over-torque 2	Activate when the drive detects over-torque. Pr.06-10 sets the over-torque detection level, and Pr.06-11 sets the over-torque detection time. (Refer to Pr.06-09–06-11)
9	Drive is ready	Activate when the drive is ON with no error detected.
10	Low voltage warning (Lv)	Activate when an extremely low voltage at DC side is detected. Activates when the DC bus voltage is too low. (refer to Pr.06-00 Low Voltage Level)
11	Malfunction indication	Activate when fault occurs (except Lv stop).
13	Overheat warning	Activate when IGBT or heat sink overheats to prevent the drive from shutting down due to overheating. (Refer to Pr.06-15)
14	Software brake signal indication	Activate when the software brake function is ON. (refer to Pr.07-00).
15	Abnormal PID feedback (Pr.08-13, Pr.08-14)	Activate when the PID feedback signal error is detected.
16	Slip error (oSL)	Activate when the slip error is detected.
17	Count value reached (Pr.02-20)	When the drive executes external counter, this contact activates if the count value is equal to the setting value for Pr.02-20. This contact deactivates when the setting value for Pr.02-20 > Pr.02-19.
18	Count value reached (Pr.02-19)	When the drive executes the external counter, this contact activates if the count value is equal to the setting value for Pr.02-19.
19	External interrupt B.B. Input (Base Block)	Activates when external interrupt (B.B.) occurs in the drive and stops outputting.
20	Warning output	Activate when a warning is detected.
21	Over-voltage	Activate when over-voltage is detected. (Refer to Chapter 14 for the action conditions of over voltage related fault codes)
22	Over-current stall prevention	Activate when the over-current stall prevention is detected.
23	Over-voltage stall prevention	Activate when over-voltage stall prevention is detected.
24	Operation mode	Activate when the source of operation command is not controlled by the digital keypad (Pr.00-21 ≠ 0).
25	Forward command	Activate when the operation direction is forward.
26	Reverse command	Activate when the operation direction is reverse.
29	Output when frequency ≥ Pr.02-34	Activate when the frequency is ≥ Pr.02-34 (actual output frequency H ≥ Pr.02-34)

Setting	Functions	Descriptions
30	Output when frequency < Pr.02-34	Activate when the frequency is < Pr.02-34 (actual output frequency H < Pr.02-34)
31	Y-connection for the motor coil	Activate when Pr.05-24 = 1, the frequency output is lower than Pr.05-23 minus 2 Hz and the time is longer than Pr.05-25.
32	Δ-connection for the motor coil	Activate when Pr.05-24 = 1, the frequency output is higher than Pr.05-23 plus 2 Hz and the time is longer than Pr.05-25.
33	Zero speed (actual output frequency)	Activate when the actual output frequency is 0 (the drive is in RUN mode).
34	Zero speed including STOP (output frequency)	Activate when the output frequency is 0 or stopped.
35	Error output selection 1 (Pr.06-23)	Activate when Pr.06-23 is ON.
36	Error output selection 2 (Pr.06-23)	Activate when Pr.06-24 is ON.
37	Error output selection 3 (Pr.06-23)	Activate when Pr.06-25 is ON.
38	Error output selection 4 (Pr.06-23)	Activate when Pr.06-26 is ON.
40	Speed reached (including Stop)	Activate when the drive's output frequency reaches the setting frequency or stopped.
42	Crane function	Use this function with Pr.02-34 and Pr.02-58. Refer to Pr.02-34 and 02-58 for details and application examples.
43	Actual motor speed detection	Activate when the motor actual speed is less than Pr.02-47.
44	Low current output	Use this function with Pr.06-71–Pr.06-73.
45	UVW output electromagnetic valve switch	Use this function with external terminal input = 49 (drive enabled) and external terminal output = 45 (electromagnetic valve enabled), and then the electromagnetic valve is ON or OFF according to the status of the drive. 
46	Master dEb output	When dEb rises at the master, MO sends a dEb signal to the slave. Output the message when the master triggers dEb. This ensures that the slave also triggers dEb. Then the slave follows the deceleration time of the master to stop simultaneously with the master.

Setting	Functions	Descriptions
51	Analog output control for RS-485 interface	For RS-485 communication control output.
53	Fire mode indication	Activate when MI setting 58 or 59 is enabled.
67	Analog input level reached	The multi-function output terminals operate when the analog input level is between the high level and the low level. Pr.03-44: Select one of the analog input channels (AVI, ACI) to be compared. Pr.03-45: The high level for the analog input, default is 50%. Pr.03-46: The low level for the analog input, default is 10%. If analog input > Pr.03-45, the multi-function output terminal operates. If analog input < Pr.03-46, the multi-function output terminal stops outputting.
69	Indication of preheating operation	Activate when enabling the function.
75	Forward RUN status	When the drive runs FWD, the output terminal for forward running is closed; when the drive stops, the output terminal for forward running is open.
76	Reverse RUN status	When the drive runs REV, the output terminal for reverse running is closed; when the drive stops, the output terminal for reverse running is open.
77	Program running	This contact is CLOSED when the drive executes PLC auto running.
78	One program step completed	This contact is CLOSED 0.5 seconds for each phase completed when the drive executes PLC auto running.
79	Program running completed	This contact is CLOSED 0.5 seconds for each phase completed when the drive executes PLC auto running.
80	Program running paused	This contact is CLOSED when the drive executes PLC auto running and the external pause auto operation terminal is activated.
81	Indication of multi-pump system error (only Master)	When all AC motor drives in multi-pump system are failed, the contact is closed.

✓ 02-18 Multi-function Output Direction

Default: 0000h

Settings 0000h–FFFFh (0: N.O.; 1: N.C.)

📖 The parameter setting is in hexadecimal.

📖 This parameter is set by a bit. If the bit is 1, the corresponding multi-function output acts in an opposite way. Example: Assume Pr.02-13 = 1 (indication when the drive is operating). If the output is positive, and the bit is set to 0, then Relay is ON when the drive runs and is OFF when the drive stops. On the contrary, if the output is negative, and the bit is set to 1, then the Relay is OFF when the drive runs and is ON when the drive stops.

bit3	bit2	bit1	bit0
MO1	Reserved	Reserved	RY

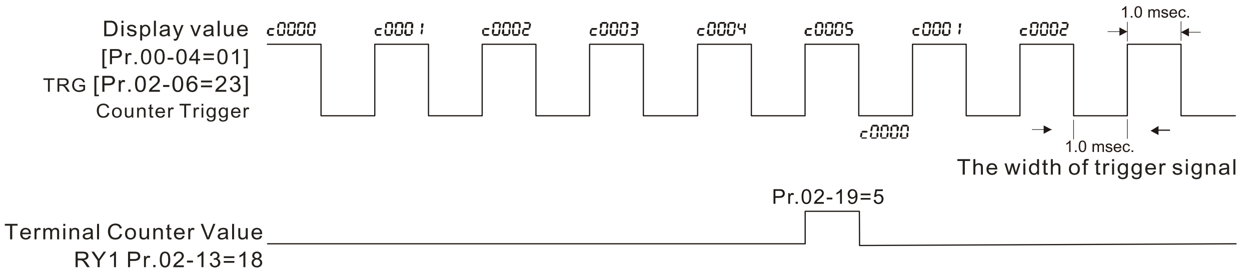
02-19 Terminal Counting Value Reached (returns to 0)

Default: 0

Settings 0–65500

- The counting function is enabled when Pr.02-19≠0.
- You can set the input point for the counter using the multi-function terminal MI4 as a trigger terminal (set Pr.02-04 to 23). When counting is completed, the specified multi-function output terminal is activated (Pr.02-13 or Pr.026 is set to 18).

The timing diagram below shows that when counting to 5, RY1 activates and displays 0.



The timing diagram of
the external counting terminals and the counting value reached

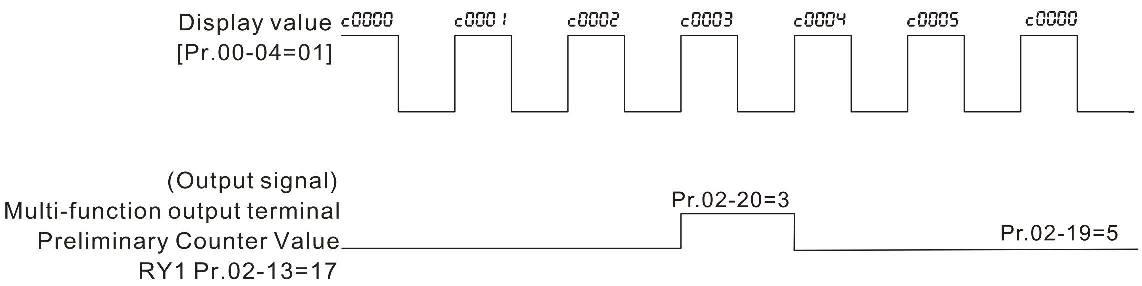
02-20 Preliminary Counting Value Reached (does not return to 0)

Default: 0

Settings 0–65500

- Use this parameter with Pr.02-19.
- When the count value counts from 1 to reach this value, the corresponding multi-function output terminal is activated (Pr.02-13 and Pr.02-16 are set to 17) and keeps counting to the last count value.
- You can use this parameter as the end of counting to make the drive run from the low speed to stop.

The timing diagram is RY1 activates when the count value is three, and the display returns to zero when counts to five:



The timing diagram of
the external counting terminals and the counting value reached

02-22 Desired Frequency Reached 1

Default: 60.00 / 50.00

Settings 0.00–599.00 Hz

02-24 Desired Frequency Reached 2

Default: 60.00 / 50.00

Settings 0.00–599.00 Hz

02-23 The Width of the Desired Frequency Reached 1

Default: 2.00

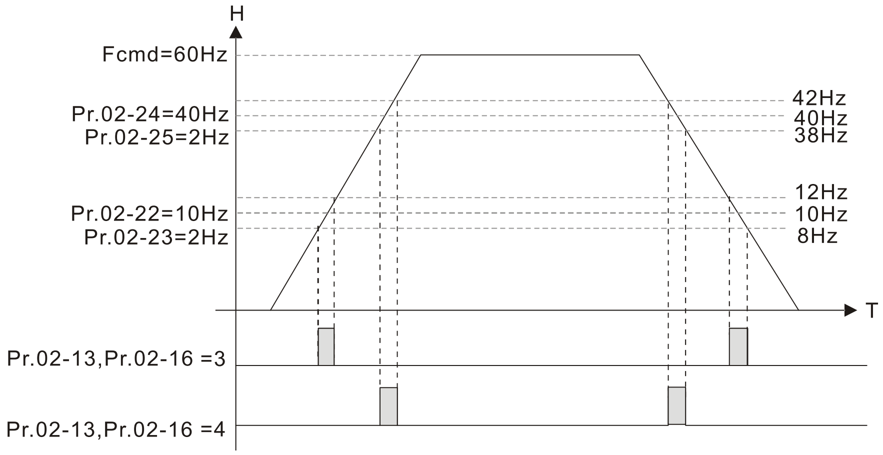
Settings 0.00–599.00 Hz

02-25 The Width of the Desired Frequency Reached 2

Default: 2.00

Settings 0.00–599.00 Hz

- Once the output speed (frequency) reaches the desired speed (frequency), if the corresponding multi-function output terminal is set to 3 or 4 (Pr.02-13, Pr.02-16), this multi-function output terminal is "closed".



02-34 Output Frequency Setting for Multi-function Output Terminal

Default: 0.00

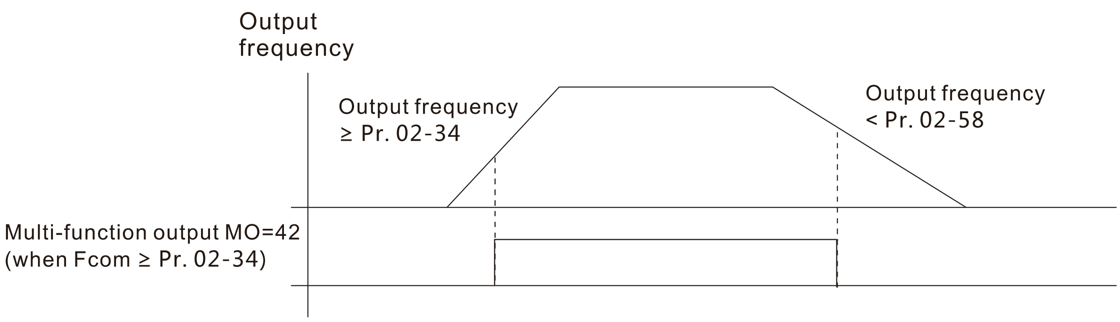
Settings 0.00–599.00 Hz

02-58 Multi-function Output Terminal (Function 42): Brake Frequency Check Point

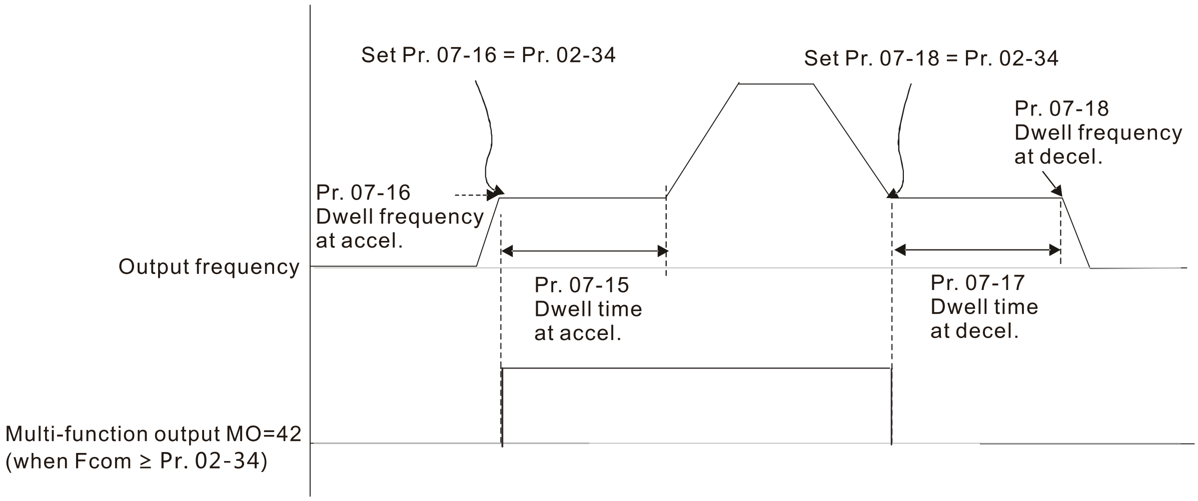
Default: 0.00

Settings 0.00–599.00 Hz

- You can use Pr.02-34 with Pr.02-58 for the crane function. You can choose the crane action # 42 to set the multi-function outputs Pr.02-13 and Pr.02-16.
- When the output frequency of the drive is higher than the setting for Pr.02-34 frequency level (≥ Pr.02-34), choose # 42 to set the multi-function output terminal.
- When the output frequency is lower than the setting for Pr.02-58 (< Pr.02-58), choose # 42 to disable the multi-function output terminal.
- Crane application example:



It is recommended that you use this with the Dwell acceleration/deceleration function as shown in the following diagram.



02-35 External Operation Control Selection after Reset and Reboot

Default: 0

Settings 0: Disabled

1: Drive runs if the RUN command remains after reset or reboot.

Set value as 1.

Please pay attention that the drive will execute the running command by itself in the following status.

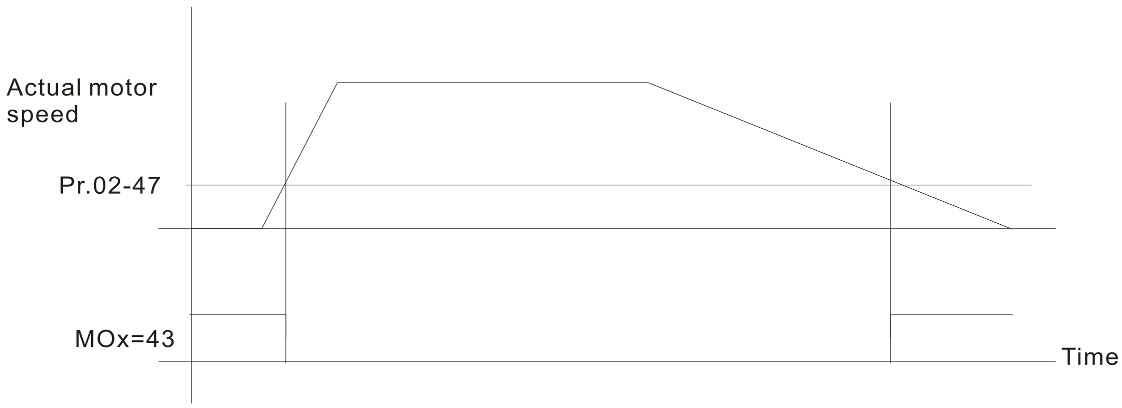
- Situation 1: After the drive is powered on and the external terminal for RUN stays ON, the drive runs.
- Situation 2: After clearing a fault once a fault is detected and the external terminal for RUN stays ON, you can run the drive by pressing the RESET key.

02-47 Motor Zero-speed Level

Default: 0

Settings 0–65535 rpm

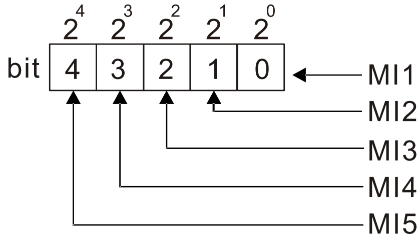
- Use this parameter to set the motor's speed level at zero-speed. When the actual speed is lower than this setting, the corresponding multi-function output terminal setting 43 is ON (by default), as shown in the diagram below.



02-50 Display the Status of Multi-function Input Terminal

Default: Read only

Settings Monitor the status of the Multi-function Input Terminal

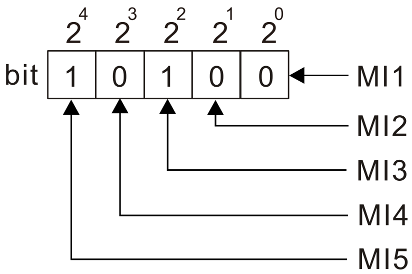


0=OFF
1=ON

NOTE
$2^4 = 16$ $2^3 = 8$ $2^2 = 4$
$2^1 = 2$ $2^0 = 1$

Example:

When Pr.02-50 displays 0014h (hex) (that is, the value is 52 (decimal) and 10100 (binary)), it means that MI3 and MI5 are ON.



0=OFF
1=ON

Setting

bit 4 x 2^4 + bit 2 x 2^2

1 x 2^4 + 1 x 2^2

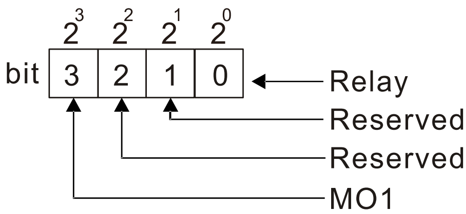
16 + 4 =20

NOTE
$2^4 = 16$ $2^3 = 8$ $2^2 = 4$
$2^1 = 2$ $2^0 = 1$

02-51 Display the Status of Multi-function Output Terminal

Default: Read only

Settings Monitor the status of the Multi-function Output Terminal

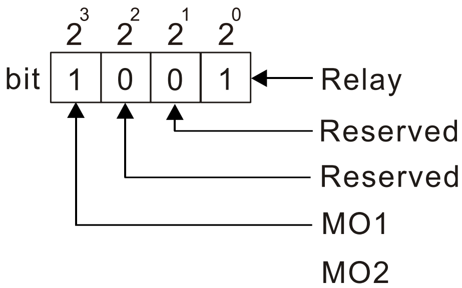


0=OFF
1=ON

NOTE
$2^3 = 8$ $2^2 = 4$
$2^1 = 2$ $2^0 = 1$

Example:

When Pr.02-51 displays 0009h (hex) (that is, the value is 9 (decimal) and 01001 (binary)), it means that Relay and MO1 are ON.



0=OFF
1=ON

Setting

= bit 3 x 2^3 + bit 0 x 2^0

= 1 x 2^3 + 1 x 2^0

= 8 + 1

= 9

NOTE
$2^3 = 8$ $2^2 = 4$
$2^1 = 2$ $2^0 = 1$

02-54 Display the Frequency Command Executed by External Terminal

Default: Read only

Settings Read only

- When you set the source of the Frequency command as the external terminal, if Lv or Fault occurs, the external terminal Frequency command is saved in this parameter.

02-72 Preheating DC Current Level

Default: 0

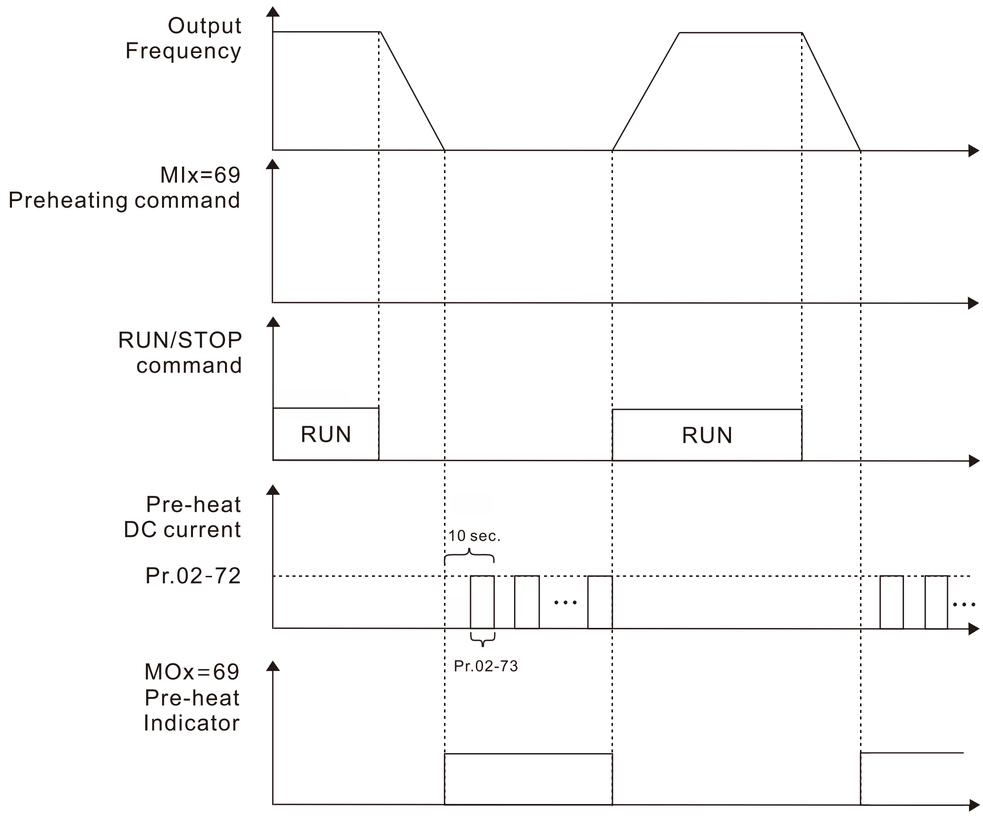
Settings 0–100%

02-73 Preheating DC current duty cycle

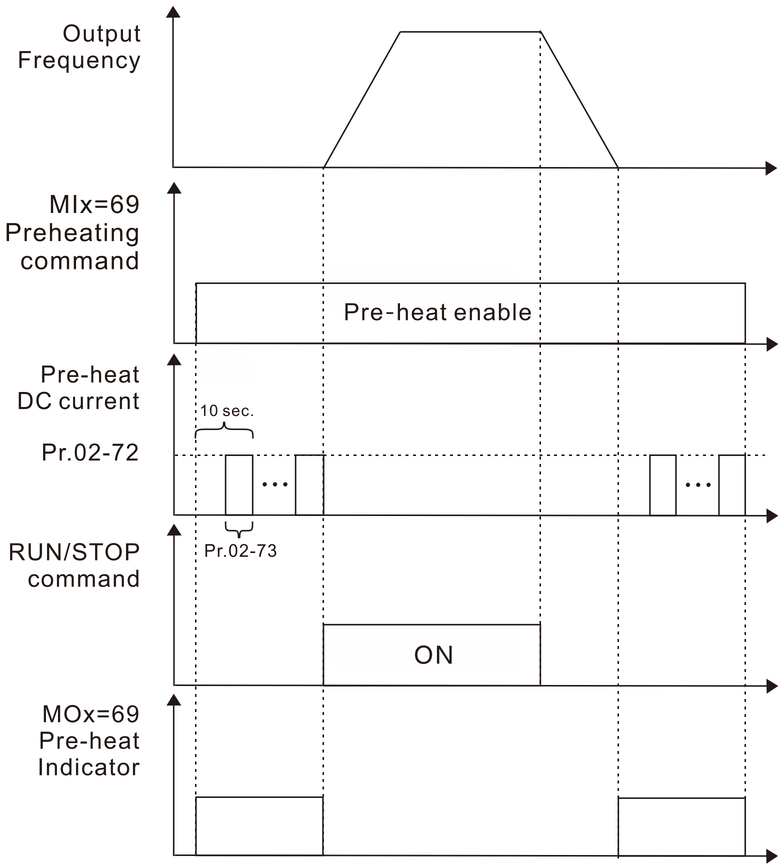
Default: 0

Settings 0–100%

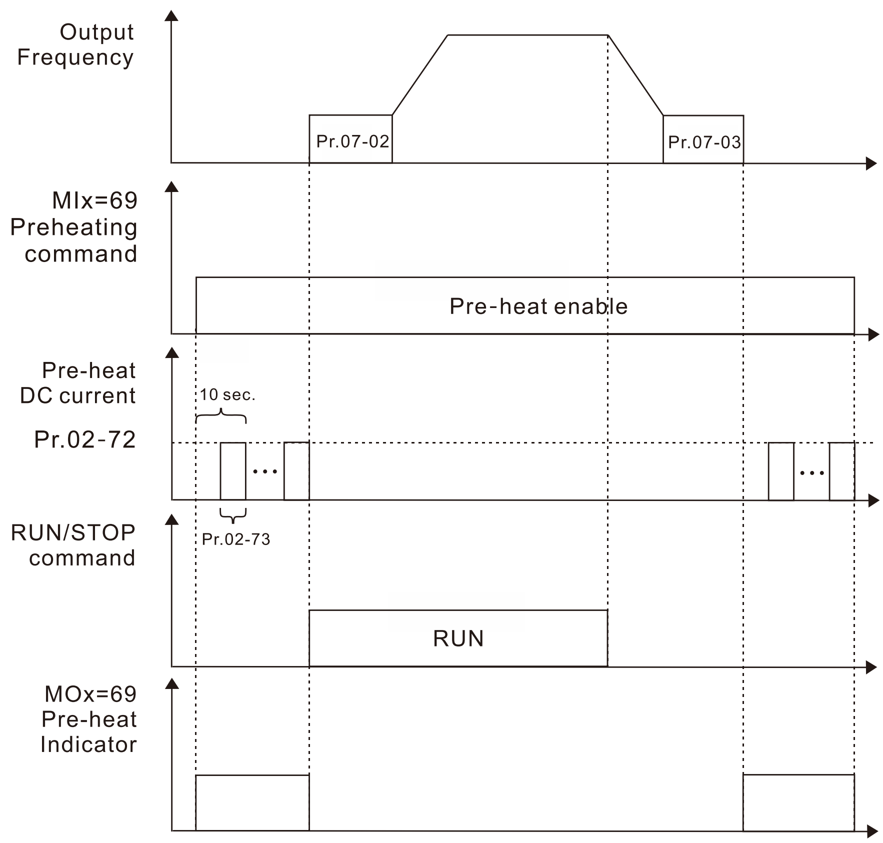
- This parameter is to set up the duty cycle of the preheating DC current input to the motor. 0–100% corresponds to 0–10 sec. If the setting is 0%, there is no output current from the motor drive; if the setting is 100%, there is continuous output DC current. For example, when the setting of this parameter is 50%, the cycle time is the time spent to input current to motor for 5 seconds and stop inputting for 5 seconds. When MI #69 is enabled, this parameter operates periodically with MI#69 until the motor drive starts to run the motor or until MI#69 is disabled.
- Preheating function works only when the setting value for Pr.02-72 and Pr.02-73 are not 0.
- When MI=69 (enable preheating function) is enabled, MI=69 controls the start and stop of preheating function.
- If user doesn't set MI=69 (enable preheating function), this function activates when the first operation stops, or immediately activates after rebooting.
- The figure below shows the timing relationship when MI=69 enable preheating function is enabled and when preheating DC current is enabled and cycle time is 50%.



📖 The figure below shows the timing relationship when MI=69 enable preheating function is disabled and when preheating DC current is enabled and cycle time is 50%. When the motor drive is stopped, the preheating function starts to output DC current continuously.



📖 The figure below shows the timing relationship between preheating function and enabling DC brake.



✓ 02-81 EF Activates when the Terminal Count Value Reached

Default: 0

Settings 0: Terminal count value reached, no EF displays (continues to operate)

1: Terminal count value reached, EF activates

✓ 02-82 Initial Frequency Command (F) Mode after Stop

Default: 0

Settings 0: Use current Frequency command

1: Use zero Frequency command

2: Refer to Pr.02-83 to set up

✓ 02-83 Initial Frequency Command (F) Setting after Stop

Default: 60.00

Settings 0.00–599.00 Hz

03 Analog Input / Output Parameters

⚡ You can set this parameter during operation.

⚡ 03-00 AVI Analog Input Selection

Default: 1

Settings
0: No Function
1: Frequency command
4: PID target value
5: PID feedback signal
6: Thermistor (PTC) input value
11: PT100 thermistor input value
12: Auxiliary frequency input
13: PID compensation value

- When you use analog input as the PID reference target input, you must set Pr.00-20 to 2 (external analog input).
  Setting method 1: Pr.03-00 set 1 as frequency command.
  Setting method 2: Pr.03-00 set 4 as PID reference target input.
- When you use analog input as the PID compensation value, you must set Pr.08-16 to 1 (source of PID compensation value is analog input). You can see the compensation value with Pr.08-17.
- When using the frequency command, the corresponding value for 0–10 V / 4–20 mA is 0–maximum operation frequency (Pr.01-00).

⚡ 03-03 Analog Input Bias (AVI)

Default: 0

Settings -100.0–100.0%

- Sets the corresponding AVI voltage for the external analog input 0.

⚡ 03-04 Analog Input Bias (ACI)

Default: 0

Settings -100.0–100.0%

- Sets the corresponding ACI current for the external analog input 0.

⚡ 03-07 Positive / Negative Bias Mode (AVI)
⚡ 03-08 Positive / Negative Bias Mode (ACI)

Default: 0

Settings 0: No bias
1: Lower than or equal to bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

- Using negative bias to set the frequency greatly reduces the noise interference. In a noisy environment, do NOT use signals less than 1 V to set the drive's operation frequency.

03-10 Reverse Setting when Analog Signal Input is Negative Frequency

Default: 0

Settings 0: Negative frequency input is not allowed. The digital keypad or external terminal controls the forward and reverse direction.

1: Negative frequency input is allowed. Positive frequency = run in a forward direction; negative frequency = run in a reverse direction. The digital keypad or external terminal control cannot change the running direction.

- Use this parameter only for AVI or ACI analog input.
- Conditions for negative frequency (reverse running)

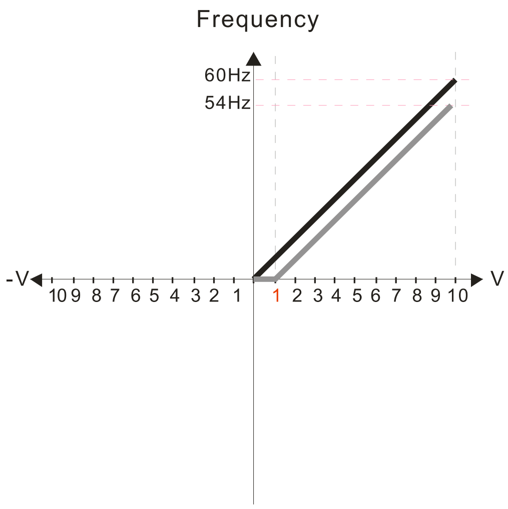
  Pr.03-10 = 1

  Bias mode = Bias serves as the center

  Corresponded analog input gain < 0 (negative); this makes the input frequency negative.

In the diagram below: Black line: Curve with no bias. Gray line: curve with bias

Diagram 01



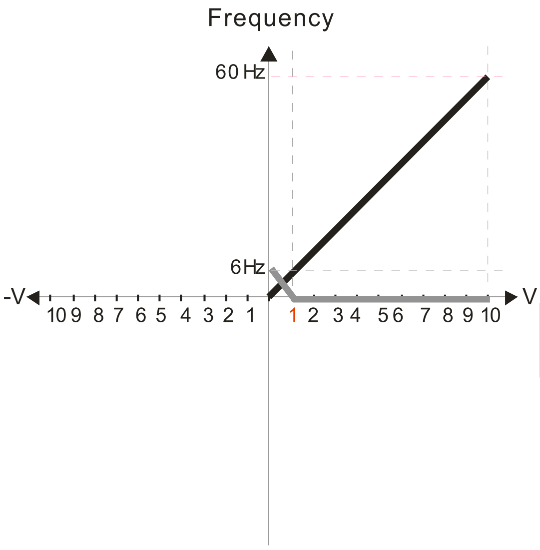
Pr.03-03=10%
Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)
0: Negative frequency is not valid. Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid. Positive frequency = forward run; negative frequency = reverse run. Direction can not be switched by digital keypad or external terminal control.

Pr.03-11 Analog input Gain (AVI) = 100%

Diagram 02



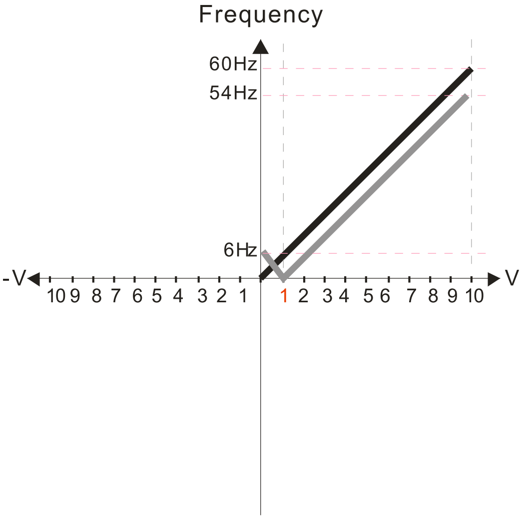
Pr.03-03=10%
Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)
0: Negative frequency is not valid. Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid. Positive frequency = forward run; negative frequency = reverse run. Direction can not be switched by digital keypad or external terminal control.

Pr.03-11 Analog input Gain (AVI) = 100%

Diagram 03



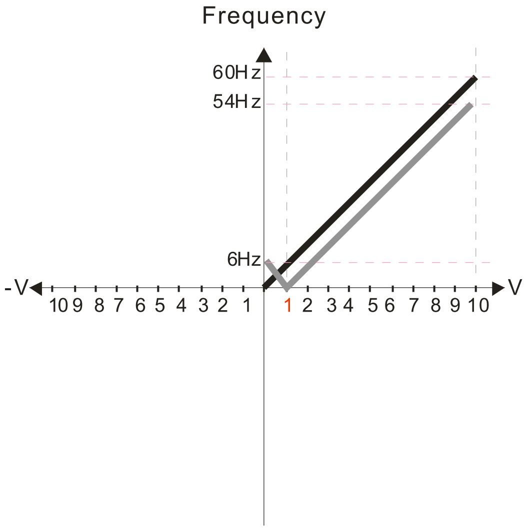
Pr.03-03=10%
Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)
0: Negative frequency is not valid. Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid. Positive frequency = forward run; negative frequency = reverse run. Direction can not be switched by digital keypad or external terminal control.

Pr.03-11 Analog input Gain (AVI) = 100%

Diagram 04



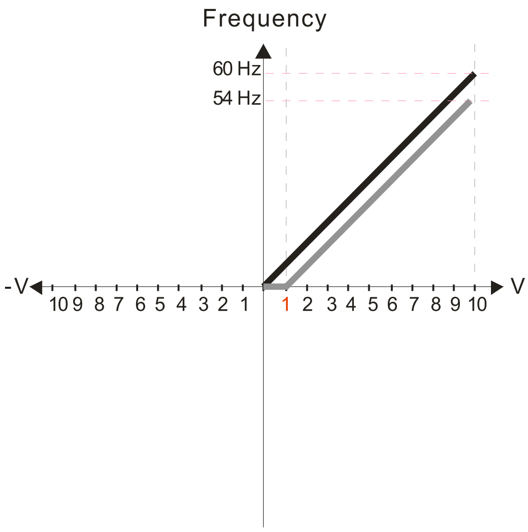
Pr.03-03=10%
Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)
0: Negative frequency is not valid. Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid. Positive frequency = forward run; negative frequency = reverse run. Direction can not be switched by digital keypad or external terminal control.

Pr.03-11 Analog input Gain (AVI) = 100%

Diagram 05



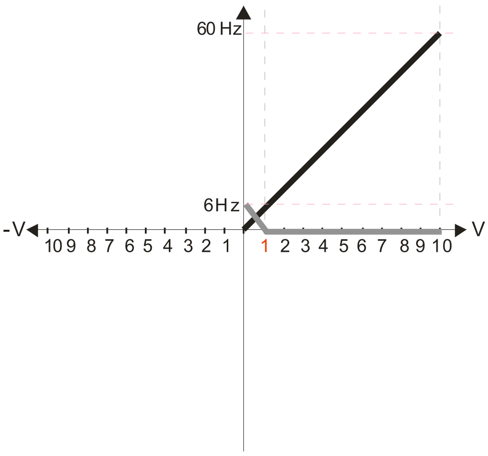
Pr.03-03=10%
Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)
0: Negative frequency is not valid. Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid. Positive frequency = forward run; negative frequency = reverse run. Direction can not be switched by digital keypad or external terminal control.

Pr.03-11 Analog input Gain (AVI) = 100%

Diagram 06



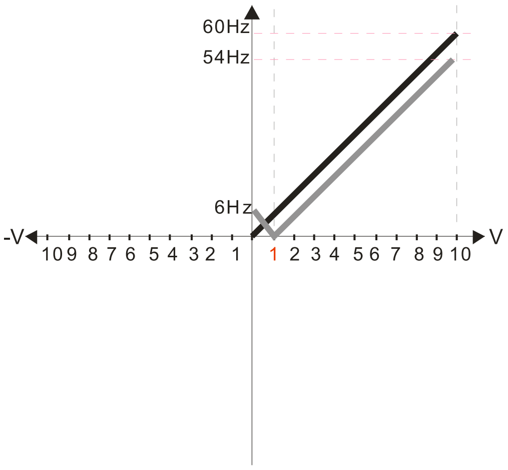
Pr.03-03=10%
Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)
0: Negative frequency is not valid. Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid. Positive frequency = forward run; negative frequency = reverse run. Direction can not be switched by digital keypad or external terminal control.

Pr.03-11 Analog input Gain (AVI) = 100%

Diagram 07



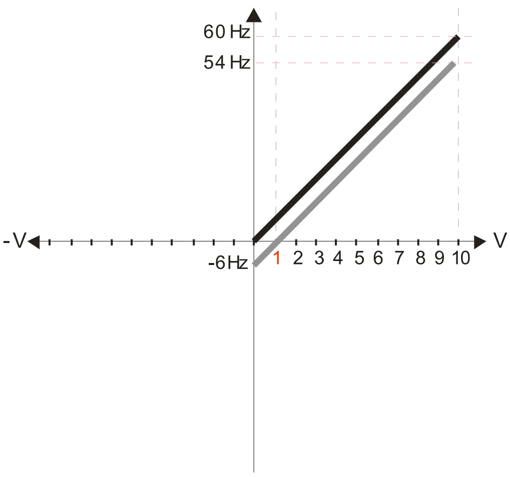
Pr.03-03=10%
Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)
0: Negative frequency is not valid. Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid. Positive frequency = forward run; negative frequency = reverse run. Direction can not be switched by digital keypad or external terminal control.

Pr.03-11 Analog input Gain (AVI) = 100%

Diagram 08



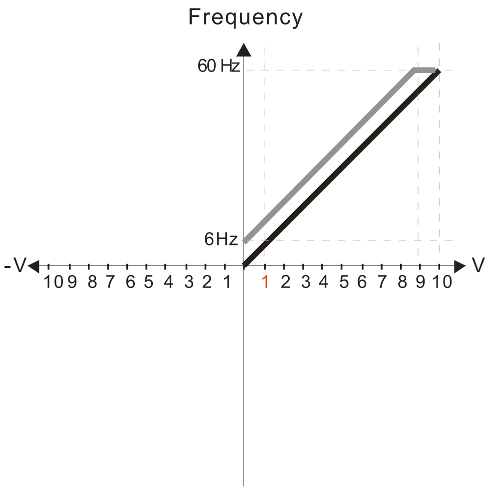
Pr.03-03=10%
Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)
0: Negative frequency is not valid. Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid. Positive frequency = forward run; negative frequency = reverse run. Direction can not be switched by digital keypad or external terminal control.

Pr.03-11 Analog input Gain (AVI) = 100%

Diagram 09



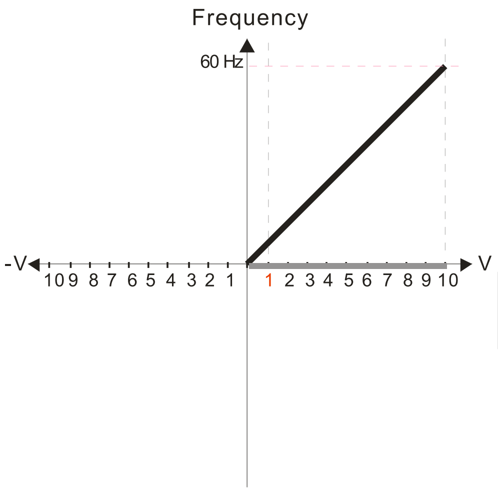
Pr.03-03=-10%
Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)
0: Negative frequency is not valid. Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid. Positive frequency = forward run; negative frequency = reverse run. Direction can not be switched by digital keypad or external terminal control.

Pr.03-11 Analog input Gain (AVI) = 100%

Diagram 10



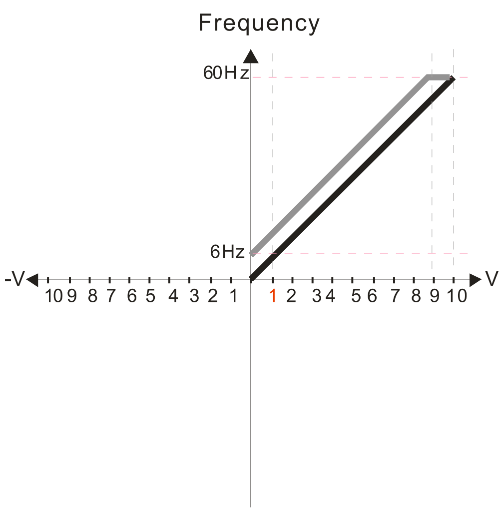
Pr.03-03=-10%
Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)
0: Negative frequency is not valid. Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid. Positive frequency = forward run; negative frequency = reverse run. Direction can not be switched by digital keypad or external terminal control.

Pr.03-11 Analog input Gain (AVI) = 100%

Diagram 11



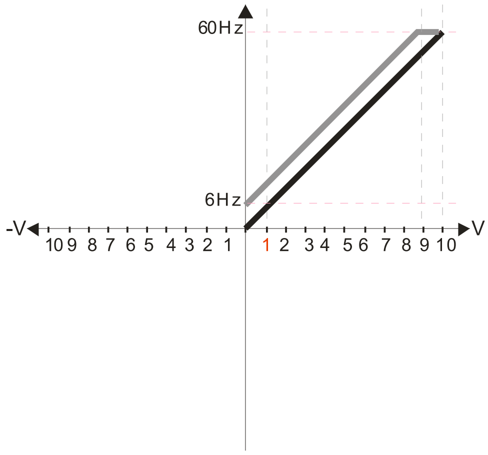
Pr.03-03=-10%
Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)
0: Negative frequency is not valid. Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid. Positive frequency = forward run; negative frequency = reverse run. Direction can not be switched by digital keypad or external terminal control.

Pr.03-11 Analog input Gain (AVI) = 100%

Diagram 12



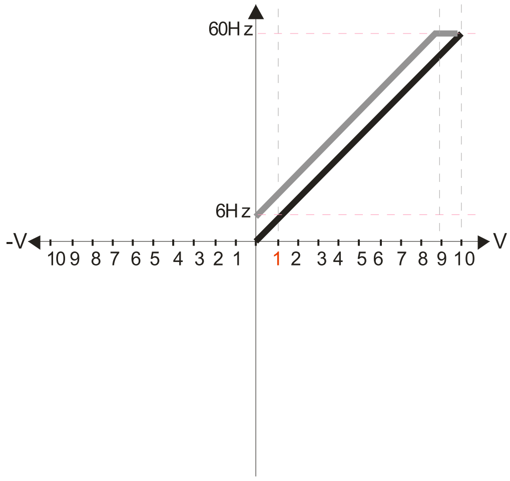
Pr.03-03=-10%
Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage
while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)
0: Negative frequency is not valid.
Forward and reverse run is controlled
by digital keyboard or external terminals.
1: Negative frequency is valid.
Positive frequency = forward run;
negative frequency = reverse run.
Direction can not be switched by digital keypad
or external terminal control.

Pr.03-11 Analog input Gain (AVI) = 100%

Diagram 13



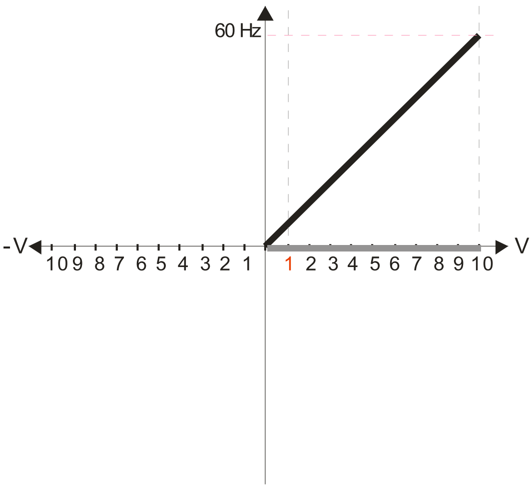
Pr.03-03=-10%
Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage
while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)
0: Negative frequency is not valid.
Forward and reverse run is controlled
by digital keyboard or external terminals.
1: Negative frequency is valid.
Positive frequency = forward run;
negative frequency = reverse run.
Direction can not be switched by digital keypad
or external terminal control.

Pr.03-11 Analog input Gain (AVI) = 100%

Diagram 14



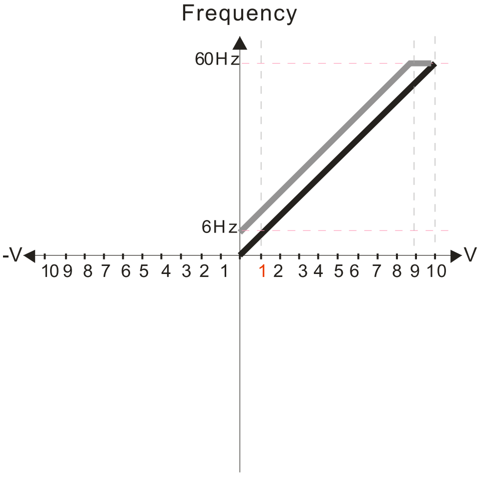
Pr.03-03=-10%
Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage
while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)
0: Negative frequency is not valid.
Forward and reverse run is controlled
by digital keyboard or external terminals.
1: Negative frequency is valid.
Positive frequency = forward run;
negative frequency = reverse run.
Direction can not be switched by digital keypad
or external terminal control.

Pr.03-11 Analog input Gain (AVI) = 100%

Diagram 15



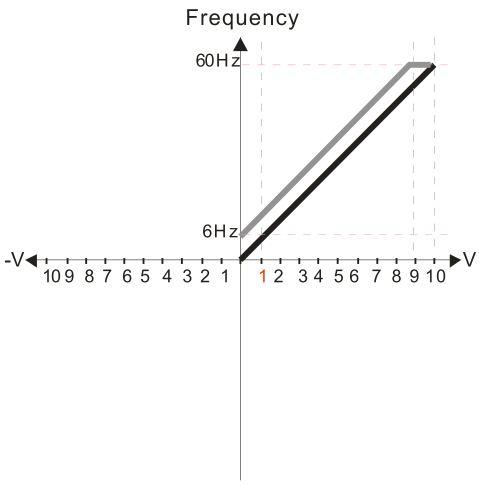
Pr.03-03=-10%
Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)
0: Negative frequency is not valid. Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid. Positive frequency = forward run; negative frequency = reverse run. Direction can not be switched by digital keypad or external terminal control.

Pr.03-11 Analog input Gain (AVI) = 100%

Diagram 16



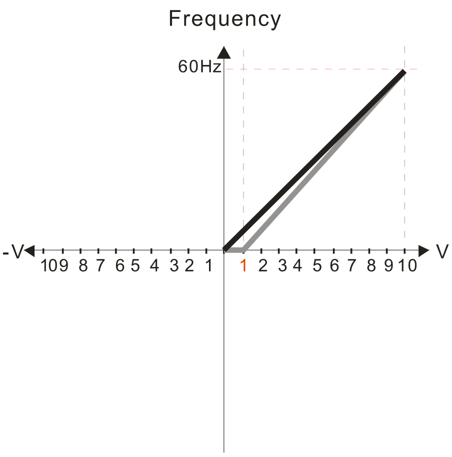
Pr.03-03=-10%
Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)
0: Negative frequency is not valid. Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid. Positive frequency = forward run; negative frequency = reverse run. Direction can not be switched by digital keypad or external terminal control.

Pr.03-11 Analog input Gain (AVI) = 100%

Diagram 17



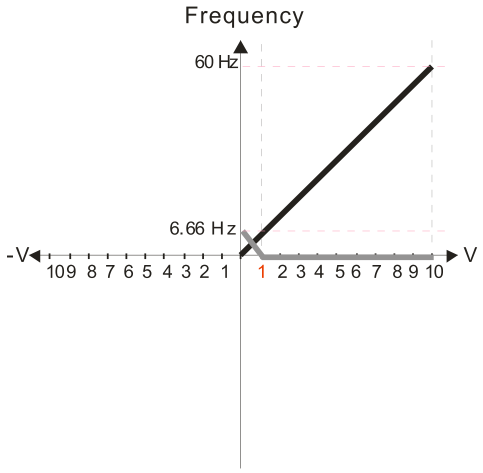
Pr.03-03=10%
Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)
0: Negative frequency is not valid. Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid. Positive frequency = forward run; negative frequency = reverse run. Direction can not be switched by digital keypad or external terminal control.

Pr.03-11 Analog input Gain (AVI) = 111.1%
10/9 = 111.1%

Diagram 18



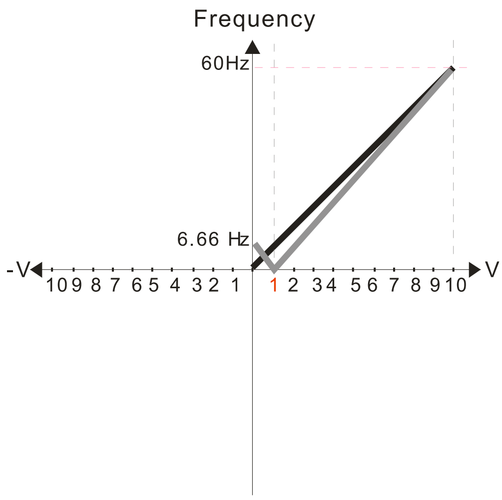
Pr.03-03=10%
Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)
0: Negative frequency is not valid. Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid. Positive frequency = forward run; negative frequency = reverse run. Direction can not be switched by digital keypad or external terminal control.

Pr.03-11 Analog input Gain (AVI) = 111.1%
10/9 = 111.1%

Diagram 19



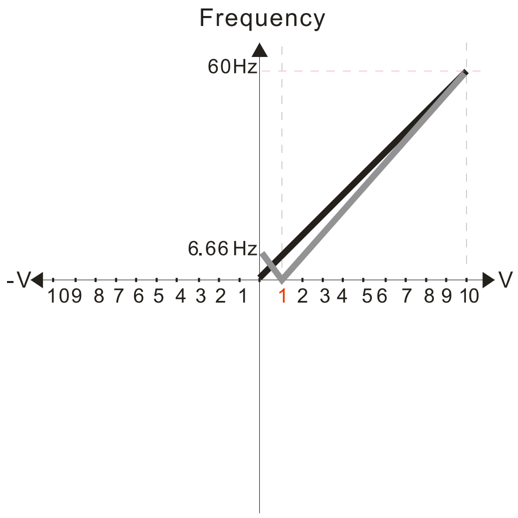
Pr.03-03=10%
Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)
0: Negative frequency is not valid. Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid. Positive frequency = forward run; negative frequency = reverse run. Direction can not be switched by digital keypad or external terminal control.

Pr.03-11 Analog input Gain (AVI) = 111.1%
10/9 = 111.1%

Diagram 20



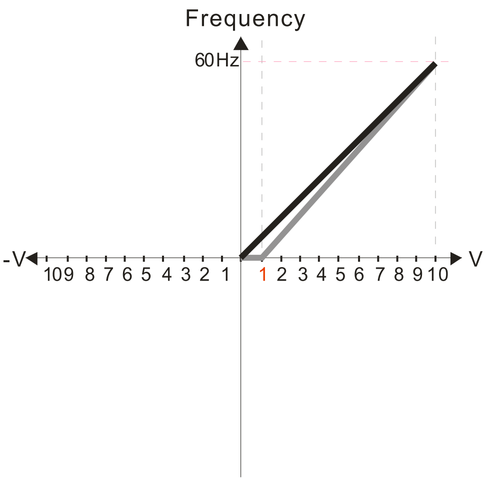
Pr.03-03=10%
Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)
0: Negative frequency is not valid. Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid. Positive frequency = forward run; negative frequency = reverse run. Direction can not be switched by digital keypad or external terminal control.

Pr.03-11 Analog input Gain (AVI) = 111.1%
10/9 = 111.1%

Diagram 21



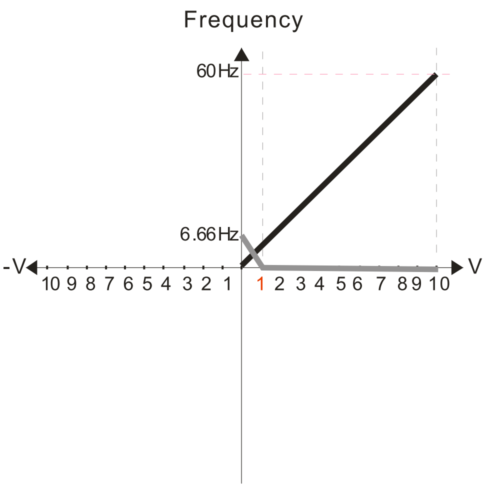
Pr.03-03=10%
Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)
0: Negative frequency is not valid. Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid. Positive frequency = forward run; negative frequency = reverse run. Direction can not be switched by digital keypad or external terminal control.

Pr.03-11 Analog input Gain (AVI) = 111.1%
10/9 = 111.1%

Diagram 22



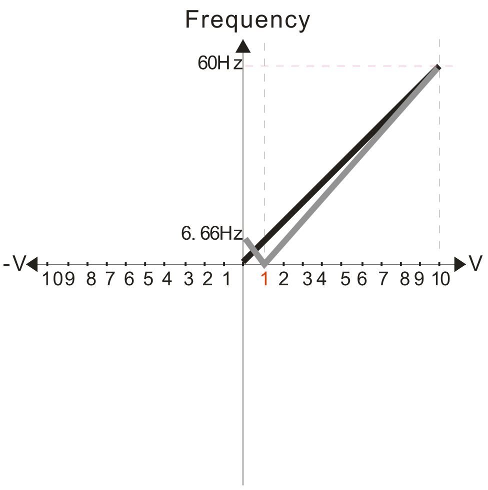
Pr.03-03=10%
Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)
0: Negative frequency is not valid. Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid. Positive frequency = forward run; negative frequency = reverse run. Direction can not be switched by digital keypad or external terminal control.

Pr.03-11 Analog input Gain (AVI) = 111.1%
10/9 = 111.1%

Diagram 23



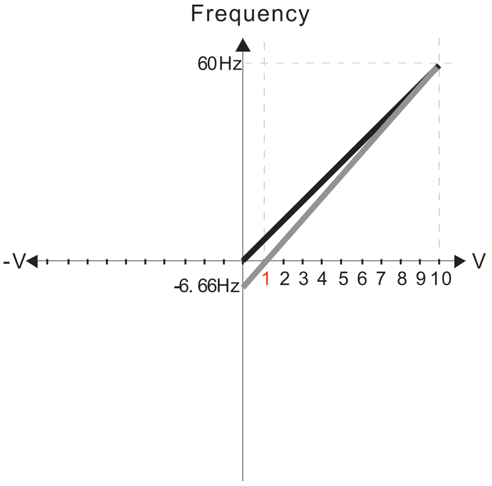
Pr.03-03=10%
Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)
0: Negative frequency is not valid. Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid. Positive frequency = forward run; negative frequency = reverse run. Direction can not be switched by digital keypad or external terminal control.

Pr.03-11 Analog input Gain (AVI) = 111.1%
10/9 = 111.1%

Diagram 24



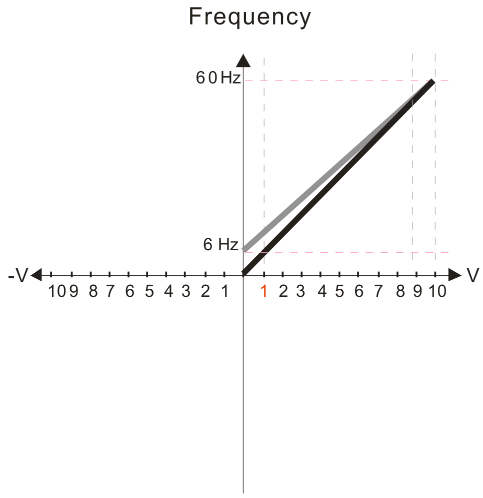
Pr.03-03=10%
Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)
0: Negative frequency is not valid. Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid. Positive frequency = forward run; negative frequency = reverse run. Direction can not be switched by digital keypad or external terminal control.

Pr.03-11 Analog input Gain (AVI) = 111.1%
10/9 = 111.1%

Diagram 25



Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)
0: Negative frequency is not valid. Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid. Positive frequency = forward run; negative frequency = reverse run. Direction can not be switched by digital keypad or external terminal control.

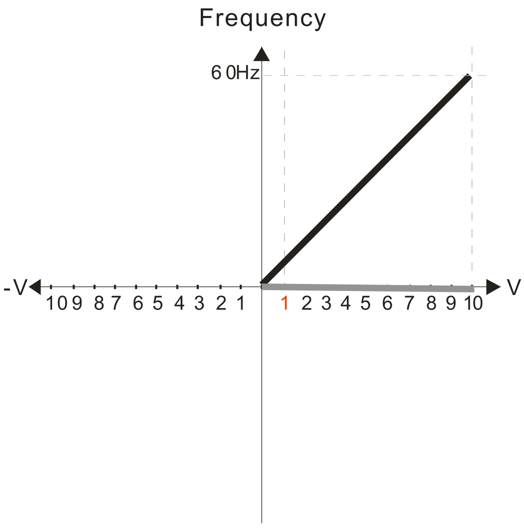
Calculate the bias:

$$\frac{60-6\text{Hz}}{10\text{V}} = \frac{6-0\text{ Hz}}{(0-X\ \text{V})} \quad XV = \frac{100}{-9} = -1.11\text{V} \quad \therefore 03\text{-}03 = \frac{-1.11}{10} \times 100\% = -11.1\ \%$$

Calculate the gain:

$$\text{Pr.03-11} = \frac{10\text{V}}{11.1\text{V}} \times 100\% = 90.0\ \%$$

Diagram 26

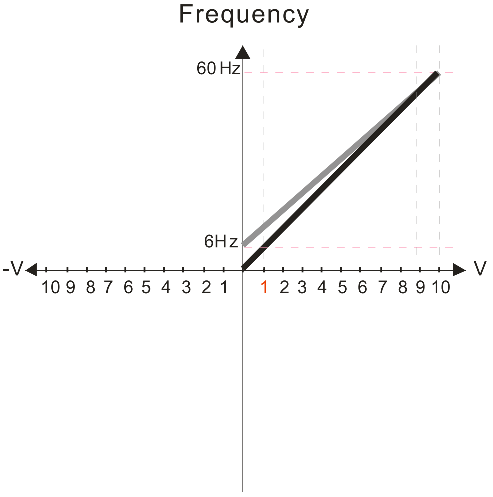


Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)
0: Negative frequency is not valid. Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid. Positive frequency = forward run; negative frequency = reverse run. Direction can not be switched by digital keypad or external terminal control.

Diagram 27



Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)
0: Negative frequency is not valid. Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid. Positive frequency = forward run; negative frequency = reverse run. Direction can not be switched by digital keypad or external terminal control.

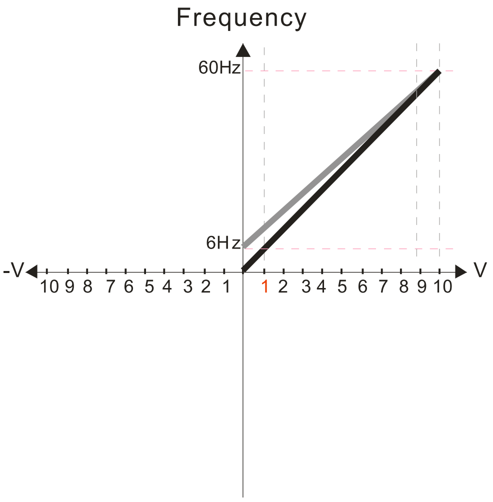
Calculate the bias:

$$\frac{60-6\text{Hz}}{10\text{V}} = \frac{6-0\text{ Hz}}{(0-XV)} \quad XV = \frac{100}{-9} = -1.11\text{V} \quad \therefore 03\text{-}03 = \frac{-1.11}{10} \times 100\% = -11.1\ \%$$

Calculate the gain:

$$\text{Pr.03-11} = \frac{10\text{V}}{11.1\text{V}} \times 100\% = 90.0\ \%$$

Diagram 28



Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)
0: Negative frequency is not valid. Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid. Positive frequency = forward run; negative frequency = reverse run. Direction can not be switched by digital keypad or external terminal control.

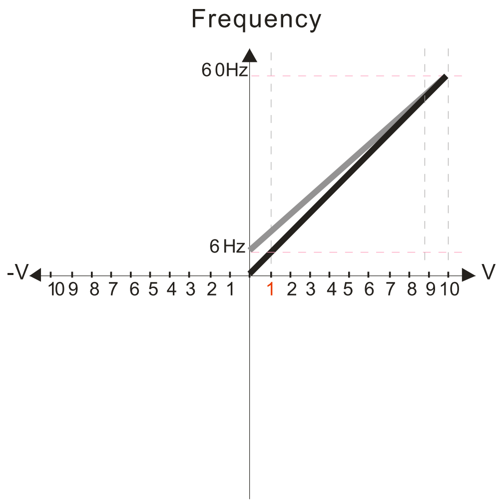
Calculate the bias:

$$\frac{60-6\text{Hz}}{10\text{V}} = \frac{6-0\text{ Hz}}{(0-XV)} \quad XV = \frac{100}{-9} = -1.11\text{V} \quad \therefore 03\text{-}03 = \frac{-1.11}{10} \times 100\% = -11.1\ \%$$

Calculate the gain:

$$\text{Pr.03-11} = \frac{10\text{V}}{11.1\text{V}} \times 100\% = 90.0\ \%$$

Diagram 29



Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)
0: Negative frequency is not valid. Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid. Positive frequency = forward run; negative frequency = reverse run. Direction can not be switched by digital keypad or external terminal control.

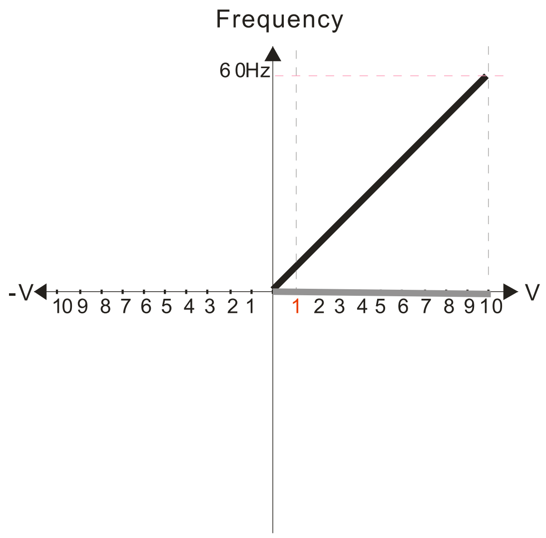
Calculate the bias:

$$\frac{60-6\text{Hz}}{10\text{V}} = \frac{6-0\text{Hz}}{(0\text{-XV})} \quad XV = \frac{100}{-9} = -1.11\text{V} \quad \therefore 03\text{-}03 = \frac{-1.11}{10} \times 100\% = -11.1\%$$

Calculate the gain:

$$\text{Pr.03-11} = \frac{10\text{V}}{11.1\text{V}} \times 100\% = 90.0\%$$

Diagram 30

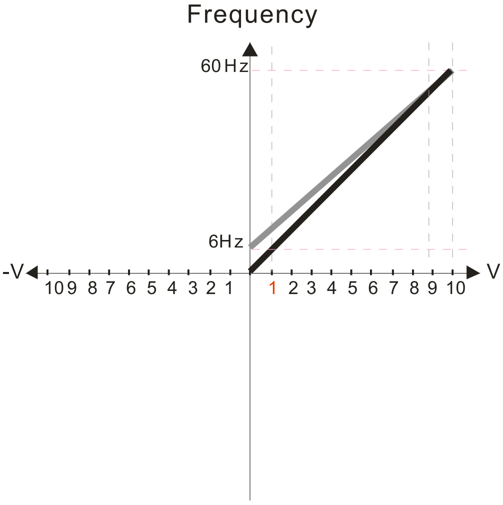


Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)
0: Negative frequency is not valid. Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid. Positive frequency = forward run; negative frequency = reverse run. Direction can not be switched by digital keypad or external terminal control.

Diagram 31



Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)
0: Negative frequency is not valid. Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid. Positive frequency = forward run; negative frequency = reverse run. Direction can not be switched by digital keypad or external terminal control.

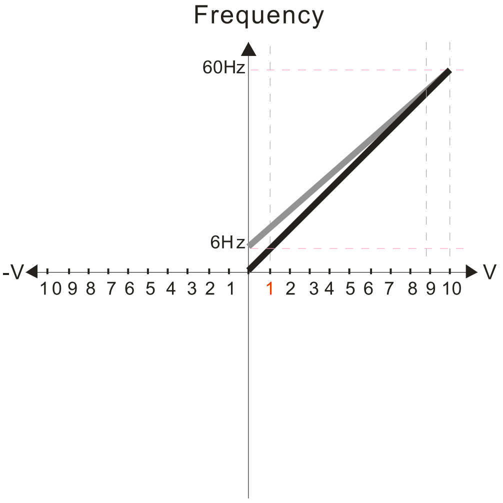
Calculate the bias:

$$\frac{60\text{-}6\text{Hz}}{10\text{V}} = \frac{6\text{-}0\text{ Hz}}{(0\text{-XV})} \quad XV = \frac{100}{-9} = -1.11\text{V} \quad \therefore 03\text{-}03 = \frac{-1.11}{10} \times 100\% = -11.1\%$$

Calculate the gain:

$$\text{Pr.03-11} = \frac{10\text{V}}{11.1\text{V}} \times 100\% = 90.0\%$$

Diagram 32



Pr.03-07–03-08 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)
0: Negative frequency is not valid. Forward and reverse run is controlled by digital keyboard or external terminals.
1: Negative frequency is valid. Positive frequency = forward run; negative frequency = reverse run. Direction can not be switched by digital keypad or external terminal control.

Calculate the bias:

$$\frac{60\text{-}6\text{Hz}}{10\text{V}} = \frac{6\text{-}0\text{ Hz}}{(0\text{-XV})} \quad XV = \frac{100}{-9} = -1.11\text{V} \quad \therefore 03\text{-}03 = \frac{-1.11}{10} \times 100\% = -11.1\%$$

Calculate the gain:

$$\text{Pr.03-11} = \frac{10\text{V}}{11.1\text{V}} \times 100\% = 90.0\%$$

03-11 Analog Input Gain (AVI)
03-12 Analog Input Gain (ACI)

Default: 100.0

Settings -500.0–500.0%

Pr.03-03–03-12 are used when the Frequency command source is the analog voltage or current signal.

03-15 Analog Input Filter Time (AVI)
03-16 Analog Input Filter Time (ACI)

Default: 0.01

Settings 0.00–20.00 sec.

- The analog signals inputed by the control terminals AVI and ACI mostly have noise. Noise affects the stability to control. Use the Input Noise Filter to create a more stable system.
- 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.

03-19 Signal Loss Selection for the Analog Input 4–20 mA

Default: 0

Settings 0: Disabled
1: Continue operation at the last frequency
2: Decelerate to 0 Hz
3: Stop immediately and display "ACE"

- Determine the treatment when the 4–20 mA signal is lost (ACIc (Pr.03-28 = 0)).
- When Pr.03-28 ≠ 2, the AVI terminal is 0–10 V or 0–20 Ma for voltage input. At this moment, Pr.03-19 setting is invalid.
- When the setting is 1 or 2, the keypad displays the warning code "ANL". It keeps blinking until the ACI signal is recovered.
- When the drive stops, the condition that causes the warning does not exist , so the warning automatically disappears.

03-20 AFM Analog Output Selection

Default: 0

Settings 0–23

Summary of Function Settings

Setting	Functions	Descriptions
0	Output frequency (Hz)	Maximum frequency (Pr.01-00) is processed as 100%.
1	Frequency command (Hz)	Maximum frequency (Pr.01-00) is processed as 100%.
2	Motor speed (Hz)	Maximum frequency (Pr.01-00) is processed as 100%.
3	Output current (rms)	(2.5 X drive rated current) is processed as 100%.
4	Output voltage	(2 X motor rated voltage) is processed as 100%.
5	DC bus voltage	230V models: 450 V = 100% 460V models: 900 V = 100%
6	Power factor	-1.000–1.000 = 100%
7	Power	(2 X drive rated power) is processed as 100%.
9	AVI	0–10 V = 0–100%
12	Iq current command	(2.5 X drive rated current) is processed as 100%.
13	Iq feedback value	(2.5 X drive rated current) is processed as 100%.
14	Id current command	(2.5 X drive rated current) is processed as 100%.
15	Id feedback value	(2.5 X drive rated current) is processed as 100%.
16	Vq-axis voltage command	250 V (500 V) = 100%

Setting	Functions	Descriptions
17	Vd-axis voltage command	250 V (500 V) = 100%
21	RS-485 analog output	For RS-485 (Modbus) control analog output Terminal: AFM, Address: 26A0H
23	Constant voltage output	Pr.03-32 controls the voltage output level. 0.00–100% of Pr.03-32 corresponds to 0–10 V of AFM.

03-21 AFM Analog Output Gain

Default: 100.0

Settings 0.0–500.0%

- Adjusts the voltage level outputted to the analog meter from the analog signal (Pr.03-20) output terminal AFM of the drive.

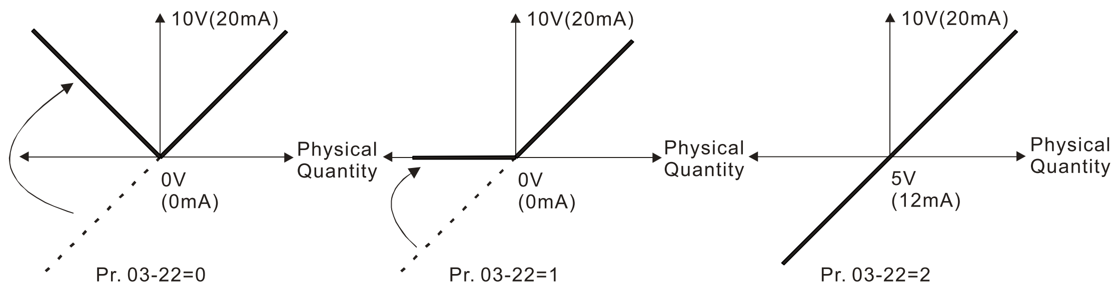
03-22 AFM Analog Output in REV Direction

Default: 0

Settings 0: Absolute value in output voltage

1: Reverse output 0 V; forward output 0–10 V

2: Reverse output 5-0 V; forward output 5–10 V



Selections for the analog output direction

03-27 AFM Output Bias

Default: 0.00

Settings -100.00–100.00%

- Example 1: AFM 0–10 V is set to the output frequency, the output equation is

  10 V × (output frequency / Pr.01-00) × Pr.03-21 + 10 V × Pr.03-27
- Example 2: AFM 0–20 mA is set to the output frequency, the output equation is

  20 mA × (output frequency / Pr.01-00) × Pr.03-21 + 20 mA × Pr.03-27
- Example 2: AFM 4–20 mA is set to the output frequency, the output equation is

  4 mA + 16 mA × (output frequency / Pr.01-00) × Pr.03-21 + 16 mA × Pr.03-27
- This parameter sets the corresponding voltage of the analog output 0.

03-28 AVI Terminal Input Selection

Default: 0

Settings 0: 0–10 V

1: 0–10 V (Pr.03-57–Pr.03-62 are valid)

2: 4–10 V (Pr.03-57–Pr.03-62 are valid)

- Use DIP switch to change voltage mode and current mode, refer to Chapter 06 for AVI terminal instruction.
- When you change the setting, proportion to the corresponding AVI will return to default.

03-32 AFM DC Output Setting Level

Default: 0.00

Settings 0.00–100.00%

03-35 AFM Output Filter Time

Default: 0.01

Settings 0.00–20.00 sec.

03-39 VR Input Selection

Default: 1

Settings 0: Disabled
1: Frequency command

- VR is the abbreviation for Variable Resistor; it is the frequency knob of the keyboard panel.

03-40 VR Input Bias

Default: 0.0

Settings -100–100%

03-41 VR Positive / Negative Bias

Default: 0

Settings 0: No bias
1: Lower than or equal to bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Bias serves as the center

03-42 VR Gain

Default: 100.0

Settings -500.0–500.0%

03-43 VR Filter Time

Default: 0.01

Settings 0.00–2.00 sec.

03-44 Multi-function Output (MO) by AVI Level Source

Default: 0

Settings 0: AVI
1: ACI

03-45 AVI Upper Level

Default: 50

Settings -100–100%

03-46 AVI Lower Level

Default: 10

Settings -100–100%

- Use this function with the multi-function output setting 67 (analog input level reached). The MO is active when the AI input level is higher than the Pr.03-45. The MO is disabled when the AI input is lower than the Pr.03-46.
- When setting levels, Pr.03-45 AI upper level must be higher than Pr.03-46 AI lower level.

03-50 Analog input curve selection

Default: 0

Settings 0: Normal curve
1: Three-point curve of AVI
2: Three-point curve of ACI

03-57 ACI Lowest Point

Default: 4.00

Settings Pr.03-28 = 1, 0.00–10.00 V
Pr.03-28 ≠ 1, 0.00–20.00 mA

03-58 ACI Proportional Lowest Point

Default: 0.00

Settings 0.00–100.00%

03-59 ACI Mid-point

Default: 12.00

Settings Pr.03-28 = 1, 0.00–10.00 V
Pr.03-28 ≠ 1, 0.00–20.00 mA

03-60 ACI Proportional Mid-point

Default: 50.00

Settings 0.00–100.00%

03-61 ACI Highest Point

Default: 20.00

Settings Pr.03-28 = 1, 0.00–10.00 V
Pr.03-28 ≠ 1, 0.00–20.00 mA

03-62 ACI Proportional Highest Point

Default: 100.00

Settings 0.00–100.00%

- When Pr.03-28 ≠ 1, the ACI is 0–20 mA or 4–20 mA and the unit is current (mA).
- When you set the analog input ACI to the Frequency command, 100% corresponds to Fmax (Pr.01-00 Maximum Operation Frequency).
- The output percentage becomes 0% when the ACI input value is lower than the lowest point setting.
  For example:
  If Pr.03-57 = 2 mA; Pr.03-58 = 10%, Then the output is 0 % when ACI input is lower than 2 mA. If the ACI input swings between 2 mA and 2.1 mA, the drive’s output frequency oscillates between 0% and 10%.

✓ 03-63 AVI Voltage Lowest Point

Default: 0.00

Settings 0.00–10.00 V

✓ 03-64 AVI Proportional Lowest Point

Default: 0.00

Settings -100.00–100.00%

✓ 03-65 AVI voltage mid-point

Default: 5.00

Settings 0.00–10.00 V

✓ 03-66 AVI proportional mid-point

Default: 50.00

Settings -100.00–100.00%

✓ 03-67 AVI Voltage Highest Point

Default: 10.00

Settings 0.00–10.00 V

✓ 03-68 AVI Proportional Highest Point

Default: 100.00

Settings -100.00–100.00%

- When you set the positive voltage AVI to the Frequency command, 100% corresponds to Fmax (Pr.01-00 Maximum Operation Frequency) and the motor runs in the forward direction.
- The requirement for these three parameters (Pr.03-63, Pr.03-65 and Pr.03-67) is Pr.03-63 < Pr.03-65 < Pr.03-67. The values for three proportional points (Pr.03-70, Pr.03-72 and Pr.03-74) have no limits. There is a linear calculation between two points.
- The output percentage becomes 0% when the positive voltage AVI input value is lower than the lowest point setting.

  Example:

  Pr.03-63 = 1V, Pr.03-64 = 10% The output is 0 % when AI1 input is lower than 1V. If the AI1 input swings between 1 V and 1.1 V, the drive's output frequency oscillates between 0% and 10%.

04 Multi-Step Speed Parameters

⌿ You can set this parameter during operation.

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

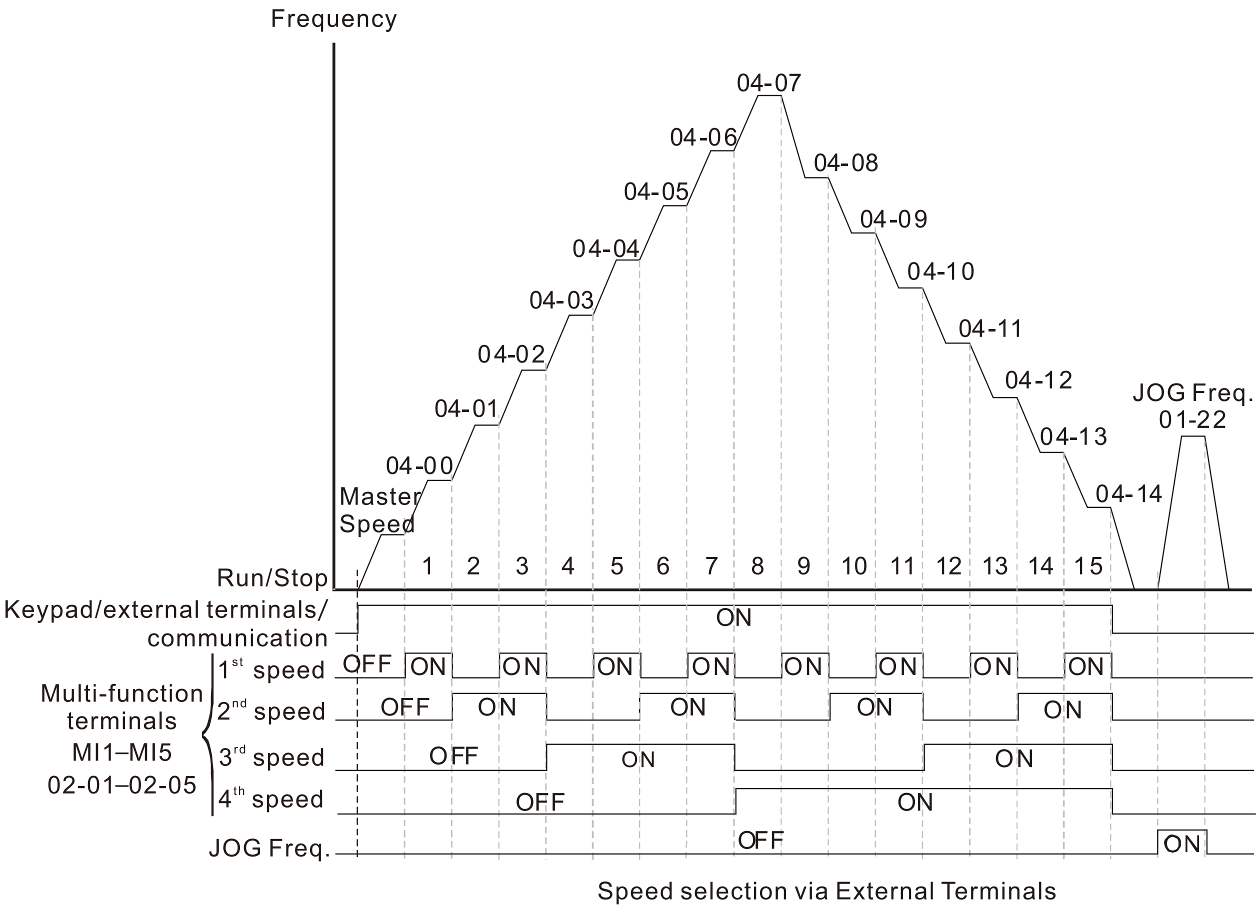
Default: 0.00

Settings 0.00–599.00 Hz

- Use the multi-function input terminals (refer to settings 1–4 of Pr.02-01–02-05 Multi-function Input Command) to select the multi-step speed command (the maximum is 15th step speed). Pr.04-00 to 04-14 sets the multi-step speed frequency as shown in the following diagram.
- The external terminal / digital keypad / communication controls the RUN and STOP commands with Pr.00-21.
- You can set each multi-step speed (frequency) between 0.00–599.00 Hz during operation.
- Explanation for the timing diagram of the multi-step speed and external terminals:

  The related parameter settings are:

  1. Pr.04-00–Pr.04-14: sets the 1st–15th multi-step speed (to set the frequency of each step speed).
  2. Pr.02-01–Pr.02-05: sets the multi-function input terminals (multi-step speed command 1–4).
- Related parameters:
  - Pr.01-22 JOG frequency setting
  - Pr.02-01 multi-function input command 1 (MI1)
  - Pr.02-02 multi-function input command 2 (MI2)
  - Pr.02-03 multi-function input command 3 (MI3)
  - Pr.02-04 multi-function input command 4 (MI4)
  - Pr.02-05 multi-function input command 4 (MI5)



04-68 Flaying Catch Retry Time

Default: 0

Settings 0–65535 sec.

- During the speed tracking, the motor drive free runs when DC bus voltage reaches OV stall level, and it will do flying catch again after Pr.04-68 setting time.

04-69 Magnetization Time

Default: 0

Settings 0–65535

- Tune Pr.04-69 according to different motors to increase the detection accuracy of initial angle for a better flying catch performance.

05 Motor Parameters

✓ You can set this parameter during operation.

05-00 Motor Parameter Auto-tuning

Default: 0

Settings 0: Disabled
1: Dynamic test for induction motor (IM)
2: Static test for induction motor (IM)
5: Rolling auto-tuning for PM (IPM / SPM)
13: High frequency stall test for PM synchronous motor

05-01 Full-Load Current for Induction Motor 1 (A)

Default: Depend on the model power

Settings 10–120% of the drive's rated current

- Set this value according to the rated current of the motor as indicated on the motor nameplate. The default is 90% of the drive's rated current.
  Example: The rated current for a 7.5 HP (5.5 kW) motor is 25 A. The default is 22.5 A.
  The setting range is 2.5–30 A
  25 × 10% = 2.5 A 25 × 120% = 30 A

✓ 05-02 Rated Power for Induction Motor 1 (kW)

Default: Depend on the model power

Settings 0.00–655.35 kW

- Sets the rated power for motor 1. The default is the drive's power value.

✓ 05-03 Rated Speed for Induction Motor 1 (rpm)

Default: Depend on the motor's number of poles

Settings 0–xxxxx rpm (Depend on the motor's number of poles)
1710 (60 Hz 4 poles); 1410 (50 Hz 4 poles)

- Sets the rated speed for the motor as indicated on the motor nameplate.

05-04 Number of Poles for Induction Motor 1

Default: 4

Settings 2–20

- Set the number of poles for the motor (must be an even number).
- Set up Pr.01-01 and Pr.05-03 before setting up Pr.05-04 to ensure that the motor operates normally.

05-05 No-load Current for Induction Motor 1 (A)

Default: Depend on the model power

Settings 0.00–Pr.05-01 default

- The default is 40% of the motor's rated current.

05-06 Stator Resistance (Rs) for Induction Motor 1
05-07 Rotor Resistance (Rr) for Induction Motor 1

Default: Depend on the model power

Settings 0.000–65.535 Ω

05-08 Magnetizing Inductance (Lm) for Induction Motor 1
05-09 Stator Inductance (Lx) for Induction Motor 1

Default: 0.0

Settings 0.0–6553.5 mH

05-13 Full-Load Current for Induction Motor 2 (A)

Default: Depend on the model power

Settings 10–120% of the drive's rated current

- Set this value according to the rated current of the motor as indicated on the motor nameplate. The default is 90% of the drive's rated current.

  Example: The rated current for a 7.5 HP (5.5 kW) motor is 25 A. The default is 22.5 A.

  The setting range is 2.5–30 A

  25 × 10% = 2.5 A 25 × 120% = 30 A

✔ 05-14 Rated Power for Induction Motor 2 (kW)

Default: Depend on the model power

Settings 0.00–655.35 kW

- Set the rated power for motor 2. The default is the drive's power value.

✔ 05-15 Rated Speed for Induction Motor 2 (rpm)

Default: Depend on the motor's number of poles

Settings 0–xxxxx rpm (Depend on the motor's number of poles)

1710 (60 Hz 4 poles); 1410 (50 Hz 4 poles)

- Set the rated speed for the motor as indicated on the motor nameplate.

05-16 Number of Poles for Induction Motor 2

Default: 4

Settings 2–20

- Set the number of poles for the motor (must be an even number).
- Set up Pr.01-35 and Pr.05-15 before setting up Pr.05-16 to ensure that the motor operates normally.

05-17 No-load Current for Induction Motor 2 (A)

Default: Depend on the model power

Settings 0.00–Pr.05-13 default

- The default is 40% of the motor's rated current.

05-18 Stator Resistance (Rs) for Induction Motor 2

Default: Depend on the model power

Settings 0.000–65.535 Ω

05-19 Rotor Resistance (Rr) for Induction Motor 2

Default: 0.000

Settings 0.000–65.535 Ω

05-20 Magnetizing Inductance (Lm) for Induction Motor 2

05-21 Stator Inductance (Lx) for Induction Motor 2

Default: 0.0

Settings 0.0–6553.5 mH

05-22 Multi-Motor (Induction) Selection

Default: 1

Settings 1: Motor 1

2: Motor 2

- Sets the motor operated by the AC motor drive. Multi-motor selection only supports single control mode. For example, when you set motor 1 as SVC control mode, the control mode of motors 2 also sets as SVC.

✓ 05-23 Frequency for Y-connection /Δ-connection Switch for an Induction Motor

Default: 60.00

Settings 0.00–599.00 Hz

05-24 Y-connection /Δ-connection Switch for an Induction Motor

Default: 0

Settings 0: Disabled

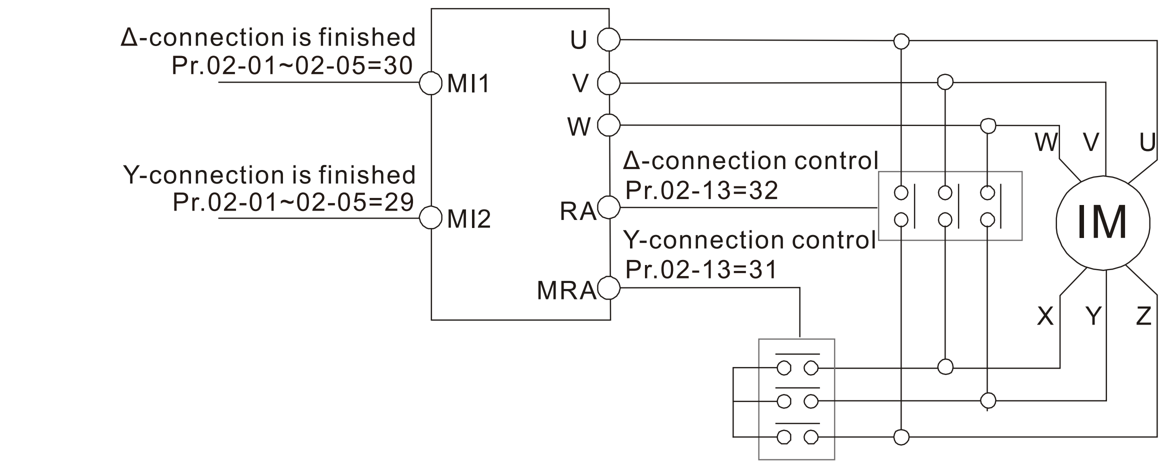
1: Enable

✓ 05-25 Delay Time for Y-connection/Δ-connection Switch for an Induction Motor

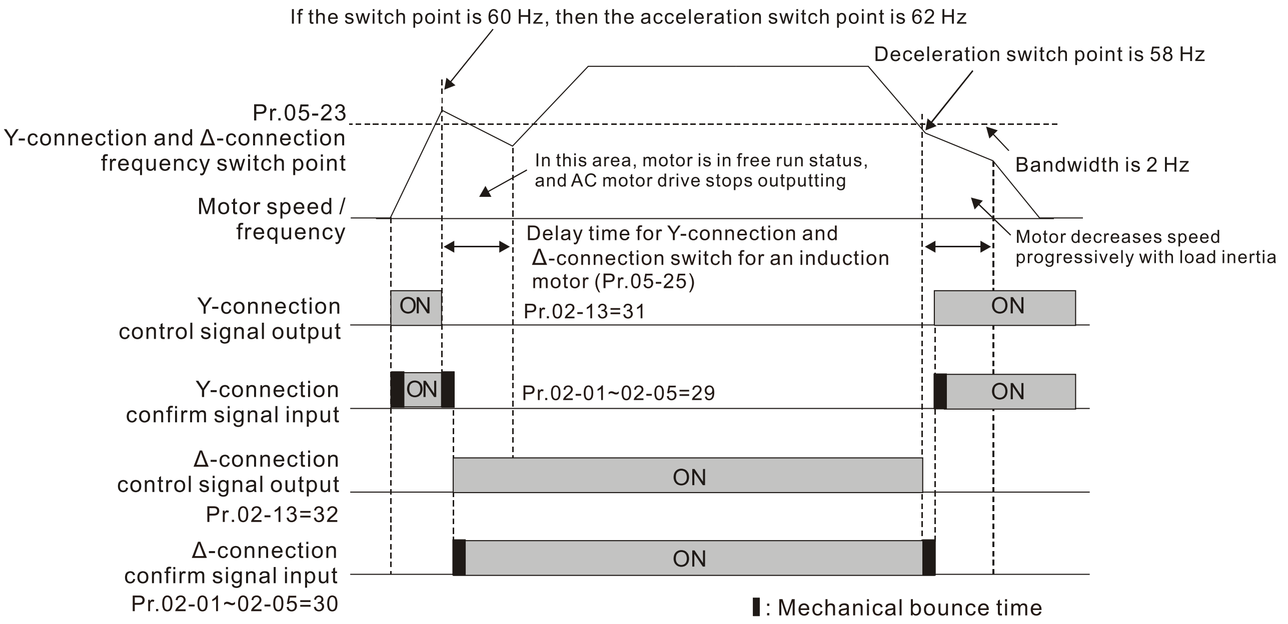
Default: 0.200

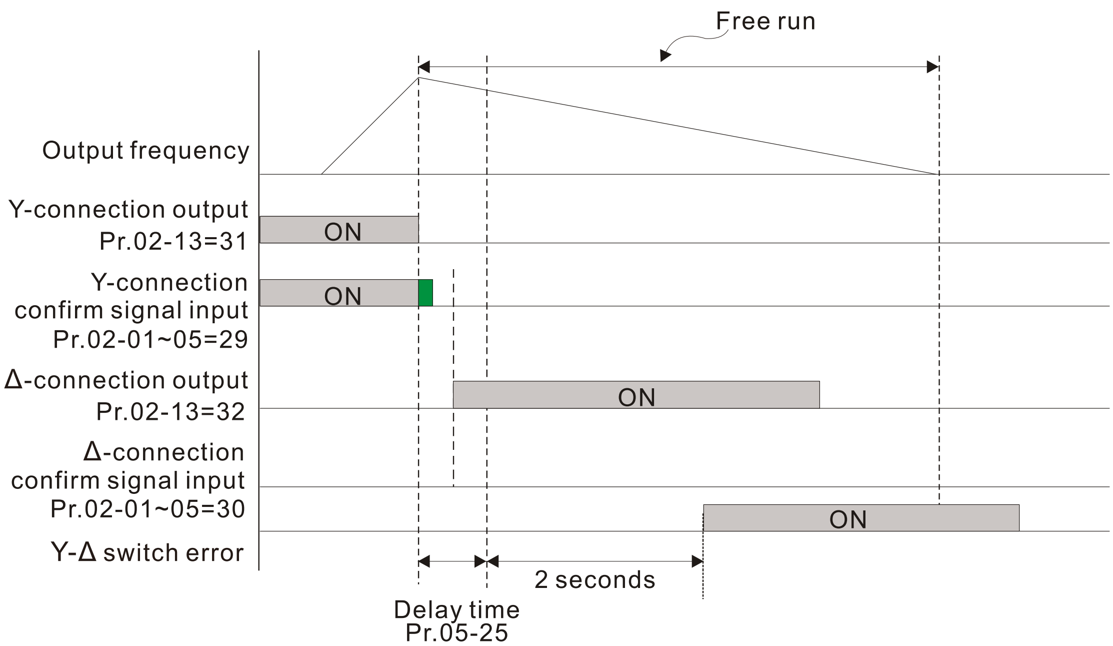
Settings 0.000–60.000 sec.

- Pr.05-23–Pr.05-25 use in wide range motors, and the motor coil executes the Y-connection / Δ-connection switch as required. The wide range motors are related to the motor design. In general, the motor has higher torque with low speed Y-connection and has higher speed with high speed Δ-connection.
- Pr.05-24 enables and disables the switch of Y-connection/Δconnection.
- When you set Pr.05-24 to 1, the drive uses the Pr.05-23 setting and current motor frequency, and switches the current motor to Y-connection or Δ-connection. You can switch the relevant motor parameter settings simultaneously.
- Pr.05-25 sets the switch delay time of Y-connection / Δ-connection.
- When the output frequency reaches the Y-connection/ Δ-connection switch frequency, the drive delays according to Pr.05-25 before activating the multi-function output terminals.



Y-Δ connection switch: can be used for wide range motor
Y-connection for low speed: higher torque can be used for rigid tapping
Δ-connection for high speed: higher torque can be used for high-speed drilling





05-26 Accumulated Watt-Millisecond for a Running Motor (W-msec.)
05-27 Accumulated Watt-Second for a Running Motor (W-sec.)
05-28 Accumulated Watt-Hour for a Running Motor (Wh)
05-29 Accumulated Kilowatt-Hour for a Running Motor (kWh)
05-30 Accumulated Megawatt-Hour for a Running Motor (MWh)

Default: 0.0

Settings Read only

- Pr.05-26–05-30 records the amount of power the motors consume. The accumulation begins when the drive is activated and the record is saved when the drive stops or turns OFF. The amount of consumed watts continues to accumulate when the drive is activated again. To clear the accumulation, set Pr.00-02 to 5 to return the accumulation record to 0.
- The accumulated total watts of the motor per second = Pr.05-27 x 65536 + Pr.05-26
  Example: when Pr.05-26 = 2548.1 and Pr.05-27 = 15.2, the accumulated total watts of the motor per second = 15.2 x 65536 + 2548.1 = 996147.2 + 2548.1 = 998695.3 kWh
- The accumulated total kilowatts of the motor per hour = Pr.05-30 x 1000000 + Pr.05-29 x 1000 + Pr.05-28 Wh
  When Pr.05-30 = 76 MWh, Pr.05-29 = 150 kWh, Pr.05-28 = 400 Wh (or 0.4 kWh), the motor accumulated watt In every hour =
  76 x 1000000 + 150 x 1000 + 400 = 76150400 Wh = 76150.4 kWh

05-31 Accumulated Motor Operation Time (minutes)

Default: 0

Settings 0–1439

05-32 Accumulated Motor Operation Time (days)

Default: 0

Settings 0–65535

- Use Pr.05-31 and Pr.05-32 to record the motor operation time. To clear the operation time, set Pr.05-31 and Pr.05-32 to 00. An operation time shorter than 60 seconds is not recorded.

05-33 Induction Motor (IM) or Permanent Magnet Synchronous AC Motor Selection

Default: 0

Settings 0: IM (Induction motor)
1: SPM (Surface permanent magnet synchronous AC motor)
2: IPM (Interior permanent magnet synchronous AC motor)

05-34 Full-Load Current for a Permanent Magnet Synchronous AC Motor

Default: Depend on the model power

Settings 0–120% of the drive's rated current

05-35 Rated Power for a Permanent Magnet Synchronous AC Motor

Default: Depend on the model power

Settings 0.00–655.35 kW

Set the rated power for the permanent magnet synchronous AC motor. The default is the drive's power value.

05-36 Rated Speed for a Permanent Magnet Synchronous AC Motor

Default: 2000

Settings 0–65535 rpm

05-37 Number of Poles for a Permanent Magnet Synchronous AC Motor

Default: 10

Settings 0–65535

05-39 Stator Resistance for a Permanent Magnet Synchronous AC Motor

Default: 0.000

Settings 0.000–65.535 Ω

05-40 Permanent Magnet Synchronous AC Motor Ld

Default: 0.00

Settings 0.00–655.35 mH

05-41 Permanent Magnet Synchronous AC Motor Lq

Default: 0.00

Settings 0.00–655.35 mH

05-43 Ke Parameter of a Permanent Magnet Synchronous AC Motor

Default: 0

Settings 0~65535 V/krpm

06 Protection Parameters (1)

✓ You can set this parameter during operation.

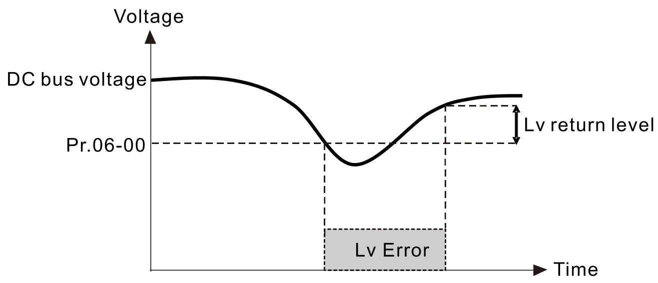
✓ 06-00 Low Voltage Level

Default: 180.0 / 360.0

Settings 115V / 230V models: 150.0–220.0 V_{DC}

460V models: 300.0–440.0 V_{DC}

- Sets the Low Voltage (LV) level. When the DC bus voltage is lower than Pr.06-00, a LV fault is triggered, and the drive stops output then the motor coasts to a stop.
- If the LV fault is triggered during operation, the drive stops output and the motor free runs to a stop. There are three LV faults, LvA (LV during acceleration), Lvd (LV during deceleration), and Lvn (LV in constant speed) that are triggered according to the status of acceleration or deceleration. You must press RESET to clear the LV fault. The drive automatically restarts if you set to restart after momentary power loss (refer to Pr.07-06 Restart after Momentary Power Loss and Pr.07-07 Allowed Power Loss Duration for details).
- If the LV fault is triggered when the drive is in STOP status, the drive displays LvS (LV during stop), which is not recorded, and the drive restarts automatically when the input voltage is higher than the LV level of 30 V (230V models), 60 V (460V models).



✓ 06-01 Over-Voltage Stall Prevention

Default: 380.0 / 760.0

Settings 0: Disabled

115V / 230V models: 0.0–390.0 V_{DC}

460V models: 0.0–780.0 V_{DC}

- Setting Pr.06-01 to 0.0 disables the over-voltage stall prevention function (connected with braking unit or brake resistor). Use this setting when braking units or brake resistors are connected to the drive.
- Setting Pr.06-01 to a value > 0.0 enables the over-voltage stall prevention. This setting refers to the power supply system and loading. If the setting is too low, then over-voltage stall prevention is easily activated, which may increase deceleration time.
- Comparison table for over-voltage stall prevention and over-voltage level:

Voltage	Over-Voltage Stall Prevention		Over-Voltage Level
	Default	Settings	Default (Read only)
230V Models	380.0 V_{DC}	0.0–390.0 V_{DC}	410.0 V_{DC}
460V Models	760.0 V_{DC}	0.0–780.0 V_{DC}	820.0 V_{DC}

- Related parameters:
  - Pr.01-13, 01-15, 01-17, 01-19 for the settings of deceleration time 1–4
  - Pr.02-13 for the setting of multi-function output terminal (Relay)

- Pr.02-16 for the setting of multi-function output terminal (MO1)
- Pr.06-02 for the setting of selection for over-voltage stall prevention

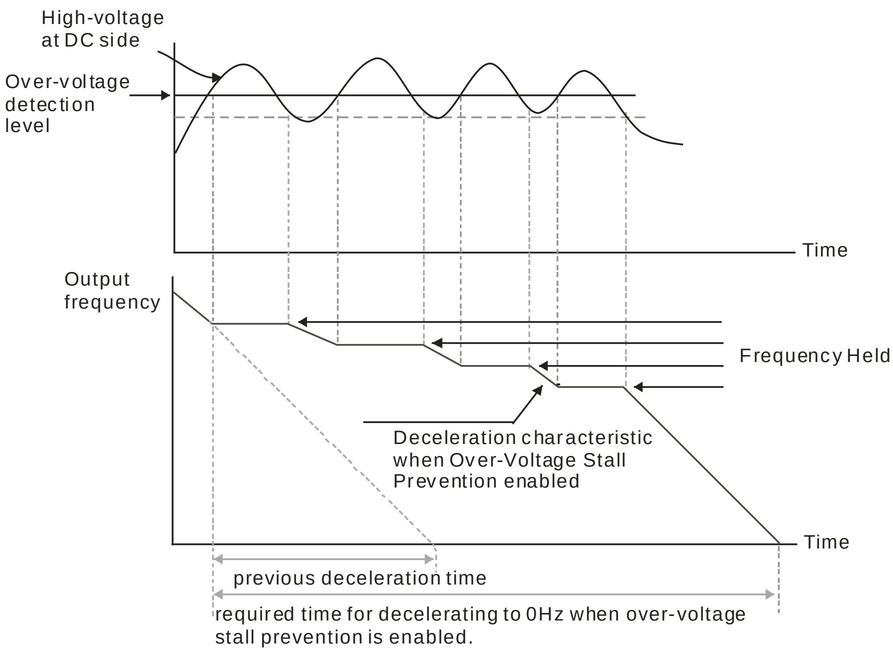
06-02 Selection for Over-voltage Stall Prevention

Default: 0

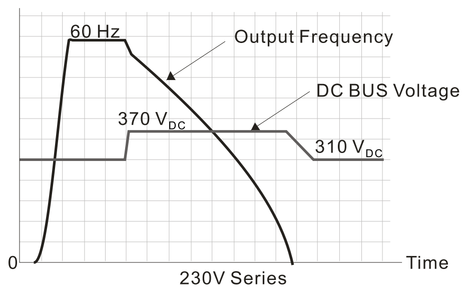
Settings 0: Traditional over-voltage stall prevention

1: Smart over-voltage stall prevention

- Use this function when you are unsure about the load inertia. When stopping under normal load, the over-voltage does not occur during deceleration and meet the deceleration time setting. Sometimes it may not stop due to over-voltage during decelerating to STOP when the load regenerative inertia increases. In this case, the AC motor drive extends the deceleration time automatically until the drive stops.
- When you set Pr.06-02 to 0, during deceleration the motor exceeds the synchronous speed due to load inertia. In this case, the motor becomes an electrical generator. The DC bus voltage may exceed its maximum allowable value due to motor regeneration in some situations, such as motor's loading inertia being too high or drive's deceleration time being set too short. When you enable traditional over-voltage stall prevention and the DC bus voltage detected is too high, the drive stops decelerating (output frequency remains unchanged) until the DC bus voltage drops below the setting value.



- When you set Pr.06-02 to 1 to use smart over-voltage stall prevention during deceleration, the drive maintains the DC bus voltage when decelerating and prevents the drive from OV.



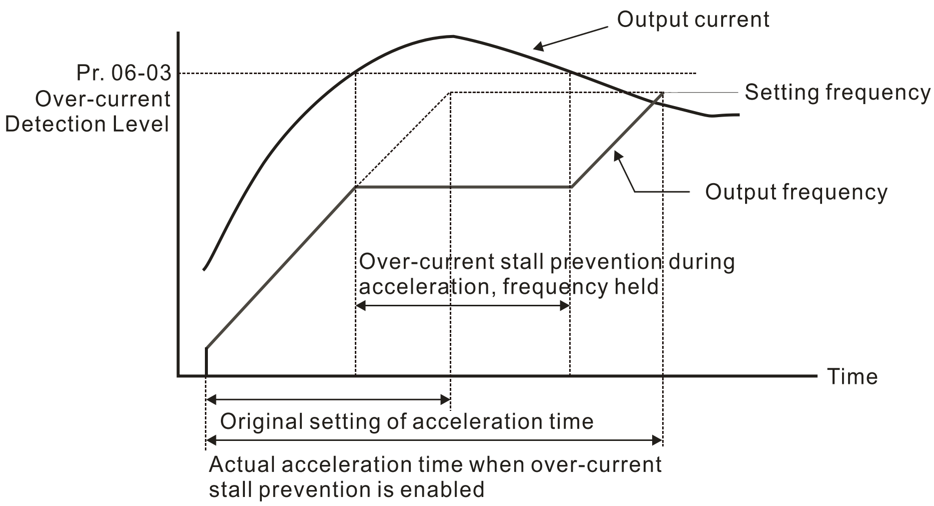
- When you enable the over-voltage stall prevention, the drive's deceleration time is longer than the setting.
- This function is inapplicable if the deceleration time hinders the application. See the troubleshooting below.
  1. Increase the deceleration time to a proper value.
  2. Install a brake resistor (refer to Section 7-1 Brake Resistors and Brake Units Used in AC Motor Drives for details) to dissipate the electrical energy that is generated from the motor.
- Related parameters:
  - Pr.01-13, 01-15, 01-17, 01-19 for the settings of deceleration time 1–4
  - Pr.02-13 for the setting of multi-function output terminal (Relay)
  - Pr.02-16 for the setting of multi-function output terminal (MO1)
  - Pr.06-01 for the setting of over-voltage stall prevention

06-03 Over-Current Stall Prevention during Acceleration

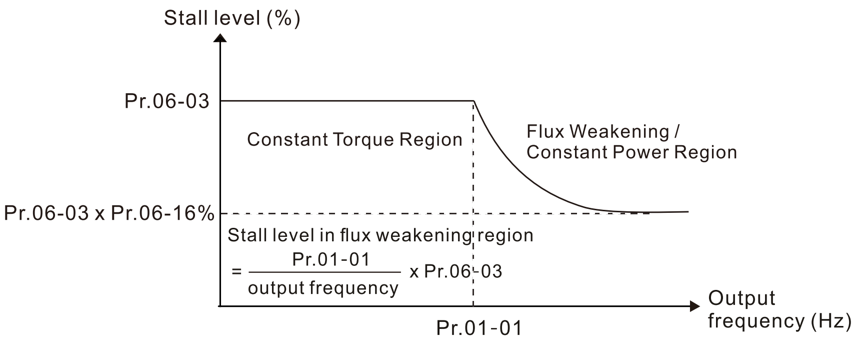
Default: 120 / 180

Settings Normal duty: 0–150% (100 % corresponds to the rated current of the drive)
Heavy load: 0–200% (100 % corresponds to the rated current of the drive)

- If the motor load is too large or the drive's acceleration time is too short, the output current of the drive may be too high during acceleration, and it may cause motor damage or trigger the drive's protection functions (OL or OC). Use this parameter to prevent these situations.
- During acceleration, the output current of the drive may increase abruptly and exceed the setting value of Pr.06-03. In this case, the drive stops accelerating and keeps the output frequency constant, and then continues to accelerate until the output current decreases.



- Refer to Pr.06-16 for the stall level in flux weakening region. The protection curve:



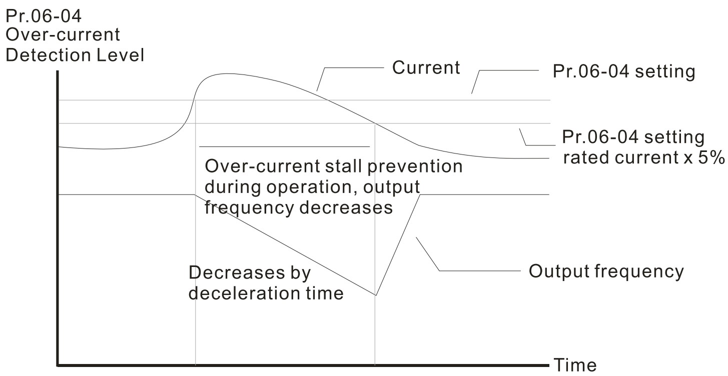
- When you enable the over-current stall prevention, the drive's acceleration time is longer than the setting.
- When the over-current stall prevention occurs because the motor capacity is too small or operates in the default, decrease the Pr.06-03 setting value.
- This function is inapplicable if the acceleration time hinders the application. See the troubleshooting below.
  1. Increase the acceleration time to a proper value.
  2. Set Pr.01-44 Auto-Acceleration and Auto-Deceleration Setting to 1, 3 or 4. (auto-acceleration)
- Related parameters:
  - Pr.01-12, 01-14, 01-16, 01-18 for the settings of acceleration time 1–4
  - Pr.01-44 for the setting of auto-acceleration and auto-deceleration
  - Pr.02-13 for the setting of multi-function output terminal (Relay)
  - Pr.02-16 for the setting of multi-function output terminal (MO1)

06-04 Over-Current Stall Prevention during Operation

Default: 120 / 180

Settings Normal duty: 0–150% (100% corresponds to the rated current of the drive)
Heavy load: 0–200% (100% corresponds to the rated current of the drive)

- This is a protection for the drive to decrease output frequency automatically when the motor overloads abruptly during constant motor operation.
- If the output current exceeds the setting value for Pr.06-04 when the drive is operating, the drive decelerates according to the Pr.06-05 setting to prevent the motor from stalling. The lower limit for the over-current stall prevention is determined by the maximum value among 0.5 Hz, Pr.01-07 and Pr.01-11.
- If the output current is lower than the setting value for Pr.06-04, the drive accelerates (according to Pr.06-05) again to the setting frequency.



Over-current stall prevention during operation

06-05 Acceleration / Deceleration Time Selection for Stall Prevention at Constant Speed

Default: 0

Settings 0: By current acceleration / deceleration time
1: By the first acceleration / deceleration time
2: By the second acceleration / deceleration time

3: By the third acceleration / deceleration time
4: By the fourth acceleration / deceleration time
5: By auto-acceleration / auto-deceleration

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

✓ 06-06 Over-Torque Detection Selection (Motor 1)

Default: 0

Settings
0: No reaction
1: Continue operation after over-torque detection during constant speed operation
2: Stop after over-torque detection during constant speed operation
3: Continue operation after over-torque detection during RUN
4: Stop after over-torque detection during RUN

✓ 06-09 Over-Torque Detection Selection (Motor 2)

Default: 0

Settings
0: No reaction
1: Continue operation after over-torque detection during constant speed operation
2: Stop after over-torque detection during constant speed operation
3: Continue operation after over-torque detection during RUN
4: Stop after over-torque detection during RUN

📖 When you set Pr.06-06 and Pr.06-09 to 1 or 3, a warning message displays but there is no error record.

📖 When you set Pr.06-06 and Pr.06-09 to 2 or 4, an error message displays and there is an error record.

✓ 06-07 Over-Torque Detection Level (Motor 1)

Default: 120

Settings 10–250% (100% corresponds to the rated current of the drive)

✓ 06-08 Over-Torque Detection Time (Motor 1)

Default: 0.1

Settings 0.0–60.0 sec.

✓ 06-10 Over-Torque Detection Level (Motor 2)

Default: 120

Settings 10–250% (100% corresponds to the rated current of the drive)

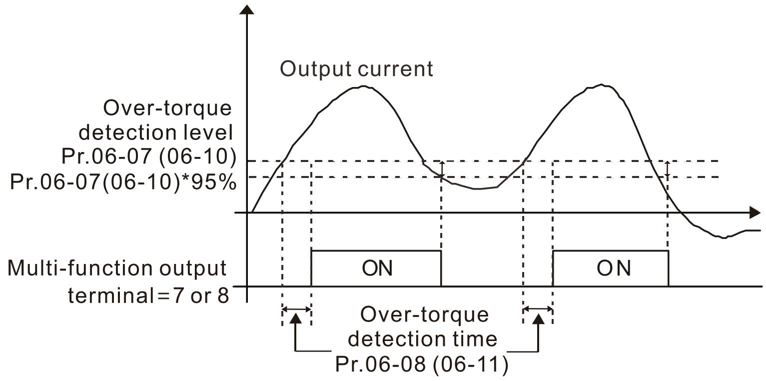
✓ 06-11 Over-Torque Detection Time (Motor 2)

Default: 0.1

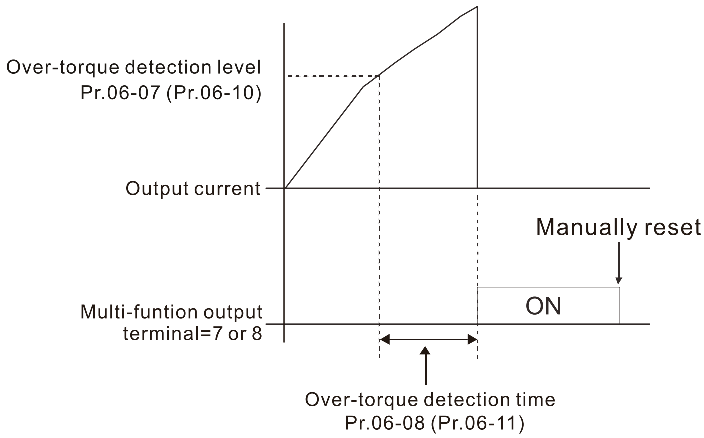
Settings 0.0–60.0 sec.

📖 When the output current exceeds the over-torque detection level (Pr.06-07 or Pr.06-10) and also exceeds the over-torque detection time (Pr.06-08 or Pr.06-11), the over-torque detection follows the setting of Pr.06-06 and Pr.06-09.

- When you set Pr.06-06 or Pr.06-09 to 1 or 3, an ot1 / ot2 warning displays while the drive keeps running after over-torque detection. The warning remains on until the output current is smaller than 5% of the over-torque detection level.



- When you set Pr.06-06 or Pr.06-09 to 2 or 4, an ot1 / ot2 fault displays and the drive stops running after over-torque detection. The drive does not run until you manually reset it.



06-13 Electronic Thermal Relay Selection 1 (Motor 1)
06-27 Electronic Thermal Relay Selection 2 (Motor 2)

Default: 2

Settings 0: Inverter motor (with external forced cooling)
1: Standard motor (motor with fan on the shaft)
2: Disabled

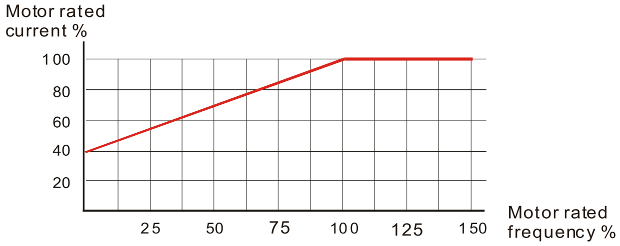
- Prevent self-cooled motor from overheating under low speed. Use an electronic thermal relay to limit the drive's output power.
- Setting the parameter to 0 is suitable for an inverter motor (motor fan using an independent power supply). For this kind of motor, there is no significant correlation between cooling capacity and motor speed. Therefore, the action of electronic thermal relays remains stable in low speed to ensure the load capability of the motor in low speed.
- Setting the parameter to 1 is suitable for standard motor (motor fan is fixed on the rotor shaft). For this kind of motor, the cooling capacity is lower in low speed; therefore, the action of an electronic thermal relay reduces the action time to ensure the life of motor.
- When the power is cycled frequently, if the power switches OFF, the electronic thermal relay protection is reset; therefore, even setting the parameter to 0 or 1 may not protect the motor well. If there are several motors connected to one drive, install an electronic thermal relay in each motor.

06-14 Electronic Thermal Relay Action Time 1 (Motor 1)
06-28 Electronic Thermal Relay Action Time 2 (Motor 2)

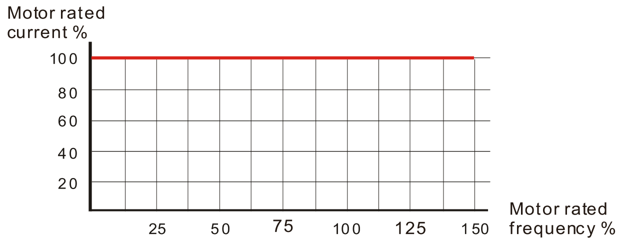
Default: 60.0

Settings 30.0–600.0 sec.

- Set the parameter to 150% of motor rated current and use with the setting of Pr.06-14 and Pr.06-28 to prevent motor damage due to overheating. When it reaches the setting, the drive displays "EoL1 / EoL2", and the motor coasts to stop.
- Use this parameter to set the action time of the electronic thermal relay. It works based on the I2t characteristic curve of electronic thermal relay, the output frequency and current of the drive, and the operation time to prevent the motor from overheating.

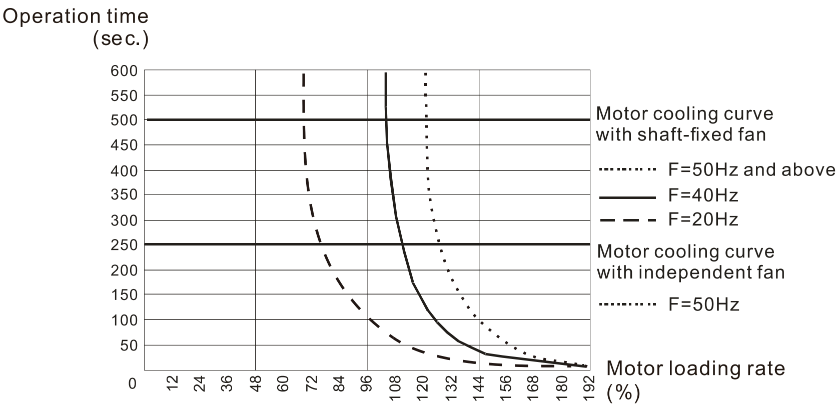


Motor cooling curve with shaft-fixed fan



Motor cooling curve with independent fan

- The action of the electronic thermal relay depends on the settings for Pr.06-13 and Pr.06-27.
  1. Pr.06-13 or Pr.06-27 is set to 0 (using inverter motor):
     When the output current of the drive is higher than 150% of the motor rated current (refer to the motor rated current % corresponded to the motor rated frequency in the motor cooling curve with independent fan), the drive starts to count the time. The electronic thermal relay acts when the accumulated time exceeds Pr.06-14 or Pr.06-28.
  2. Pr.06-13 or Pr.06-27 is set to 1 (using standard motor):
     When the output current of the drive is higher than 150% of the motor rated current (refer to the motor rated current % corresponded to the motor rated frequency in the motor cooling curve with shaft-fixed fan), the drive starts to count the time. The electronic thermal relay acts when the accumulated time exceeds Pr.06-14 or Pr.06-28.
- The actual electronic thermal relay action time adjusts according to the drive output current (shown as the motor loading rate %). The action time is short when the current is high, and the action time is long when the current is low. Refer to the following diagram.
  (The motor cooling curve with shaft-fixed fan and motor cooling curve with independent fan F = 50 Hz are the same one.)



✓ 06-15 Temperature Level Overheat (OH) Warning

Default: Depending on the model power

Settings 0.0–110.0ºC

- Sets the drive's internal IGBT overheat warning level. When the temperature is higher than Pr.06-15 setting, the oH1 fault displays and the warning remains but it does not affect the drive operation.
- Use this parameter to check the motor overheat in advance in order to take precautionary measures to decrease the temperature and maintain the motor's normal operation.
- If you set the temperature 5ºC higher than the maximum setting value for Pr.06-15, IGBT overheating occurs and the drive stops. Refer to Chapter 14 oH1 fault descriptions for details.

✓ 06-16 Stall Prevention Limit Level (Weak Magnetic Field Current Stall Prevention Level)

Default: 100

Settings 0–100% (Refer to Pr.06-03–Pr.06-04)

- This parameter only works in VF and SVC control modes of Induction motor.
- Set the over-current stall prevention level when the motor's operation frequency is larger than Pr.01-01 (base frequency). This parameter only works during acceleration.
- Example: Pr.06-03 = 150%, Pr.06-04 = 100% and Pr.06-16 = 80%.
  When the operation frequency is larger than Pr.01-01 (Base motor frequency), the lowest over-current stall prevention level during acceleration is:
  Pr.06-03 × Pr.06-16 = 150 × 80% = 120% (Refer to Pr.06-03 diagram for the protection curve)

06-17 Fault Record 1
06-18 Fault Record 2
06-19 Fault Record 3
06-20 Fault Record 4
06-21 Fault Record 5
06-22 Fault Record 6

Default: 0

Display

0: No fault record

1: Over-current during acceleration (ocA)

2: Over-current during deceleration (ocd)

3: Over-current during steady operation (ocn)

4: Ground fault (GFF)

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 at constant speed (Lvn)
14: Low-voltage at stop (LvS)
15: Phase loss protection (orP)
16: IGBT overheating (oH1)
18: IGBT temperature detection failure (tH1o)
21: Over load
22: Electronic thermal relay 1 protection (EoL1)
23: Electronic thermal relay 2 protection (EoL2)
24: Motor overheating PTC/ PT100 (oH3)
26: Over torque 1 (ot1)
27: Over torque 2 (ot2)
28: Under current (uC)
31: EEPROM read error (cF2)
33: U-phase error (cd1)
34: V-phase error (cd2)
35: W-phase error (cd3)
36: cc hardware error (Hd0)
37: oc hardware error (Hd1)
40: Auto-tuning error (AUE)
41: PID feedbacks to ACI (AFE)
48: ACI loss (ACE)
49: External fault (EF)
50: Emergency stop (EF1)
51: External base block (bb)
52: Enter wrong password three times and locked (Pcod)
54: Illegal command (CE1)
55: Illegal data address (CE2)
56: Illegal data value (CE3)
57: Data is written to read-only address (CE4)
58: Modbus transmission time-out (CE10)
63: Over slip error (oSL)
72: S1 internal loop error is detected (STL1) (for STO models only)
76: STO (STO) (for STO models only)
77: S2 internal loop error is detected (STL2) (for STO models only)
78: Internal loop error is detected (STL3) (for STO models only)
82: Output phase loss U phase (oPL1)
83: Output phase loss V phase (oPL2)
84: Output phase loss W phase (oPL3)
87: Low frequency overload protection (oL3)
142: Auto-tuning error 1 (AuE1) (DC test stage)
143: Auto-tuning error 2 (AuE2) (high frequency stall stage)

144: Auto-tuning error 1 (AuE3)

149: Total resistance measurement fault (AUE5)

150: No-load current I_0 measurement fault (AUE6)

151: dq axis inductance measurement fault (AUE7)

152: High frequency injection measurement fault (AUE8)

157: Pump PID feedback error (dEv)

- The parameters record when the fault occurs and forces a stop.
- When low-voltage at stop fault (LvS) occurs, the fault is not recorded. When low-voltage during operation faults (LvA, Lvd, Lvn) occur, the faults are recorded.
- When dEb function is valid and enabled, the drive executes dEb and records fault code 62 to Pr.06-17–Pr.06-22 and Pr.14-70–Pr.14-73 simultaneously.

06-23 Fault Output Option 1
06-24 Fault Output Option 2
06-25 Fault Output Option 3
06-26 Fault Output Option 4

Default: 0

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

- Use these parameters with multi-function output terminal (set Pr.06-23–Pr.06-26 to 35–38) for the specific requirement. When a fault occurs, the corresponding terminals are activated. Convert the binary value to a decimal value before you enter the value for Pr.06-23–Pr.06-26.

Fault Code	bit0	bit1	bit2	bit3	bit4	bit5	bit6
	current	Volt.	OL	SYS	FBK	EXI	CE
0: No fault record							
1: Over-current during acceleration (ocA)	●						
2: Over-current during deceleration (ocd)	●						
3: Over-current during steady operation (ocn)	●						
4: Ground fault (GFF)	●						
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 at constant speed (Lvn)		●					
14: Low-voltage at stop (LvS)		●					
15: Phase loss protection (orP)		●					
16: IGBT overheating (oH1)			●				
18: IGBT temperature detection failure (tH1o)			●				
21: Over load			●				

Fault Code	bit0	bit1	bit2	bit3	bit4	bit5	bit6
	current	Volt.	OL	SYS	FBK	EXI	CE
22: Electronic thermal relay 1 protection (EoL1)			●				
23: Electronic thermal relay 2 protection (EoL2)			●				
24: Motor overheating PTC/ PT100 (oH3)			●				
26: Over torque 1 (ot1)			●				
27: Over torque 2 (ot2)			●				
28: Under current (uC)	●						
31: EEPROM read error (cF2)				●			
33: U-phase error (cd1)				●			
34: V-phase error (cd2)				●			
35: W-phase error (cd3)				●			
36: cc hardware error (Hd0)				●			
37: oc hardware error (Hd1)				●			
40: Auto-tuning error (AUE)				●			
41: PID loss ACI (AFE)					●		
48: ACI loss (ACE)					●		
49: External fault (EF)						●	
50: Emergency stop (EF1)						●	
51: External base block (bb)						●	
52: Enter wrong password three times and locked (Pcod)				●			
54: Illegal command (CE1)							●
55: Illegal data address (CE2)							●
56: Illegal data value (CE3)							●
57: Data is written to read-only address (CE4)							●
58: Modbus transmission time-out (CE10)							●
63: Over slip error (oSL)						●	
72: S1 internal loop error is detected (STL1)				●			
76: STO (STO) (for STO models only)				●			
77: S2 internal loop error is detected (STL2)				●			
78: Internal loop error is detected (STL3)				●			
82: Output phase loss U phase (OPH1)	●						
83: Output phase loss V phase (OPH2)	●						
84: Output phase loss W phase (OPH3)	●						
87: Low frequency overload protection (oL3)			●				
142: Auto-tuning error 1 (AUE1) (DC test stage)				●			
143: Auto-tuning error 2 (AUE2) (High frequency test stage)				●			
144: Auto-tuning error 1 (AuE3)				●			

Fault Code	bit0 current	bit1 Volt.	bit2 OL	bit3 SYS	bit4 FBK	bit5 EXI	bit6 CE
149: Total resistance measurement fault (AUE5)				●			
150: No-load current I_0 measurement fault (AUE6)				●			
151: dq axis inductance measurement fault (AUE7)				●			
152: High frequency injection measurement fault (AUE8)				●			
157: Pump PID feedback error (dEv)				●			

06-29 PTC Detection Selection

Default: 0

Settings 0: Warn and continue operation
1: Fault and ramp to stop
2: Fault and coast to stop
3: No warning

- Set the operation mode of a drive after detecting PTC.
- Running a motor at low frequency for a long time reduces the cooling function of the motor fan. To prevent the motor from damage due to overheating, use a Positive Temperature Coefficient thermistor on the motor, and connect the thermistor output signal to the drive's analog input terminals.

06-30 PTC Level

Default: 50.0

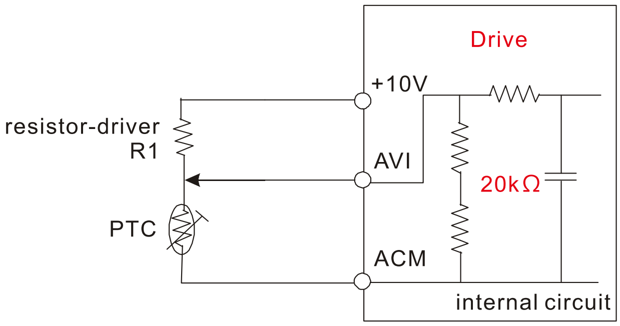
Settings 0.0–100.0%

- Pr.03-00 (AVI / ACI analog input function) should be 6 [thermistor (PTC) input value)].
- Use this parameter to set the PTC level; 100% PTC level corresponds to the maximum analog input value.
- When using the AVI terminal, you must set Pr.03-28 to 0 and switch AVI to 0–10 V voltage mode. At this time, the AVI input impedance is 20 KΩ.
- When the temperature reaches to the set protection level, the motor acts according to the settings for Pr.06-29 and displays warning "oH3" (if Pr.06-29 = 1–3). When the temperature is lower than the set protection level, you can press RESET key to clear the fault.
- The PTC uses the AVI-input and is connected through divider resistance as shown below:
  1. The voltage between +10V to ACM: lies within 10–11V.
  2. The impedance for AVI is around 20K Ω. The recommended value for divider resistance is 1K–10K Ω.
  3. Contact your motor dealer for the curve of temperature and resistance value for PTC.

  Protection level (Pr.06-30) = V+10 x (RPTC//20K) / [R1+(RPTC//20K)]

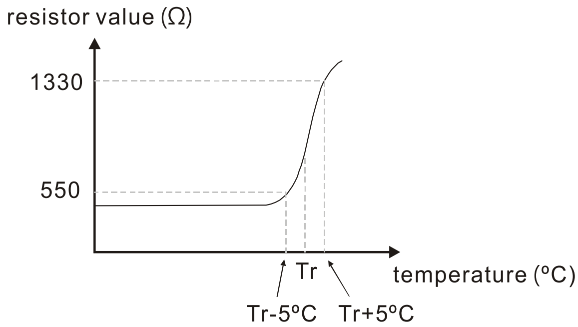
  - V+10: voltage between +10V-ACM actual value;
  - RPTC: motor PTC overheat protection level;

- 20K Ω: the AVI input impedance;
- R1: divider resistance (recommended value: 1–10k Ω)



Example:

Take the standard PTC thermistor as an example: if the protection level is 1330 Ω, the actual voltage between +10V-ACM is 10.5 V and divider resistance R1 is 4.4k Ω.



Refer to the following calculation when Pr.06-30 is set to 23% and motor temperature overheating protection level is 1330 Ω:

1330//20000 = (1330 x 20000) / (1330 + 20000) = 1247.07

10.5 x 1247.07 / (4400 + 1247.07) = 2.32 (V) ≒ 2.3 (V)

The PTC protection level = 2.3 / 10 V x % = 23%

06-31 Frequency Command at Malfunction

Default: Read only

Display 0.00–599.00 Hz

📖 When a malfunction occurs, check the current Frequency command. If the error happens again, this parameter overwrites the previous record.

06-32 Output Frequency at Malfunction

Default: Read only

Display 0.00–599.00 Hz

📖 When an error occurs, you can check the output frequency for the malfunction. If the error happens again, this parameter overwrites the previous record.

06-33 Output Voltage at Malfunction

Default: Read only

Display 0.0–6553.5 V

📖 When a malfunction occurs, check the current output voltage. If the error happens again, this parameter overwrites the previous record.

06-34 DC bus Voltage at Malfunction

Default: Read only

Display 0.0–6553.5 V

📖 When an error occurs, you can check the DC bus voltage for the malfunction. If the error happens again, this parameter overwrites the previous record.

06-35 Output Current at Malfunction

Default: Read only

Display 0.00–655.35 Amps

📖 When an error occurs, you can check the output current for the malfunction. If the error happens again, this parameter overwrites the previous record.

06-36 IGBT Temperature at Malfunction

Default: Read only

Display -3276.7–3276.7 ºC

📖 When an error occurs, you can check the IGBT temperature for the malfunction. If the error happens again, this parameter overwrites the previous record.

06-38 Motor Speed at Malfunction

Default: Read only

Display -3276.7–3276.7 rpm

📖 When a malfunction occurs, check the current motor speed in rpm. If the error happens again, this parameter overwrites the previous record.

06-39 Torque Command at Malfunction

Default: Read only

Display -32767–32767%

📖 When a malfunction occurs, check the present torque command. If the error happens again, this parameter overwrites the previous record.

06-40 Status of the Multi-function Input Terminal at Malfunction

Default: Read only

Display 0000h–FFFFh

06-41 Status of the Multi-function Output Terminal at Malfunction

Default: Read only

Display 0000h–FFFFh

📖 When a malfunction occurs, check the present status of the multi-function input / output terminals. If the error happens again, this parameter overwrites the previous record.

06-42 Drive Status at Malfunction

Default: Read only

Display 0000h–FFFFh

📖 When a malfunction occurs, check the present drive status (communication address 2101H). If the error happens again, this parameter overwrites the previous record.

06-44 STO Latch Fuction (for STO models only)

Default: 0

Settings bit0: STO Latch auto reset (0: OFF / 1: ON)

bit1: STO Latch indication shielding (0: OFF / 1: ON)

- Pr.06-44 bit0 is STO Latch auto reset, when the warning is latched and STO warning occurs, whether to reset the drive after restoring the state.
- Pr.06-44 bit1 is STO Latch indication shielding, when the warning is latched, whether the indication for fault will pop up and the terminal will output.
- All of the STL1–STL3 faults are “Warning Latch” mode (in STL1–STL3 mode, the Pr.06-44 function is not effective).

06-45 Output Phase Loss Detection Action (OPHL)

Default: 3

Settings 0: Warn and continue operation

1: Fault and ramp to stop

2: Fault and coast to stop

3: No warning

- The OPHL protection is enabled when Pr.06-45 is not set to 3.

06-46 Detection Time for Output Phase Loss

Default: 0.500

Settings 0.000–65.535 sec.

06-47 Current Detection Level for Output Phase Loss

Default: 1.00

Settings 0.00–100.00%

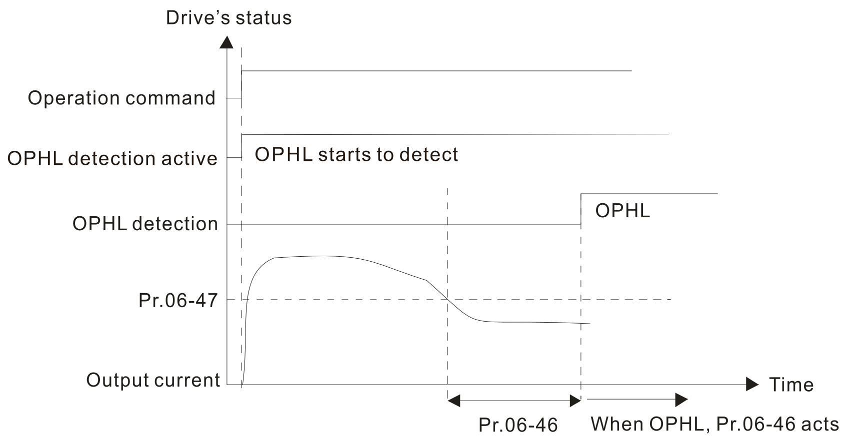
06-48 DC Brake Time for Output Phase Loss

Default: 0.000

Settings 0.000–65.535 sec.

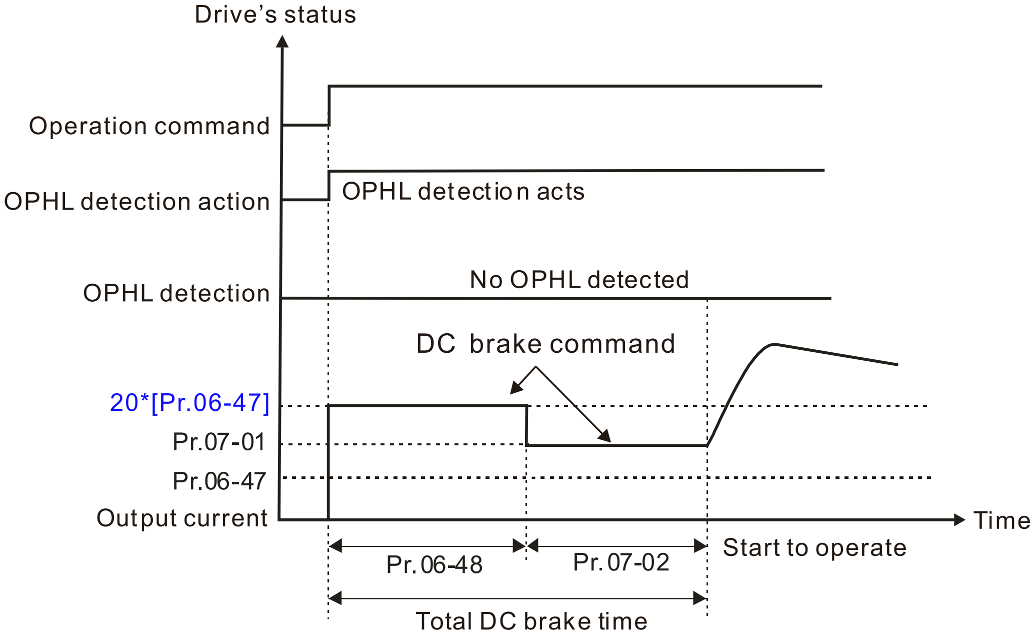
- Setting Pr.06-48 to 0 disables the OPHL detection function before operation.
- The status of output phase loss detection are as following:
  - Status 1: The drive is in operation

    When any phase is less than the Pr.06-47 setting, and exceeds the Pr.06-46 setting time, the drive executes according to the Pr.06-45 setting.

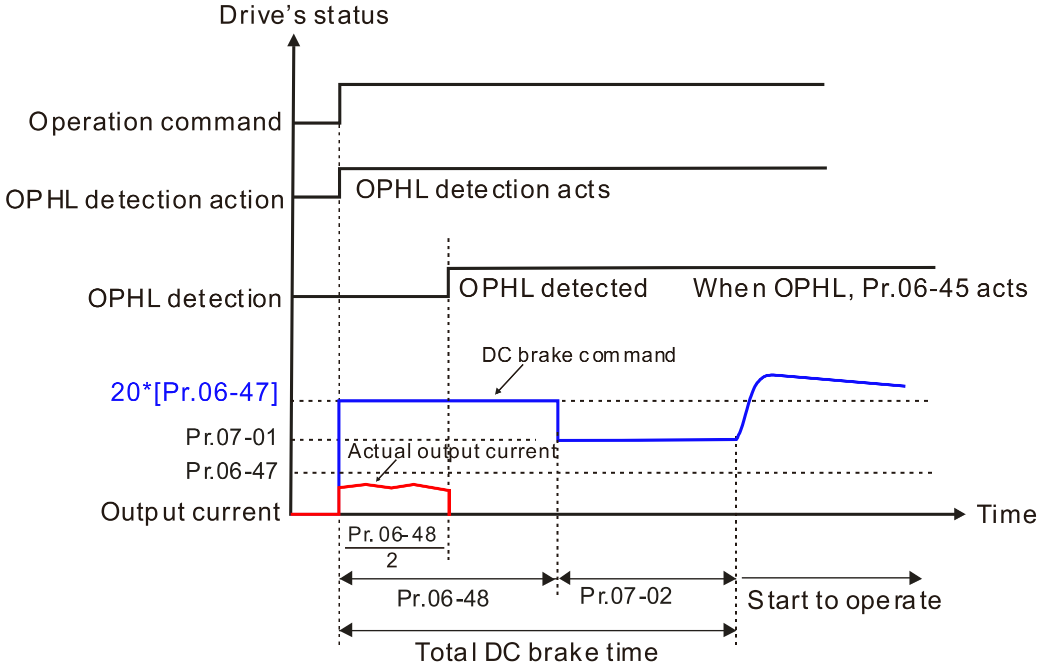


- Status 2: The drive is in STOP; Pr.06-48 ≠ 0; Pr.07-02 ≠ 0
  When the drive starts, it executes Pr.06-48 first, and then executes Pr.07-02 (DC brake). The DC brake current level in this state includes two parts: one is 20 times the Pr.06-47 setting value in Pr.06-48 setting time; the other is the Pr.07-01 setting value in Pr.07-02 setting time. The total DC brake time T = Pr.06-48 + Pr.07-02.

  Status 2-1: Pr.06-48 ≠ 0, Pr.07-02 ≠ 0 (No OPHL detected before operation)

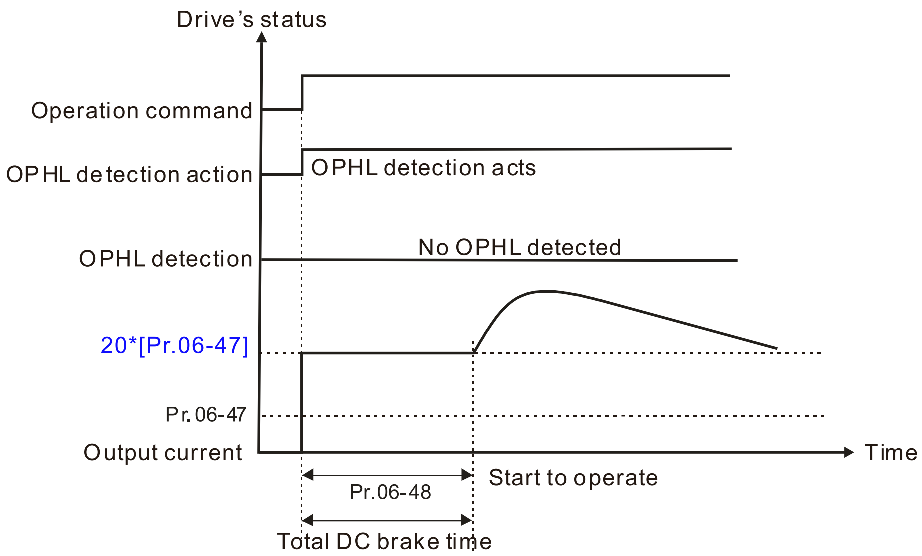


Status 2-2: Pr.06-48 ≠ 0, Pr.07-20 ≠ 0 (OPHL detected before operation)
In this period, if an OPHL occurs within the time for Pr.06-48, the drive executes the Pr.06-45 setting after the drive starts counting for half the time of Pr.06-48.

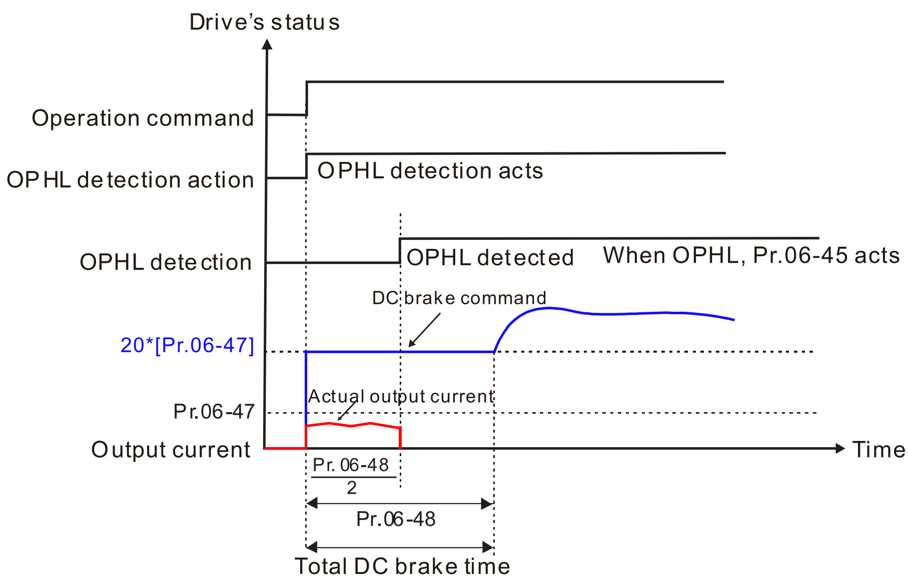


- Status 3: The drive is in STOP; Pr.06-48 ≠ 0; Pr.07-02 = 0
  When the drive starts, it executes Pr.06-48 as the DC brake. The DC brake current level is 20 times the Pr.06-47 setting value.

  Status 3-1: Pr.06-48 ≠ 0, Pr.07-02 = 0 (No OPHL detected before operation)



Status 3-2: Pr.06-48 ≠ 0, Pr.07-20 = 0 (OPHL detected before operation)
In this period, if an OPHL occurs within the time for Pr.06-48, the drive executes the Pr.06-45 setting after the drive starts counting for half the time of Pr.06-48.



06-49 LvX Set Function

Default: 0

Settings bit0: LvX auto reset (0: OFF / 1: ON)
bit1: LvX indication shielding (0: OFF / 1: ON)

- Pr.06-49 is LvX auto reset, when the warning is latched and LvX occurs, whether to reset the drive after restoring the state.
- Pr.06-44 bit1 is LvX indication shielding, when the warning is latched, whether the indication for fault will pop up and the terminal will output.

06-53 Input Phase Loss Detection Action (OrP)

Default: 0

Settings 0: Fault and ramp to stop

1: Fault and coast to stop

- The drive executes the input phase loss protection according to Pr.06-53.

06-55 Derating Protection

Default: 0

Settings 0: Constant rated current and limit carrier frequency by load current and temperature

1: Constant carrier frequency and limit load current by setting carrier frequency

2: Constant rated current (same as setting 0), but close current limit

- The allowable maximum output frequency and the minimum carrier frequency limit in control mode:
  For VF, SVC modes: When the maximum output frequency is 599 Hz, the minimum carrier wave is 6 k.
- Setting 0:
  - Actual over-current stall prevention level = derating ratio × over-current stall prevention level (Pr.06-03 and Pr.06-04).
  - Rated current derating level: derating ratio × rated current (Pr.00-01).
  - When the operating point is greater than the derating curve, the carrier frequency (Fc) output by the drive decreases automatically according to the ambient temperature, overload output current and time.
  - Applicable conditions: If overloads are not frequent, and the concern is only about the carrier frequency operating with the rated current for a long time, and changes to the carrier wave due to short overload are acceptable, set to 0
  - Take VFD9A0ME43ANSAA normal duty for example: ambient temperature 50°C, UL Open Type, and independent installation. When the carrier wave is set to 10 kHz, it corresponds to 75% of the derating ratio. When the output current is higher than the value, it automatically decreases the carrier frequency according to the ambient temperature, output current and overload time. At this time, the over-current stall prevention level is 150%.
- Setting 1:
  - Actual over-current stall prevention level = derating ratio × over-current stall prevention level (Pr.06-03 and Pr.06-04).
  - When the operating point is greater than the derating curve 1, the carrier frequency (Fc) output by the drive is fixed to the default value.
  - Applicable conditions: Select this mode if the change of carrier frequency and motor noise caused by ambient temperature and frequent overload are not acceptable.
  - Take VFD9A0ME43ANSAA normal duty for example: ambient temperature 50°C, UL Open Type, and independent installation. When the carrier wave is set to 10 kHz, it corresponds to 75% of the derating ratio. When the output current is higher than the value, the carrier

frequency will not be reduced by this, but if the overload continues for a long time, the oH1 fault (IGBT overheating) or oL fault (the inverter is overloaded) will be triggered due to the IGBT temperature rise, and the motor will eventually stop

- The OL protection executes when the current is 120% × 75% = 90% for one minute; therefore, it must operate by the curve to keep the carrier frequency.

📖 Setting 2:

- Actual over-current stall prevention level = derating ratio × over-current stall prevention level (Pr.06-03 and Pr.06-04).
- Rated current derating level: derating ratio × rated current (Pr.00-01).
- The protection method and action are set to 0, but this disables the current limit when output current is the derating ratio x 120% of output current in normal load, and derating ratio x 180% of output current in light load.
  The advantage is that it provides a higher starting output current when the carrier frequency setting is higher than the default.
  However, the carrier frequency derates easily when it overloads.
- For example: when Pr.06-55 = 0 or 1, the over-current stall prevention level = Ratio × Pr.06-03.
- When Pr.06-55 = 2, the over-current stall prevention level = Pr.06-03

📖 Use this parameter with Pr.00-16 and Pr.00-17.

📖 The ambient temperature also affects the derating. Refer to Section 9-6 Derating Curve.
Take VFD9A0ME43ANSAA in normal duty for example: ambient temperature 50ºC, UL open-type, and independent installation. When the carrier frequency is set to 10 kHz, it corresponds to 75% of the rated output current. The ambient temperature 60ºC corresponds to 75% x 75% of the rated output current.

✓ 06-56 PT100 Voltage Level 1

Default: 5.000

Settings 0.000–10.000 V

✓ 06-57 PT100 Voltage Level 2

Default: 7.000

Settings 0.000–10.000 V

📖 Condition settings: Pr.06-57 > Pr.06-56

✓ 06-58 PT100 Level 1 Frequency Protection

Default: 0.00

Settings 0.00–599.00 Hz

✓ 06-59 PT100 Activation Level 1 Protection Frequency Delay Time

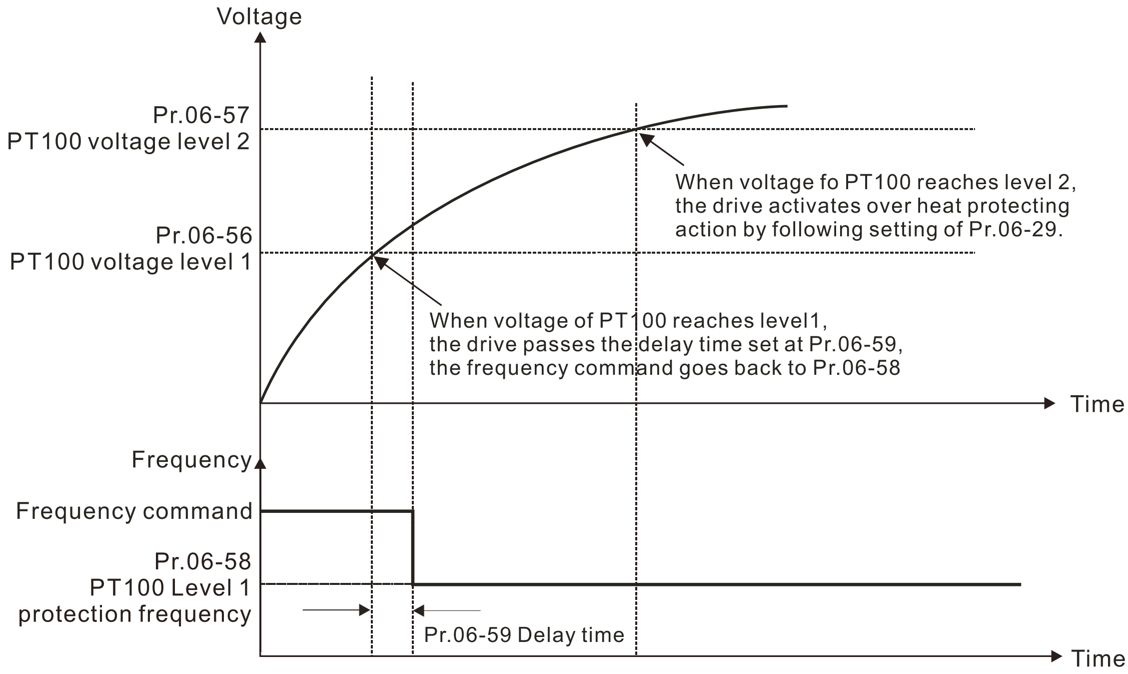
Default: 60

Settings 0–6000 sec.

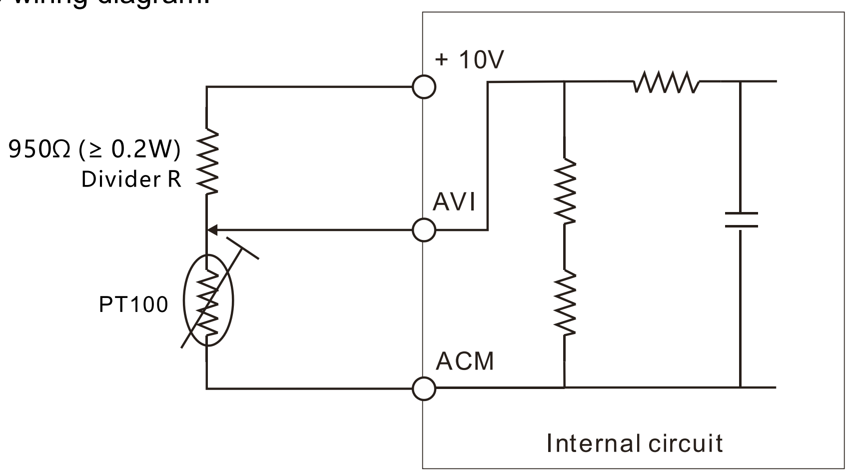
📖 PT100 operation instructions

1. Use voltage type analog input (AVI voltage 0–10 V) and select PT100 mode
2. Set Pr.03-00 = 11 and Pr.03-28 = 0
3. Need to connect divider resistance and recommended voltage is 950Ω (≥ 0.2W).

4. There are two types of action levels for PT100. The diagram below shows the PT100 protection action.



5. PT100 wiring diagram.



📖 Example:

When using PT100, if the motor temperature is higher than 135°C (275°F), the drive starts to count the delay time for auto-deceleration (Pr.06-59). The drive decreases the motor frequency to the setting for Pr.06-58 when it reaches the delay time count value. The drive operates at the frequency set for Pr.06-58 until the motor temperature is lower than 135°C (275°F). If the motor temperature is higher than 150°C (302°F), the drive automatically decelerates to STOP and displays the warning “oH3”.

Set up process:

1. Refer to the PT100 wiring diagram for wiring.
2. Refer to the RTD temperature and resistance comparison table
   Temperature = 135°C, resistance = 151.71 Ω, voltage: about 1.37 VDC
   Temperature = 150°C, resistance = 157.33 Ω, voltage: about 1.42 VDC

3. When the RTD temperature > 135°C, the drive decelerates to the specified operation frequency automatically.
   Then, Pr.06-56 = 1.37 and Pr.06-58 = 10 Hz. When Pr.06-58 = 0, it disables the specified operation frequency.
4. When RTD temperature > 150°C, the drive outputs a fault, decelerates to STOP, and displays the warning "OH3".
   Then, Pr.06-57 = 1.42 and Pr.06-29 = 1 (warn and ramp to stop).

06-60 Software Detection GFF Current Level

Default: 60.0

Settings 0.0–6553.5%

06-61 Software Detection GFF Filter Time

Default: 0.10

Settings 0.00–655.35 sec.

When the drive detects that the unbalanced three-phase output current is higher than the setting for Pr.06-60, GFF protection activates. The drive then stops output.

06-63 Operation Time of Fault Record 1 (Days)
06-65 Operation Time of Fault Record 2 (Days)
06-67 Operation Time of Fault Record 3 (Days)
06-69 Operation Time of Fault Record 4 (Days)
06-90 Operation Time of Fault Record 5 (Days)
06-92 Operation Time of Fault Record 6 (Days)

Default: Read only

Display 0–65535 days

06-64 Operation Time of Fault Record 1 (Minutes)
06-66 Operation Time of Fault Record 2 (Minutes)
06-68 Operation Time of Fault Record 3 (Minutes)
06-70 Operation Time of Fault Record 4 (Minutes)
06-91 Operation Time of Fault Record 5 (Minutes)
06-93 Operation Time of Fault Record 6 (Minutes)

Default: Read only

Display 0–1439 min.

If there is any malfunction when the drive operates, Pr.06-17–06-22 records the malfunctions, and Pr.06-63–06-70 records the operation time for four sequential malfunctions. Check if there is any problem with the drive according to the interval of the recorded fault.

Example:

The first error: ocA occurs after motor drive operates for 1000 minutes.

The second error: ocd occurs after another 1000 minutes.

The third error: ocn occurs after another 1000 minutes.

The fourth error: ocA occurs after another 1000 minutes.

The fifth error: ocd occurs after another 1000 minutes.

The sixth error: ocn occurs after another 1000 minutes.

Then Pr.06-17–06-22 and Pr.06-63–06-70 are recorded as follows:

Parameter	1st fault	2nd fault	3rd fault	4th fault	5th fault	6th fault
06-17	ocA	ocd	ocn	ocA	ocd	ocn
06-18	0	ocA	ocd	ocn	ocA	ocd
06-19	0	0	ocA	ocd	ocn	ocA
06-20	0	0	0	ocA	ocd	ocn
06-21	0	0	0	0	ocA	ocd
06-22	0	0	0	0	0	ocA
06-63	1000	560	120	1120	680	240
06-64	0	1	2	2	3	4
06-65	0	1000	560	120	1120	680
06-66	0	0	1	2	2	3
06-67	0	0	1000	560	120	1120
06-68	0	0	0	1	2	2
06-69	0	0	0	1000	560	120
06-70	0	0	0	0	1	2

Note: By examining the time record, you can see that the last fault (Pr.06-17) happened after the drive ran for four days and 240 minutes.

06-71 Low Current Setting Level

Default: 0.0

Settings 0.0–100.0%

06-72 Low Current Detection Time

Default: 0.00

Settings 0.00–360.00 sec.

06-73 Low Current Action

Default: 0

Settings 0: No Function

1: Fault and coast to stop

2: Fault and ramp to stop by the 2nd deceleration time

3: Warn and continue operation

- The drive operates according to the setting for Pr.06-73 when the output current is lower than the setting for Pr.06-71 and when the time of the low current exceeds the detection time for Pr.06-72. This parameter can use with the external multi-function output terminal setting 44 (low current output).
- The low current detection function does not execute when drive is in sleep or standby status.

06-80 Fire Mode

Default: 0

Settings 0: Disabled

1: Forward (counterclockwise) operation

2: Reverse (clockwise) operation

- Use this parameter with multi-function input terminal setting 58 or 59, and multi-function output terminal setting 53.

0: Fire detection is invalid.

1: The motor operates in a counterclockwise direction (U, V, W).

2: The motor operates in a clockwise direction (U, W, V).

✍ 06-81 Operating Frequency in Fire Mode

Default: 60.00

Settings 0.00–599.00 Hz

📖 Enable fire mode (Pr.06-80 = 1 or 2) and set the operation frequency in fire mode (Pr.06-81). The drive operates with operation frequency in fire mode when the fire mode is enabled.

06-88 Operation Times in Fire Mode

Default: Read only

Settings 0–65535 times

📖 Count once when fire mode operates for 4 minutes.

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07 Special Parameters

〆 You can set this parameter during operation.

〆 07-00 Software Brake Chopper Action Level

Default: 370.0 / 740.0

Settings 115V / 230V models: 350.0–450.0 V_{DC}

460V models: 700.0–900.0 V_{DC}

- Set the DC bus voltage at which the brake chopper is activated. Choose a suitable brake resistor to achieve the optimal deceleration performance. Refer to Chapter 7 Optional Accessories for information about brake resistors.

〆 07-01 DC Brake Current Level

Default: 0

Settings 0–100%

- Set the level of the DC brake current output to the motor at start-up and stop. When setting the DC brake current, the rated current (Pr.00-00) 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.

〆 07-02 DC Brake Time at Start-up

Default: 0.0

Settings 0.0–60.0 sec.

- The motor may continue rotating due to external forces or the inertia of the motor itself. If you use the drive with the motor rotating, it may cause motor damage or trigger drive protection due to over-current. This parameter outputs DC current, generating torque to force the motor stop to get a stable start before motor operation. This parameter determines the duration of the DC brake current output to the motor when the drive starts up. Set this parameter to 0.0 to disable the DC brake at start-up.

〆 07-03 DC brake time at STOP

Default: 0.0

Settings 0.0–60.0 sec.

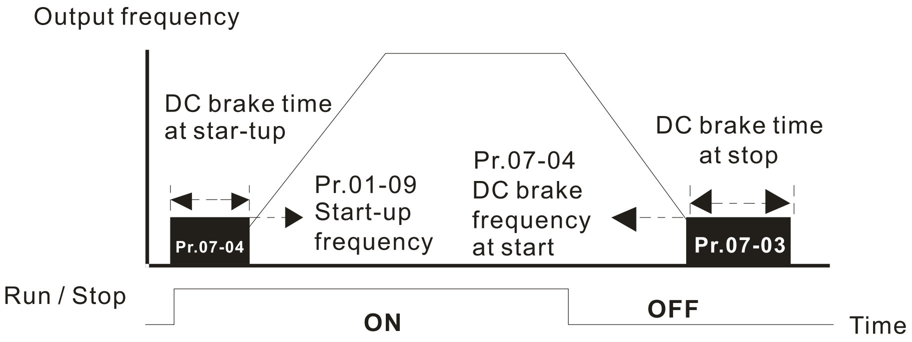
- The motor may continue rotating after the drive stops output due to external forces or the inertia of the motor itself. This parameter outputs DC current, generating torque to force the motor stop after the drive stops output to make sure that the motor stops.
- This parameter determines the duration of the DC Brake current output to the motor when braking. To enable the DC brake at STOP, you must set Pr.00-22 (Stop Method) to 0 (ramp to stop). Set this parameter to 0.0 to disable the DC brake at stop.
- Related parameters: Pr.00-22 Stop Method, Pr.07-04 DC Brake Frequency at STOP.

〆 07-04 DC brake frequency at STOP

Default: 0.00

Settings 0.00–599.00 Hz

- Determine the start frequency of the DC brake before the drive ramps to stop. When this setting is less than Pr.01-09 (Start-up Frequency), the start frequency for the DC brake begins at the minimum frequency.



DC Brake Output Timing Diagram

- Use the DC brake before running the motor when the load is movable at stop, such as with fans and pumps. The motor is in free running status and in unknown rotation direction before the drive starts up. Execute the DC brake before you start the motor.
- Use the DC Brake at STOP when you need to brake the motor quickly or to control the positioning, such as with cranes or cutting machines.

07-05 Voltage Increasing Gain

Default: 100

Settings 1–200%

- When Pr.01-49 = 3, this parameter can adjust voltage increment slope.
- The voltage increment slope is [Pr.07-05]*[1V/1ms].

07-06 Restart after Momentary Power Loss

Default: 0

Settings 0: Stop operation
1: Speed tracking by the speed before the power loss
2: Speed tracking by the minimum output frequency

- Determine the operation mode when the drive restarts from a momentary power loss.
- The power system connected to the drive may power off momentarily for many reasons. This function allows the drive to keep outputting voltages after the drive is repowered and does not cause the drive to stop.
- 1: Frequency tracking begins before momentary power loss and accelerates to the master Frequency command after the drive output frequency and motor rotator speed are synchronous. Use this setting when there is a lot of inertia with little resistance on the motor load. For example, in equipment with a large inertia flywheel, there is NO need to wait until the flywheel stops completely after a restart to execute the operation command; therefore, it saves time.
- 2: Frequency tracking starts from the minimum output frequency and accelerates to the master Frequency command after the drive output frequency and motor rotator speed are synchronous. Use this setting when there is little inertia and large resistance.

07-07 Allowed Power Loss Duration

Default: 2.0

Settings 0.0–20.0 sec.

- Determine the maximum time of allowable power loss. If the duration of a power loss exceeds this parameter setting, the AC motor drive stops output after the power recovers.
- Pr.07-06 is valid when the AC motor drive displays “LV” during the maximum allowable power loss time. If the AC motor drive powers off due to overload which even does not exceed the allowed power loss duration, Pr.07-06 is invalid after the power recovers.

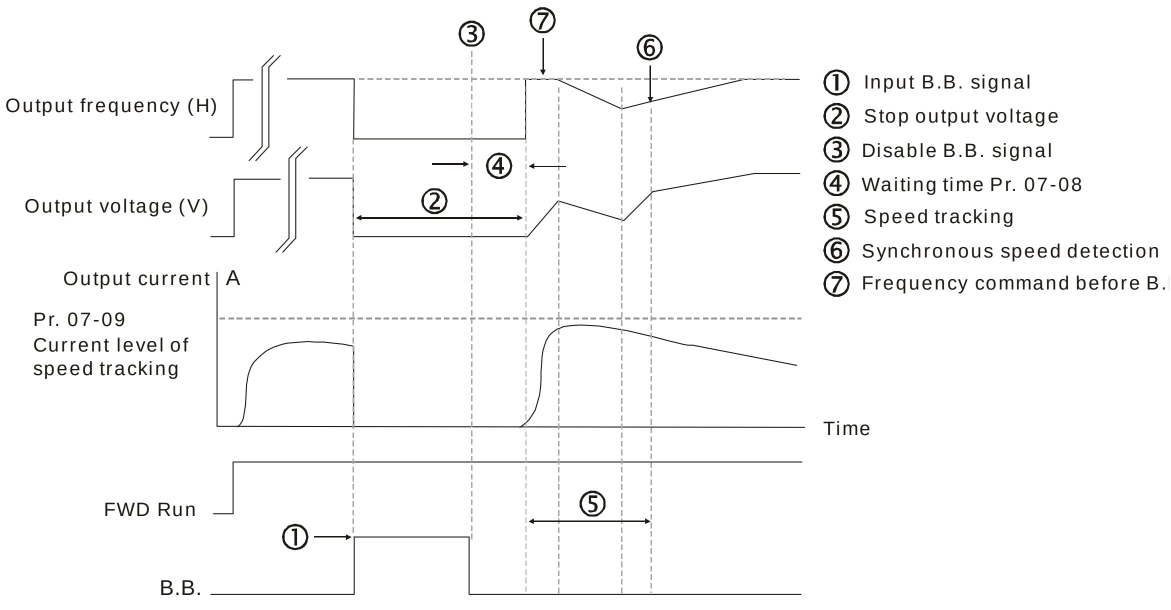
07-08 Base Block Time

Default: 0.5

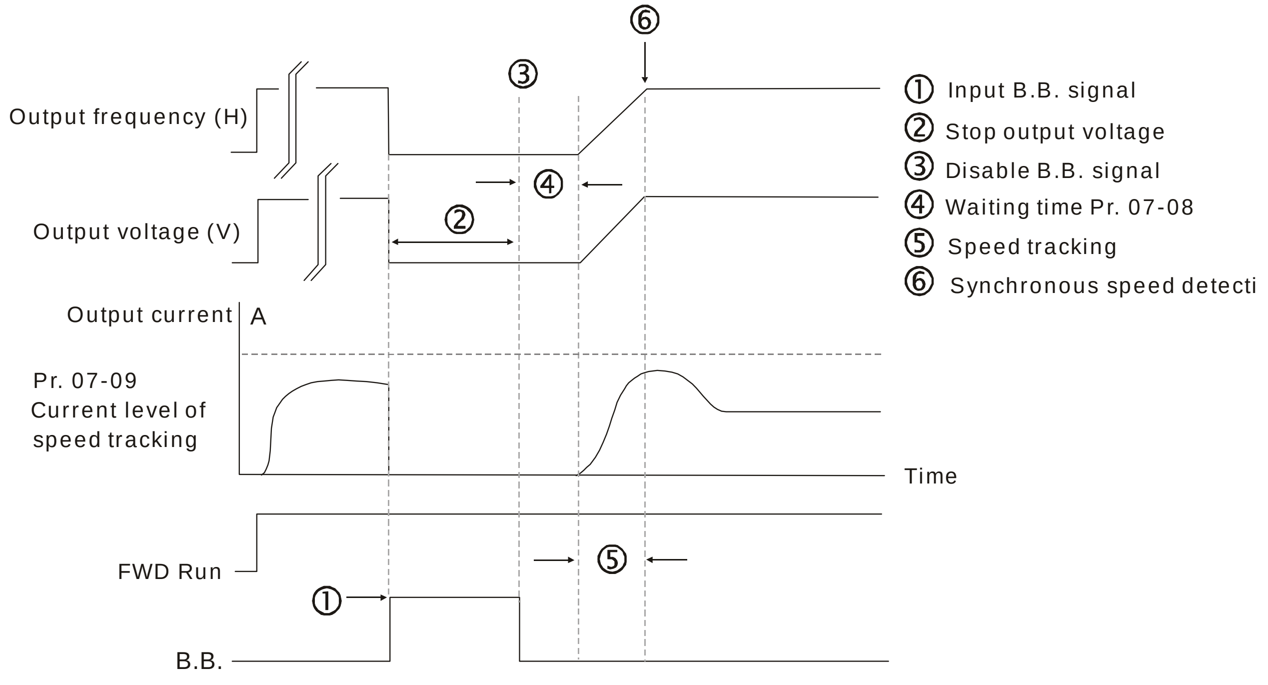
Settings 0.0–60.0 sec.

- When momentary power loss is detected, the AC motor drive blocks its output and then waits for a specified period of time (determined by Pr.07-08, called Base Block Time) before resuming operation. Set this parameter to the time that allows the residual voltage at the output side to decrease to 0 V before activating the drive again.
- This parameter is not only for the B.B. time, but also is the re-start delay time after free run.
- The RUN command during a free run operation is memorized, and runs or stops with the last frequency command after the delay time.
- This delay time is only applicable in “Re-start after coast to stop” status, and does not limit ramp to stop. The coast to stop can be caused by various control command source, or by errors.
- Following table is the recommended setting for re-start delay time of each model power. You must set Pr.07-08 according to this table (the default of each model power is based on this table as well).

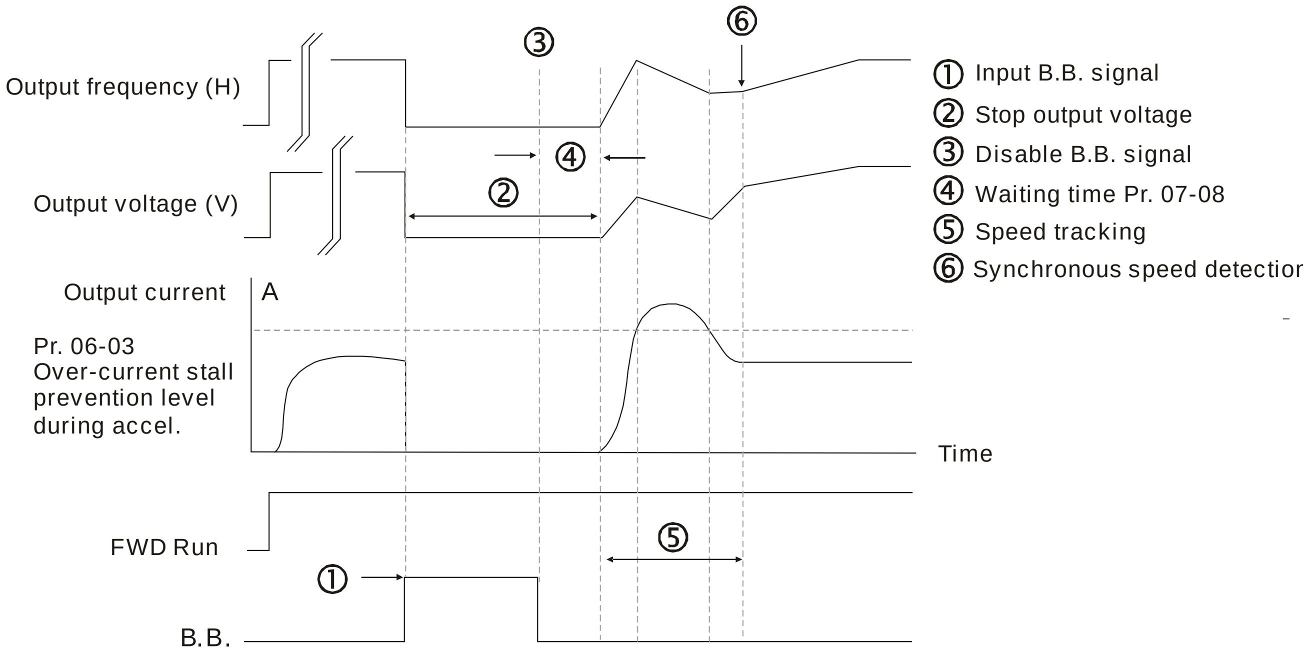
kW	0.75	1.5	2.2	3.7	5.6	7.5	11.0	15.0	18.5	22.0
HP	1	2	3	5	7.5	10	15	20	25	30
Delay Time (sec.)	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2



B.B. Speed tracking: from last output frequency



B.B. Speed tracking: from minimum output frequency



Over-current stall prevention

07-09 Current Limit of Speed Tracking

Default: 100

Settings 20–200%

- The AC motor drive executes speed tracking only when the output current is greater than the value set in Pr.07-09.
- The maximum current for speed tracking affects the synchronous time. The larger the parameter setting, the faster the synchronization occurs. However, if the parameter setting is too large, the overload protection function may be activated.

07-10 Restart after Fault Action

Default: 0

Settings 0: Stop operation
1: Speed tracking by current speed
2: Speed tracking by the minimum output frequency

- Faults include: bb, oc, ov, occ. To restart after oc, ov, occ, you can NOT set Pr.07-11 to 0.

07-11 Number of times of restart after fault

Default: 0

Settings 0–10

- After fault (allowed fault: oc, ov, occ) occurs, the AC motor drive can reset and restart automatically up to 10 times. If Pr.07-11 is set to 0, the drive does not reset or restart automatically after faults occur. The drive starts according to the Pr.07-10 setting after restarting after fault.
- If the number of faults exceeds the Pr.07-11 setting, the drive does not reset and restart until you press “RESET” manually and execute the operation command again.

07-12 Speed Tracking during Start-up

Default: 0

Settings 0: No reaction
1: Speed tracking by the maximum output frequency
2: Speed tracking by the motor frequency at start-up
3: Speed tracking by the minimum output frequency

- Speed tracking is suitable for punch, fans and other large inertia loads. For example, a mechanical punch usually has a large inertia flywheel, and the general stop method is coast to stop. If it needs to be restarted again, the flywheel may take 2–5 minutes or longer to stop. This parameter setting allows you to start the flywheel operating again without waiting until the flywheel stops completely.

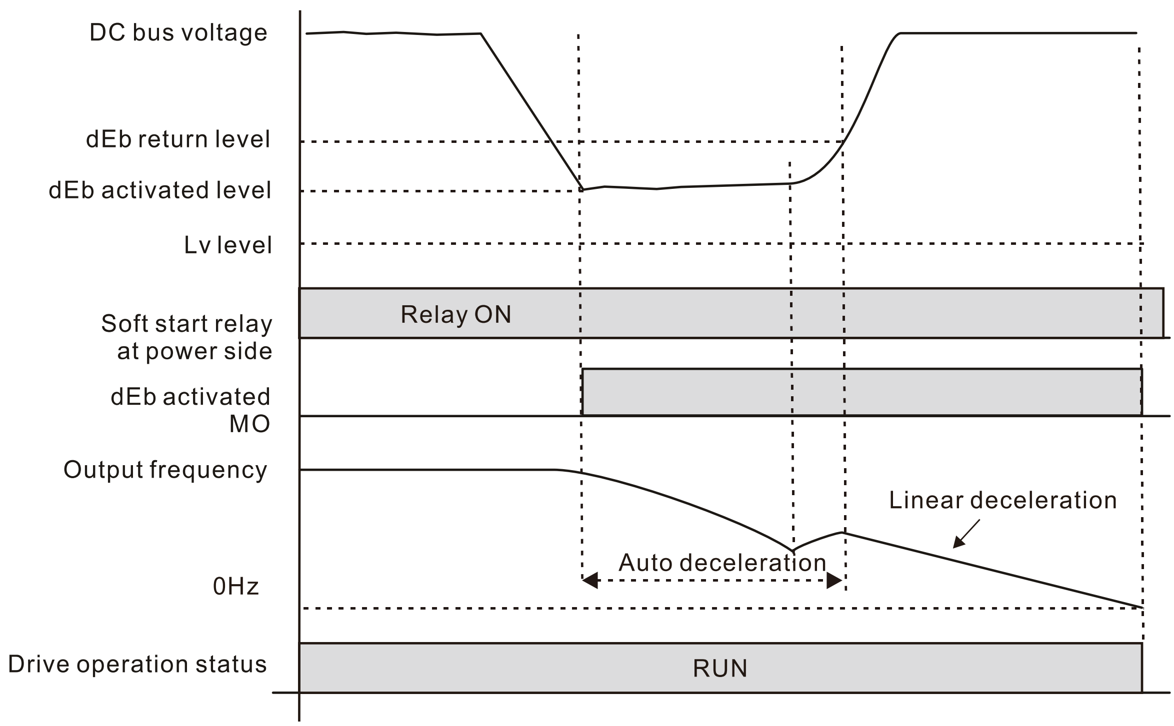
07-13 dEb Function Selection

Default: 0

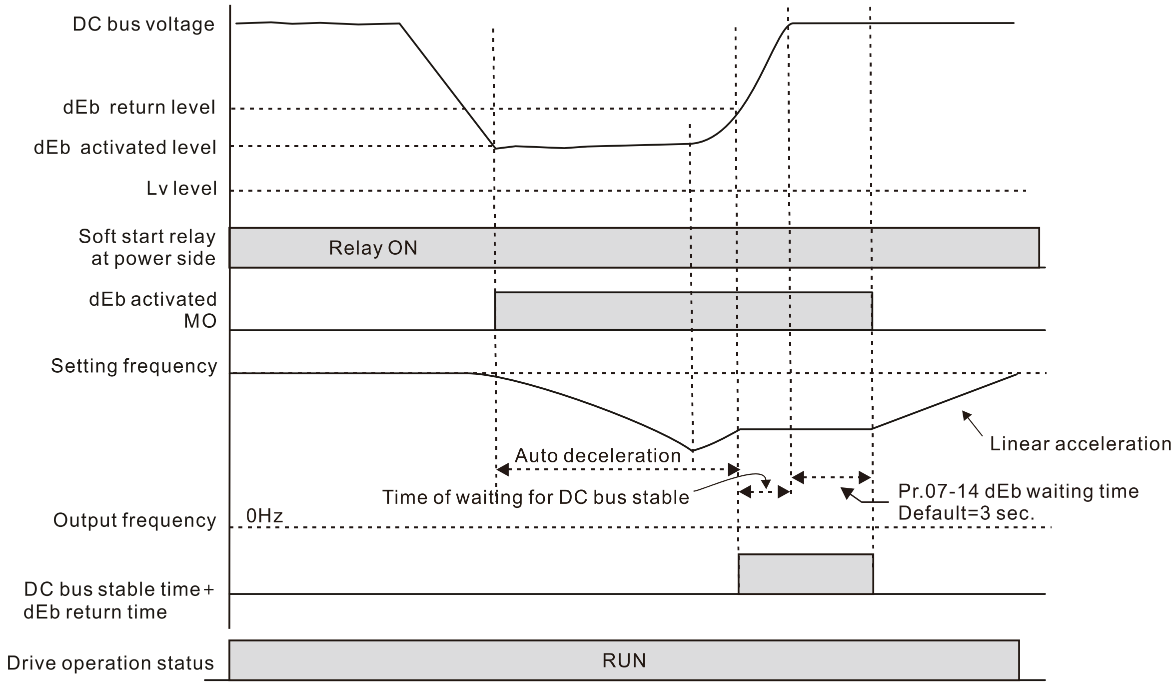
Settings 0: No reaction
1: dEb with auto-acceleration / auto-deceleration, the drive does not output the frequency after the power is restored.
2: dEb with auto-acceleration / auto-deceleration, the drive outputs the frequency after the power is restored.

- dEb (Deceleration Energy Backup) lets the motor decelerate to stop when momentary power loss occurs. When the power loss is instantaneous, use this function to let the motor decelerate to zero speed. If the power recovers at this time, the drive restarts the motor after the dEb return time.
- Lv return level: Default value depends on the drive power model.
  - Frame A, B, C, D = Pr.06-00 + 60 V / 30 V (230V models)
  - Frame E and above = Pr.06-00 + 80 V / 40 V (230V models)
- Lv level: Default is Pr.06-00.
- During dEb operation, other protection, such as ryF, ov, oc, occ, and EF may interrupt it, and these error codes are recorded.

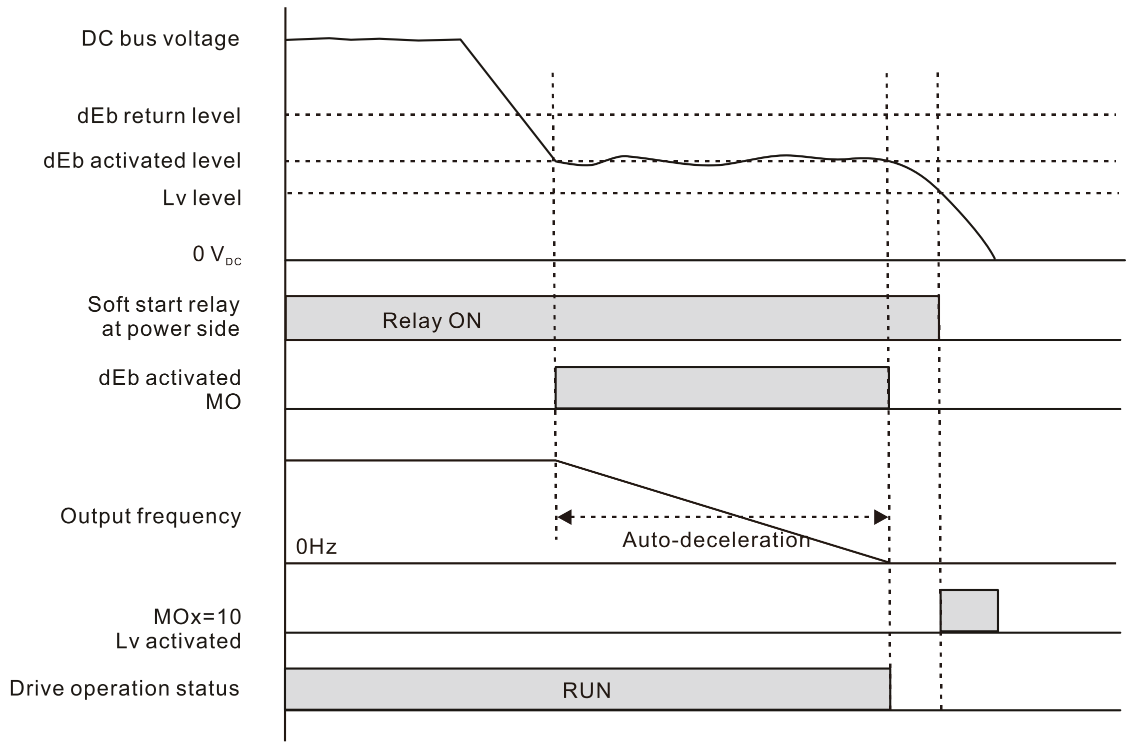
- The STOP (RESET) command does not work during the dEb auto-deceleration, and the drive continues decelerating to stop. To make the drive coast to stop immediately, use another function (EF) instead.
- The B.B. function does not work when executing dEb. The B.B. function is enabled after the dEb function finishes.
- Even though the Lv warning does not display during dEb operation, if the DC bus voltage is lower than the Lv level, MO = 10 (Low voltage warning) still operates.
- The following explains the dEb action:
  When the DC bus voltage drops below the dEb setting level, the dEb function starts to work (soft start relay remains closed), and the drive executes auto-deceleration.
  - Situation 1: Momentary power loss, or too low and unstable power voltage, or power supply sliding down because of sudden heavy load
    Pr.07-13 = 1 and power recovers
    When the power recovers and DC bus voltage exceeds the dEb return level, the drive linearly decelerates to 0 Hz and stops. The keypad displays the “dEb” warning until you manually reset it, so you can see the reason for the stop.



- Situation 2: Momentary power loss, or too low and unstable power voltage, or power supply sliding down because of sudden heavy load
  Pr.07-13 = 2 and power recovers
  During the dEb deceleration (includes 0 Hz run), if the power recovers to a voltage higher than dEb return level, the drive maintains the frequency for three seconds and then accelerates again. The "dEb" warning on the keypad is automatically cleared.

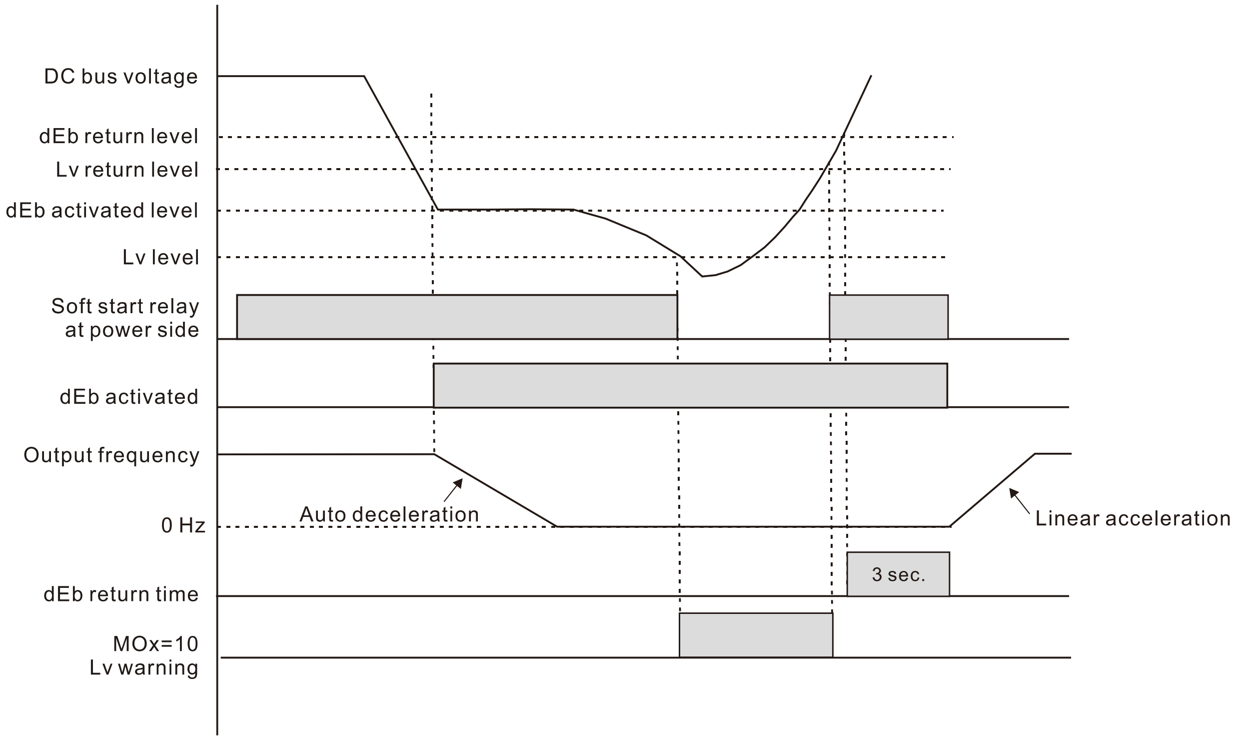


- Situation 3: Unexpected power shut down or power loss
  Pr.07-13 = 1 and power does not recover
  The keypad displays the "dEb" warning and the drive stops after decelerating to the lowest operating frequency. When the DC bus voltage is lower than the Lv level, the drive disconnects the soft start relay until the power completely runs out.



- Situation 4: Pr.07-13 = 2 and power does not recover, same situation as Situation 3. The drive decelerates to 0 Hz. The DC bus voltage continues to decrease until the voltage is lower than the Lv level, and then the drive disconnects the soft start relay. The keypad displays "dEb" warning until the drive completely runs out of power.

- Situation 5: Pr.07-13 = 2 and power recovers after the DC bus voltage is lower than the Lv level.
  The drive decelerates to 0 Hz. The DC bus voltage continues to decrease until the voltage is lower than the Lv level, and then the drive disconnects the soft start relay. The soft start relay closes again after the power recovers and the DC bus voltage is higher than the Lv return level. When the DC bus voltage is higher than the dEb return level, the drive maintains the frequency for three seconds and starts to accelerate linearly. The "dEb" warning on the keypad is automatically cleared.



07-15 Dwell Time at Acceleration

Default: 0.00

Settings 0.00–600.00 sec.

07-17 Dwell Time at Deceleration

Default: 0.00

Settings 0.00–600.00 sec.

07-16 Dwell Frequency at Acceleration

Default: 0.00

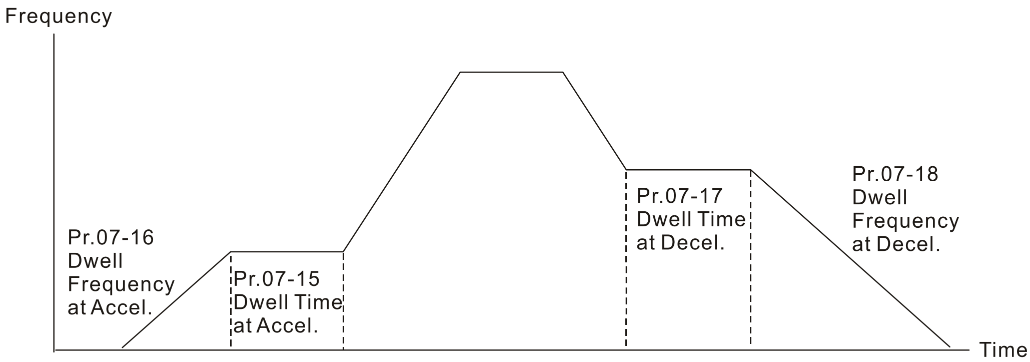
Settings 0.00–599.00 Hz

07-18 Dwell Frequency at Deceleration

Default: 0.00

Settings 0.00–599.00 Hz

- In heavy load situations, the Dwell temporarily maintains stable output frequency. Use this parameter for cranes, elevators, and so on.
- When the load is heavier, use Pr.07-15–Pr.07-18 to give protection for avoiding OV or OC.



Dwell at acceleration / deceleration

✓ 07-19 Fan cooling control

Default: 3

Settings 0: Fan is always ON

1: Fan is OFF after the AC motor drive stops for one minute.

2: When the AC motor drive runs, the fan is ON. When the AC motor drive stops, the fan is OFF.

3: Fan turns ON when the temperature (IGBT) reaches around 60 ºC .

5: Fan turns ON / OFF according to the run / stop of the AC motor drive, and stays in Stand By mode at zero speed.

- Use this parameter to control the fan.
- 0: Fan runs immediately when the drive power is turned ON.
- 1: Fan runs when the AC motor drive runs. One minute after the AC motor drive stops, the fan stops.
- 2: Fan runs when the AC motor drive runs and stops immediately when the AC motor drive stops.
- 3: Fan is ON when temperature of the IGBT or capacitance is > 60ºC.
  Fan is OFF when the temperature of the IGBT and capacitance both are < 40ºC, and the drive stops running.

✓ 07-20 Emergency Stop (EF) & Force to Stop Selection

Default: 0

Settings 0: Coast to stop

1: Stop by the first deceleration time

2: Stop by the second deceleration time

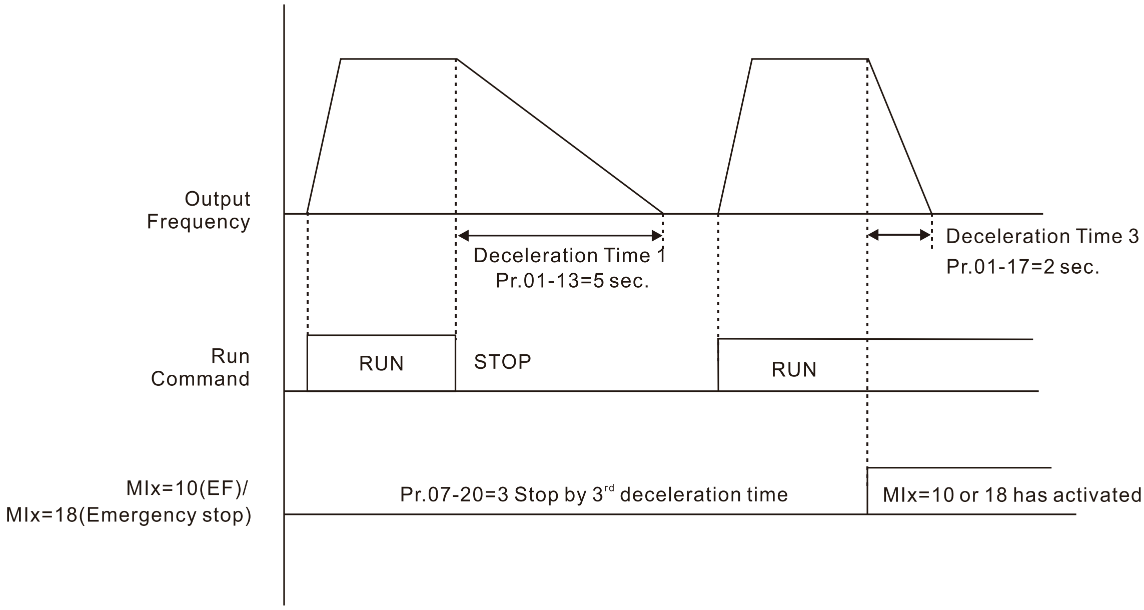
3: Stop by the third deceleration time

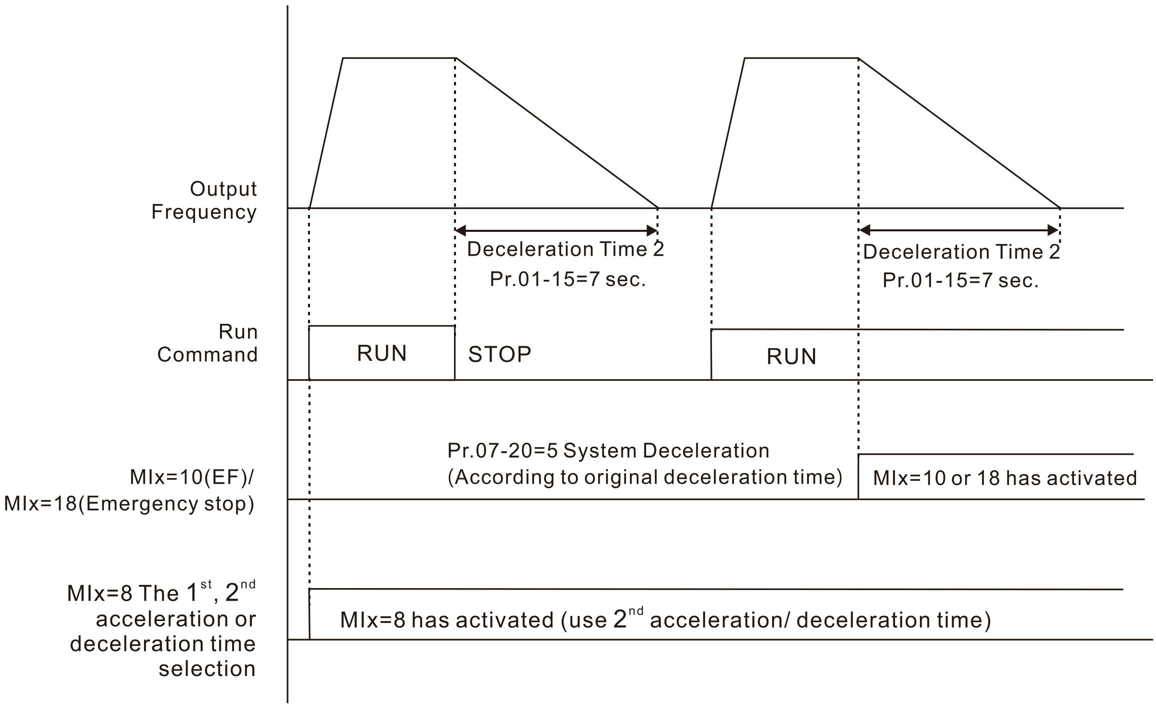
4: Stop by the fourth deceleration time

5: System deceleration

6: Automatic deceleration

- When the multi-function input terminal setting is set to 10 (EF input) or 18 (force to stop) and the terminal contact is ON, the drive stops according to the setting of this parameter.





07-21 Automatic Energy-saving Setting

Default: 0

Settings 0: Disabled

1: Power factor energy-saving improvement

- When energy-saving is enabled, the motor acceleration/deceleration operates with full voltage. During constant speed operation, it automatically calculates the best voltage value according to the load power. This function is not suitable for fluctuating loads or loads which are nearly full during operation.
- When the output frequency is constant (that is, constant operation), the output voltage decreases automatically as the load decreases. Therefore, the drive operates with minimum multiplication of voltage and current (electric power) to reach the energy-saving.

07-23 Automatic Voltage Regulation (AVR) Function

Default: 0

Settings 0: Enable AVR
1: Disable AVR
2: Disable AVR during deceleration

- The rated voltage of a motor is usually 220 V / 200 V, 60 Hz / 50 Hz, and the input voltage of the AC motor drive may vary from 180–264 VAC, 50 Hz / 60 Hz. Therefore, when using the AC motor drive without the AVR function, the output voltage is the same as the input voltage. When the motor runs at the voltage exceeding 12–20% of the rated voltage, it causes higher temperatures, damaged insulation, and unstable torque output, which result in losses due to shorter motor lifetime.
- The AVR function automatically regulates the output voltage of the AC motor drive to the motor's rated voltage when the input voltage exceeds the motor's rated voltage. For example, if the V/F curve is set at 200 VAC, 50 Hz and the input voltage is at 200–264 VAC, then the drive automatically reduces the output voltage to the motor to a maximum of 200 VAC, 50 Hz. If the input voltage is at 180–200 VAC, the output voltage to motor is in direct proportion to the input voltage.
- 0: When the AVR function is enabled, the drive calculates the output voltage according to the actual DC bus voltage. The output voltage does NOT change when the DC bus voltage changes.
- 1: When the AVR function is disabled, the drive calculates the output voltage according to the actual DC bus voltage. The output voltage changes with the DC bus voltage, and may cause insufficient current, over-current or oscillation.
- 2: The drive disables the AVR function only during deceleration to stop, and at this time, you can accelerate the braking to achieve the same result.
- When the motor ramps to stop, disable the AVR function to shorten the deceleration time. Then, use with the auto-acceleration and auto-deceleration functions to make the motor's deceleration more stable and quicker.

07-24 Torque Command Filter Time

Default: 0.050

Settings 0.001–10.000 sec.

- Applicable only to IMVF and PMSVC control modes.
- 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.

07-25 Slip Compensation Filter Time

Default: 0.100

Settings 0.001–10.000 sec.

- Applicable only to IMSVC control mode.
- Change the compensation response time with Pr.07-24 and Pr.07-25.

- If you set Pr.07-24 and Pr.07-25 to 10 seconds, the compensation response time is the slowest; however, the system may be unstable if you set the time too short.

07-26	Torque Compensation Gain
07-71	Torque Compensation Gain (Motor 2)

Default: 1

Settings IM: 0–10 (when Pr.05-33 = 0)
PM: 0–5000 (when Pr.05-33 = 1 or 2)

- Applicable only to IMVF and PMSVC control modes.
- With a large motor load, a part of the drive output voltage is absorbed by the stator winding resistor; therefore, the air gap magnetic field is insufficient. This causes insufficient voltage at motor induction and results in excessive output current but insufficient output torque. Auto-torque compensation can automatically adjust the output voltage according to the load and keep the air gap magnetic fields stable to get the optimal operation.
- In the V/F control, the voltage decreases in direct proportion with decreasing frequency. The torque decreases at low speed because of a decreasing AC resistor and an unchanged DC resistor. The auto-torque compensation function increases the output voltage at low frequency to get a higher starting torque.
- When the compensation gain is set too high, it may cause motor over-flux and result in a too large output current of the drive, motor overheating or trigger the drive's protection function.
- This parameter affects the output current when the drive runs. The effect is smaller at the low-speed area.
- Set this parameter higher when the no-load current is too large. But the motor may vibrate if the setting is too high. If the motor vibrates when operating, reduce the setting.

07-27	Slip Compensation Gain
07-72	Slip Compensation Gain (Motor 2)

Default: 0.00
(Default is 1.00 in SVC mode)

Settings 0.00–10.00

- Applicable only to IMSVC control mode.
- The induction motor needs constant slip to produce electromagnetic torque. It can be ignored at higher motor speeds, such as rated speed or 2–3% of slip.
- However, during the drive operation, the slip and the synchronous frequency are in reverse proportion to produce the same electromagnetic torque. The slip is larger with the reduction of the synchronous frequency. Moreover, the motor may stop when the synchronous frequency decreases to a specific value. Therefore, the slip seriously affects the motor speed accuracy at low speed.
- In another situation, when you use an induction motor with the drive, the slip increases when the load increases. It also affects the motor speed accuracy.

📖 Use this parameter to set the compensation frequency, and reduce the slip to maintain the synchronous speed when the motor runs at the rated current in order to improve the accuracy of the drive. When the drive output current is higher than Pr.05-05 (No-load Current for Induction Motor 1 (A)), the drive compensates the frequency according to this parameter.

📖 This parameter is set to 1.00 automatically when speed control mode (Pr.00-11) changes from V/F mode to vector mode. Otherwise, it is automatically set to 0.00. Apply the slip compensation after load and acceleration. Increase the compensation value from small to large gradually. Add the output frequency to the [motor rated slip x Pr.07-27 (Slip Compensation Gain)] when the motor is at the rated load. If the actual speed ratio is slower than expected, increase the parameter setting value; otherwise, decrease the setting value.

✎ 07-29 Slip Deviation Level

Default: 0

Settings 0.0–100.0%

0: No detection

✎ 07-30 Over-slip Deviation Detection Time

Default: 1.0

Settings 0.0–10.0 sec.

✎ 07-31 Over-slip Deviation Treatment

Default: 0

Settings 0: Warn and continue operation

1: Fault and ramp to stop

2: Fault and coast to stop

3: No warning

📖 Pr.07-29–Pr.07-31 set the allowable slip level/time and the over-slip treatment when the drive is running.

✎ 07-32 Motor Oscillation Compensation Factor

Default: 1000

Settings 0–10000

📖 If there are current wave motions which cause severe motor oscillation in some specific area, setting this parameter can effectively improve this situation.

📖 When the current wave motion occurs in low frequency and high power, increase the value for Pr.07-32.

✎ 07-33 Auto-restart Interval of Fault

Default: 60.0

Settings 0.0–6000.0 sec.

📖 When a reset/restart occurs after a fault, the drive uses Pr.07-33 as a timer and starts counting the number of faults within this time period. Within this period, if the number of faults does not exceed the setting for Pr.07-11, the counting clears and starts from 0 when the next fault occurs.

07-38 PMSVC Voltage Feed Forward Gain

Default: 1.00

Settings 0.00–2.00

- Adjust the voltage feedback forward gain under PMSVC control, and to meet the demand of rapid feedback application.
- Pr.07-38 = 1.00 means forward feedback = Ke × motor rotor speed
- Refer to Section 12-2 “PMSVC adjustment” for details.

✎ 07-62 dEb Gain (Kp)

Default: 8000

Settings 0–65535

✎ 07-63 dEb Gain (Ki)

Default: 150

Settings 0–65535

- Set the PI gain of DC bus voltage controller when the dEb function activates.
- If the DC bus voltage drops too fast, or the speed oscillation occurs during deceleration after the dEb function activates, adjust Pr.07-62 and Pr.07-63. Increase the Kp setting to quicken the control response, but the oscillation may occur if the setting is too large. Use Ki parameter to decrease the steady-state error to zero, and increase the setting to quicken the response speed.

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08 High-function PID Parameters

✓ You can set this parameter during operation.

✓ **08-00** Terminal Selection of PID Feedback

Default: 0

Settings 0: No Function

1: Negative PID feedback: by analog input (Pr.03-00)

4: Positive PID feedback: by analog input (Pr.03-00)

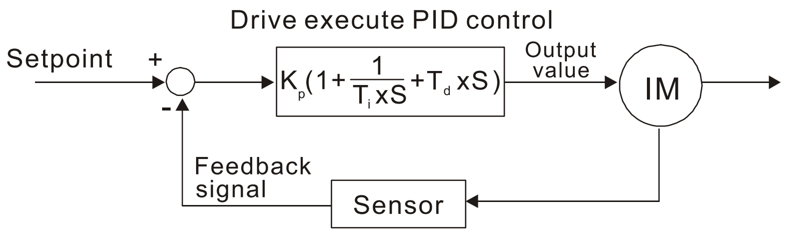
7: Negative PID feedback: by communication protocols

8: Positive PID feedback: by communication protocols

- Negative feedback: Error = Target value (set point) – Feedback. Use negative feedback when the detection value increases if the output frequency increases.
- Positive feedback: Error = Feedback - Target value (set point). Use positive feedback when the detection value decreases if the output frequency increases.
- When Pr.08-00 ≠ 7 or ≠ 8, the input value is disabled. The setting value does not remain when the drive is powered off.

1. Common applications for PID control:
   - Flow control: Use a flow sensor to feedback the flow data and perform accurate flow control.
   - Pressure control: Use a pressure sensor to feedback the pressure data and perform precise pressure control.
   - Air volume control: Use an air volume sensor to feedback the air volume data to achieve excellent air volume regulation.
   - Temperature control: Use a thermocouple or thermistor to feedback temperature data for comfortable temperature control.
   - Speed control: Use a speed sensor to feedback motor shaft speed or input another machine speed as a target value for synchronous control.

2. PID control loop:



K_P Proportional Gain (P), T_i Integral Time (I), T_d Differential Time (D), S Calculation

3. Concept of PID control:

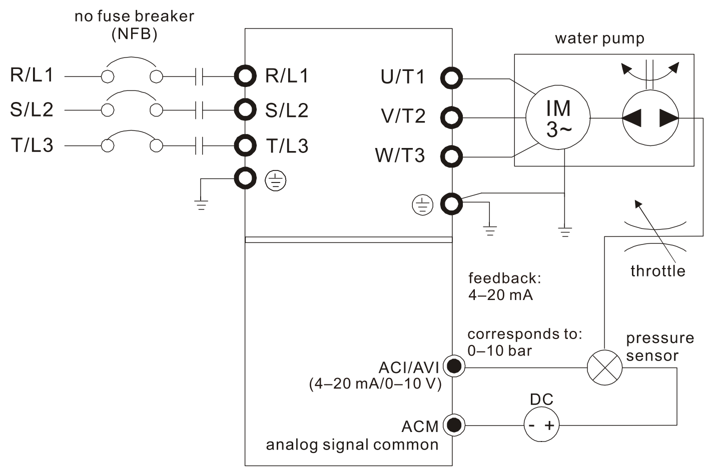
   (1) Proportional gain (P):
   The output is proportional to input. With only a proportional gain control, there is always a steady-state error.

   (2) Integral time (I):
   The controller output is proportional to the integral of the controller input. When an automatic control system is in a steady state and a steady-state error occurs, the

system is called a System with Steady-state Error. To eliminate the steady-state error, add an "integral part" to the controller. The integral time controls the relation between the integral part and the error. The integral part increases over time even if the error is small. It gradually increases the controller output to eliminate the error until it is zero. This stabilizes the system without a steady-state error by using proportional gain control and integral time control.

(3) Differential control (D):
The controller output is proportional to the differential of the controller input. During elimination of the error, oscillation or instability may occur. Use the differential control to suppress these effects by acting before the error. That is, when the error is near 0, the differential control should be 0. Use proportional gain (P) and differential control (D) to improve the system state during PID adjustment.

4. Using PID control in a constant pressure pump feedback application:
Set the application's constant pressure value (bar) to be the set point of PID control. The pressure sensor sends the actual value as the PID feedback value. After comparing the PID set point and PID feedback, an error display. The PID controller calculates the output by using proportional gain (P), integral time (I) and differential time (D) to control the pump. It controls the drive to use a different pump speed and achieves constant pressure control by using a 4–20 mA signal corresponding to 0–10 bar as feedback to the drive.



- Pr.00-04 = 10 (display PID feedback (b) (%))
- Pr.01-12 Acceleration Time is set according to actual conditions.
- Pr.01-13 Deceleration Time is set according to actual conditions.
- Pr.00-21 = 0, operate through the digital keypad
- Pr.00-20 = 0, the digital keypad controls the set point.
- Pr.08-00 = 1 (negative PID feedback from analog input)
- AVI analog input Pr.03-00 = 5, PID feedback signal.
- Set / fine-tune Pr.08-01-08-03 according to actual condition.
  If there is no oscillation in the system, increase Pr.08-01 (Proportional Gain (P))
  If there is no oscillation in the system, decrease Pr.08-02 (Integral Time (I))
  If there is no oscillation in the system, increase Pr.08-03 (Differential Time (D))
- Refer to Pr.08-00–08-21 for PID parameter settings.

✐ 08-01 Proportional Gain (P)

Default: 1.00

Settings 0.0–100.0 (when Pr.08-23 setting bit 1 = 0)
0.00–100.00 (when Pr.08-23 setting bit 1 = 1)

- If the setting is 1.0, Kp gain is 100%; if the setting is 0.5, Kp gain is 50%.
- Sets the proportional gain to determine the deviation response speed. The higher the proportional gain, the faster the response speed, and causes oscillation. The lower the proportional gain, the slower the response speed. Eliminate the system deviation; usually used to decrease the deviation and get faster response speed. If you set the value too high, overshoot occurs and it may cause system oscillation and instability.
- If you set the other two gains (I and D) to zero, proportional control is the only effective parameter.

✐ 08-02 Integral Time (I)

Default: 1.00

Settings 0.00–100.00 sec.

- Use the integral controller to eliminate the deviation during stable system operation. The integral control does not stop working until the deviation is zero. The integral is affected by the integral time. The smaller the integral time, the stronger the integral action. It is helpful to reduce overshoot and oscillation for a stable system. Accordingly, the speed to lower the steady-state deviation decreases. The integral control is often used with the other two controls for the PI controller or PID controller.
- Set the integral time of the I controller. When the integral time is long, there is a small I controller gain, with slower response and slow external control. When the integral time is short, there is a large I controller gain, with faster response and rapid external control.
- When the integral time is too short, it may cause overshoot or oscillation for the output frequency and system.
- Set Integral Time to 0.00 to disable the I controller.

✐ 08-03 Differential Time (D)

Default: 0.00

Settings 0.00–1.00 sec.

- Use the differential controller to show the system deviation change, as well as to preview the change in the deviation. You can use the differential controller to eliminate the deviation in order to improve the system state. Using a suitable differential time can reduce overshoot and shorten adjustment time; however, the differential operation increases noise interference. Note that a too large differential causes more noise interference. In addition, the differential shows the change and the differential output is 0 when there is no change. Note that you cannot use the differential control independently. You must use it with the other two controllers for the PD controller or PID controller.
- Set the D controller gain to determine the deviation change response. Using a suitable differential time reduces the P and I controllers overshoot to decrease the oscillation for a stable system. A differential time that is too long may cause system oscillation.

📖 The differential controller acts on the change in the deviation and cannot reduce the interference. Do not use this function when there is significant interference.

✎ 08-04 Upper Limit of Integral Control

Default: 100.0

Settings 0.0–100.0%

📖 Define an upper bound for the integral gain (I) and therefore limits the master frequency. The formula is: Integral upper bound = Maximum Operation Frequency (Pr.01-00) x (Pr.08-04%)

📖 An excessive integral value causes a slow response due to sudden load changes and may cause motor stall or machine damage. If so, decrease it to a proper value.

✎ 08-05 PID Output Command Limit (Positive Limit)

Default: 100.0

Settings 0.0–100.0%

📖 Define the percentage of the output frequency limit during the PID control.
The formula is Output Frequency Limit = Maximum Operation Frequency (Pr.01-00) × (Pr.08-05%)

✎ 08-06 PID Feedback Value by Communication Protocol

Default: 0.00

Settings -200.00%–200.00%

📖 Use communications to set the PID feedback value when the PID feedback input is set to communications (Pr.08-00 = 7 or 8).

✎ 08-07 PID Delay Time

Default: 0.0

Settings 0.0–2.5 sec.

08-20 PID Mode Selection

Default: 0

Settings 0: Serial connection
1: Parallel connection

📖 0: Use conventional PID control structure.
1: The proportional gain, integral gain and differential gain are independent. You can customize the P, I and D value to fit your application.

📖 This parameter determines the primary low pass filter time when in PID control. Setting a large time constant may slow down the drive's response speed.

📖 PID control output frequency is filtered with a primary low pass function. This function can filter a mix of frequencies. A long primary low pass time means the filter degree is high and a short primary low pass time means the filter degree is low.

📖 Inappropriate delay time setting may cause system oscillation.

📖 PI Control:
Controlled only by the P action, so the deviation cannot be entirely eliminated. In general, to eliminate residual deviations, use the P + I controls. When you use the PI control, it eliminates the deviation caused by the targeted value changes and the constant external interferences. However, if the I action is too powerful, it delays the response when there is rapid variation. You can use the

P action by itself to control the loading system with the integral components.

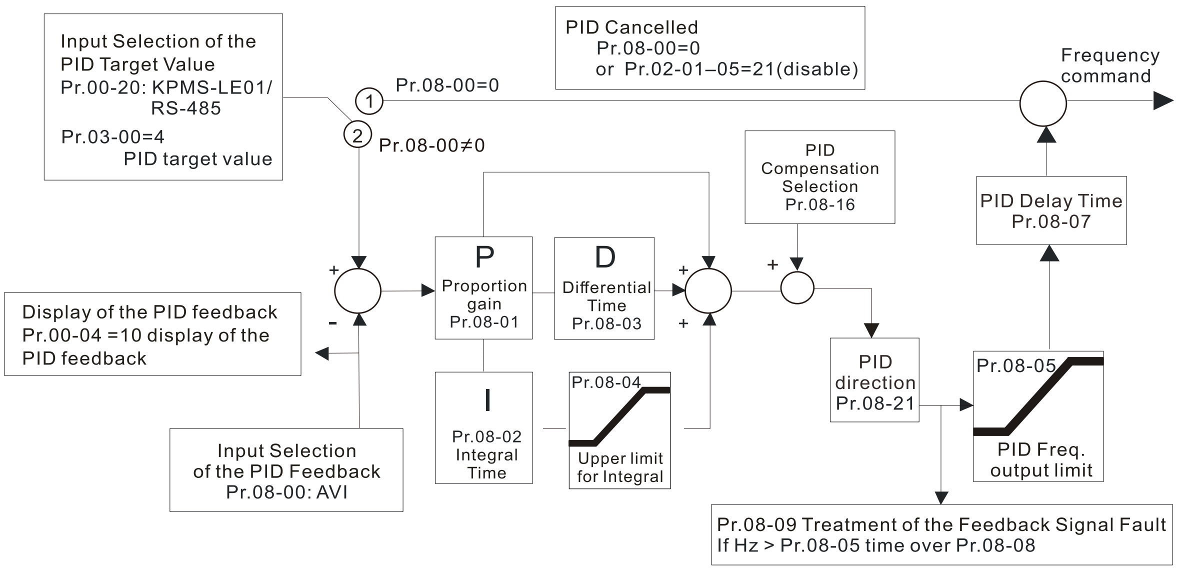
📖 PD Control:

When deviation occurs, the system immediately generates an operation load that is greater than the load generated only by the D action to restrain the deviation increment. If the deviation is small, the effectiveness of the P action decreases as well. The control objects include applications with integral component loads, which are controlled by the P action only. Sometimes, if the integral component is functioning, the whole system may oscillate. In this case, use the PD control to reduce the P action's oscillation and stabilize the system. In other words, this control is useful with no brake function's loading over the processes.

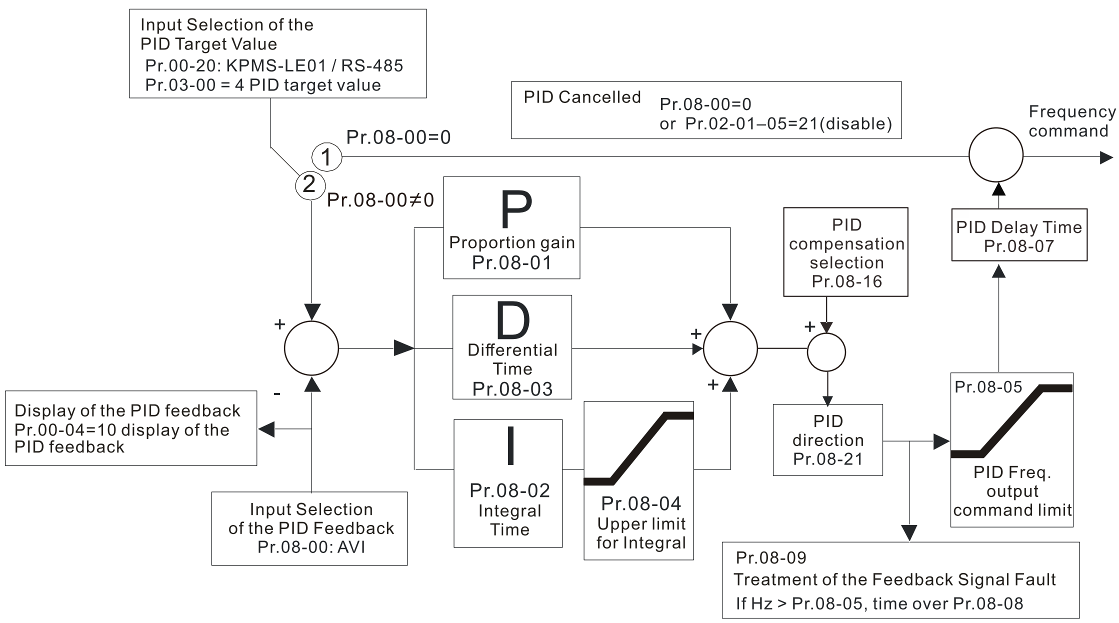
📖 PID Control:

Use the I action to eliminate the deviation and the D action to reduce oscillation; then combine this with the P action for the PID control. Use the PID method for a control process with no deviations, high accuracy, and a stable system.

Serial connection



Parallel connection



✍ 08-08 Feedback Signal Detection Time

Default: 0.0

Settings 0.0–3600.0 sec.

- Valid only when the feedback signal is 4–20 mA (Pr.03-28 = 2).
- This parameter sets the detection time for abnormal PID signal feedback. You can also use it when the system feedback signal response is extremely slow. (Setting the detection time to 0.0 disables the detection function.)

✍ 08-09 Feedback Signal Fault Treatment

Default: 0

Settings 0: Warn and continue operation
1: Fault and ramp to stop
2: Fault and coast to stop
3: Warn and operate at last frequency

- Valid only when the feedback signal is 4–20 mA (Pr.03-28 = 2).
- Sets the treatments when the PID feedback signal is abnormal.

✍ 08-10 Sleep Level

Default: 0.00

Settings 0.00–599.00 Hz / 0.00–200.00%

- Determine the sleep frequency, and if the sleep time and the wake-up frequency are enabled or disabled. Pr.08-10 = 0: Disabled; Pr.08-10 ≠ 0: Enabled

✍ 08-11 Wake-Up Level

Default: 0.00

Settings 0.00–599.00 Hz / 0.00–200.00%

- Determine the sleep frequency, and if the sleep time and the wake-up frequency are enabled or disabled. Pr.08-10 = 0: Disabled; Pr.08-10 ≠ 0: Enabled
- Pr.08-18 = 0: The unit for Pr.08-10 and that for Pr.08-11 change to frequency. The settings are between 0.00–599.00 Hz.
- Pr.08-18 = 1: The unit for Pr.08-10 and that for Pr.08-11 change to percentage. The settings are between 0.00–200.00%.
- The percentage is based on the current command value, not the maximum value.
  For example, if the maximum value is 100 kg, and the present command value is 30 kg, then if Pr.08-11 = 40%, the value is 12 kg.

✍ 08-12 Sleep Delay Time

Default: 0.0

Settings 0.0–6000.0 sec.

- When the Frequency command is smaller than the sleep frequency and less than the sleep time, the Frequency command is equal to the sleep frequency. However, the Frequency command remains at 0.00 Hz until the Frequency command becomes equal to or larger than the wake-up frequency.

✎ 08-13 PID Feedback Signal Error Deviation Level

Default: 10.0

Settings 1.0–50.0%

✎ 08-14 PID Feedback Signal Error Deviation Detection Time

Default: 5.0

Settings 0.1–300.0 sec.

✎ 08-15 PID Feedback Signal Filter Time

Default: 5.0

Settings 0.1–300.0 sec.

- When the PID control function is normal, it should calculate the value within a period of time that is close to the target value.
  Refer to the PID control diagram for details. When executing PID feedback control, if |PID reference target value - detection value| > Pr.08-13 PID Feedback Signal Error Deviation Level and time exceeds Pr.08-14 setting, it is regarded as a PID control fault, and the multi-function output terminal setting 15 (PID feedback error) activates.

✎ 08-16 PID Compensation Selection

Default: 0

Settings 0: Parameter setting
1: Analog input

- If the setting of Pr.08-16 is 0, you have to set PID compensation via Pr.08-17

✎ 08-17 PID Compensation

Default: 0

Settings -100.0–100.0%

- The PID compensation value = maximum PID target value × Pr.08-17. For example, if Pr.01-00 the maximum operation frequency = 60 Hz, and Pr.08-17 = 10.0%, the PID compensation value increases the output frequency 6.00 Hz. 60.00 Hz × 100.00% × 10.0% = 6.00 Hz

08-18 Sleep Mode Function Setting

Default: 0

Settings 0: Refer to PID output command
1: Refer to PID feedback signal

- Pr.08-18 = 0: The unit for Pr.08-10 and that for Pr.08-11 change to frequency. The settings are between 0.00–599.00 Hz.
- Pr.08-18 = 1: The unit for Pr.08-10 and that for Pr.08-11 change to percentage. The settings are between 0.00–200.00%.

✎ 08-19 Wake-up Integral Limit

Default: 50.0

Settings 0.0–200.0%

- This parameter is wake-up integral upper limit. The formula is: Integral upper limit frequency = Maximum Operation Frequency (Pr.01-00) x (Pr.08-19%).
- Reduces the reaction time from sleep to wake-up.

08-21 Enable PID to Change the Operation Direction

Default: 0

Settings 0: Operation direction cannot be changed

1: Operation direction can be changed

08-22 Wake-up Delay Time

Default: 0.00

Settings 0.00–600.00 sec.

📖 Refer to Pr.08-18 for more information.

08-23 PID Control Flag

Default: 2

Settings bit 0 = 1, PID running in reverse follows the setting for Pr.00-23.

bit 0 = 0, PID running in reverse refers to PID's calculated value.

bit 1 = 1, two decimal places for PID Kp

bit 1 = 0, one decimal place for PID Kp

📖 bit 0 = 1: PID running in reverse function is valid only when Pr.08-21 = 1.

📖 bit 0 = 0: If the PID calculated value is positive, the direction is forward. If the PID calculated value is negative, the direction is reverse.

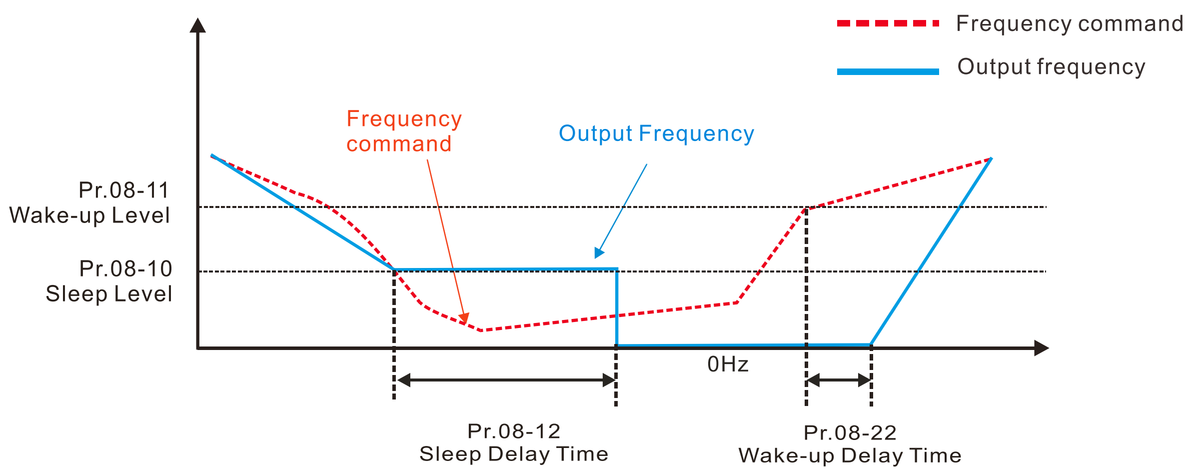
📖 When the bit1 setting changes, the Kp gain does not change. For example: Kp = 6. When Pr.08-23 bit1 = 0, Kp = 6.0; when Pr.08-23 bit1 = 1, Kp = 6.00.

📖 There are three scenarios for the sleep and wake-up frequency.

1. Frequency Command (PID is not in use, Pr.08-00 = 0. Works only in VF mode)

When the output frequency reaches the sleep level (Pr.08-10), the drive operates in sleep level and starts to count the sleep delay time (Pr.08-12). When the counts exceed the sleep delay time, the drive enters sleep mode (frequency becomes 0 Hz).

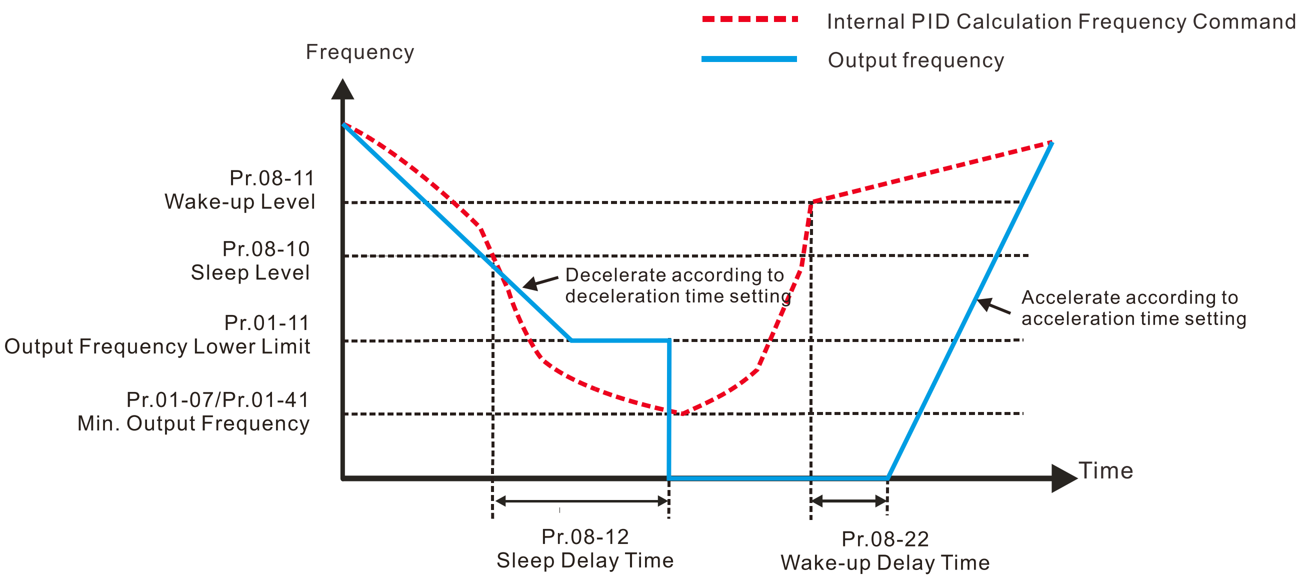
When the Frequency command reaches the wake-up level (Pr.08-11), the drive starts to count the wake-up delay time (Pr.08-22). When the drive counts exceeding the wake-up delay time, it starts to catch up to reach the Frequency command value by the acceleration time.



2. Internal PID Calculation Frequency Command (PID is in use, Pr.08-00 ≠ 0 and Pr.08-18=0.)

When the PID calculation frequency command reaches the sleep level (Pr.08-10), the drive starts to count the sleep delay time (Pr.08-12). When the counts exceed the sleep delay time, the drive enters sleep mode (frequency becomes 0 Hz). If the drive does not reach the preset sleep time, the output frequency remains at the lower frequency limit (if the lower limit is not set to zero), or it remains at the minimum output frequency set for Pr.01-07 (if the lower limit is set to zero) and waits until it reaches the sleep delay time before going into sleep mode (0 Hz).

When the PID calculated Frequency command reaches the wake-up frequency, the drive starts to count the wake-up delay time (Pr.08-22). Once it exceeds the wake-up delay time, the drive starts to catch up to reach the PID Frequency command value by the acceleration time.



3. PID Feedback Value Percentage (PID is in use, Pr.08-00 ≠ 0 and Pr.08-18 = 1)

When the PID feedback value reaches the sleep level (Pr.08-10), the drive starts to count the sleep delay time (Pr.08-12). When the counts exceed the sleep delay time, the drive enters sleep mode (frequency becomes 0 Hz). If the drive does not reach the preset sleep time, the output frequency remains at the lower frequency limit (if the lower limit is not set to zero), or it remains at the minimum output frequency set for Pr.01-07 (if the lower limit is set to zero) and waits until it reaches the sleep delay time before entering sleep mode (0 Hz).

When the PID feedback value reaches the wake-up level (Pr.08-11), the drive starts to count the wake-up delay time (Pr.08-22). Once it counts exceeding the wake-up delay time, the drive starts to catch up to reach the PID Frequency command value by the acceleration time.

Example 01: PID negative feedback

- Pr.08-10 must > Pr.08-11
- The datum reference is 30 kg.
- Set the parameters below:

  Pr.03-00 = 5 (AVI is PID feedback signal)

  Pr.08-00 = 1 (PID negative feedback: AVI simulation input function selection)

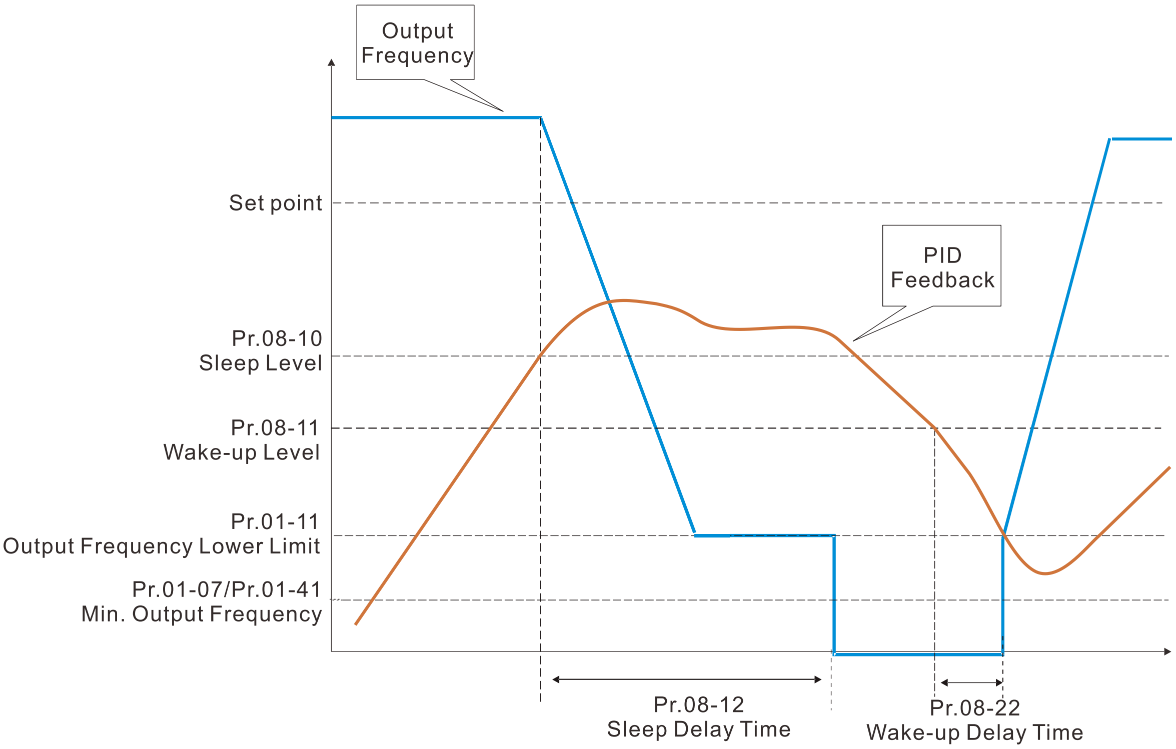
Pr.08-10 = 40% (Sleep level: 12 kg = 40% x 30 kg)

Pr.08-11 = 20% (Wake-up level: 6 kg = 20% x 30 kg)

Case 01: If the feedback > 12kg, then the frequency decreases

Case 02: If the feedback < 6 kg, then the frequency increases

Area	PID physical quantity
Sleep area	> 12 kg: the drive enters sleep state
Excessive area	Between 6 kg and 12 kg: the drive remains in the present
Wake-up area	< 6 kg: the drive wakes up



Example 02: PID positive feedback

- Pr.08-10 must < Pr.08-11
- The datum reference is 30 kg.
- Set the parameters below:

Pr.03-00 = 5 (AVI is PID feedback signal)

Pr.08-00 = 4 (PID positive feedback: AVI simulation input function selection)

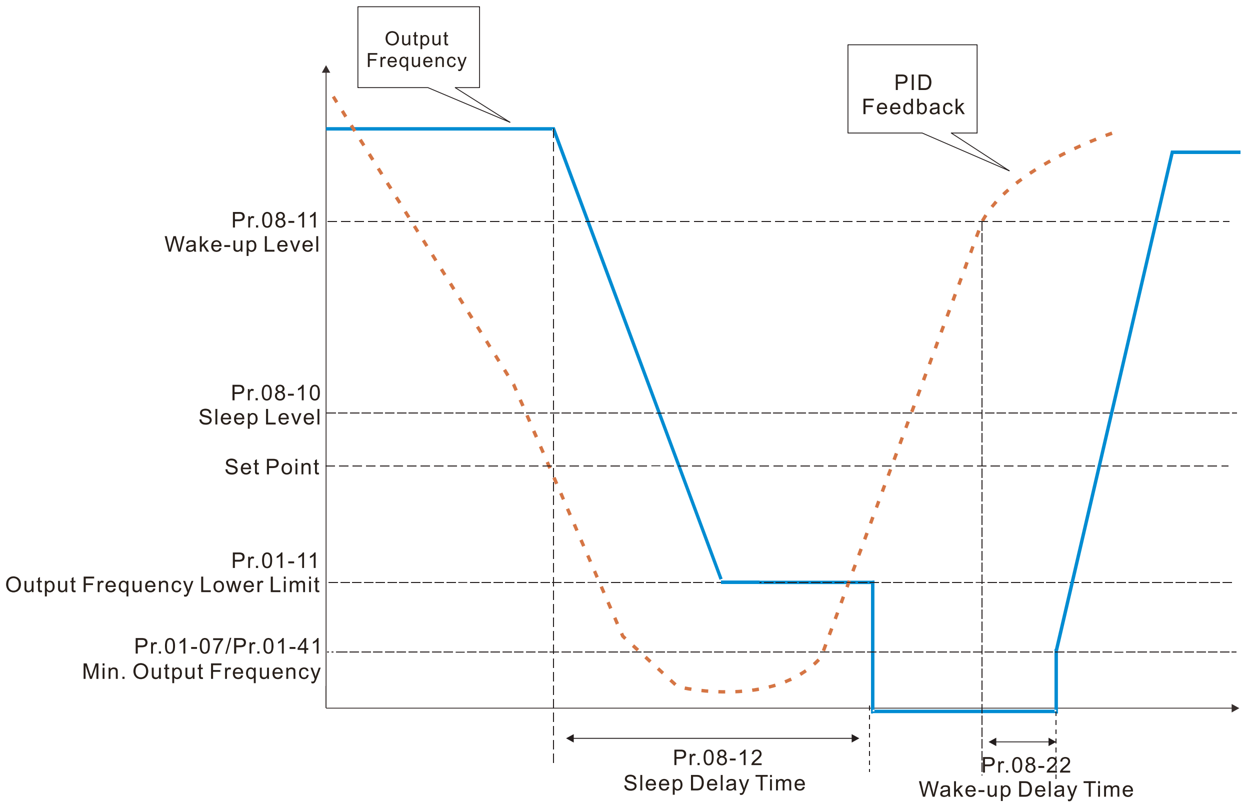
Pr.08-10 = 110% (Sleep level: 33 kg = 110% x 30 kg)

Pr.08-11 = 120% (Wake-up level: 36 kg = 120% x 30 kg)

Case 01: If the feedback < 33 kg, then the frequency decreases

Case 02: If the feedback > 36 kg, then the frequency increases

Area	PID physical quantity
Sleep area	> 36 kg: the drive enters sleep state
Excessive area	Between 33 kg and 36 kg: the drive remains in the present
Wake-up area	< 33 kg: the drive wakes up



08-26 PID Output Command Limit (Reverse Limit)

Default: 100.0

Settings 0.0–100.0%

- When PID enables the reverse direction, the PID output is a negative value, and the PID output value is limited by the setting for Pr.08-26. Use this function with Pr.08-21.

08-27 Acceleration / Deceleration Time for PID Command

Default: 0.00

Settings 0.00–655.35 sec.

- When Pr.08-27 is 0.00 second, PID acceleration / deceleration command is disabled, the PID target value is equal to the PID command. When Pr.08-27 is not 0.00 second: PID acceleration / deceleration command is enabled. When the PID target value changes, the increment / decrement of command value is executed according to this parameter.
- For example, if we set this parameter to 10.00 seconds, when PID target value changes from 0% to 100%, it takes 10 seconds for the PID command to change from 0% to 100%. In a similar way, when PID target value changes from 100% to 0%, it takes 10 seconds for the PID command to change from 100% to 0%.

08-31 Proportional Gain 2

Default: 1.00

Settings 0.0–1000.0 (when Pr.08-23 setting bit 1 = 0)
0.00–100.00 (when Pr.08-23 setting bit 1 = 1)

08-32 Integral Time 2

Default: 1.00

Settings 0.00–100.00 sec.

⌿ 08-33 Differential Time 2

Default: 0.00

Settings 0.00–1.00 sec.

08-61 Feedback of PID Physical Quantity Value

Default: 99.9

Settings 1.0–99.9

08-62 Treatment of the Erroneous PID Feedback Level

Default: 0

Settings 0: Warn and continue operation (no treatment)

1: Fault and coast to stop

2: Fault and ramp to stop

3: Ramp to stop and restart after time set at Pr.08-63 (Without displaying fault and warning)

4: Ramp to stop and restart after time set at Pr.08-63. The number of times of restart depends on the setting for Pr.08-64.

08-63 Delay Time for Restart of Erroneous PID Deviation Level

Default: 60

Settings 1–9999 sec.

⌿ 08-64 Number of Times of Restart after PID Error

Default: 0

Settings 0–1000 times

⌿ 08-65 PID Target Value Source

Default: 0

Settings 0: Frequency command (Pr.00-20, Pr.00-30)

1: Pr.08-66 setting

2: RS-485 communication input

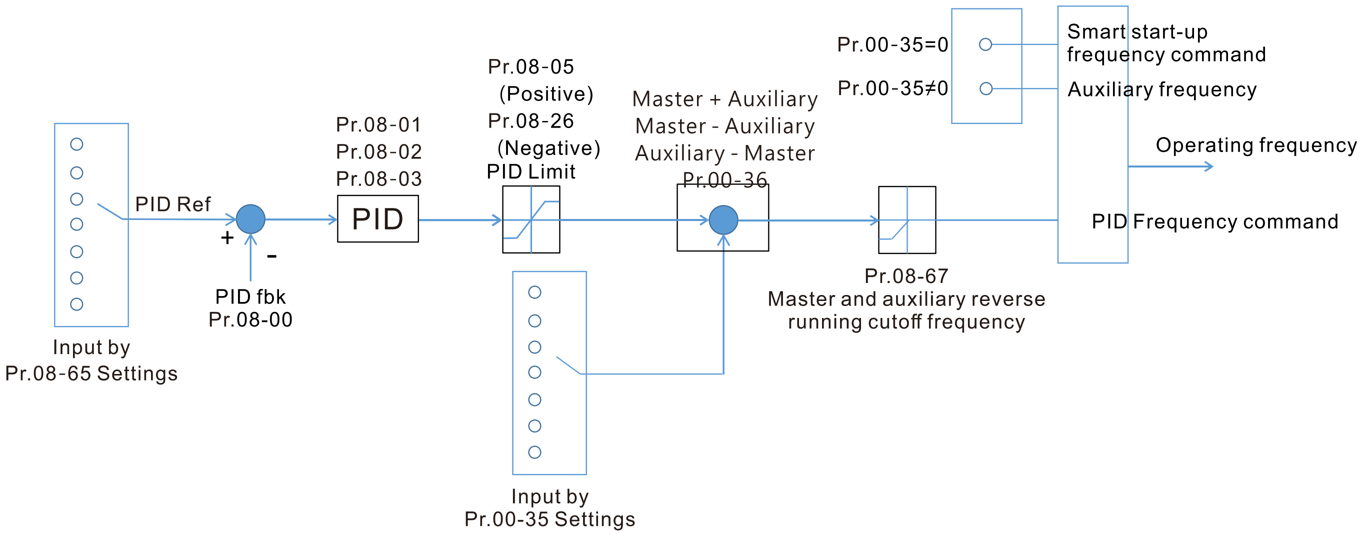
3: External analog input (Refer to Pr.03-00)

6: Communication card (CANopen card not included)

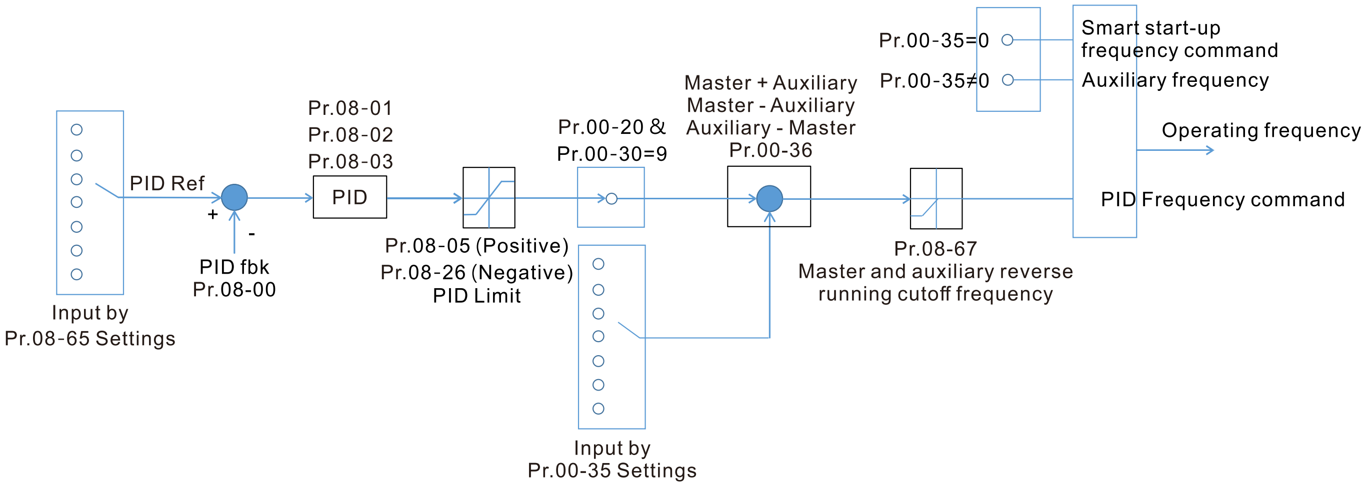
7: Frequency knob on the digital keypad

- Select the target value source for the PID controller.
- When Pr.08-65 = 0, the maximum operation frequency Pr.01-00 is 60 Hz, the error is 100%, and Pr.08-01 = 1.00, then the output frequency is “1” times the Pr.01-00 maximum operation frequency. Therefore, the output frequency = 60 x 100% x 1 = 60 Hz.
  Output frequency = Fmax (Pr.01-00) × error% ((PID reference value (Pr.00-20 / Pr.00-30) - PID feedback (Pr.08-00)) × Pr.08-01
- When Pr.08-65 ≠ 0, the internal calculation of the proportional gain is reduced by 100 times, that is, when Pr.01-00 Fmax = 60 Hz, error = 100%, Pr.08-01 = 1.00, then the output frequency is “0.01” times the Pr.01-00 Fmax. Therefore, the output frequency = 60 x 100% x 0.01 = 0.6 Hz.
  Calculation formula: Output frequency = Fmax (Pr.01-00) x error% ((PID reference value (Pr.08-66) – PID feedback value (Pr.08-00)) x Pr.08-01 x 0.01.

📖 When Pr.08-65 = 0, the PID controller architecture shows as the diagram below:



📖 When Pr.08-65 ≠ 0, the PID controller architecture shows as the diagram below:



📖 When Pr.08-65 is not set to 0, Pr.00-20 is automatically set to 9.

📖 When Pr.08-65 is set to 1, set the PID command through Pr.08-66; when Pr.08-65 is not set to 1, Pr.08-66 displays the PID command.

📖 When Pr.08-65 is set to 2, 4, and 6, the corresponding communication address is 2003H.

✓ 08-66 PID Target Value Setting

Default: 50.00

Settings -100.00–100.00%

📖 The target value setting of the PID controller (Pr.08-66) is a relative value.

✓ 08-67 Master and Auxiliary Reverse Running Cutoff Frequency

Default: 10.0

Settings 0.0–100.0%

📖 100% corresponds to Pr.01-00 the maximum operation frequency.

- In some cases, it is only possible for the PID to control the set point and the feedback to the same status when the PID output frequency is negative (the motor runs in reverse). However, an excessively high reverse frequency is not allowed in some cases, and Pr.08-67 is used to determine the upper limit of the reverse frequency.

08-68 PID Deviation Limit

Default: 0.00

Settings 0.00–100.00%

- When Pr.08-68 is not set to 0, the PID deviation limit function is enabled.
- When PID deviation ≤ PID deviation limit, PID stops adjusting action. It means the PID output frequency maintains the previous value and this function is effective for some closed-loop control applications.

08-69 Integral Separation Level

Default: 0.00

Settings 0.00–100.00%

- Reduces overshoot when overshoot occurs in the PID feedback at start-up.
- When Pr.08-69 is not set to 0, the integral separation function is enabled.
- The benchmark for the integral separation level is the PID error%.
- The integral separation function activates only once at start-up.
- When PID deviation ≥ Pr.08-69, the integral effect is canceled to avoid the increasing system overshoot due to the integral effect. When PID deviation is smaller than Pr.08-69, the integral effect is activated to eliminate the steady-state error.

08-70 Smart Start-up Level

Default: 5.00

Settings 0.00–100.00%

08-71 Smart Start-up Frequency Command

Default: 0.00

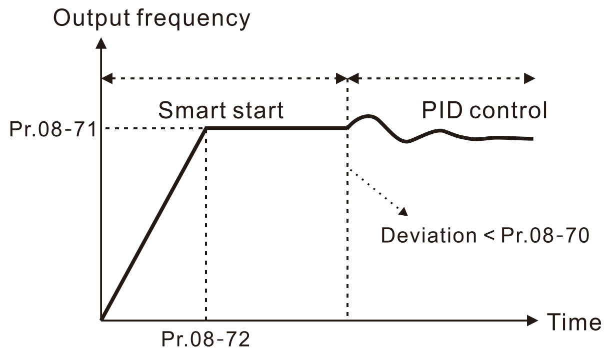
Settings 0.00–599.00 Hz

08-72 Smart Start-up Acceleration Time

Default: 3.00

Settings 0.00–600.00 sec.

- When Pr.08-71 is not set to 0, the smart start-up function is enabled.
- The benchmark for the smart start-up level is the percentage of PID deviation.
- Use the smart start-up function to reduce overshoot when overshoot occurs in the PID feedback at start-up. The smart start-up activates only once at start-up.
- When the smart start-up function is enabled, it starts with the Pr.08-71 frequency and Pr.08-72 acceleration time (Pr.08-72 acceleration time is the time that it accelerates to Pr.08-71). When the PID deviation is smaller than Pr.08-70, it switches to the normal PID control (the smart start-up frequency is filled into the PID integral when switching to PID control to avoid discontinuous frequency).



08-75 PID2 Parameter Switch Condition

Default: 0

Settings 0: No switching (refer to Pr.08-01–Pr.08-03)

1: Auto-switch based on the output frequency

2: Auto-switch based on the deviation

08-76 PID2 Parameter Switch Deviation 1

Default: 10.00

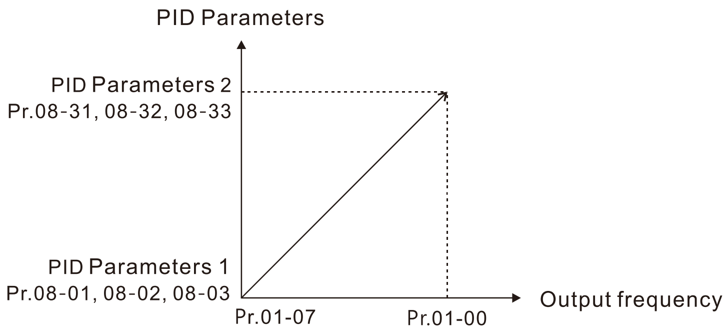
Settings 0.00–Pr.08-77%

08-77 PID2 Parameter Switch Deviation 2

Default: 40.00

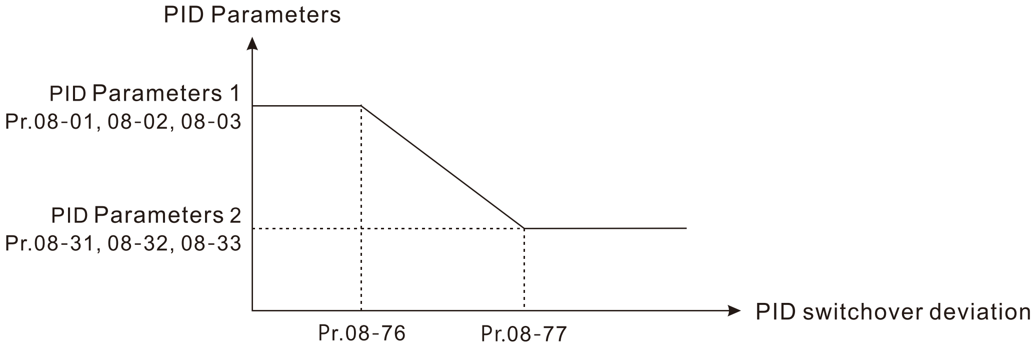
Settings Pr.08-76–100.00%

- A set of PID parameters cannot meet the requirements of the entire running process in some applications. Use Pr.08-75 to switch to the second set of PID parameters Pr.08-31–08-33. The setting method for Pr.08-31–08-33 is the same as that for Pr.08-01–08-03.
- The two sets of PID parameters switch automatically according to the frequency and deviation.
- Switch according to the output frequency:
  - When the output frequency is between Pr.01-07 and Pr.01-00, the PID parameter is the linear interpolation value between the two PID parameter groups.



Switch according to the deviation:

- When the deviation absolute value between the set point and feedback is smaller than Pr.08-76 (PID2 Parameter Switch Deviation 1), the first group PID parameters are used.
- When the deviation absolute value between the set point and feedback is larger than Pr.08-77 (PID2 Parameter Switch Deviation 2), the second group PID parameters are used.
- When the deviation absolute value between the set point and feedback is between Pr.08-76 and Pr.08-77, the PID parameter is the linear interpolation value between the two PID parameter groups.



08-78 Allowed Reverse Running Time after Start-up

Default: 0.0

Settings 0.0–6553.5 sec.

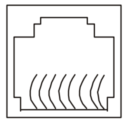
- When Pr.08-78 is not set to 0, the allowed reverse running time after start-up is enabled.
- When it is set to 1 second, the PID control is not allowed to change the running direction within 0–1 seconds of starting time (Pr.08-21=0), and is allowed to change after 1 second of starting time (Pr.08-21=1).

09 Communication Parameters

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 orIFD6500 as a communication converter.

8←1



RS-485

Modbus RS-485
Pin 1, 2, 6: Reserved
Pin 3, 7: GND2
Pin 4: SG-
Pin 5: SG+
Pin 8: D+10V

✓ You can set this parameter during operation.

✓ 09-00 Modbus Communication Address

Default: 1

Settings 1–254

- Set 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 Modbus Transmission Speed

Default: 9.6

Settings 4.8–38.4 Kbps

- Set the transmission speed between the computer and the AC motor drive.
- Options are 4.8 Kbps, 9.6 Kbps, 19.2 Kbps, 38.4 Kbps, otherwise, the transmission speed is set to the default 9.6 Kbps.

✓ 09-02 Modbus Transmission Fault Treatment

Default: 3

Settings
0: Warn and continue operation
1: Fault and ramp to stop
2: Fault and coast to stop
3: No warning, no fault, and continue operation

- Determines the treatment when an error is detected that the host controller does not continuously transmit data to the AC motor drive during Modbus communication. The detection time is based on the Pr.09-03 setting.
- When a transmission error occurs (for example, the error code CE10 displays), the error remains even if the transmission status returns to normal, and is not cleared automatically. In this case, set a reset command (Reset) to clear the error.

✓ 09-03 Modbus Time-out Detection

Default: 0.0

Settings 0.0–100 sec.

- Set the communication time-out value.

✓ 09-04 Modbus Communication Protocol

Default: 1

Settings
1: 7, N, 2 (ASCII)
2: 7, E, 1 (ASCII)

3: 7, O, 1 (ASCII)
4: 7, E, 2 (ASCII)
5: 7, O, 2 (ASCII)
6: 8, N, 1 (ASCII)
7: 8, N, 2 (ASCII)
8: 8, E, 1 (ASCII)
9: 8, O, 1 (ASCII)
10: 8, E, 2 (ASCII)
11: 8, O, 2 (ASCII)
12: 8, N, 1 (RTU)
13: 8, N, 2 (RTU)
14: 8, E, 1 (RTU)
15: 8, O, 1 (RTU)
16: 8, E, 2 (RTU)
17: 8, O 2 (RTU)

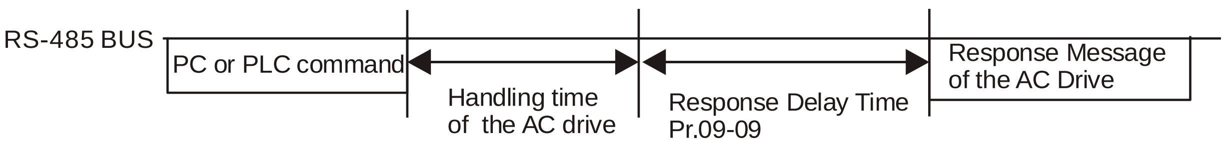
- Control by PC (Computer Link)
  When using the RS-485 serial communication interface, you must specify each drive's communication address in Pr.09-00. The computer then implements control using the drives' individual addresses.
- Modbus ASCII (American Standard Code for Information Interchange): Each byte of data is the combination of two ASCII characters. For example, one byte of data: 64 Hex, shown as '64' in ASCII, consists of '6' (36Hex) and '4' (34Hex).

09-09 Communication Response Delay Time

Default: 2.0

Settings 0.0–200.0 ms

- If the host controller 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.



09-10 Communication Main Frequency

Default: 60.00

Settings 0.00–599.00 Hz

- When you set Pr.00-20 to 1 (RS-485 communication input), the AC motor drive saves the last frequency command into Pr.09-10 when there is abnormal power off or momentary power loss. When power is restored, the AC motor drive operates with the frequency in Pr.09-10 if there is no new Frequency command input. When a Frequency command of 485 changes (the frequency command source must be set as Modbus), this parameter also changes.

✓ **09-11**	Block Transfer 1
✓ **09-12**	Block Transfer 2
✓ **09-13**	Block Transfer 3
✓ **09-14**	Block Transfer 4
✓ **09-15**	Block Transfer 5
✓ **09-16**	Block Transfer 6
✓ **09-17**	Block Transfer 7
✓ **09-18**	Block Transfer 8
✓ **09-19**	Block Transfer 9
✓ **09-20**	Block Transfer 10
✓ **09-21**	Block Transfer 11
✓ **09-22**	Block Transfer 12
✓ **09-23**	Block Transfer 13
✓ **09-24**	Block Transfer 14
✓ **09-25**	Block Transfer 15
✓ **09-26**	Block Transfer 16

Default: 0

Settings 0–65535

- There is a group of block transfer parameters available in the AC motor drive (Pr.09-11–Pr.09-26). Using communication code 03H, you can store the parameters (Pr.09-11–Pr.09-26) that you want to read.
- For example: according to the Address List (as shown in the table below), Pr.01-42 is shown as 012A.
  Set Pr.09-11 to 012Ah (Pr.01-42, motor 2 minimum output voltage is 2.0 V), and use Pr.09-11 (communication address 090B) to read the communication parameter, the read value is 2.0

AC motor drive parameters	GGnnH	GG is the parameter group, nn is the parameter number; for example, the address of Pr.04-10 is 040AH.

- Mind if the block transfer parameters are read only. If the data is written to read-only parameters from the upper unit, a communication error may occur.

09-30 Communication decoding method

Default: 1

Settings 0: Decoding method 1
1: Decoding method 2

Communication decoding method		Decoding Method 1	Decoding Method 2
Source of Operation Control	Digital Keypad	Digital keypad controls the drive action regardless of decoding method 1 or 2.	
	External Terminal	External terminal controls the drive action regardless of decoding method 1 or 2.	
	RS-485	The address for reference are 2000h–20FFh regardless of decoding method 1 or 2.	

09-31 COM1 internal communication protocol

Default: 0

Settings 0: Modbus 485

-21: Pump Master

-22: Pump Slave 1

-23: Pump Slave 2

-24: Pump Slave 3

10 Speed Feedback Control Parameters

✎ You can set this parameter during operation.

✎ 10-16 Pulse Input Type Setting

Default: 0

Settings 0: Disabled
5: Single-phase pulse input
6: PWM signal input

- When Pr.00-20 = 4, the command source is MI5. Then, you can select external command as PWM mode through Pr.10-16.
- Pr.10-16 = 0, the function is disabled; Pr.10-16 = 5, the input pulse type is by single-phase pulse. With a steady maximum input pulse frequency of 10 kHz, the corresponding relationship between pulse signals and frequency command is 0–10 kHz to 0–Fmax (Pr.01-00). For example: When Pr.01-00 is 60 Hz and the input pulse is 5 kHz, the maximum operation frequency is (5 kHz ÷10 kHz) x 60 Hz = 30 Hz. If input pulse exceeds 10 kHz, then the frequency command remains at Fmax (Pr.01-00).
- Pr.10-16 = 0, the function is disabled; Pr.10-16 = 6, the input pulse type is by PWM signals. Pr.12-51 sets how many times the PWM averages to output a command; Pr.12-52 sets external PWM cycle. The average value for frequency command and output speed depends on these two parameters. Refer to Pr.12-51, Pr.12-52 for detailed descriptions.

✎ 10-29 Upper Limit of Frequency Deviation

Default: 20.00

Settings 0.00–100.00 Hz

- Limits the maximum frequency deviation.
- If you set this parameter too high, an abnormal feedback malfunction occurs.

✎ 10-31 I/F Mode, Current Command

Default: 40

Settings 0–150% rated current of the motor

- Set the current command for the drive in low speed area.
  When the motor stalls on heavy duty start-up or forward / reverse with load, increase the parameter value. If the inrush current is too high and causes oc stall, then decrease the parameter value.

✎ 10-32 PM FOC Sensorless Speed Estimator Bandwidth

Default: 5.00

Settings 0.00–600.00 Hz

- Set the speed estimator bandwidth. Adjust the parameter to influence the stability and the accuracy of the motor speed.
- If there is low frequency vibration (the waveform is similar to a sine wave) during the process, then increase the bandwidth. If there is high frequency vibration (the waveform shows extreme vibration and is like a spur), then decrease the bandwidth.

✎ 10-34 PM Sensorless Speed Estimator Low-pass Filter Gain

Default: 1.00

Settings

- Influences the response speed of the speed estimator.
- If there is low frequency vibration (the waveform is similar to a sine wave) during the process, then increase the gain.
- If there is high frequency vibration (the waveform shows extreme vibration and is like a spur), then decrease the gain.

✎ 10-42 Initial Angle Detection Pulse Value

Default: 1.0

Settings 0.0–3.0

- The angle detection is fixed to 3: Use the pulse injection method to start. The parameter influences the value of the pulse during the angle detection. The larger the pulse, the higher the accuracy of rotor's position. A larger pulse might cause oc.
- Increases the parameter when the running direction and the command are opposite during start-up. If oc occurs at start-up, then decrease the parameter.
- Refer to Section 12-2 Adjustment & Application for detailed motor adjustment procedure.

✎ 10-49 Zero Voltage Time during Start-up

Default: 00.000

Settings 00.000–60.000 sec.

- This parameter is valid only when the setting of Pr.07-12 (Speed Tracking during Start-up) = 0.
- When the motor is in static state at start-up, this increases the accuracy when estimating angles. In order to put the motor in static state, set the three-phase of the drive output to the motor to 0 V. The Pr.10-49 setting time is the length of time for three-phase output at 0 V.
- It is possible that even when you apply this parameter, the motor cannot go in to the static state because of inertia or some external force. If the motor does not go into a complete static state in 0.2 seconds, increase this setting value appropriately.
- If Pr.10-49 is set too high, the start-up time is longer. If it is too low, then the braking performance is weak.

✎ 10-51 Injection Frequency

Default: 500

Settings 0–1200 Hz

- This parameter is a high frequency injection command in PM SVC control mode, and usually you do not need to adjust it. But if a motor's rated frequency (for example, 400 Hz) is too close to the frequency setting for this parameter (that is, the default of 500 Hz), it affects the accuracy of the angle detection.
  Refer to the setting for Pr.01-01 before you adjust this parameter.
- If the setting value for Pr.00-17 is lower than Pr.10-51 × 10, then increase the frequency of the carrier wave.
- Pr.10-51 is valid only when Pr.10-53 = 2.

⌁ 10-52 Injection Magnitude

Default: 15.0 / 30.0

Settings 115V / 230V models: 100.0 V

460V models: 200.0 V

Note: The setting range varies depending on the voltage.

- The parameter is the magnitude command for the high frequency injection signal in PM SVC control mode.
- Increasing the parameter can increase the accuracy of the angle estimation, but the electromagnetic noise might be louder if the setting value is too high.
- The system uses this parameter when the motor’s parameter is “Auto”. This parameter influences the angle estimation accuracy.
- When the ratio of the salient pole (Lq/Ld) is lower, increase Pr.10-52 to make the angle detection more accurate.
- Pr.10-52 is valid only when Pr.10-53 = 2.

⌁ 10-53 Angle Detection Method

Default: 0

Settings 0: Disabled

1: Force attracting the rotor to zero degrees

2: High frequency injection

3: Pulse injection

- Set to 2 for IPM; set to 3 for SPM.
  If these settings cause problems, then set the parameter to 1.

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11 Advanced Parameters

✎ You can set this parameter during operation.

11-00 System Control

Default: 0

Settings bit 3: Dead time compensation closed

bit 7: Save or do not save the frequency

11-41 PWM Mode Selection

Default: 2

Settings 0: Two-phase modulation mode

2: Space vector modulation mode

- Two-phase modulation mode: effectively reduces the drive power component losses and provides better performance in long wiring applications.
- Space vector modulation mode: effectively reduces the power loss and electromagnetic noise of the motor.

✎ 11-42 System Control Flag

Default: 0000

Settings 0000–FFFFh

bit No.	Functions	Descriptions
0	Reserved	
1	FWD / REV action control	0: FWD / REV cannot be controlled by Pr.02-12 bit 0 & 1. 1: FWD / REV can be controlled by Pr.02-12 bit 0 & 1.
2–15	Reserved	

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12 Function Parameters

✐ You can set this parameter during operation.

✐ **12-00** Set point deviation level

Default: 0

Settings 0–100%

✐ **12-01** Detection Time of Set Point Deviation Level

Default: 10

Settings 1–9999 sec.

- When the deviation is less than Pr.12-00 (in the range of PID set point to Pr.12.00 x PID set point) for a time exceeding the setting of Pr.12-01, the AC motor drive decelerates to stop to be constant pressure status (this deceleration time is the setting for Pr.01-15). The system is in standby status when the deviation is within the range of PID set point (Pr.12-00) during deceleration.

Example:
If the set point of constant pressure control of a pump is 4 kg, Pr.12-00 is set to 5%, Pr.12-01 is set to 15 seconds, then the deviation is 0.2 kg (4 bar x 5% = 0.2 bar). It means when the feedback value is higher than 3.8 kg for a time exceeding 15 seconds, the AC motor drive decelerates to stop (this deceleration time acts according to Pr.01-15). When the feedback value is less than 3.8 kg, the AC motor drive starts to run.

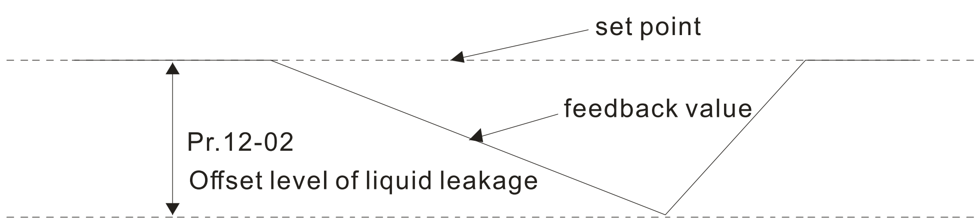
✐ **12-02** Offset Level of Water Leakage

Default: 0

Settings 0–50%

- The base of the parameter is the set point of PID control setting. When the system is on standby at constant pressure, if the deviation caused by water leakage (with slight pressure loss) is greater than Pr.12-02 x PID set point, the AC motor drive starts running.
- This parameter is mainly to prevent the drive from frequent run / stop operation due to water leakage (with slight pressure loss) in the system.

Water leakage restart detection:



✐ **12-03** Water Leakage Change Detection

Default: 0

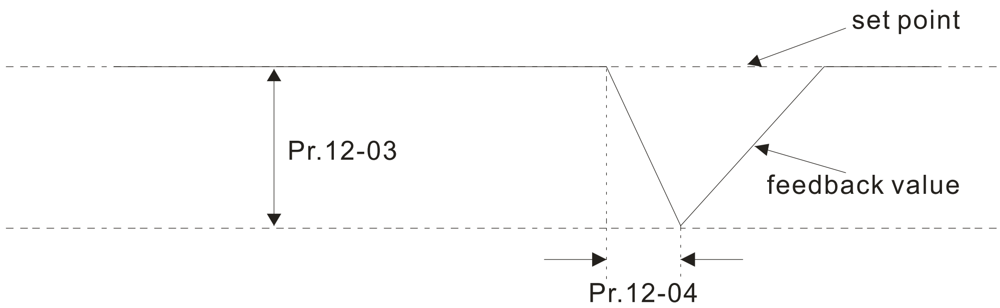
Settings 0: Disabled
0–100%

12-04 Time Setting for Water Leakage Change

Default: 0.5

Settings 0: Disabled
0.1–10.0 sec.

- Pr.12-03 and Pr.12-04 define the conditions of water leakage (with slight pressure loss) by viewing the change of feedback value per unit time.
- Pr.12-03 is the change of feedback value, its base is the set point of PID control setting; Pr.12-04 is the setting value per unit value. When the change of feedback value is less than the settings for Pr.12-03 and Pr.12-04, the system is leaking. When the system is on standby at constant pressure, if the change of feedback value is greater than the setting, the AC motor drive will start running to maintain the stability of the system.
  Water leakage / water use restart detection:



Example:
If the set point of constant pressure control of a pump is 4 kg, Pr.12-00 is 5%, Pr.12-01 is 15 seconds, Pr.12-02 is 25%, Pr.12-03 is 3% and Pr.12-04 is 0.5 seconds, then the deviation is 0.2 kg (4 kg x 5% = 0.2 kg). It means when the feedback value is greater than 3.8 kg for a time exceeding 15 seconds, the AC motor drive decelerates to stop, this deceleration time acts according to Pr.01-15.

- Situation 1
  When the drive is on standby at constant pressure, and the change of feedback value does not exceed 0.12 kg in 0.5 seconds (4 kg x 3 % = 0.12 kg). If the feedback value decreases with the change speed until the deviation to set point is 1 kg (4 kg x 25% = 1 kg), that is, if the feedback value < 3 kg, then the drive starts running.
- Situation 2
  When the drive is on standby at constant pressure, and the change of feedback value exceeds 0.12 kg in 0.5 seconds (4 kg x 3 % = 0.12 kg). If the feedback value < 3.88 kg in 0.5 seconds, then the drive starts running.

12-05 Multi-Pump Control Mode

Default: 0

Settings 0–2
0: Disabled
1: Fixed time circulation (alternative operation)
2: Fixed quantity control (multi-pump operating at constant pressure)

- When using multi-pump control mode, the setting for Pr.12-05 of each pump must be the same.

✎ 12-07 Multi-Pump's Fixed Time Circulation Period

Default: 60

Settings 1–65535 minutes

- Fixed time circulation mode (alternative operation): for example, after the operation time of the first pump is longer than the setting of Pr.12-07, turn OFF the first pump and turn ON the second pump, so on and so forth.
- Fixed quantity control (multi-pump run at constant pressure): for example, after the operation time of the master pump is longer than the setting of Pr.12-07, the operation changes from the master pump to the slave pump.
- This parameter is valid for the setting of master pump.

✎ 12-08 Frequency to Start Switching Pumps

Default: 60.00

Settings 0.00 Hz–FMAX (Pr.01-00)

✎ 12-09 Time Detected When Pump Reaches the Starting Frequency

Default: 1.0

Settings 0.0–3600.0 sec.

✎ 12-10 Frequency to Stop Switching Pumps

Default: 48.00

Settings 0.00 Hz–FMAX (Pr.01-00)

✎ 12-11 Time Detected When Pump Reaches the Stopping Frequency

Default: 1.0

Settings 0.0–3600.0 sec.

- This parameter is valid for master pump.
- This parameter is valid only for fixed quantity control (multi-pump run at constant pressure).
- When master pump operation frequency ≥ Pr.12-08 and the elapsed time exceeds the setting in Pr.12-09, activate the next pump; if the water is still insufficient, activate the third, forth pump according to the same conditions.
- When master pump operation frequency ≤ Pr.12-10 and the elapsed time exceeds the setting in Pr.12-11, turns the first slave pump OFF; If the master pump still satisfies those conditions, then the second slave pump and the third pump stop consecutively, the master pump remains in operation
- Whether the master pump runs or stops depends on the automation stop function.

✎ 12-12 Pump's Frequency at Time-Out (Disconnection)

Default: 0.00

Settings 0.00 Hz–FMAX (Pr.01-00)

- This parameter is valid for salve pump.
- Refer to Pr.09-02 (COM1 transmission fault treatment) and Pr.09-03 (COM1 time-out detection) for the conditions to disconnect communication and treatment
- If a time-out occurs under fixed quantity control (multi-pump run at constant pressure) and a slave pump's time-out frequency = Pr.12-12, the slave pump is in stand-alone mode after stop command is given. Set the RUN command and operation frequency by the slave pump parameters.
- The master pump has the function to re-detect if a slave pump is time-out.

12-13 Pump's Error Treatment

Default: 1

Settings bit 0: During the operation, whether to switch to an alternative pump when operating pump error occurs

0: Stop all pumps' action

1: Switch to an alternative pump

bit 1: During the operation, stop or standby after resetting from error

0: Standby after resetting

1: Stop after resetting

bit 2: Before the operation, whether the system runs or stops if the pump has an error

0: The system can not operate

1: The system selects another pump to operate

- This parameter is valid for master pump.
- This parameter only works under auto mode. If the pump switches to manual mode by setting MIx = 97 (multi-pump manual / auto switch) or press STOP button on the keypad to be not controlled by multi-pump, then the parameter setting does not effect the pump.
- When a pump is failed in the multi-pump system, the master pump deals with system behavior of during and before the operation and the operation of the failed pump according to this parameter setting.
- bit 0: During the operation, whether to switch to an alternative pump when operating pump error occurs

  bit 0 = 0: Stop all pumps' action

  bit 0 = 1: Stop the failed pump, and select another pump to operate according to the principle of activation.
- bit 1: During the operation, stop or standby after resetting from error

  bit 1 = 0, Standby: After resetting the failed pump, the master pump does not accept RUN command .

  bit 1 = 1, Stop: After resetting the failed pump, this pump can not accept master pump's command until restart the system.
- bit 2: Before the operation, whether the system runs or stops if the pump has an error

  bit 2 = 0: Any pump of the system is failed, the master pump does not accept RUN command.

  bit2 = 1: Any pump of the system is failed, the master pump can accept RUN command, and select another pump to operate according to the principle of activation.
- This parameter only works under auto mode.

12-14 Selection of Pump Start-Up Sequence

Default: 1

Settings 0: According to the serial numbers of the pumps

1: According to the operating time

- 0: According to the serial numbers of the pumps (1 → 2 → 3 → 4 → 1)
- 1: According to the shortest operating time

✎ 12-15 Running Time of Multi-Pump under Alternative Operation

Default: 60.0

Settings 0.0–360.0 sec.

📖 The time setting value for the switch between master pump and slave pump. This parameter is valid for master pump.

✎ 12-20 Simple Positioning Stop Frequency 0

Default: 0.00

Settings 0.00–599.00 Hz

✎ 12-21 Simple Positioning Stop Frequency 1

Default: 5.00

Settings 0.00–599.00 Hz

✎ 12-22 Simple Positioning Stop Frequency 2

Default: 10.00

Settings 0.00–599.00 Hz

✎ 12-23 Simple Positioning Stop Frequency 3

Default: 20.00

Settings 0.00–599.00 Hz

✎ 12-24 Simple Positioning Stop Frequency 4

Default: 30.00

Settings 0.00–599.00 Hz

✎ 12-25 Simple Positioning Stop Frequency 5

Default: 40.00

Settings 0.00–599.00 Hz

✎ 12-26 Simple Positioning Stop Frequency 6

Default: 50.00

Settings 0.00–599.00 Hz

✎ 12-27 Simple Positioning Stop Frequency 7

Default: 60.00

Settings 0.00–599.00 Hz

📖 The settings for Pr.12-20–Pr.12-27 must meet the following condition:
Pr.12-20 ≤ Pr.12-21 ≤ Pr.12-22 ≤ Pr.12-23 ≤ Pr.12-24 ≤ Pr.12-25 ≤ Pr.12-26 ≤ Pr.12-27.

📖 If any two of the parameters (between Pr.012-20–Pr.12-27) have the same stop frequency, their Delay Time of Simple Positioning Stop must be the same as well.

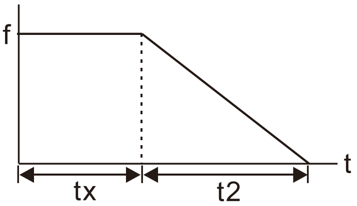
✎ 12-28 Delay Time of Simple Positioning Stop 0
✎ 12-29 Delay Time of Simple Positioning Stop 1
✎ 12-30 Delay Time of Simple Positioning Stop 2
✎ 12-31 Delay Time of Simple Positioning Stop 3
✎ 12-32 Delay Time of Simple Positioning Stop 4
✎ 12-33 Delay Time of Simple Positioning Stop 5
✎ 12-34 Delay Time of Simple Positioning Stop 6

12-35 Delay Time of Simple Positioning Stop 7

Default: 0.00

Settings 0.00–600.00 sec.

- These parameters are valid only when Pr.00-22 = 2 (motor stops with simple positioning method)
- Pr.12-20–Pr.12-27 have to use with Pr.12-28–Pr.12-35, and they correspond to each other in order, for example, Pr.12-20 uses with Pr.12-28 as one group.
- These parameters are for simple positioning. Speed starts to decelerate after the time set at Pr.12-28–Pr.12-35 elapse. The accuracy of positioning is self-assessed by user.



$$S = n \times \left(\frac{t_x + (t_x + t_2)}{2} \right) \qquad n = f \times \frac{120}{p}$$

$$S = n \times \left(\frac{t_x + (t_x + t_2)}{2} \right) \qquad n = f \times \frac{120}{p}$$

s: distance travelled (revolution)

n: rotation speed (revolution/second)

t_x: delay time (second)

t_2: deceleration time (second)

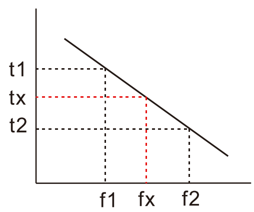
n: rotation speed (rmp) (revolution/ minute)

p: number of poles of motors

f: rotation frequency (Hz)

The value of t_x in the equation above is as shown below:

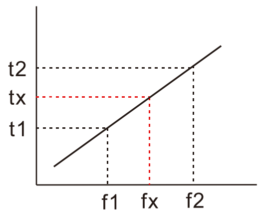
1.1 When the slope is negative (t1 > t2)



$$t_x = t_1 + \left(\frac{f_x - f_1}{f_2 - f_1}\right) \times (t_2 - t_1)$$

$$= t_1 + \left(\frac{f_x - f_1}{10}\right) \times (t_2 - t_1)$$

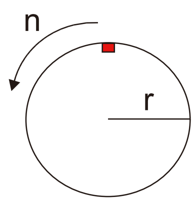
1.2 When the slope is positive (t1 < t2)



$$t_x = t_2 - \left(\frac{f_2 - f_x}{f_2 - f_1}\right) \times (t_2 - t_1)$$

$$= t_2 - \left(\frac{f_2 - f_x}{10}\right) \times (t_2 - t_1)$$

As shown in the image below, a four-pole motor turntable's diameter = r and its rotation speed = n (rpm).

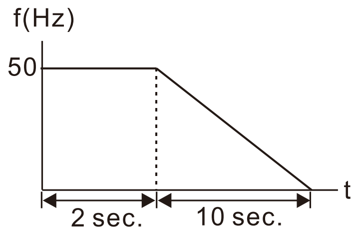


Example 01:

If the motor turntable rotates at 50 Hz, when Pr.00-22 =2 (motor stops with simple positioning method), Pr.12-26 = 50 Hz (simple positioning stop frequency 6), and its corresponding Pr.12-34 = 2 seconds (delay time of simple positioning stop 6), the deceleration time is 10 seconds for decreasing from 50 Hz to 0 Hz. When STOP command is given, Simple Positioning Stop is activated, its rotation speed is

n = 120 x 50 ÷ 4 (revolution / minute) = 25 (revolution / second).

Number of revolutions of motor turntable = (25 x (2 + 12)) ÷ 2 = 175 (revolutions)



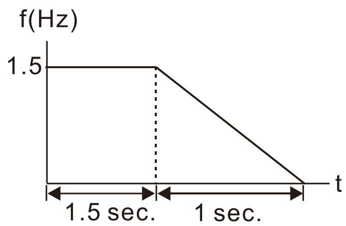
Therefore, the distance traveled by the motor after the STOP command is given = number of revolutions x circumference = 175x 2 π r. It means the turntable returns to the top after 175 revolutions.

Example 02:

If the motor turntable rotates at 1.5 Hz, Pr.12-22 = 10 Hz (simple positioning stop frequency 2), Pr.12-21 = 0 Hz, and Pr.12-30 =10 seconds (delay time of simple positioning stop 2), then the deceleration time is 40 seconds for decreasing from 60 Hz to 0 Hz. The delay time to stop of 1.5 Hz is 1.5 seconds, the deceleration time is 1 second for decreasing from 1.5 Hz to 0 Hz When STOP command is given, Simple Positioning Stop is activated, its rotation speed is

n = 120 x 1.5 ÷ 4 (revolution / minute) = 1.5 (revolution / second).

Number of revolutions of motor turntable = (1.5 x (1.5 + 2.5)) ÷ 2 = 1.5 (revolutions)



Therefore, the distance traveled by the motor after the STOP command is given = number of revolutions x circumference = 1.5 x 2 π r. It means the turntable stops after 1.5 revolutions (the red dot is at the bottom).

12-40 Automatic Operation Mode

Default: 0

Settings 0: Disabled

1: Automatically operate one cycle and stop

2: Automatically operate cycles

3: Automatically operate one cycle and stop (with STOP interval)

4: Automatically operate cycles (with STOP intervals)

5: Disable automatic operation, but the direction setting at multi-step speed 1 to 7 are effective

📖 This parameter is applicable to the operation procedure control of general small machines, food processing machines, washing equipment, to replace the control circuits such as relays, switches, timers. Many related parameters settings for using Pr.12-40, make sure every detail is correct, see the explanations below.

📖 When Pr.12-40 = 5 to run by external multi-speed, the highest priority of the operation direction is Pr.12-41.

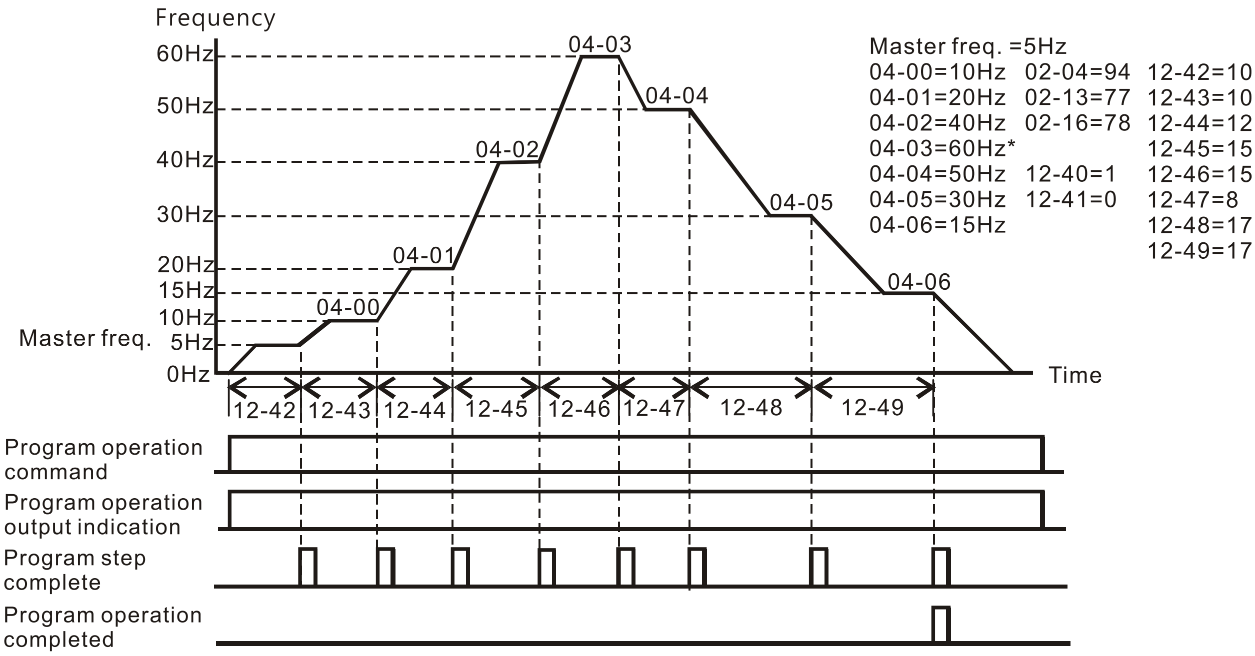
📖 Examples & explanations:

Example 01: Pr.12-40 = 1, execute one cycle of programmable operation and then stop (continuous mode)

The related parameter settings are:

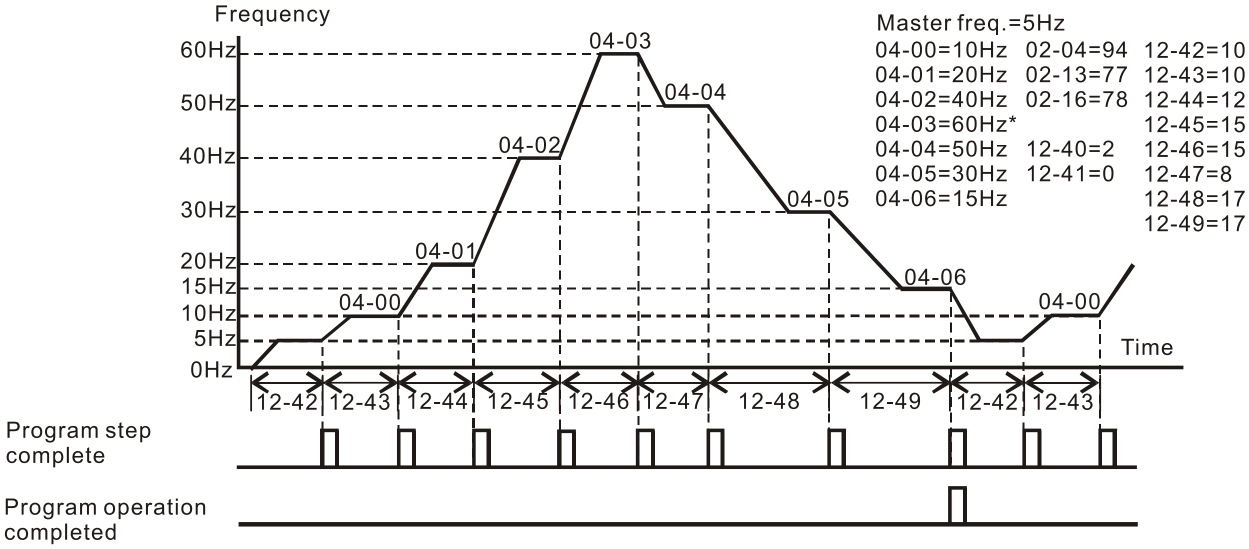
- Pr.04-00–Pr.04-06: 1st–7th step speed settings (set the frequency of each step speed).
- Pr.02-01–Pr.02-05: multi-function input terminals settings (set one multi-function terminal to be 94 - programmable AUTO RUN)
- Pr.02-13–Pr.02-16: multi-function output terminals settings (set multi-function terminals to be 77 - program running, 78 - One program step completed, 79 - program running completed)
- Pr.12-40: automatic operation mode setting
- Pr.12-41: the master speed and 1st–7th step speed settings for operation direction (set operation direction of each speed).
- Pr.12-42–Pr.12-49:: the master speed and 1st–7th step speed settings for operation time (set operation time of each speed).

Explanation: see the diagram below, once the AUTO RUN command is given, the drive operates according to those parameters' settings until the 7th step speed is completed, and then it stops automatically. To restart the operation, gives "OFF" to the AUTO RUN command and then ON again.



Example 02: Pr.12-40 = 2, execute programmable operation cycles (continuous mode)

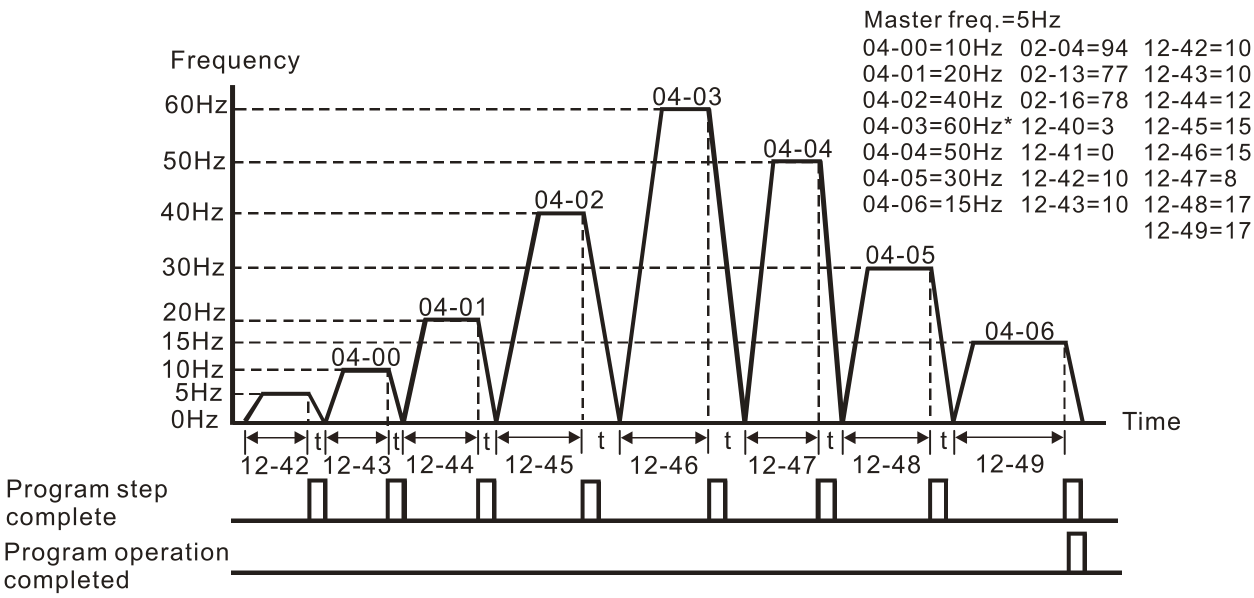
Explanation: see the diagram below, once the AUTO RUN command is given, the drive operates according to those parameters' settings, it automatically operates from the 1st step speed again when the 7th step speed is completed, and it does not stop until the AUTO RUN command is OFF.



Example 03: Pr.12-40 = 3, execute one cycle of programmable operation and then stop (STOP mode)

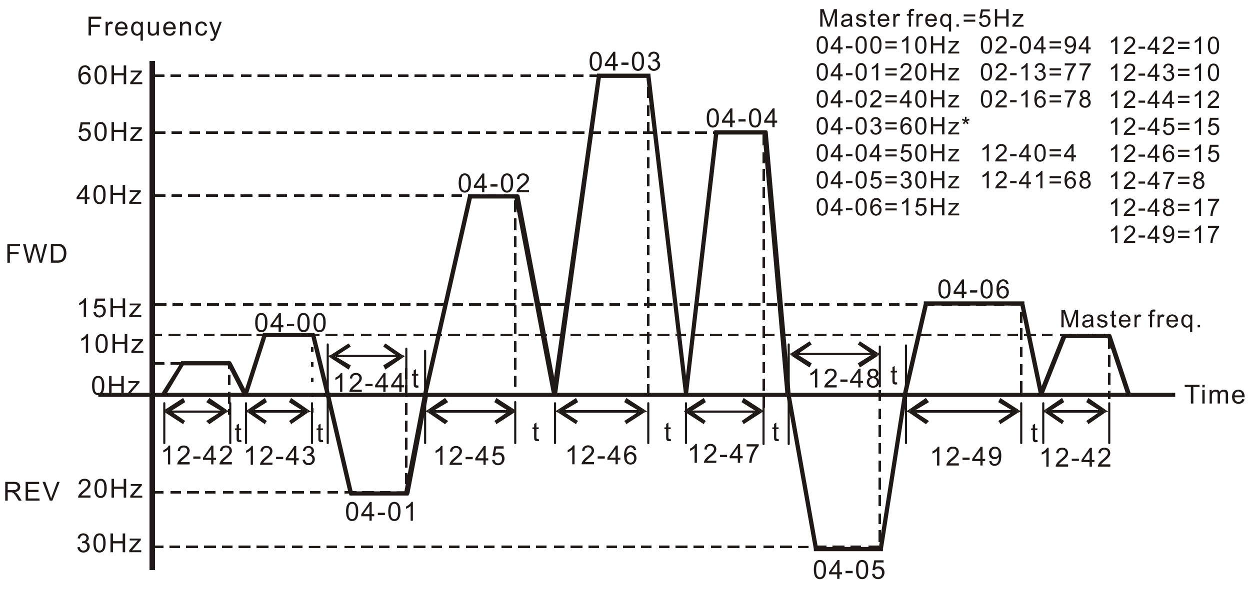
Explanation: see the diagram below, once the AUTO RUN command is given, the drive operates according to those parameters' settings. Before changing each step, the drive will stop and then start again .

In this mode, the acceleration time / deceleration time of RUN and STOP should be taken account of (for example, the time "t" in the diagram means the time not in the time setting range, but the extra time generated in deceleration in this mode.



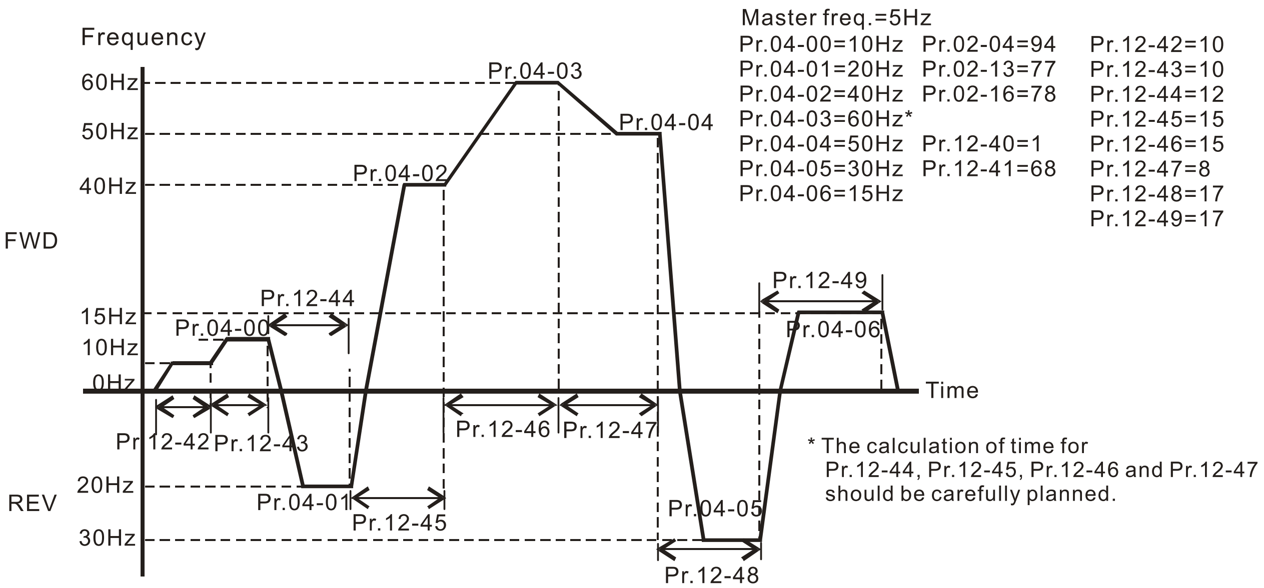
Example 04: Pr.12-40 = 4, execute programmable operation cycles (STOP mode)

Explanation: see the diagram below, once the AUTO RUN command is given, the drive operates according to those parameters' settings. Before changing each step, the drive will stop and then start again, and it does not stop until the AUTO RUN command is OFF.



Example 05: Pr.12-40 = 1, execute one cycle of programmable operation and then stop (continuous mode)

Explanation: see the diagram below, this is in continuous mode, the time division of each step operation.



12-41 PLC Program Running Direction Mode

Default: 0

Settings bit 0–bit 7 (0: FWD RUN, 1: REV RUN)

bit 0: Direction of auto-operation's main speed

bit 1: Direction of the first speed for Pr.04-00

bit 2: Direction of the second speed for Pr.04-01

bit 3: Direction of the second speed for Pr.04-02

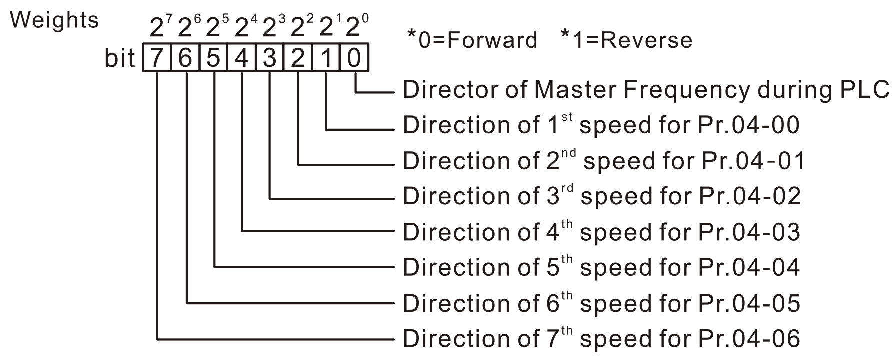
bit 4: Direction of the second speed for Pr.04-03

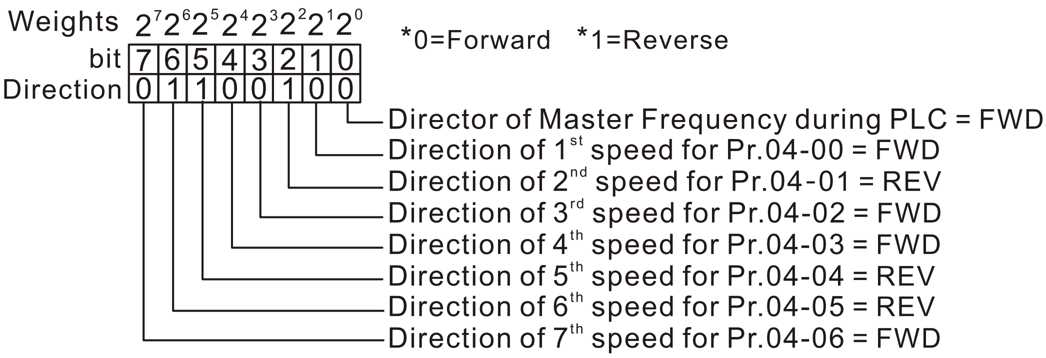
bit 5: Direction of the second speed for Pr.04-04

bit 6: Direction of the second speed for Pr.04-05

bit 7: Direction of the second speed for Pr.04-06

- Determine operation direction of multi-step speed Pr.04-00–04-06 and master speed in program running.
  Setting method: the operation direction setting uses the value which binary 8-bit converts to decimal, and then enters the value to this parameter.





The setting value

$= bit7 \times 2^7 + bit6 \times 2^6 + bit5 \times 2^5 + bit4 \times 2^4 + bit3 \times 2^3 + bit2 \times 2^2 + bit1 \times 2^1 + bit0 \times 2^0$

$= 0 \times 2^7 + 1 \times 2^6 + 1 \times 2^5 + 0 \times 2^4 + 0 \times 2^3 + 1 \times 2^2 + 0 \times 2^1 + 0 \times 2^0$

$= 0+64+32+16+0+0+2+0$

$= 100$ Setting Pr.12-41 = 100

$2^0=1$	$2^3=8$	$2^6=64$
$2^1=2$	$2^4=16$	$2^7=128$
$2^2=4$	$2^5=32$	

12-42	Master Speed Operating Time Setting
12-43	1st Speed Operating Time Setting
12-44	2nd Speed Operating Time Setting
12-45	3rd Speed Operating Time Setting
12-46	4th Speed Operating Time Setting
12-47	5th Speed Operating Time Setting
12-48	6th Speed Operating Time Setting
12-49	7th Speed Operating Time Setting

Default: 0

Settings 0–65500 sec.

- The time settings in Pr.12-42–Pr.12-49 cooperate with the operation time of each step in auto-programmable operation. The maximum value for these parameters is 65500 sec., and it displays as 65.5.

  Explanation:

  If any of these eight parameters is 0 (0 second), it means that automatically skips the operation of this step to the next. That is to say, ME300 series supports eight-step speed program running, but users can still reduce program steps as required, this function can be flexibly used by setting the time of the step to be d 0 (0 second).

12-51 Average PWM Signal

Default: 1

Settings 1–100 times

- This parameter calculates the corresponding frequency command based on the average values according to the set number of times for PWM signal period. The smaller the number of times set, the faster the frequency changes.

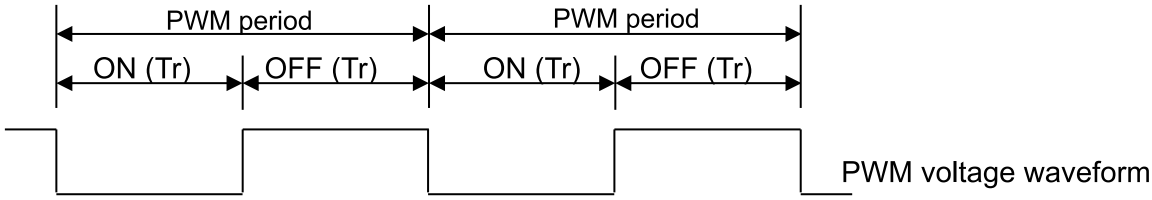
12-52 PWM Signal Period

Default: 1

Settings 1–2000 ms

- Set the period for PWM signal input.
- ME300 can control the operation frequency of the drive through PWM / pulse signals output from devices such as PLC, and PWM signals can only be input from MI5. You have to set Pr.00-20 (frequency command source, AUTO / REMOTE) = 4 (pulse input without direction command), and set Pr.10-16 (pulse input type setting) = 6 (PWM signal input). Set PWM outputs a command after the average of how many times in Pr.12-51, and set external PWM signal period in Pr.12-52. Calculate the corresponding output frequency by these two parameters settings.
- If the PWM signal period input actually is not equal to Pr.12-52 setting, the calculation of output frequency will be wrong.

📖 The relation between PWM signals and frequency command shows as the diagram below:



Frequency command value (Hz) = (ON time / PWM period) × the maximum output frequency (Hz)

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13 Industry Application Parameters

✓ You can set this parameter during operation.

13-00 Industry-specific Parameter Application

Default: 00

Settings
- 00: Disabled
- 01: User-defined
- 03: Fan
- 04: Pump
- 05: Conveyor
- 07: Packing
- 10: Logistics
- 11: Tension PID
- 12: Tension PID + master / auxiliary frequency

📖 Note: After you select the macro, some of the default values adjust automatically according to the application selection.

📖 Setting 03: Fan

The following table lists the relevant fan setting application parameters.

Pr.	Parameter Name	Setting
00-11	Speed Control Mode	0 (IM V/F)
00-16	Load Selection	0: Normal duty
00-17	Carrier Frequency	Default setting
00-20	Master frequency command source (AUTO, REMOTE)	2 (External analog input)
00-21	Operation command source (AUTO, REMOTE)	1 (External terminals)
00-22	Stop Method	1 (Coast to stop)
00-23	Motor Direction Control	1 (Disable reverse)
00-30	Master frequency command source (HAND, LOCAL)	0 (Digital keypad)
00-31	Operation command source (HAND, LOCAL)	0 (Digital keypad)
01-00	Maximum Operation Frequency of Motor 1	Default setting
01-01	Motor 1 Rated / Base Frequency	Default setting
01-02	Motor 1 Rated / Base Voltage	Default setting
01-03	Mid-point frequency 1 of motor 1	Default setting
01-04	Mid-point voltage 1 of motor 1	Default setting
01-05	Mid-point frequency 1 of motor 2	Default setting
01-06	Mid-point voltage 1 of motor 2	Default setting
01-07	Minimum output frequency of motor 1	Default setting
01-08	Minimum output voltage of motor 1	Default setting
01-10	Output frequency upper limit	50.00 (Hz)
01-11	Output frequency lower limit	35.00 (Hz)
01-12	Acceleration time 1	15.00 (sec.)
01-13	Deceleration time 1	15.00 (sec.)
01-43	V/F curve selection	2 (V/F curve to the power of 2)

Pr.	Parameter Name	Setting
02-05	Multi-function input command 5 (MI5)	15 (Rotating speed command from AVI)
02-16	Multi-function output 2 (MO1)	11 (Malfunction indication)
03-00	AI1 analog input selection	1 (Frequency command)
03-28	AI Terminal Input Selection	0 (0–10 V)
03-50	Analog input curve selection	1 (Three-point curve of AVI (& AI10))
07-06	Restart after momentary power loss	2 (Speed tracking by the minimum output frequency)
07-11	Number of times of restart after fault	5 (times)
07-33	Auto-restart interval of fault	60.0 (sec.)

📖 Setting 04: Pump

The following table lists the relevant pump setting application parameters.

Pr.	Parameter Name	Setting
00-11	Speed Control Mode	0 (IM V/F)
00-16	Load Selection	0: Normal duty
00-20	Master frequency command source (AUTO, REMOTE)	2 (External analog input)
00-21	Operation command source (AUTO, REMOTE)	1 (External terminals)
00-23	Motor Direction Control	1 (Disable reverse)
01-00	Maximum Operation Frequency of Motor 1	Default setting
01-01	Motor 1 Rated / Base Frequency	Default setting
01-02	Motor 1 Rated / Base Voltage	Default setting
01-03	Mid-point frequency 1 of motor 1	Default setting
01-04	Mid-point voltage 1 of motor 1	Default setting
01-05	Mid-point frequency 1 of motor 2	Default setting
01-06	Mid-point voltage 1 of motor 2	Default setting
01-07	Minimum output frequency of motor 1	Default setting
01-08	Minimum output voltage of motor 1	Default setting
01-10	Output frequency upper limit	50.00 (Hz)
01-11	Output frequency lower limit	35.00 (Hz)
01-12	Acceleration time 1	15.00 (sec.)
01-13	Deceleration time 1	15.00 (sec.)
01-43	V/F curve selection	2 (V/F curve to the power of 2)
07-06	Restart after momentary power loss	2 (Speed tracking by the minimum output frequency)
07-11	Number of times of restart after fault	5 (times)
07-33	Auto-restart interval of fault	60.0 (sec.)

📖 Setting 05: Conveyor

The following table lists the relevant conveyor setting application parameters.

Pr.	Parameter Name	Setting
00-11	Speed Control Mode	0 (IM V/F)
00-16	Load Selection	0: Normal duty

Pr.	Parameter Name	Setting
00-20	Master frequency command source (AUTO, REMOTE)	2 (External analog input)
00-21	Operation command source (AUTO, REMOTE)	1 (External terminals)
01-00	Maximum Operation Frequency of Motor 1	Default setting
01-01	Motor 1 Rated / Base Frequency	Default setting
01-02	Motor 1 Rated / Base Voltage	Default setting
01-03	Mid-point frequency 1 of motor 1	Default setting
01-04	Mid-point voltage 1 of motor 1	Default setting
01-05	Mid-point frequency 1 of motor 2	Default setting
01-06	Mid-point voltage 1 of motor 2	Default setting
01-07	Minimum output frequency of motor 1	Default setting
01-08	Minimum output voltage of motor 1	Default setting
01-12	Acceleration time 1	10.00 (sec.)
01-13	Deceleration time 1	10.00 (sec.)

📖 Setting 07: Packing

The following table lists the relevant packing setting application parameters.

Pr.	Parameter Name	Setting
00-11	Speed Control Mode	0 (IM V/F)
00-20	Master frequency command source (AUTO, REMOTE)	0 (Digital keypad)
00-21	Operation command source (AUTO, REMOTE)	2 (RS-485 communication input)
02-00	Two-wire / Three-wire Operation Control	1: Two-wire mode 1, power ON for operation control (M1: FWD / STOP, M2: REV / STOP)
01-00	Maximum Operation Frequency of Motor 1	Default setting
01-01	Motor 1 Rated / Base Frequency	Default setting
01-02	Motor 1 Rated / Base Voltage	Default setting
01-03	Mid-point frequency 1 of motor 1	Default setting
01-04	Mid-point voltage 1 of motor 1	Default setting
01-05	Mid-point frequency 1 of motor 2	Default setting
01-06	Mid-point voltage 1 of motor 2	Default setting
01-07	Minimum output frequency of motor 1	Default setting
01-08	Minimum output voltage of motor 1	Default setting
01-12	Acceleration time 1	10.00 (sec.)
01-13	Deceleration time 1	10.00 (sec.)
01-24	S-Curve for Acceleration Begin Time 1	Default setting
01-25	S-Curve for Acceleration Arrival Time 2	Default setting
01-26	S-Curve for Deceleration Begin Time 1	Default setting
01-27	S-Curve for Deceleration Arrival Time 2	Default setting
03-00	AI1 analog input selection	1 (Frequency command)
03-28	AI Terminal Input Selection	Default setting

📖 Setting 10: Logistics

The following table lists the relevant logistics setting application parameters.

Pr.	Parameter Name	Setting
00-20	Master frequency command source (AUTO, REMOTE)	7 (Digital keypad potentiometer knob)
00-21	Operation command source (AUTO, REMOTE)	1 (External terminals)
01-00	Maximum Operation Frequency of Motor 1	Default setting
01-01	Motor 1 Rated / Base Frequency	Default setting
01-02	Motor 1 Rated / Base Voltage	400.0
01-04	Mid-point voltage 1 of motor 1	20.0
01-06	Mid-point voltage 1 of motor 2	20.0
01-08	Minimum output voltage of motor 1	20.0
01-03	Mid-point frequency 1 of motor 1	1.50
01-07	Minimum output frequency of motor 1	1.50
01-12	Acceleration time 1	3.00 (sec.)
01-13	Deceleration time 1	3.00 (sec.)
01-24	S-Curve for Acceleration Begin Time 1	0.00
01-25	S-Curve for Acceleration Arrival Time 2	0.00
01-26	S-Curve for Deceleration Begin Time 1	0.00
01-27	S-Curve for Deceleration Arrival Time 2	0.00
06-03	Over-current stall prevention during acceleration	200%
06-04	Over-current stall prevention during operation	200%
06-05	Acceleration / deceleration time selection for stall prevention at constant speed	2: By the second acceleration / deceleration time
07-23	Automatic Voltage Regulation (AVR) Function	1: Disable AVR
07-26	Torque compensation gain	0

📖 Setting 11: Tension PID

The following table lists the relevant tension PID setting application parameters.

Pr.	Parameter Name	Setting
00-20	Master frequency command source (AUTO, REMOTE)	9 (PID controller)
00-21	Operation command source (AUTO, REMOTE)	1 (External terminals)
01-00	Maximum Operation Frequency of Motor 1	Default setting
01-12	Acceleration time 1	3 (sec.)
01-13	Deceleration time 1	3 (sec.)
03-00	AI1 analog input selection	5 (PID feedback signal)
03-50	Analog input curve selection	1: Three-point curve of AVI (& AI10)
03-63	AVI voltage lowest point	0.00
03-65	AVI voltage mid-point	9.99
03-66	AVI proportional mid-point	100.00%
08-00	Terminal Selection of PID Feedback	1: Negative PID feedback: by analog input (Pr.03-00)

Pr.	Parameter Name	Setting
08-01	Proportional Gain (P)	10
08-02	Integral time (I)	1.00 (sec.)
08-20	PID Mode Selection	1: Parallel connection
08-21	Enable PID to Change the Operation Direction	0: Operation direction cannot be changed
08-65	PID Target Value Source	1: Pr.08-66 setting
08-66	PID Target Value Setting	50.00%

📖 Setting 12: Tension PID + master / auxiliary frequency

The following table lists the relevant tension PID + master / auxiliary frequency setting application parameters.

Pr.	Parameter Name	Setting
00-20	Master frequency command source (AUTO, REMOTE)	9 (PID controller)
00-21	Operation command source (AUTO, REMOTE)	1 (External terminals)
01-00	Maximum Operation Frequency of Motor 1	Default setting
01-12	Acceleration time 1	3.00 (sec.)
01-13	Deceleration time 1	3.00 (sec.)
00-35	Auxiliary Frequency Source	3 (Analog input)
03-00	AI1 analog input selection	5 (PID feedback signal)
03-10	Reverse setting when analog signal input is negative frequency	0: Negative frequency input is not allowed. The digital keypad or external terminal controls the forward and reverse direction.
03-12	Analog input gain (ACI)	100.0%
03-50	Analog input curve selection	1: Three-point curve of AVI (& AI10)
03-63	AVI voltage lowest point	0.00
03-65	AVI voltage mid-point	9.99
03-66	AVI proportional mid-point	100.00%
08-00	Terminal Selection of PID Feedback	1: Negative PID feedback: by analog input (Pr.03-00)
08-01	Proportional gain (P)	10
08-02	Integral time (I)	1.00 (sec.)
08-20	PID Mode Selection	1: Parallel connection
08-21	Enable PID to Change the Operation Direction	0: Operation direction cannot be changed
08-65	PID target value source	1: Pr.08-66 setting
08-66	PID Target Value Setting	50.00%
08-67	Master and Auxiliary Reverse Running Cutoff Frequency	10.0%

13-00 – 13-50 Application parameter (user-defined)

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14 Protection Parameters (2)

✎ You can set this parameter during operation.

14-50	Output Frequency at Malfunction 2
14-54	Output Frequency at Malfunction 3
14-58	Output Frequency at Malfunction 4
14-62	Output Frequency at Malfunction 5
14-66	Output Frequency at Malfunction 6

Default: Read only

Settings 0.00–599.00 Hz

📖 When an error occurs, you can check the output frequency for the malfunction. If the error happens again, this parameter overwrites the previous record.

14-51	DC bus Voltage at Malfunction 2
14-55	DC bus Voltage at Malfunction 3
14-59	DC bus Voltage at Malfunction 4
14-63	DC bus Voltage at Malfunction 5
14-67	DC bus Voltage at Malfunction 6

Default: Read only

Display 0.0–6553.5 V

📖 When an error occurs, check the present DC bus voltage. If the error happens again, this parameter overwrites the previous record.

14-52	Output Current at Malfunction 2
14-56	Output Current at Malfunction 3
14-60	Output Current at Malfunction 4
14-64	Output Current at Malfunction 5
14-68	Output Current at Malfunction 6

Default: Read only

Display 0.00–655.35 Amps

📖 When an error occurs, you can check the output current for the malfunction. If the error happens again, this parameter overwrites the previous record.

14-53	IGBT Temperature at Malfunction 2
14-57	IGBT Temperature at Malfunction 3
14-61	IGBT Temperature at Malfunction 4
14-65	IGBT Temperature at Malfunction 5
14-69	IGBT Temperature at Malfunction 6

Default: Read only

Display -3276.7–3276.7 °C

📖 When an error occurs, you can check the IGBT temperature for the malfunction. If the error happens again, this parameter overwrites the previous record.

14-70	Fault Record 7
14-71	Fault Record 8
14-72	Fault Record 9
14-73	Fault Record 10

Default: 0

Display
0: No fault record
Over-current during acceleration (ocA)
2: Over-current during deceleration (ocd)
3: Over-current during steady operation (ocn)
4: Ground fault (GFF)
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 at constant speed (Lvn)
14: Low-voltage at stop (LvS)
15: Phase loss protection (orP)
16: IGBT overheating (oH1)
18: IGBT temperature detection failure (tH1o)
21: Over load
22: Electronics thermal relay 1 protection (EoL1)
23: Electronics thermal relay 2 protection (EoL2)
24: Motor overheating PTC/ PT100 (oH3)
26: Over torque 1 (ot1)
27: Over torque 2 (ot2)
28: Under current (uC)
31: EEPROM read error (cF2)
33: U-phase error (cd1)
34: V-phase error (cd2)
35: W-phase error (cd3)
36: cc hardware error (Hd0)
37: oc hardware error (Hd1)
40: Auto-tuning error (AUE)
41: PID feedbacks to ACI (AFE)
48: ACI loss (ACE)
49: External fault (EF)
50: Emergency stop (EF1)

51: External base block (bb)
52: Password is locked (Pcod)
54: Illegal command (CE1)
55: Illegal data address (CE2)
56: Illegal data value (CE3)
57: Data is written to read-only address (CE4)
58: Modbus transmission time-out (CE10)
63: Over slip error (oSL)
72: S1 internal loop detection error (STL1) (for STO models only)
76: STO (STO) (for STO models only)
77: S2 internal loop detection error (STL2) (for STO models only)
78: Internal loop detection error (STL3) (for STO models only)
82: Output phase loss U phase (oPL1)
83: Output phase loss V phase (oPL2)
84: Output phase loss W phase (oPL3)
87: Low frequency overload protection (oL3)
142: Auto-tune error 1 (AuE1) (DC test stage)
143: Auto-tune error 2 (AuE2) (high frequency stall stage)
149: Total resistance measurement fault (AUE5)
150: No-load current I_0 measurement fault (AUE6)
151: dq axis inductance measurement fault (AUE7)
152: High frequency injection measurement fault (AUE8)
157: Pump PID feedback error (dEv)

📖 The parameters record when the fault occurs and forces a stop.

📖 When low-voltage at stop fault (LvS) occurs, the fault is not recorded. When low-voltage during operation faults (LvA, Lvd, Lvn) occur, the faults are recorded.

📖 When dEb function is valid and enabled, the drive executes dEb and records fault code 62 to Pr.06-17–Pr.06-22 and Pr.14-70–Pr.14-73 simultaneously.

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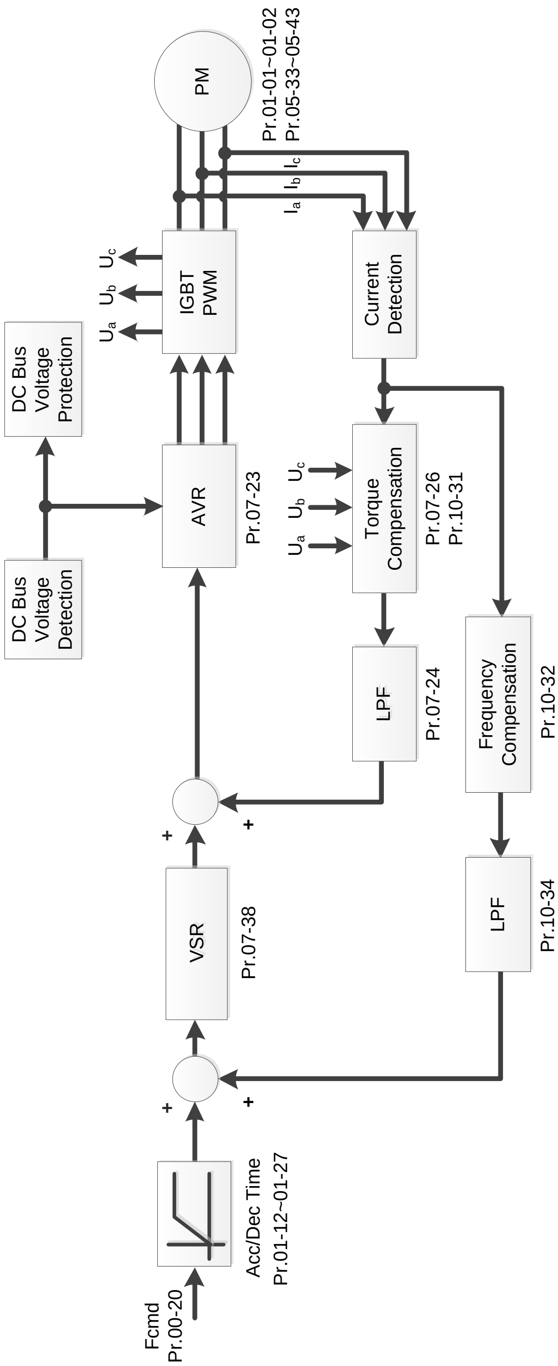
12-2 Adjustment & Application

The following are abbreviations for different types of motors:

- IM: Induction motor
- PM: Permanent magnet synchronous AC motor
- IPM: Interior permanent magnet synchronous AC motor
- SPM: Surface permanent magnet synchronous AC motor

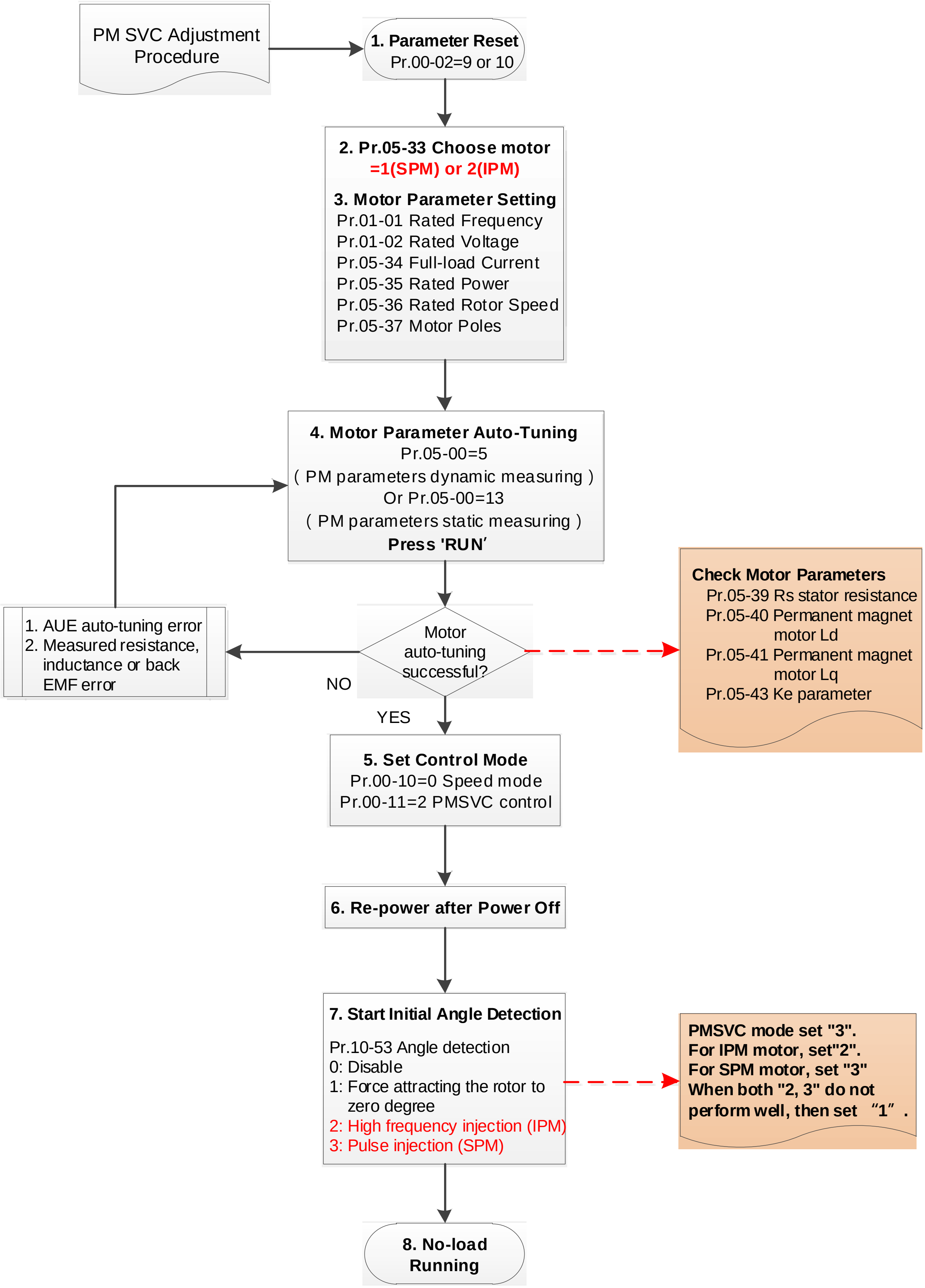
Permanent-Magnet Synchronous Motor, Space Vector Control Adjustment Procedure (PM SVC, Pr.00-11 = 2)

- PMSVC control diagram



- PM SVC adjustment procedure (The number marked on the procedure corresponds to the number of following adjustment explanations)

  (1) PM SVC motor parameters adjustment flowchart



📖 Basic motor parameters adjustment

1. Parameter reset::

   Reset Pr.00-02 = 9 (50 Hz) or 10 (60 Hz) to the default value

2. Select PM motor type:

   Pr.05-33 = 1 (SPM) or 2 (IPM)

3. Motor nameplate parameter setting:

Parameter no.	Parameter Name
Pr.01-01	Motor 1 Rated / Base Frequency (Hz)
Pr.01-02	Motor 1 Rated / Base Voltage (V_{AC})
Pr.05-34	Rated current (A)
Pr.05-35	Rated power (kW)
Pr.05-36	Rated Speed (rpm)
Pr.05-37	Number of Poles for a Motor

4. PM parameter auto-tuning:

   Set Pr.05-00 = 5 (rolling auto-tuning for PM, with no load) or 13 (static auto-tuning for PM) and press RUN key to finish motor auto-tuning, then you will get the following parameters:

Parameter no.	Parameter Name
Pr.05-39	Stator resistance (Ω)
Pr.05-40	Permanent Magnet Synchronous AC Motor Ld (mH)
Pr.05-41	Permanent Magnet Synchronous AC Motor Lq (mH)
Pr.05-43	Ke Parameter of a Permanent Magnet Synchronous AC Motor ($V_{phase, rms}$ / krpm) (When Pr.05-00 = 5, the Ke parameter is measured based on the actual motor rotation.) Pr.05-00: (V / 13 rpm), the Ke parameter of PM synchronous AC motor (you can calculate this automatically according to power, current, and speed of the motor).

If an auto-tuning error (AUE) occurs, refer to Chapter 14 “Fault Codes and Descriptions” for further treatment.

AUE Error (code)	Description
AUE (40)	Motor auto-tuning error
AUE 1 (142)	No feedback current error when the motor parameter automatically detects
AUE 2 (143)	Motor phase loss error when the motor parameter automatically detects

5. Set control mode:

   Pr. 00-10 = 0: Speed mode

   Pr. 00-11 = 2: PM SVC mode

6. Re-power ON after powering OFF

7. Measure the initial magnetic pole angle of PM, set Pr.10-53 PM initial rotor position detection method:

   0: Disabled

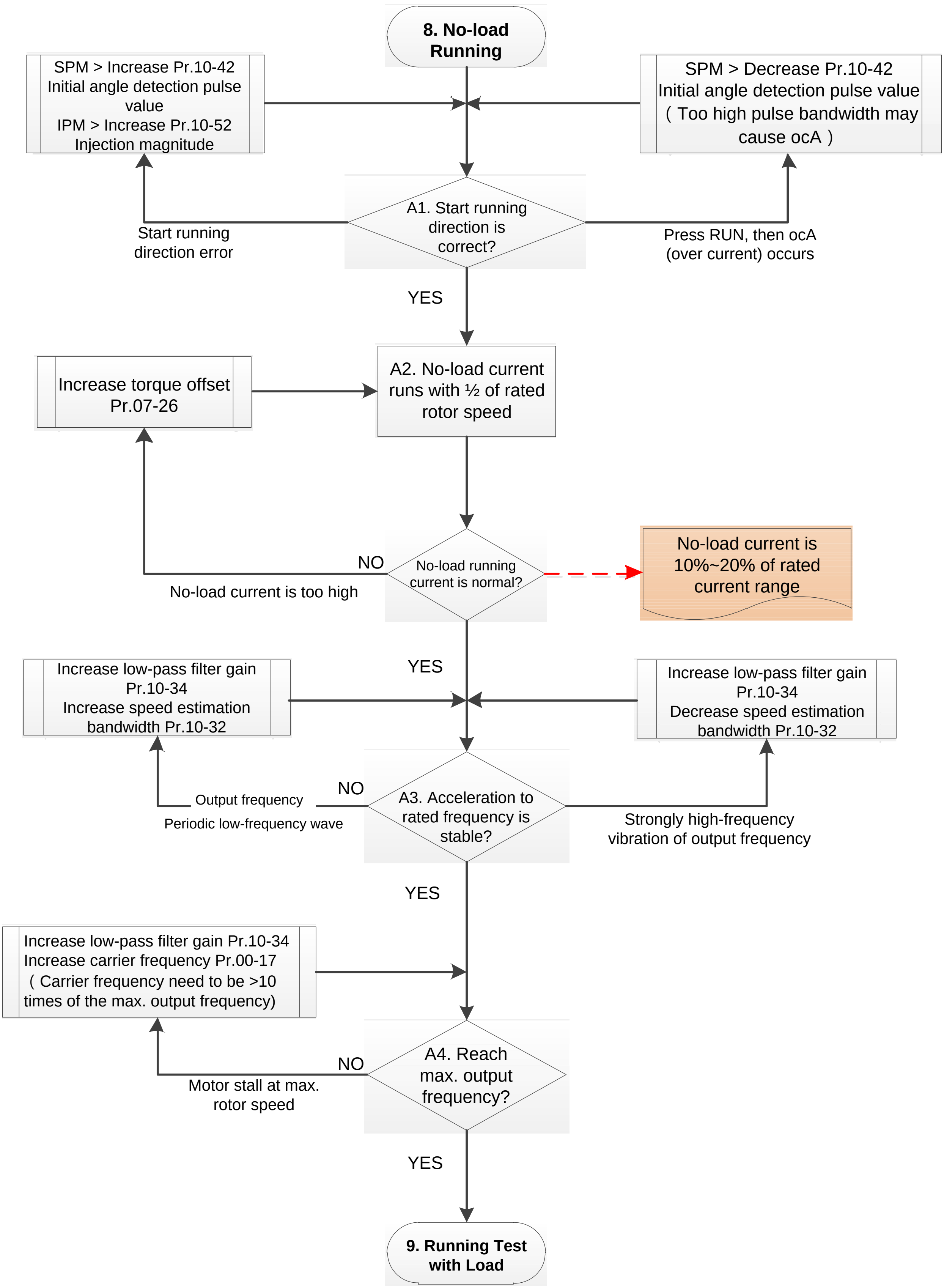
   1: Force attracting the rotor to zero degrees

   2: High frequency injection (applicable to IPM)

   3: Pulse injection (applicable to SPM / IPM)

   (For IPM, the setting value is suggested to be 2; for SPM, the setting value is suggested to be 3. You can choose the setting 1 if the result is not good of setting as 2 or 3.)

(2) PM SVC adjustment flowchart for operation with no load / light load



📖 Adjustment for operation with light load

8. Start the motor without load / with light load and operate to 1/2 of the rated rotor speed

A1. Start operation direction:

a. If the start operation direction is wrong
SPM: increase the current proportion for Pr.10-42 (initial angle detection pulse value) to improve the accuracy of the angle detection.
IPM: Increase the voltage for Pr.10-52 (injection magnitude) to improve the accuracy of the angle detection.

b. If an ocA error occurs when pressing RUN to start the motor, decrease the current proportion for Pr.10-42 (initial angle detection pulse value).

A2. Operate the motor in 1/2 of the rated rotor speed, adjust the no-load operating current
If the no-load operating current exceeds 20% of the rated current, increase Pr.07-26 (torque compensation gain) and observe the no-load operating current.

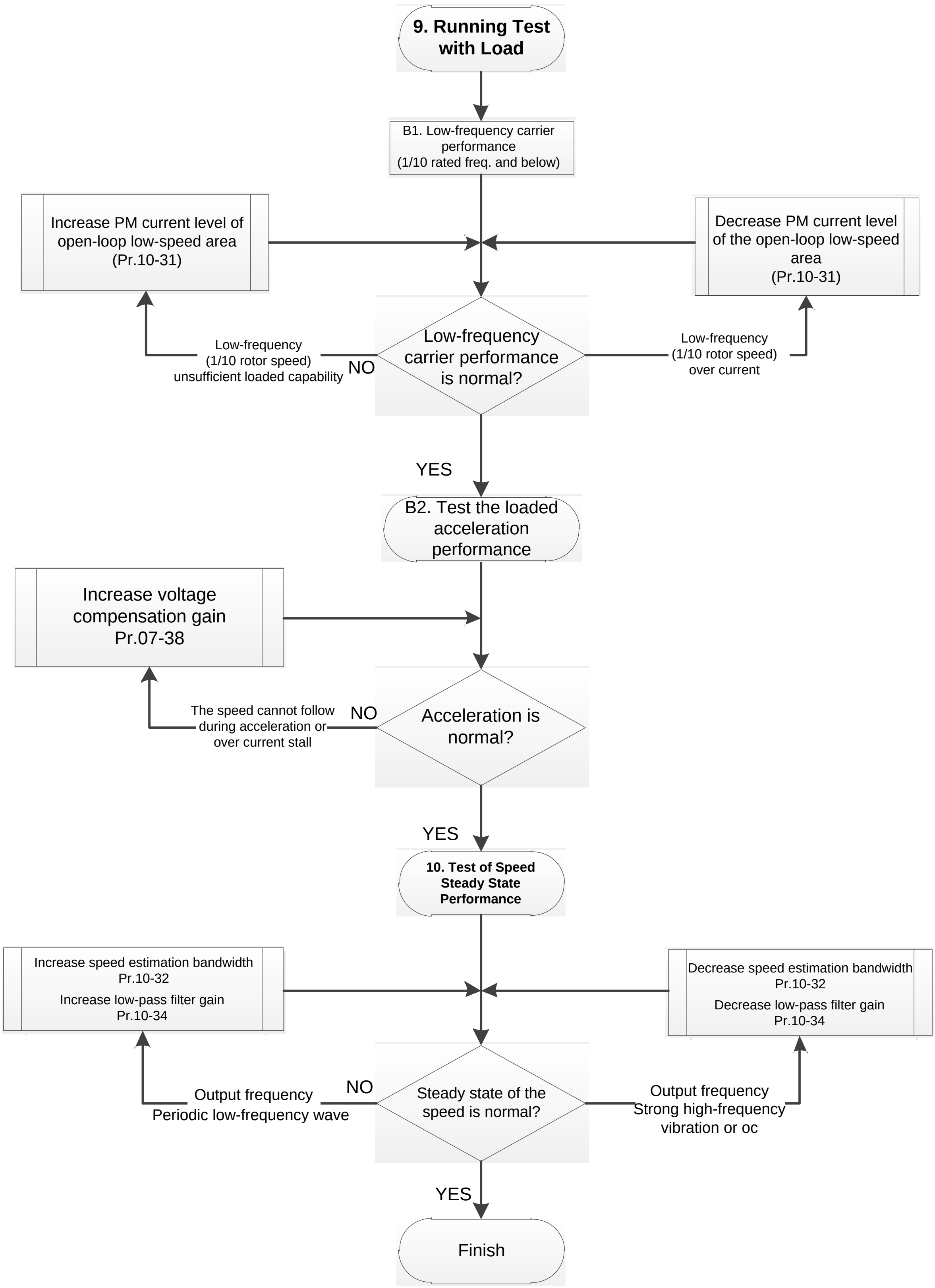
A3. Accelerate to the rated frequency and observe if the motor operates stably.

a. If the motor output rotor speed presents periodic low-frequency wave, increase Pr.10-34 (PM sensorless speed estimator low-pass filter gain), or increase Pr.10-32 (PM FOC sensorless speed estimator bandwidth).

b. If the output frequency reflects high frequency vibration, decrease Pr.10-34 or decrease Pr.10-32.

A4. Accelerate the motor to the maximum rotor speed, and observe if it operates stably.
If the motor stalls when accelerating to the maximum rotor speed, then increase Pr.10-34 (PM sensorless speed estimator low-pass filter gain), or increase Pr.00-17 (carrier frequency, you must set the carrier frequency larger than 10 times of the maximum output frequency)

(3) PM SVC adjustment flowchart for operation starts with load



📖 Adjustment for operation with heavy load

9. Load operating test

B1. Low-frequency loading performance is below 1/10 of rated frequency:

a. If the low-frequency loading performance is insufficient, or the rotor speed is not smooth, increase Pr.10-31 (current command of I/F mode).

b. If the low-frequency current is large, decrease Pr.10-31 (current command of I/F mode).

B2. Test the with-load accelerating performance:

When the motor operates in 1/10 of rotor speed and above, if the speed cannot follow the acceleration time during accelerating, or the current stalls, increase Pr.07-38 (PMSVC voltage feedback forward gain).

10. Stability test at constant speed operation: the motor operates stably at constant speed

a. If the motor output rotor speed presents periodic low-frequency wave, increase Pr.10-34 (PM sensorless speed estimator low-pass filter gain), or increase Pr.10-32 (PM FOC sensorless speed estimator bandwidth).

b. If the output frequency reflects high frequency vibration, decrease Pr.10-34 or decrease Pr.10-32.

- PM SVC related parameters

Refer to Section 12-1 Description of Parameter Settings for more details.

Parameter no.	Parameter Name	Unit	Default	Settings
Pr.07-24	Torque Command Filter Time	sec.	0.050	0.001–10.000
Pr.07-26	Torque compensation gain	NA	0	0–5000
Pr.10-31	I/F mode, current command	%	40	0–150
Pr.10-32	PM FOC sensorless speed estimator bandwidth	Hz	5.00	0.00–600.00
Pr.10-34	PM Sensorless Speed Estimator Low-pass Filter Gain	NA	1.00	0.00–655.35
Initial Angle Estimating Parameters				
Pr.10-42	Initial Angle Detection Pulse Value	NA	1.0	0.0–3.0
Pr.10-51	Injection Frequency (applicable when Pr.10-53 = 2)	Hz	500	0–1200
Pr.10-52	Injection Magnitude (applicable when Pr.10-53 = 2)	V	15.0 / 30.0	0.0–200.0
Pr.10-53	Angle Detection Method 0: Disabled 1: Force attracting the rotor to zero degrees 2: High frequency injection 3: Pulse injection	NA	0	0–3

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Chapter 13 Warning Codes

Summary of Warning Codes

ID No.	Warning Name	ID No.	Warning Name
0	No record	22_1	Motor overheating (oH3) PTC
3	Communication error 3 (CE3)	22_2	Motor overheating (oH3) PT100
4	Communication error 4 (CE4)	24	Over-slip warning (oSL)
5	Communication error 10 (CE10)	25	Auto-tuning (tUn)
7	Save error 1 (SE1)	28	Output phase loss (OPHL)
8	Save error 2 (SE2)	30	Save error 3 (SE3)
9	IGBT overheating warning (oH1)	98	Fire mode ON (FirE)
11	PID feedback error (PID)	102	Deceleration energy backup error (dEb)
12	ACI analog signal loss (AnL)	103	PID feedback fault (dEv)
13	Under current (uC)	127	Hardware positive limit (HPL)
20	Over-torque (ot1)	128	Hardware negative limit (HnL)
21	Over-torque (ot2)		

<table>
<tr><th>No.</th><th>Display on LED Keypad</th><th>Warning Name</th><th>Descriptions</th></tr>
<tr><td>3</td><td>CE3</td><td>Communication error 3 (CE3)</td><td>RS485 Modbus illegal data value</td></tr>
<tr><th colspan="4">Action and Reset</th></tr>
<tr><td colspan="2">Action Condition</td><td colspan="2">When the length of communication data is too long</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="2">Immediately</td></tr>
<tr><td colspan="2">Warning Setting Parameter</td><td colspan="2">None</td></tr>
<tr><td colspan="2">Reset Method</td><td colspan="2">“Warning” occurs when Pr.09-02=0 and the motor drive keeps running.
The drive resets automatically when receiving the correct communication data value.</td></tr>
<tr><td colspan="2">Reset Condition</td><td colspan="2">Immediately</td></tr>
<tr><td colspan="2">Record</td><td colspan="2">N/A</td></tr>
<tr><th colspan="2">Cause</th><th colspan="2">Corrective Actions</th></tr>
<tr><td colspan="2">Incorrect communication command from upper unit</td><td colspan="2">Check if the communication command is correct.</td></tr>
<tr><td colspan="2">Malfunction caused by interference</td><td colspan="2">Verify the wiring and grounding of the communication circuit. It is recommended to separate the communication circuit from the main circuit, or wire in 90 degree for effective anti-interference performance.</td></tr>
<tr><td colspan="2">Different communication setting from the upper unit</td><td colspan="2">Check if the setting for Pr.09-01 and Pr.09-04 are the same as the setting for the upper unit.</td></tr>
<tr><td colspan="2">Disconnection or bad connection of the cable</td><td colspan="2">Check the cable and replace it if necessary.</td></tr>
</table>

No.	Display on LED Keypad	Warning Name	Descriptions
4	CE4	Communication error 4 (CE4)	RS485 Modbus data is written to read-only address

Action and Reset	
Action Condition	When the data is written to read-only address
Action Time	Immediately
Warning Setting Parameter	None
Reset Method	“Warning” occurs when Pr.09-02 = 0 and the motor drive keeps running. The drive resets automatically when receiving the correct written address of communication data.
Reset Condition	Immediately
Record	N/A

Cause	Corrective Actions
Incorrect communication command from upper unit	Check if the communication command is correct.
Malfunction caused by interference	Verify the wiring and grounding of the communication circuit. It is recommended to separate the communication circuit from the main circuit, or wire in 90 degree for effective anti-interference performance.
Different communication setting from the upper unit	Check if the setting for Pr.09-01 and Pr.09-04 are the same as the setting for the upper unit.
Disconnection or bad connection of the cable	Check the cable and replace it if necessary.

No.	Display on LCD Keypad	Warning Name	Descriptions
5	CE10	Communication error 10 (CE10)	RS-485 Modbus transmission time-out

Action and Reset	
Action Condition	When the communication time exceeds the detection time of Pr.09-03 communication time-out
Action Time	Pr.09-03
Warning Setting Parameter	None
Reset Method	“Warning” occurs when Pr.09-02 = 0 and the motor drive keeps running. The drive resets automatically when receiving the next communication packet.
Reset Condition	Immediately
Record	N/A

Cause	Corrective Actions
The upper unit does not transmit the communication command within Pr.09-03 setting time	Check if the upper unit transmits the communication command within the setting time for Pr.09-03.
Malfunction caused by interference	Verify the wiring and grounding of the communication circuit. It is recommended to separate the communication circuit from the main circuit, or wire in 90 degree for effective anti-interference performance.
Different communication setting from the upper unit	Check if the setting for Pr.09-01 and Pr.09-04 are the same as the setting for the upper unit.
Disconnection or bad connection of the cable	Check the cable and replace it if necessary.

No.	Display on LED Keypad	Warning Name	Descriptions
7	SE1	Save error 1 (SE1)	Keypad COPY error 1: Keypad copy time-out

Action and Reset	
Action Condition	“SE1” warning occurs when the keypad does not transmit the COPY command to the drive, and does not transmit any data to the drive again in 10 ms at the time you copy the parameters to the drive.
Action Time	10ms
Warning Setting Parameter	None
Reset Method	Manual reset
Reset Condition	Immediately
Record	N/A

Cause	Corrective Actions
Communication connection error	SE1: The causes of error are mostly communication problems between the keypad and control board. Potential causes include communication signal interference and the unacceptable communication command to the Slave. It is suggested to check the status of communication and remove the error causes first. Check if the error occurs randomly, or only occurs when copying certain parameters (the error displays on the upper right corner of the copy page). If you cannot clear the error, please contact Delta.
Keypad error	
Control board error	

<table>
<tr><th>No.</th><th>Display on LED Keypad</th><th>Warning Name</th><th>Descriptions</th></tr>
<tr><td>8</td><td>SE2</td><td>Save error 1 (SE2)</td><td>Keypad COPY error 2: parameter writing error</td></tr>
<tr><th colspan="4">Action and Reset</th></tr>
<tr><td colspan="2">Action Condition</td><td colspan="2">“SE2” warning occurs when writing the parameters incorrectly at the time you copy parameters to the drive. For example, you copy the new firmware version with added parameters to the drive with old firmware version.</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="2">None</td></tr>
<tr><td colspan="2">Warning Setting Parameter</td><td colspan="2">None</td></tr>
<tr><td colspan="2">Reset Method</td><td colspan="2">Manual reset</td></tr>
<tr><td colspan="2">Reset Condition</td><td colspan="2">Immediately</td></tr>
<tr><td colspan="2">Record</td><td colspan="2">N/A</td></tr>
<tr><th colspan="2">Cause</th><th colspan="2">Corrective Actions</th></tr>
<tr><td colspan="2">Add new parameters to the new firmware version.</td><td colspan="2">SE2: In this stage, the copied data has been transmitted to the Slave.
The Slave compares and processes the copied data, and then saves the data to the Data ROM. During the process, the data error (should be attribution error) may occur, or the data cannot be saved to EEPROM. At this time, the warning occurs.
It is suggested to check the status of Data ROM and remove the error causes first.
If you cannot clear the error, please contact Delta.</td></tr>
<tr><td colspan="2">Malfunction caused by interference</td><td colspan="2">Verify the wiring and grounding of the main circuit, control circuit for effective anti-interference performance.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Display on LED Keypad</th><th>Warning Name</th><th>Descriptions</th></tr>
<tr><td>9</td><td>oH1</td><td>IGBT overheating warning (oH1)</td><td>The AC motor drive detects overheating of IGBT, and over the protection level of oH1 warning. (When Pr.06-15 is higher than the IGBT overheating level, the drive shows oH1 error without displaying oH1 warning.)</td></tr>
<tr><th colspan="4">Action and Reset</th></tr>
<tr><td colspan="2">Action Condition</td><td colspan="2">Pr.06-15</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="2">“oH1” warning occurs when IGBT temperature is higher than Pr.06-15 setting value.</td></tr>
<tr><td colspan="2">Warning Setting Parameter</td><td colspan="2">None</td></tr>
<tr><td colspan="2">Reset Method</td><td colspan="2">Auto-reset</td></tr>
<tr><td colspan="2">Reset Condition</td><td colspan="2">The drive auto-resets when IGBT temperature is lower than oH1 warning level minus (–) 5°C</td></tr>
<tr><td colspan="2">Record</td><td colspan="2">N/A</td></tr>
<tr><th colspan="2">Cause</th><th colspan="2">Corrective Actions</th></tr>
<tr><td colspan="2">Check if the ambient temperature or temperature inside the cabinet is too high, or if there is obstruction in the ventilation hole of the control cabinet.</td><td colspan="2">1. Check the ambient temperature.
2. Regularly inspect the ventilation hole of the control cabinet.
3. Change the installed place if there are heating objects, such as brake resistors, in the surroundings.
4. Install / add cooling fan or air conditioner to lower the temperature inside the cabinet.</td></tr>
<tr><td colspan="2">Check if there is any obstruction on the heat sink or if the fan is running</td><td colspan="2">Remove the obstruction or replace the cooling fan.</td></tr>
<tr><td colspan="2">Insufficient ventilation space</td><td colspan="2">Increase ventilation space of the drive.</td></tr>
<tr><td colspan="2">Check if the drive matches the corresponded loading</td><td colspan="2">1. Decrease loading.
2. Decrease the carrier wave.
3. Replace with a drive with larger capacity.</td></tr>
<tr><td colspan="2">The drive has run 100% or more of the rated output for a long time</td><td colspan="2">Replace with a drive with larger capacity.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Display on LED Keypad</th><th>Warning Name</th><th colspan="2">Descriptions</th></tr>
<tr><td>11</td><td>PId</td><td>PID feedback error (PID)</td><td colspan="2">PID feedback loss (warning for analog feedback signal; works only when PID enables)</td></tr>
<tr><th colspan="5">Action and Reset</th></tr>
<tr><td colspan="2">Action Condition</td><td colspan="3">When the analog input is lower than 4 mA (only detects analog input 4–20 mA)</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="3">Pr.08-08</td></tr>
<tr><td colspan="2">Warning Setting Parameter</td><td colspan="3">Pr.08-09
0: Warn and continue operation
1: Fault and ramp to stop
2: Fault and coast to stop
3: Warn and operate at last frequency</td></tr>
<tr><td colspan="2" rowspan="2">Reset Method</td><td>Auto</td><td colspan="2">“Warning” occurs when Pr.08-09=0 or 3.
When the feedback signal is > 4 mA, the ”Warning” will be automatically cleared.</td></tr>
<tr><td>Manual</td><td colspan="2">When Pr.08-09 = 1 or 2, this is a “Fault”. You must reset manually.</td></tr>
<tr><td colspan="2">Reset Condition</td><td colspan="3">Immediately</td></tr>
<tr><td colspan="2">Record</td><td colspan="3">When Pr.08-09 = 1 or 2, this is a “fault”, and it will be recorded.
When Pr.08-09 = 0 or 3, this is a “warning”, and it will not be recorded.</td></tr>
<tr><th colspan="2">Cause</th><th colspan="3">Corrective Actions</th></tr>
<tr><td colspan="2">Loose or broken PID feedback wiring</td><td colspan="3">Tighten the terminals again.
Replace with a new cable.</td></tr>
<tr><td colspan="2">Feedback device malfunction</td><td colspan="3">Replace with a new feedback device.</td></tr>
<tr><td colspan="2">Hardware failure</td><td colspan="3">If the PID error still occurs after checking all the wiring, return to the factory for repair.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Display on LED Keypad</th><th colspan="2">Warning Name</th><th>Descriptions</th></tr>
<tr><td>12</td><td>AnL</td><td colspan="2">ACI analog signal loss (AnL)</td><td>Analog input current loss (including all analog 4–20 mA signals)</td></tr>
<tr><td colspan="5">Action and Reset</td></tr>
<tr><td colspan="2">Action Condition</td><td colspan="3">When the analog input is lower than 4 mA (only detects analog input 4–20 mA)</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="3">Immediately</td></tr>
<tr><td colspan="2">Warning Setting Parameter</td><td colspan="3">Pr.03-19
0: Disabled
1: Continue operation at the last frequency (warning, keypad displays AnL)
2: Decelerate to 0 Hz (warning, keypad displays AnL)
3: Stop immediately and display “ACE”</td></tr>
<tr><td colspan="2" rowspan="2">Reset Method</td><td>Auto</td><td colspan="2">When Pr.03-19 = 1 or 2, this is a “warning”.
The “Warning” will be automatically cleared when the analog input signal is larger than 4 mA.</td></tr>
<tr><td>Manual</td><td colspan="2">“When Pr.03-19 = 3, this is a “fault”. You must reset manually.</td></tr>
<tr><td colspan="2">Reset Condition</td><td colspan="3">Immediately</td></tr>
<tr><td colspan="2">Record</td><td colspan="3">When Pr.03-19 = 3, this is a “fault”, and it will be recorded.
When Pr.03-19 = 1 or 2, this is a “warning”, and it will not be recorded.</td></tr>
<tr><td colspan="2">Cause</td><td colspan="3">Corrective Actions</td></tr>
<tr><td colspan="2">Loose or broken ACI wiring</td><td colspan="3">Tighten the terminals again.
Replace with a new cable.</td></tr>
<tr><td colspan="2">External device error</td><td colspan="3">Replace with a new device.</td></tr>
<tr><td colspan="2">Hardware failure</td><td colspan="3">If the AnL error still occurs after checking all the wiring, return to the factory for repair.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Display on LED Keypad</th><th colspan="2">Warning Name</th><th>Descriptions</th></tr>
<tr><td>13</td><td>uC</td><td colspan="2">Under current (uC)</td><td>Low current</td></tr>
<tr><td colspan="5">Action and Reset</td></tr>
<tr><td colspan="2">Action Condition</td><td colspan="3">Pr.06-71</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="3">Pr.06-72</td></tr>
<tr><td colspan="2">Warning Setting Parameter</td><td colspan="3">Pr.06-73
0: No Function
1: Fault and coast to stop
2: Fault and ramp to stop by the 2nd deceleration time
3: Warn and continue operation</td></tr>
<tr><td colspan="2" rowspan="2">Reset Method</td><td>Auto</td><td colspan="2">When Pr.06-73 = 3, this is a “Warning”.
The warning will be automatically cleared when the output current > (Pr.06-71+0.1A).</td></tr>
<tr><td>Manual</td><td colspan="2">When Pr.06-73 = 1 or 2, this is a “Fault”. You must reset manually.</td></tr>
<tr><td colspan="2">Reset Condition</td><td colspan="3">Immediately</td></tr>
<tr><td colspan="2">Record</td><td colspan="3">When Pr.06-73 = 1 or 2, this is a “fault”, and it will be recorded.
When Pr.06-73 = 3, this is a “warning”, and it will not be recorded.</td></tr>
<tr><td colspan="2">Cause</td><td colspan="3">Corrective Actions</td></tr>
<tr><td colspan="2">Broken motor cable</td><td colspan="3">Remove the connection issue of the motor and its load.</td></tr>
<tr><td colspan="2">Improper setting for the low current protection</td><td colspan="3">Set the proper settings for Pr.06-71, Pr.06-72 and Pr.06-73.</td></tr>
<tr><td colspan="2">Low load</td><td colspan="3">Check the loading status.
Make sure the loading matches the motor capacity.</td></tr>
</table>

No.	Display on LED Keypad	Warning Name	Descriptions
20	ot1	Over-torque (ot1)	Over-torque 1 warning

Action and Reset	
Action Condition	Pr.06-07
Action Time	Pr.06-08
Warning Setting Parameter	Pr.06-06 Over-torque Detection Selection (Motor 1) = 1 or 3 0: Disabled 1: Continue operation after over-torque detection during constant speed operation 2: Stop after over-torque detection during constant speed operation 3: Continue operation after over-torque detection during RUN 4: Stop after over-torque detection during RUN
Reset Method	The warning will be automatically cleared when the output current < (Pr.06-07 – 5%)
Reset Condition	The warning will be automatically cleared when the output current < (Pr.06-07 – 5%)
Record	N/A

Cause	Corrective Actions
Incorrect parameter setting	Configure the settings for Pr.06-07 and Pr.06-08 again.
Mechanical error (e.g. mechanical lock due to over-torque)	Remove the causes of malfunction.
The load is too large	Decrease the loading. Replace with a motor with larger capacity.
Accel./Decel. time and working cycle is too short	Increase setting values for Pr.01-12–01-19 (accel./decel. time).
V/F voltage is too high	Adjust the V/F curve (Motor 1, Pr.01-01–01-08), especially the setting value for the mid-point voltage (if the mid-point voltage is set too low, the load capacity decreases at low speed).
The motor capacity is too small	Replace with a motor with larger capacity.
Overload during low-speed operation	Decrease the loading during low-speed operation. Increase the motor capacity.
The torque compensation is too large	Adjust the torque compensation (refer to Pr.07-26 torque compensation gain) until the current reduces and the motor does not stall.
Improper parameter settings for the speed tracking function (including restart after momentary power loss and restart after fault)	Correct the parameter settings for speed tracking. Start the speed tracking function. Adjust the maximum current for Pr.07-09 speed tracking.

No.	Display on LED Keypad	Warning Name	Descriptions
21	ot2	Over-torque (ot2)	Over-torque 2 warning

Action and Reset	
Action Condition	Pr.06-10
Action Time	Pr.06-11
Warning Setting Parameter	Pr.06-09 Over-torque Detection Selection (Motor 2) =1 or 3 0: Disabled 1: Continue operation after over-torque detection during constant speed operation 2: Stop after over-torque detection during constant speed operation 3: Continue operation after over-torque detection during RUN 4: Stop after over-torque detection during RUN
Reset Method	The warning will be automatically cleared when the output current < (Pr.06-10 – 5%).
Reset Condition	The warning will be automatically cleared when the output current < (Pr.06-10 – 5%).
Record	N/A

Cause	Corrective Actions
Incorrect parameter setting	Configure the settings for Pr.06-10 and Pr.06-11 again.
Mechanical error (e.g. mechanical lock due to over-torque)	Remove the causes of malfunction.
The load is too large	Decrease the loading. Replace with a motor with larger capacity.
Accel./Decel. time and working cycle is too short	Increase setting values for Pr.01-12–01-19 (accel./decel. time).
V/F voltage is too high	Adjust the V/F curve (Motor 2, Pr.01-35–01-42), especially the setting value for the mid-point voltage (if the mid-point voltage is set too low, the load capacity decreases at low speed).
The motor capacity is too small	Replace with a motor with larger capacity.
Overload during low-speed operation	Decrease the loading during low-speed operation. Increase the motor capacity.
The torque compensation is too large	Adjust the torque compensation (refer to Pr.07-26 torque compensation gain) until the current reduces and the motor does not stall.
Improper parameter settings for the speed tracking function (including restart after momentary power loss and restart after fault)	Correct the parameter settings for speed tracking. Start the speed tracking function. Adjust the maximum current for Pr.07-09 speed tracking.

No.	Display on LED Keypad	Warning Name	Descriptions
22_1	oH3	Motor overheating (oH3) PTC	Motor overheating warning. The AC motor drive detects the temperature inside the motor is too high

Action and Reset	
Action Condition	Pr.03-00 = 6 (PTC), PTC input level > Pr.06-30 setting (default = 50%)
Action Time	Immediately
Warning Setting Parameter	Error treatment: Pr.06-29 0: Warn and continue operation 1: Fault and ramp to stop 2: Fault and coast to stop 3: No warning When Pr.06-29 = 0 and the temperature < Pr.06-30, oH3 will be automatically cleared. When Pr.06-29 = 0, oH3 is a “Warning”. The “Warning” will be automatically cleared.
Reset Method	When Pr.06-29 = 0, oH3 displays as “Warning”. When the temperature is < Pr.06-30 level, the oH3 warning will be automatically cleared.
Reset Condition	When the temperature is < Pr.06-30 level, the oH3 warning will be automatically cleared.
Record	N/A

Cause	Corrective Actions
Motor locked	Clear the motor lock status.
The load is too large	Decrease the loading. Replace with a motor with larger capacity.
Ambient temperature is too high	Change the installed place if there are heating devices in the surroundings. Install / add cooling fan or air conditioner to lower the ambient temperature.
Motor cooling system error	Check the cooling system to make it work normally.
Motor fan error	Replace the fan.
Operates at low-speed too long	Decrease low-speed operation time. Change to dedicated motor for the drive. Increase the motor capacity.
Accel./Decel. time and working cycle is too short	Increase setting values for Pr.01-12–01-19 (accel./decel. time).
V/F voltage is too high	Adjust the V/F curve (Motor 1, Pr.01-01–01-08), especially the setting value for the mid-point voltage (if the mid-point voltage is set too low, the load capacity decreases at low speed).
Check if the motor rated current matches the motor nameplate	Configure the correct rated current value of the motor again.
Check if the PTC is properly set and wired	Check the connection between PTC thermistor and the heat protection.
Check if the setting for stall prevention is correct	Set the stall prevention to the proper value.
Unbalanced three-phase impedance of the motor	Replace the motor.
Harmonics is too high	Use remedies to reduce harmonics.

No.	Display on LED Keypad	Warning Name	Descriptions
22_2	oH3	Motor overheating (oH3) PT100	Motor overheating warning. The AC motor drive detects the temperature inside the motor is too high

Action and Reset	
Action Condition	Pr.03-00 = 11 (PT100), PT100 input level > Pr.06-57 (default = 7V)
Action Time	Immediately
Warning Setting Parameter	Error treatment: Pr.06-29 0: Warn and continue operation 1: Fault and ramp to stop 2: Fault and coast to stop 3: No warning When Pr.06-29 = 0 and the temperature < Pr.06-56, oH3 will be automatically cleared. If the temperature is between Pr.06-56 and Pr.06-57, the frequency outputs according to the operating frequency setting for Pr.06-58.
Reset Method	When Pr.06-29 = 0, oH3 displays as “Warning”. When the temperature is < Pr.06-56 level, the oH3 warning will be automatically cleared.
Reset Condition	When the temperature is < Pr.06-56 level, the oH3 warning will be automatically cleared.
Record	N/A

Cause	Corrective Actions
Motor locked	Clear the motor lock status.
The load is too large	Decrease the loading. Replace with a motor with larger capacity.
Ambient temperature is too high	Change the installed place if there are heating devices in the surroundings. Install / add cooling fan or air conditioner to lower the ambient temperature.
Motor cooling system error	Check the cooling system to make it work normally.
Motor fan error	Replace the fan.
Operates at low-speed too long	Decrease low-speed operation time. Change to dedicated motor for the drive. Increase the motor capacity.
Accel./Decel. time and working cycle is too short	Increase setting values for Pr.01-12–01-19 (accel./decel. time).
V/F voltage is too high	Adjust the V/F curve (Motor 1, Pr.01-01–01-08), especially the setting value for the mid-point voltage (if the mid-point voltage is set too low, the load capacity decreases at low speed).
Check if the motor rated current matches the motor nameplate	Configure the correct rated current value of the motor again.
Check if the PT100 is properly set and wired	Check the connection between PT100 thermistor and the heat protection.
Check if the setting for stall prevention is correct	Set the stall prevention to the proper value.
Unbalanced three-phase impedance of the motor	Replace the motor.
Harmonics is too high	Use remedies to reduce harmonics.

No.	Display on LED Keypad	Warning Name	Descriptions
24	oSL	Over-slip warning (oSL)	Over slip warning. By using the maximum slip (Pr.10-29) as the base, when the drive outputs at constant speed, and the F > H or F < H exceeds Pr.07-29 level and Pr.07-30 setting time, 100% of Pr.07-29 = Pr.10-29.

Action and Reset	
Action Condition	When the drive outputs at constant speed, and F > H or F < H exceeds the Pr.07-29 level.
Action Time	Pr.07-30
Warning Setting Parameter	Pr.07-31 = 0 Warning 0: Warn and continue operation 1: Fault and ramp to stop 2: Fault and coast to stop 3: No warning
Reset Method	When Pr.07-31 = 0 and the drive outputs at constant speed, and F > H or F < H no longer exceeds the Pr.07-29 level, the oSL warning will be automatically cleared.
Reset Condition	None
Record	N/A

Cause	Corrective Actions
Check if the motor parameter is correct	Check the motor parameter.
The load is too large	Decrease the loading.
Check if the settings for Pr.07-29, Pr.07-30 and Pr.10-29 are properly set	Check the parameter settings for oSL protection.

No.	Display on LED Keypad	Warning Name	Descriptions
25	tUn	Auto-tuning (tUn)	Parameter auto-tuning is processing. When running auto-tuning, the keypad displays “tUn”.

Action and Reset	
Action Condition	When running Pr.05-00 motor parameter auto-tuning, the keypad displays “tUn”.
Action Time	None
Warning Setting Parameter	None
Reset Method	When auto-tuning is finished and no error occurs, the warning will be automatically cleared.
Reset Condition	When auto-tuning is finished and no error occurs.
Record	N/A

Cause	Corrective Actions
The motor parameter is running auto-tuning	When the auto-tuning is finished, the warning will be automatically cleared.

No.	Display on LED Keypad	Warning Name	Descriptions
28	oPHL	Output phase loss (OPHL)	Output phase loss of the drive

Action and Reset	
Action Condition	Pr.06-47
Action Time	None
Warning Setting Parameter	Pr.06-45 0: Warn and continue operation 1: Fault and ramp to stop 2: Fault and coast to stop 3: No warning
Reset Method	If Pr.06-45 = 0, the oPHL warning will be automatically cleared after the drive stops.
Reset Condition	None
Record	N/A

Cause	Corrective Actions
Unbalanced three-phase impedance of the motor	Replace the motor.
Check if the wiring is incorrect	Check the cable. Replace the cable.
Check if the motor is a single-phase motor	Choose a three-phase motor.
Check if the current sensor is broken.	Check if the control board cable is loose. If yes, reconnect the cable and run the drive to test. If the error still occurs, return to the factory for repair. Check if the three-phase current is balanced with a current clamp meter. If the current is balanced and the OPHL error still shows on the display, return to the factory for repair.
Check if capacity of the drive is larger than the motor	Choose a drive’s capacity matches a motor’s.

No.	Display on LED Keypad	Warning Name	Descriptions
30	SE3	Save error 3 (SE3)	Keypad COPY error 3: copy model error
Action and Reset			
Action Condition		"SE3" warning occurs when different drive identity codes are found during copying parameters.	
Action Time		Immediately act when the error is detected	
Warning Setting Parameter		None	
Reset Method		Manual reset	
Reset Condition		None	
Record		N/A	
Cause		Corrective Actions	
Keypad copy between different power range drives		It is mainly to prevent parameter copies between different HP/models.	

No.	Display on LED Keypad	Warning Name	Descriptions
98	FirE	Fire mode ON (FirE)	Display when fire mode is triggered
Action and Reset			
Action Condition	MIx = 58 is triggered and run, or MIx = 59 is triggered		
Action Time	Immediately act		
Warning Setting Parameter	Refer to Pr.06-81, Pr.06-88 to set the operating frequency and the operation times in fire mode		
Reset Method	Manual reset		
Reset Condition	Reset in five seconds after the fault is cleared		
Record	Yes		
Cause	Corrective Actions		
MIx = 58 is triggered and run, or MIx = 59 is triggered	If it is triggered in four minutes, then cancel MI setting. If it is triggered over four minutes, then re-power ON.		

<table>
<tr><th>No.</th><th>Display on LED Keypad</th><th>Warning Name</th><th colspan="2">Descriptions</th></tr>
<tr><td>102</td><td>dEb</td><td>Deceleration energy backup error (dEb)</td><td colspan="2">When Pr.07-13 is not 0, and the power is suddenly off, causing the DC bus voltage lower than the dEb action condition, the dEb function acts and the motor ramps to stop. Then dEb displays on the keypad.</td></tr>
<tr><th colspan="5">Action and Reset</th></tr>
<tr><td colspan="2">Action Condition</td><td colspan="3">When Pr.07-13 is not 0, and the DC bus voltage is lower than the level of dEb.</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="3">Immediately</td></tr>
<tr><td colspan="2">Fault treatment parameter</td><td colspan="3">None</td></tr>
<tr><td colspan="2" rowspan="2">Reset Method</td><td>Auto</td><td colspan="2">When Pr.07-13=2 (dEb with auto-acceleration / auto-deceleration, the drive outputs the frequency after the power is restored): dEb will be automatically cleared.</td></tr>
<tr><td>Manual</td><td colspan="2">When Pr.07-13=1 (dEb with auto-acceleration / auto-deceleration, the drive does not output the frequency after the power is restored): The drive stops when dEb acts and the rotation speed becomes 0 Hz, then the drive can be reset manually.</td></tr>
<tr><td colspan="2">Reset Condition</td><td colspan="3">Auto: The fault is automatically cleared.
Manual: When the drive decelerates to 0 Hz.</td></tr>
<tr><td colspan="2">Record</td><td colspan="3">Yes</td></tr>
<tr><th colspan="2">Cause</th><th colspan="3">Corrective Actions</th></tr>
<tr><td colspan="2">Unstable power source or the power is off</td><td colspan="3">Check the power system.</td></tr>
<tr><td colspan="2">There is any other large load operates in the power system</td><td colspan="3">Replace power system with a larger capacity.
Use a different power system from the large load system.</td></tr>
</table>

No.	Display on LED Keypad	Warning Name	Descriptions
103		PID feedback fault (dEv)	Abnormal PID feedback

Action and Reset	
Action Condition	The value of the feedback deviation is lower than the setting in Pr.08-13.
Action Time	Pr.08-14
Fault treatment parameter	Pr.08-62
Reset Method	Manual reset
Reset Condition	When the feedback value is back to the setting range of Pr.08-13, this warning resets automatically.
Record	Yes
Cause	
PID feedback loss	Verify if any feedback mistake or loss.
Pressure sensor fault	Verify if any feedback mistake or loss.
Insufficient pressure	Verify if any feedback mistake or loss.

No.	Display on LED Keypad	Warning Name	Descriptions
127	HPL	Hardware positive limit (HPL)	When under FOCPG mode, the positive running limit (hardware limit switch) of the MI terminals is activated.

Action and Reset	
Action Condition	When under IMFOCPG/PMFOCPG mode, the motor drive reaches positive running limit.
Action Time	Immediately acts
Fault treatment parameter	N/A
Reset Method	Move the motor away from the limit position, the warning automatically clears.
Reset Condition	Immediately resets
Record	N/A
Cause	
Error occurs on hardware limit switch	1. Verify if the switch of hardware limit works properly. 2. Verify if the switch of hardware limit is installed at the right position. 3. Verify if the corresponding MI terminals of the positive limit switch is at the right status such as Normal Open and Normal Close.
Overshoot	1. Verify if the Acceleration/ Deceleration time of the motor drive is right. 2. Verify if the frequency command of the motor drive is right.
Select the wrong homing method	Verify if the mechanical parts and homing method co-work properly.

<table>
<tr><th>No.</th><th>Display on LED Keypad</th><th>Warning Name</th><th>Descriptions</th></tr>
<tr><td>128</td><td>HnL</td><td>Hardware negative limit (HnL)</td><td>When under FOCPG mode, the negative running limit (hardware limit switch) of the MI terminals is activated.</td></tr>
<tr><th colspan="4">Action and Reset</th></tr>
<tr><td colspan="3">Action Condition</td><td>When under IMFOCPG/PMFOCPG mode, the motor drive reaches negative running limit.</td></tr>
<tr><td colspan="3">Action Time</td><td>Immediately acts</td></tr>
<tr><td colspan="3">Fault treatment parameter</td><td>N/A</td></tr>
<tr><td colspan="3">Reset Method</td><td>Move the motor away from the limit position, the warning automatically clears.</td></tr>
<tr><td colspan="3">Reset Condition</td><td>Immediately reset</td></tr>
<tr><td colspan="3">Record</td><td>N/A</td></tr>
<tr><th colspan="3">Cause</th><th></th></tr>
<tr><td colspan="3">Error occurs on hardware limit switch</td><td>1. Verify if the switch of hardware limit works properly.
2. Verify if the switch of hardware limit is installed at the right position.
3. Verify if the corresponding MI terminals of the positive limit switch is at the right status such as Normal Open and Normal Close.</td></tr>
<tr><td colspan="3">Overshoot</td><td>1. Verify if the acceleration/ deceleration time of the motor drive is right.
2. Verify if the frequency command of the motor drive is right</td></tr>
<tr><td colspan="3">Select the wrong homing method</td><td>Verify if the mechanical parts and homing method co-work properly.</td></tr>
</table>

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Chapter 14 Fault Codes

Summary of Fault Codes

ID No.	Fault Name	ID No.	Fault Name
0	No record	48	ACI loss (ACE)
1	Over-current during acceleration (ocA)	49	External fault (EF)
2	Over-current during deceleration (ocd)	50	Emergency stop (EF1)
3	Over-current during steady operation (ocn)	51	External base block (bb)
4	Ground fault (GFF)	52	Enter wrong password three times and locked (Pcod)
6	Over-current at stop (ocS)	53	SW code error (ccod)
7	Over-voltage during acceleration (ovA)	54	Illegal command (CE1)
8	Over-voltage during deceleration (ovd)	55	Illegal data address (CE2)
9	Over-voltage at constant speed (ovn)	56	Illegal data value (CE3)
10	Over-voltage at stop (ovS)	57	Data is written to read-only address (CE4)
11	Low-voltage during acceleration (LvA)	58	Modbus transmission time-out (CE10)
12	Low-voltage during deceleration (Lvd)	61	Y-connection / Δ-connection switch error (ydc)
13	Low-voltage at constant speed (Lvn)	62	Deceleration energy backup error (dEb)
14	Low-voltage at stop (LvS)	63	Over slip error (oSL)
15	Phase loss protection (OrP)	72	S1 internal loop error is detected (STL1)
16	IGBT overheating (oH1)	76	Safe torque off (STO)
17	Over-heat key components (oH2)	77	S2 internal loop error is detected (STL2)
18	IGBT temperature detection failure (tH1o)	78	Internal loop error is detected (STL3)
19	Capacitor hardware fault (tH2o)	79	U-phase over-current before run (Aoc)
21	Over load (oL)	80	V-phase over-current before run (boc)
22	Electronic thermal relay 1 protection (EoL1)	81	W-phase over-current before run (coc)
23	Electronic thermal relay 2 protection (EoL2)	82	Output phase loss U phase (oPL1)
24_1	Motor overheating (oH3) PTC	83	Output phase loss V phase (oPL2)
24_2	Motor overheating (oH3) PT100	84	Output phase loss W phase (oPL3)
26	Over torque 1 (ot1)	87	Overload protection at low frequency (oL3)
27	Over torque 2 (ot2)	89	Rotor position detection error (roPd)
28	Under current (uC)	140	oc hardware error (Hd6)
31	EEPROM read error (cF2)	141	GFF occurs before run (b4GFF)
33	U-phase error (cd1)	142	Auto-tuning error 1 (AUE1)
34	V-phase error (cd2)	143	Auto-tuning error 2 (AUE2)
35	W-phase error (cd3)	144	Auto-tuning error 3 (AUE3)
36	Cc hardware failure (Hd0)	149	Auto-tuning 5 (AUE5)
37	oc hardware error (Hd1)	150	No-load current I_0 measurement fault (AUE6)
38	ov hardware error (Hd2)	151	dq axis inductance measurement fault (AUE7)
40	Auto-tuning error (AUE)	152	High frequency injection measurement fault (AUE8)
41	PID loss ACI (AFE)	157	Pump PID feedback error (dEv)

No.	Display on LED Keypad	Fault Name	Descriptions
1	ocA	Over-current during acceleration (ocA)	Output current exceeds three times of the rated current during acceleration. When ocA occurs, the drive closes the gate of the output immediately, the motor runs freely, and the display shows an ocA error.

Action and Reset	
Action Condition	250% of the rated current (software)
Action Time	Immediately
Fault Treatment Parameter	None
Reset Method	Manual reset
Reset Condition	Reset in five seconds after the fault is cleared
Record	Yes

Cause	Corrective Actions
Acceleration time is too short	1. Increase the acceleration time 2. Increase the acceleration time of S-curve 3. Set auto-acceleration and auto-deceleration (Pr.01-44). 4. Set over-current stall prevention function (Pr.06-03) 5. Replace the drive with a larger capacity model.
Short-circuit at motor output due to poor insulation wiring	Check the motor cable and remove causes of the short circuits, or replace the cable before turning on the power.
Motor burnout or aging insulation occurred	Check the motor insulation value with megger. Replace the motor if the insulation is poor.
The load is too large	Check if the output current during the whole working process exceeds the AC motor drive's rated current. If yes, replace the AC motor drive with a larger capacity model.
Impulsive change of the load	Reduce the load or increase the capacity of AC motor drive.
Use special motor or motor with larger capacity than the drive	Check the motor capacity (the rated current on the motor's nameplate should ≤ the rated current of the drive)
Use ON / OFF controller of an electromagnetic contactor at the output (U / V / W) of the drive.	Check the action timing of the contactor and make sure it is not turned ON/OFF when the drive outputs the voltage.
V/F curve setting error	Adjust the V/F curve setting and frequency/voltage. When the fault occurs, and the frequency voltage is too high, reduce the voltage.
The torque compensation is too large	Adjust the torque compensation (refer to Pr.07-26 torque compensation gain) until the current reduces and the motor does not stall.
Malfunction caused by interference	Verify the wiring of the control circuit, and the wiring/grounding of the main circuit to prevent interference.
The motor starts when in free run	Enable the speed tracking during start-up of Pr.07-12.
Improper parameter settings for the speed tracking function (including restart after momentary power loss and restart after fault)	Correct the parameter settings for speed tracking. 1. Start the speed tracking function. 2. Adjust the maximum current for Pr.07-09 speed tracking.
Incorrect combination of control mode and used motor	Check the settings for Pr.00-11 control mode: 1. For IM, Pr.00-11 = 0, 2; Pr.05-33 = 0 2. For PM, Pr.00-11 = 2; Pr.05-33 = 1, 2
The length of motor cable is too long	Increase the drive capacity. Install AC reactor(s) on the output side (U / V / W).

Hardware failure	The ocA occurs due to the short circuit or ground fault at the output side of the drive. Check for possible short circuits between terminals with the electric meter: If short circuit occurs, return to the factory for repair. B1 corresponds to U, V and W; DC- corresponds to U, V and W; ⏚ corresponds to U, V and W.
Check if the setting for stall prevention is correct	Set the stall prevention to the proper value.

No.	Display on LED Keypad	Fault Name	Descriptions
2	ocd	Over-current during deceleration (ocd)	Output current exceeds three times of the rated current during deceleration. When ocd occurs, the drive closes the gate of the output immediately, the motor runs freely, and the display shows an ocd error.

Action and Reset	
Action Condition	250% of the rated current
Action Time	Immediately
Fault Treatment Parameter	None
Reset method	Manual reset
Reset Condition	Reset in five seconds after the fault is cleared
Record	Yes

Cause	Corrective Actions
Acceleration time is too short	1. Increase the deceleration time 2. Increase the deceleration time of S-curve 3. Set auto-acceleration and auto-deceleration (Pr.01-44). 4. Set over-current stall prevention function (Pr.06-03) 5. Replace the drive with a larger capacity model.
Check if the mechanical brake of the motor activates too early	Check the action timing of the mechanical brake
Short-circuit at motor output due to poor insulation wiring	Check the motor cable and remove causes of the short circuits, or replace the cable before turning on the power.
Motor burnout or aging insulation occurred	Check the motor insulation value with megger. Replace the motor if the insulation is poor.
The load is too large	Check if the output current during the whole working process exceeds the AC motor drive's rated current. If yes, replace the AC motor drive with a larger capacity model.
Impulsive change of the load	Reduce the load or increase the capacity of AC motor drive.
Use special motor or motor with larger capacity than the drive	Check the motor capacity (the rated current on the motor's nameplate should ≤ the rated current of the drive)
Use ON / OFF controller of an electromagnetic contactor at the output (U / V / W) of the drive.	Check the action timing of the contactor and make sure it is not turned ON/OFF when the drive outputs the voltage.
V/F curve setting error	Adjust the V/F curve setting and frequency/voltage. When the fault occurs, and the frequency voltage is too high, reduce the voltage.
The torque compensation is too large	Adjust the torque compensation (refer to Pr.07-26 torque compensation gain) until the current reduces and the motor does not stall.
Malfunction caused by interference	Verify the wiring of the control circuit, and the wiring/grounding of the main circuit to prevent interference.
The length of motor cable is too long	Increase the drive capacity. Install AC reactor(s) on the output side (U / V / W).
Hardware failure	The ocd occurs due to the short circuit or ground fault at the output side of the drive. Check for possible short circuits between terminals with the electric meter: If short circuit occurs, return to the factory for repair. B1 corresponds to U, V and W; DC- corresponds to U, V and W; ⏚ corresponds to U, V and W.
Check if the setting for stall prevention is correct	Set the stall prevention to the proper value.

No.	Display on LED Keypad	Fault Name	Descriptions
3	ocn	Over-current during steady operation (ocn)	Output current exceeds 2.5 times of the rated current during constant speed. When ocn occurs, the drive closes the gate of the output immediately, the motor runs freely, and the display shows an ocn error.

Action and Reset	
Action Condition	250% of the rated current
Action Time	Immediately
Fault Treatment Parameter	None
Reset method	Manual reset
Reset Condition	Reset in five seconds after the fault is cleared
Record	Yes

Cause	Corrective Actions
Short-circuit at motor output due to poor insulation wiring	Check the motor cable and remove causes of the short circuits, or replace the cable before turning on the power.
Check for possible shaft lock, burnout or aging insulation of the motor	Troubleshoot the motor shaft lock. Check the motor insulation value with megger. Replace the motor if the insulation is poor.
Impulsive change of the load	Reduce the load or increase the capacity of AC motor drive.
Use special motor or motor with larger capacity than the drive	Check the motor capacity (the rated current on the motor's nameplate should ≤ the rated current of the drive)
Use ON / OFF controller of an electromagnetic contactor at the output (U / V / W) of the drive.	Check the action timing of the contactor and make sure it is not turned ON/OFF when the drive outputs the voltage.
V/F curve setting error	Adjust the V/F curve setting and frequency/voltage. When the fault occurs, and the frequency voltage is too high, reduce the voltage.
The torque compensation is too large	Adjust the torque compensation (refer to Pr.07-26 torque compensation gain) until the current reduces and the motor does not stall.
Malfunction caused by interference	Verify the wiring of the control circuit, and the wiring/grounding of the main circuit to prevent interference.
The length of motor cable is too long	Increase the drive capacity. Install AC reactor(s) on the output side (U / V / W).
Hardware failure	The ocn occurs due to short circuit or ground fault at the output side of the drive. Check for possible short circuits between terminals with the electric meter: If short circuit occurs, return to the factory for repair. B1 corresponds to U, V and W; DC- corresponds to U, V and W; ⏚ corresponds to U, V and W.

No.	Display on LED Keypad	Fault Name	Descriptions
4	GFF	Ground fault (GFF)	When (one of) the output terminal(s) is grounded, short circuit current is larger than Pr.06-60 setting value, and the detection time is longer than Pr.06-61 time setting, GFF occurs Note: the short circuit protection is provided for AC motor drive protection, not to protect you.

Action and Reset	
Action Condition	Pr.06-60 (default = 60%)
Action Time	Pr.06-61 (default = 0.10 sec.)
Fault Treatment Parameter	None
Reset method	Manual reset
Reset Condition	Reset in five seconds after the fault is cleared
Record	Yes

Cause	Corrective Actions
Motor burnout or aging insulation occurred	Check the motor insulation value with megger. Replace the motor if the insulation is poor.
Short circuit due to broken cable	Troubleshoot the short circuit. Replace the cable.
Larger stray capacitance in the cable and terminal ⏚	If the motor cable length exceeds 100 m, decrease the setting value for the carrier frequency. Take remedies to reduce stray capacitance.
Malfunction caused by interference	Verify the wiring and grounding of the communication circuit. It is recommended to separate the communication circuit from the main circuit, or wire in 90 degree for effective anti-interference performance.
Hardware failure	Cycle the power after checking the status of motor, cable and cable length. If GFF still exists, return to the factory for repair.

<table>
<tr><th>No.</th><th>Display on LED Keypad</th><th>Fault Name</th><th>Descriptions</th></tr>
<tr><td>6</td><td>ocS</td><td>Over-current at stop (ocS)</td><td>Over-current or hardware failure in current detection at stop.
Cycle the power after ocS occurs. If the hardware failure occurs, the display shows cd1, cd2 or cd3.</td></tr>
<tr><th colspan="4">Action and Reset</th></tr>
<tr><td colspan="2">Action Condition</td><td colspan="2">240% of the rated current</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="2">Immediately</td></tr>
<tr><td colspan="2">Fault Treatment Parameter</td><td colspan="2">None</td></tr>
<tr><td colspan="2">Reset method</td><td colspan="2">Manual reset</td></tr>
<tr><td colspan="2">Reset Condition</td><td colspan="2">Reset in five seconds after the fault is cleared</td></tr>
<tr><td colspan="2">Record</td><td colspan="2">Yes</td></tr>
<tr><th colspan="2">Cause</th><th colspan="2">Corrective Actions</th></tr>
<tr><td colspan="2">Malfunction caused by interference</td><td colspan="2">Verify the wiring of the control circuit, and the wiring/grounding of the main circuit to prevent interference.</td></tr>
<tr><td colspan="2">Hardware failure</td><td colspan="2">Check if other error codes such as cd1–cd3 occur after cycling the power. If yes, return to the factory for repair.</td></tr>
</table>

No.	Display on LED Keypad	Fault Name	Descriptions
7		Over-voltage during acceleration. (ovA)	DC bus over-voltage during acceleration. When ovA occurs, the drive closes the gate of the output, the motor runs freely, and the display shows an ovA error.

Action and Reset	
Action Condition	230V models: 410V_{DC} 460V models: 820V_{DC}
Action Time	Immediately act when the DC bus voltage is higher than the level
Fault Treatment Parameter	None
Reset method	Manual reset
Reset Condition	Reset only when the DC bus voltage is lower than 90% of the over-voltage level
Record	Yes

Cause	Corrective Actions
Acceleration is too slow (e.g. When executing acceleration for descent due to lifting load)	Decrease the acceleration time Use a braking unit or DC bus Replace with a drive with larger capacity.
The setting for the action condition of stall prevention is smaller than no-load current	The setting should be greater than no-load current
Power voltage is too high	Check if the input voltage is within the rated AC motor drive input voltage range, and check for possible voltage spikes.
ON / OFF switch action of phase-in capacitor in the same power system	If the phase-in capacitor or silicon controlled rectifier (SCR) acts in the same power system, the input voltage may surge abnormally in a short time. In this case, install an AC reactor.
Regenerative voltage of motor inertia	Use over-voltage stall prevention function (Pr.06-01) Set auto-acceleration and auto-deceleration (Pr.01-44). Use a braking unit or DC bus
Acceleration time is too short	Check if the over-voltage warning occurs after acceleration stops. When the warning occurs, do the following: 1. Increase the acceleration time 2. Set Pr.06-01 over-voltage stall prevention 3. Increase the setting value for Pr.01-25 S-curve acceleration arrival time 2
Motor ground fault	The ground short circuit current charges the capacitor in the main circuit through the power. Check if there is ground fault on the motor cable, wiring box and its internal terminals. Troubleshoot the ground fault.
Incorrect wiring of brake resistor or brake unit	Check the wiring of the brake resistor or braking unit.
Malfunction caused by interference	Verify the wiring of the control circuit, and the wiring/grounding of the main circuit to prevent interference.

No.	Display on LED Keypad	Fault Name	Descriptions
8		Over-voltage during deceleration. (ovd)	DC bus over-voltage during deceleration. When ovd occurs, the drive closes the gate of the output immediately, the motor runs freely, and the display shows an ovd error.

Action and Reset	
Action Condition	230V models: 410V_{DC} 460V models: 820V_{DC}
Action Time	Immediately act when the DC bus voltage is higher than the level
Fault Treatment Parameter	None
Reset method	Manual reset
Reset Condition	Reset only when the DC bus voltage is lower than 90% of the over-voltage level
Record	Yes

Cause	Corrective Actions
Deceleration time is too short, causing too large regenerative energy of the load	1. Increase the setting value of Pr.01-13, Pr.01-15, Pr.01-17 and Pr.01-19 (deceleration time) 2. Connect the brake resistor, braking unit or DC bus on the drive. 3. Reduce the brake frequency. 4. Replace with a drive with larger capacity. 5. Use S-curve acceleration/deceleration. 6. Use over-voltage stall prevention function (Pr.06-01) 7. Use auto-acceleration and auto-deceleration (Pr.01-44). 8. Adjust the braking level (Pr.07-01 or the bolt position of the brake unit).
The setting for the action condition of stall prevention is smaller than no-load current	The setting should be greater than no-load current
Power voltage is too high	Check if the input voltage is within the rated AC motor drive input voltage range, and check for possible voltage spikes.
ON / OFF switch action of phase-in capacitor in the same power system	If the phase-in capacitor or silicon controlled rectifier (SCR) acts in the same power system, the input voltage may surge abnormally in a short time. In this case, install an AC reactor.
Motor ground fault	The ground short circuit current charges the capacitor in the main circuit through the power. Check if there is ground fault on the motor cable, wiring box and its internal terminals. Troubleshoot the ground fault.
Incorrect wiring of brake resistor or brake unit	Check the wiring of the brake resistor or braking unit.
Malfunction caused by interference	Verify the wiring of the control circuit, and the wiring/grounding of the main circuit to prevent interference.

No.	Display on LED Keypad	Fault Name	Descriptions
9		Over-voltage during constant speed (ovn)	DC bus over-voltage at constant speed. When ovn occurs, the drive closes the gate of the output immediately, the motor runs freely, and the display shows an ovn error.

Action and Reset	
Action Condition	230V models: 410V_{DC} 460V models: 820V_{DC}
Action Time	Immediately act when the DC bus voltage is higher than the level
Fault Treatment Parameter	None
Reset method	Manual reset
Reset Condition	Reset only when the DC bus voltage is lower than 90% of the over-voltage level
Record	Yes

Cause	Corrective Actions
Impulsive change of the load	1. Connect the brake resistor, braking unit or DC bus on the drive. 2. Reduce the load. 3. Replace with a drive with larger capacity. 4. Adjust the braking level (Pr.07-01 or the bolt position of the brake unit).
The setting for the action condition of stall prevention is smaller than no-load current	The setting should be greater than no-load current
Regenerative voltage of motor inertia	Use over-voltage stall prevention function (Pr.06-01) Use a braking unit or DC bus
Power voltage is too high	Check if the input voltage is within the rated AC motor drive input voltage range, and check for possible voltage spikes.
ON / OFF switch action of phase-in capacitor in the same power system	If the phase-in capacitor or silicon controlled rectifier (SCR) acts in the same power system, the input voltage may surge abnormally in a short time. In this case, install an AC reactor.
Motor ground fault	The ground short circuit current charges the capacitor in the main circuit through the power. Check if there is ground fault on the motor cable, wiring box and its internal terminals. Troubleshoot the ground fault.
Incorrect wiring of brake resistor or brake unit	Check the wiring of the brake resistor or braking unit.
Malfunction caused by interference	Verify the wiring of the control circuit, and the wiring/grounding of the main circuit to prevent interference.

<table>
<tr><th>No.</th><th>Display on LED Keypad</th><th>Fault Name</th><th>Descriptions</th></tr>
<tr><td>10</td><td>ovS</td><td>Over-voltage at stop. (ovS)</td><td>Over-voltage at stop</td></tr>
<tr><th colspan="4">Action and Reset</th></tr>
<tr><td colspan="2">Action Condition</td><td colspan="2">230V models: $410V_{DC}$
460V models: $820V_{DC}$</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="2">Immediately act when the DC bus voltage is higher than the level</td></tr>
<tr><td colspan="2">Fault Treatment Parameter</td><td colspan="2">None</td></tr>
<tr><td colspan="2">Reset method</td><td colspan="2">Manual reset</td></tr>
<tr><td colspan="2">Reset Condition</td><td colspan="2">Reset only when the DC bus voltage is lower than 90% of the over-voltage level</td></tr>
<tr><td colspan="2">Record</td><td colspan="2">Yes</td></tr>
<tr><th colspan="2">Cause</th><th colspan="2">Corrective Actions</th></tr>
<tr><td colspan="2">Power voltage is too high</td><td colspan="2">Check if the input voltage is within the rated AC motor drive input voltage range, and check for possible voltage spikes.</td></tr>
<tr><td colspan="2">ON / OFF switch action of phase-in capacitor in the same power system</td><td colspan="2">If the phase-in capacitor or silicon controlled rectifier (SCR) acts in the same power system, the input voltage may surge abnormally in a short time. In this case, install an AC reactor.</td></tr>
<tr><td colspan="2">Incorrect wiring of brake resistor or brake unit</td><td colspan="2">Check the wiring of the brake resistor or braking unit.</td></tr>
<tr><td colspan="2">Malfunction caused by interference</td><td colspan="2">Verify the wiring of the control circuit, and the wiring/grounding of the main circuit to prevent interference.</td></tr>
<tr><td colspan="2">Hardware failure in voltage detection</td><td colspan="2">Check if other error codes such as cd1–cd3 occur after cycling the power. If yes, return to the factory for repair.</td></tr>
<tr><td colspan="2">Motor ground fault</td><td colspan="2">The ground short circuit current charges the capacitor in the main circuit through the power. Check if there is ground fault on the motor cable, wiring box and its internal terminals.
Troubleshoot the ground fault.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Display on LED Keypad</th><th>Fault Name</th><th>Descriptions</th></tr>
<tr><td>11</td><td>LvA</td><td>Low-voltage during acceleration (LvA)</td><td>DC bus voltage is lower than Pr.06-00 setting value during acceleration</td></tr>
<tr><th colspan="4">Action and Reset</th></tr>
<tr><td colspan="2">Action Condition</td><td colspan="2">Pr.06-00 (Default = depend on the model)</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="2">Immediately act when the DC bus voltage is lower than Pr.06-00</td></tr>
<tr><td colspan="2">Fault Treatment Parameter</td><td colspan="2">None</td></tr>
<tr><td colspan="2">Reset method</td><td colspan="2">Manual reset</td></tr>
<tr><td colspan="2">Reset Condition</td><td colspan="2">Reset when DC bus voltage is higher than Pr.06-00 + 30 V (230V models), or Pr.06-00 + 60 V (460V models).</td></tr>
<tr><td colspan="2">Record</td><td colspan="2">N/A</td></tr>
<tr><th colspan="2">Cause</th><th colspan="2">Corrective Actions</th></tr>
<tr><td colspan="2">Power-off</td><td colspan="2">Improve power supply condition.</td></tr>
<tr><td colspan="2">Power voltage changes</td><td colspan="2">Adjust voltage to the power range of the drive</td></tr>
<tr><td colspan="2">Start up the motor with large capacity</td><td colspan="2">Check the power system.
Increase the capacity of power equipment.</td></tr>
<tr><td colspan="2">The load is too large</td><td colspan="2">Reduce the load.
Increase the drive capacity.
Increase the acceleration time.</td></tr>
<tr><td colspan="2">DC bus</td><td colspan="2">Install DC reactor(s).</td></tr>
<tr><td colspan="2">Check if there is short circuit plate or any DC reactor installed between terminal +1 and +2</td><td colspan="2">Connect short circuit plate or DC reactor between terminal +1 and +2.
If the error still exists, return to the factory for repair.</td></tr>
</table>

No.	Display on LED Keypad	Fault Name	Descriptions
12	Lvd	Low-voltage during deceleration (Lvd)	DC bus voltage is lower than Pr.06-00 setting value during deceleration

Action and Reset	
Action Condition	Pr.06-00 (Default = depend on the model)
Action Time	Immediately act when the DC bus voltage is lower than Pr.06-00
Fault Treatment Parameter	None
Reset method	Manual reset
Reset Condition	Reset when DC bus voltage is higher than Pr.06-00 + 30 V (230V models), or Pr.06-00 + 60 V (460V models).
Record	N/A

Cause	Corrective Actions
Power-off	Improve power supply condition.
Power voltage changes	Adjust voltage to the power range of the drive
Start up the motor with large capacity	Check the power system. Increase the capacity of power equipment.
Sudden load	Reduce the load. Increase the drive capacity.
DC bus	Install DC reactor(s).

No.	Display on LED Keypad	Fault Name	Descriptions
13	Lvn	Low-voltage at constant speed (Lvn)	DC bus voltage is lower than Pr.06-00 setting value at constant speed

Action and Reset	
Action Condition	Pr.06-00 (Default = depend on the model)
Action Time	Immediately act when the DC bus voltage is lower than Pr.06-00
Fault Treatment Parameter	None
Reset method	Manual reset
Reset Condition	Reset when DC bus voltage is higher than Pr.06-00 + 30 V (230V models), or Pr.06-00 + 60 V (460V models).
Record	N/A

Cause	Corrective Actions
Power-off	Improve power supply condition.
Power voltage changes	Adjust voltage to the power range of the drive
Start up the motor with large capacity	Check the power system. Increase the capacity of power equipment.
Sudden load	Reduce the load. Increase the drive capacity.
DC bus	Install DC reactor(s).

<table>
<tr><th>No.</th><th>Display on LED Keypad</th><th>Fault Name</th><th>Descriptions</th></tr>
<tr><td>14</td><td></td><td>Low-voltage at stop (LvS)</td><td>1. DC bus voltage is lower than Pr.06-00 setting value at stop
2. Hardware failure in voltage detection</td></tr>
<tr><th colspan="4">Action and Reset</th></tr>
<tr><td colspan="2">Action Condition</td><td colspan="2">Pr.06-00 (Default = depend on the model)</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="2">Immediately act when the DC bus voltage is lower than Pr.06-00</td></tr>
<tr><td colspan="2">Fault Treatment Parameter</td><td colspan="2">None</td></tr>
<tr><td colspan="2">Reset method</td><td colspan="2">Manual / Automatic
230V models: Lv level + 30 V_{DC} + 500 ms
460V models: Lv level + 60 V_{DC} + 500 ms</td></tr>
<tr><td colspan="2">Reset Condition</td><td colspan="2">500ms</td></tr>
<tr><td colspan="2">Record</td><td colspan="2">Yes</td></tr>
<tr><th colspan="2">Cause</th><th colspan="2">Corrective Actions</th></tr>
<tr><td colspan="2">Power-off</td><td colspan="2">Improve power supply condition.</td></tr>
<tr><td colspan="2">Incorrect drive models</td><td colspan="2">Check if the power specification matches the drive.</td></tr>
<tr><td colspan="2">Power voltage changes</td><td colspan="2">Adjust voltage to the power range of the drive
Cycle the power after checking the power. If LvS error still exists, return to the factory for repair.</td></tr>
<tr><td colspan="2">Start up the motor with large capacity</td><td colspan="2">Check the power system.
Increase the capacity of power equipment.</td></tr>
<tr><td colspan="2">DC bus</td><td colspan="2">Install DC reactor(s).</td></tr>
</table>

No.	Display on LED Keypad	Fault Name	Descriptions
15	orP	Phase loss protection (orP)	Phase loss of power input

Action and Reset	
Action Condition	When DC bus ripple is higher than the protection level, and the output current exceeds 50% of the rated current, the drive starts counting. When the counting value reaches the upper limit, an orP error occurs.
Action Time	None
Fault Treatment Parameter	Pr.06-53
Reset method	Manual reset
Reset Condition	Immediately reset when DC bus is higher than Pr.07-00
Record	Yes

Cause	Corrective Actions
Phase loss of the input power	Verify the wiring of the main circuit.
Single phase power input on a three-phase model	Choose the model whose power matches the voltage.
Power voltage changes	If the power of main circuit works well, check if the MC of the main circuit is broken. Cycle the power after checking the power, if OrP error still exists, return to the factory for repair.
Loose wiring terminal of input power	Tighten the terminal screws with the torque listed in the user manual.
Check if the input cable of three-phase power is broken	Make sure the wiring is correct. Replace the cut off cable.
Unbalanced three-phase of the input power	Check the status of three-phase power.

No.	Display on LED Keypad	Fault Name	Descriptions
16	oH1	IGBT overheating (oH1)	IGBT temperature exceeds the protection level. (Refer to Pr.06-15)

Action and Reset	
Action Condition	When Pr.06-15 is higher than the IGBT overheating protection level, the drive shows oH1 error without displaying oH1 warning.
Action Time	IGBT temperature exceeds the protection level for more than 100 ms, oH1 error occurs.
Fault Treatment Parameter	None
Reset method	Manual reset
Reset Condition	Reset only when IGBT temperature is lower than oH1 error level minus (-) 10°C
Record	Yes

Cause	Corrective Actions
Check if the ambient temperature or temperature inside the cabinet is too high, or if there is obstruction in the ventilation hole of the control cabinet.	Check the ambient temperature. Regularly inspect the ventilation hole of the control cabinet. Change the installed place if there are heating objects, such as brake resistors, in the surroundings. Install/add cooling fan or air conditioner to lower the temperature inside the cabinet.
Check if there is any obstruction on the heat sink or if the fan is running	Remove the obstruction or replace the cooling fan.
Insufficient ventilation space	Increase ventilation space of the drive.
Check if the drive matches the corresponded loading	1. Decrease loading. 2. Decrease the carrier wave. 3. Replace with a drive with larger capacity.
The drive has run 100% or more of the rated output for a long time	Replace with a drive with larger capacity.

No.	Display on LED Keypad	Fault Name	Descriptions
17	oH2	Over-heat key components (oH2)	The drive has detected the key components are over heat

Action and Reset	
Action Condition	Refer to the table below for oH2 level of each models
Action Time	The oH2 fault occurs when the temperature sensor of key components detects the temperature is higher than the protection condition for 1 second.
Fault Treatment Parameter	N/A
Reset method	Manual reset
Reset Condition	The drive auto-resets when the temperature sensor of key components detects the temperature is lower than oH2 error level minus (–) 10°C
Record	Yes

Cause	Corrective Actions
Check if the ambient temperature or temperature inside the control cabinet is too high, or if there is obstruction in the ventilation hole of the control cabinet.	1. Check ambient temperature. 2. Regularly inspect the ventilation hole of the control cabinet. 3. Change the installed place if there are heating objects, such as braking resistors, in the surroundings. 4. Install/ add cooling fan or air conditioner to lower the temperature inside the cabinet.
Check if there is any obstruction on the heat sink or if the fan is running.	Remove the obstruction or replace the cooling fan.
Insufficient ventilation space	Increase ventilation space of the drive.
Check if the drive matches the corresponding load	1. Reduce the load 2. Reduce the carrier 3. Replace the drive with a larger capacity model.
The drive has run 100% or more than 100% of the rated output for a long time	Replace the drive with a larger capacity model.
Unstable power	Install reactor(s)
Load changes frequently	Reduce load changes

<table>
<tr><th>No.</th><th>Display on LED Keypad</th><th>Fault Name</th><th>Descriptions</th></tr>
<tr><td>18</td><td>tH1o</td><td>IGBT temperature detection failure (tH1o)</td><td>IGBT hardware failure in temperature detection</td></tr>
<tr><th colspan="4">Action and Reset</th></tr>
<tr><td colspan="2">Action Condition</td><td colspan="2">NTC broken or wiring failure</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="2">When the IGBT temperature is higher than the protection level, and detection time exceeds 100 ms, the tH1o protection activates.</td></tr>
<tr><td colspan="2">Fault Treatment Parameter</td><td colspan="2">None</td></tr>
<tr><td colspan="2">Reset method</td><td colspan="2">Manual reset</td></tr>
<tr><td colspan="2">Reset Condition</td><td colspan="2">Immediately reset</td></tr>
<tr><td colspan="2">Record</td><td colspan="2">Yes</td></tr>
<tr><th colspan="2">Cause</th><th colspan="2">Corrective Actions</th></tr>
<tr><td colspan="2">Hardware failure</td><td colspan="2">Wait for 10 minutes, and then cycle the power. Check if tH1o protection still exists. If yes, return to the factory for repair.</td></tr>
</table>

No.	Display on LED Keypad	Fault Name	Descriptions
19	tH2o	Capacitor hardware fault (tH2o)	Hardware failure in capacitor temperature detection

Action and Reset	
Action Condition	NTC broken or wiring failure
Action Time	When the IGBT temperature is higher than the protection condition, and detection time exceeds 100ms, the tH2o protection occurs.
Fault Treatment Parameter	N/A
Reset method	Manual reset
Reset Condition	Reset immediately
Record	Yes
Cause	**Corrective Actions**
Hardware failure	Wait for 10 minutes, and then cycle the power. Check if tH2o protection still occurs. If yes, return to the factory for repair.

No.	Display on LED Keypad	Fault Name	Descriptions
21	oL	Over load (oL)	The AC motor drive detects excessive drive output current. Normal duty: Sustains for one minute when the drive outputs 120 % of the drive's rated output current. Sustains for three seconds when the drive outputs 150 % of the drive's rated output current. Heavy duty: Sustains for one minute when the drive outputs 150 % of the drive's rated output current. Sustains for three seconds when the drive outputs 200 % of the drive's rated output current.

Action and Reset	
Action Condition	According to overload curve and derating curve (refer to Pr.06-55).
Action Time	When the load is higher than the protection level and exceeds allowable time, the oL protection activates.
Fault Treatment Parameter	None
Reset method	Manual reset
Reset Condition	Reset in five seconds after the fault is cleared
Record	Yes

Cause	Corrective Actions
The load is too large	Reduce the load.
Accel./Decel. time and working cycle is too short	Increase setting values for Pr.01-12–01-19 (accel./decel. time).
V/F voltage is too high	Adjust the V/F curve (Motor 1, Pr.01-01–01-08), especially the setting value for the mid-point voltage (if the mid-point voltage is set too low, the load capacity decreases at low speed). Refer to the V/F curve selection of Pr.01-43.
The capacity of the drive is too small	Replace the drive with a larger capacity model.
Overload during low-speed operation	Decrease the loading during low-speed operation. Increase the drive capacity. Decrease the carrier frequency of Pr.00-17.
The torque compensation is too large	Adjust the torque compensation (refer to Pr.07-26 torque compensation gain) until the current reduces and the motor does not stall.
Check if the setting for stall prevention is correct	Set the stall prevention to the proper value.
Output phase loss	Check the status of three-phase motor. Check if the cable is broken or the screws are loose.
Improper parameter settings for the speed tracking function (including restart after momentary power loss and restart after fault)	Correct the parameter settings for speed tracking. Start the speed tracking function. Adjust the maximum current for Pr.07-09 speed tracking.

No.	Display on LED Keypad	Fault Name	Descriptions
22	EoL 1	Electronics thermal relay 1 protection (EoL1)	Electronics thermal relay 1 protection. The drive coasts to stop once it activates.

Action and Reset	
Action Condition	Start counting when the output current > 150% of the motor 1 rated current
Action Time	Pr.06-14 (If the output current is larger than 105% of the motor 1 rated current again within 60 sec., the counting time reduces and is less than Pr.06-14)
Fault Treatment Parameter	None
Reset method	Manual reset
Reset Condition	Reset in five seconds after the fault is cleared
Record	Yes

Cause	Corrective Actions
The load is too large	Reduce the load.
Accel./Decel. time and working cycle is too short	Increase setting values for Pr.01-12–01-19 (accel./decel. time).
V/F voltage is too high	Adjust the V/F curve (Motor 1, Pr.01-01–01-08), especially the setting value for the mid-point voltage (if the mid-point voltage is set too low, the load capacity decreases at low speed).
Overload during low-speed operation When using a general motor, even it operates below rated current, an overload may still occur during low-speed operation.	Decrease low-speed operation time. Change to dedicated motor for the drive. Increase the motor capacity.
When using VFD dedicated motors, Pr.06-13 = 0 (electronic thermal relay selection motor 1 = 0 inverter motor)	Pr.06-13 = 1 electronic thermal relay selection motor 1 = standard motor (motor with fan on the shaft).
Incorrect value of electronic thermal relay	Configure the correct rated current value of the motor again.
The maximum motor frequency is set too low	Reset to the correct motor rated frequency.
One drive to multiple motors	Set Pr.06-13 = 2 electronic thermal relay selection motor 1= disabled, and install thermal relay on each motor.
Check if the setting for stall prevention is correct	Set the stall prevention to the proper value.
The torque compensation is too large	Adjust the torque compensation (refer to Pr.07-26 torque compensation gain) until the current reduces and the motor does not stall.
Motor fan error	Check the status of the fan, or replace the fan.
Unbalanced three-phase impedance of the motor	Replace the motor.

<table>
<tr><th>No.</th><th>Display on LED Keypad</th><th>Fault Name</th><th>Descriptions</th></tr>
<tr><td>23</td><td>EoL2</td><td>Electronics thermal relay 2 protection (EoL2)</td><td>Electronics thermal relay 2 protection. The drive coasts to stop once it activates.</td></tr>
<tr><th colspan="4">Action and Reset</th></tr>
<tr><td colspan="2">Action Condition</td><td colspan="2">Start counting when the output current > 150% of the motor 2 rated current</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="2">Pr.06-28 (If the output current is larger than 105% of the motor 1 rated current again within 60 sec., the counting time reduces and is less than Pr.06-28)</td></tr>
<tr><td colspan="2">Fault Treatment Parameter</td><td colspan="2">None</td></tr>
<tr><td colspan="2">Reset method</td><td colspan="2">Manual reset</td></tr>
<tr><td colspan="2">Reset Condition</td><td colspan="2">Reset in five seconds after the fault is cleared</td></tr>
<tr><td colspan="2">Record</td><td colspan="2">Yes</td></tr>
<tr><th colspan="2">Cause</th><th colspan="2">Corrective Actions</th></tr>
<tr><td colspan="2">The load is too large</td><td colspan="2">Reduce the load.</td></tr>
<tr><td colspan="2">Accel./Decel. time and working cycle is too short</td><td colspan="2">Increase setting values for Pr.01-12–01-19 (accel./decel. time).</td></tr>
<tr><td colspan="2">V/F voltage is too high</td><td colspan="2">Adjust the V/F curve (Motor 1, Pr.01-01–01-08), especially the setting value for the mid-point voltage (if the mid-point voltage is set too low, the load capacity decreases at low speed).</td></tr>
<tr><td colspan="2">Overload during low-speed operation
When using a general motor, even it operates below rated current, an overload may still occur during low-speed operation.</td><td colspan="2">Decrease low-speed operation time.
Change to dedicated motor for the drive.
Increase the motor capacity.</td></tr>
<tr><td colspan="2">When using VFD dedicated motors, Pr.06-27 = 0 (electronic thermal relay selection motor 2 = 0 inverter motor)</td><td colspan="2">Pr.06-27 = 2 electronic thermal relay selection motor 1 = standard motor (motor with fan on the shaft).</td></tr>
<tr><td colspan="2">Incorrect value of electronic thermal relay</td><td colspan="2">Configure the correct rated current value of the motor again.</td></tr>
<tr><td colspan="2">The maximum motor frequency is set too low</td><td colspan="2">Reset to the correct motor rated frequency.</td></tr>
<tr><td colspan="2">One drive to multiple motors</td><td colspan="2">Set Pr.06-27 = 2 electronic thermal relay selection motor 2= disabled, and install thermal relay on each motor.</td></tr>
<tr><td colspan="2">Check if the setting for stall prevention is correct</td><td colspan="2">Set the stall prevention to the proper value.</td></tr>
<tr><td colspan="2">The torque compensation is too large</td><td colspan="2">Adjust the torque compensation (refer to Pr.07-26 torque compensation gain) until the current reduces and the motor does not stall.</td></tr>
<tr><td colspan="2">Motor fan error</td><td colspan="2">Check the status of the fan, or replace the fan.</td></tr>
<tr><td colspan="2">Unbalanced three-phase impedance of the motor</td><td colspan="2">Replace the motor.</td></tr>
</table>

No.	Display on LED Keypad	Fault Name	Descriptions
24_1	oH3	Motor overheating (oH3) PTC	Motor overheating (PTC) (Pr.03-00–Pr.03-02=6 PTC), when PTC input > Pr.06-30, the fault treatment acts according to Pr.06-29.

Action and Reset	
Action Condition	PTC input value > Pr.06-30 setting (default = 50%)
Action Time	Immediately
Fault Treatment Parameter	Pr.06-29 0: Warn and continue operation 1: Fault and ramp to stop 2: Fault and coast to stop 3: No warning
Reset method	When Pr.06-29 = 0, oH3 is a “Warning”. The “Warning” is automatically cleared. When Pr.06-29 = 1 or 2, oH3 is a “Fault”. You must reset it manually.
Reset Condition	Immediately reset
Record	When Pr.06-29 = 1 or 2, oH3 is a “Fault”, and the fault will be recorded.

Cause	Corrective Actions
Motor locked	Remove the shaft lock.
The load is too large	Reduce the load. Increase the motor capacity.
Ambient temperature is too high	Change the installed place if there are heating devices in the surroundings. Install / add a cooling fan or an air conditioner to lower the ambient temperature.
Motor cooling system error	Check the cooling system to make it work normally.
Motor fan error	Replace the fan.
Operates at low-speed too long	Decrease low-speed operation time. Change to dedicated motor for the drive. Increase the motor capacity.
Accel./Decel. time and working cycle is too short	Increase setting values for Pr.01-12–01-19 (accel./decel. time).
V/F voltage is too high	Adjust the V/F curve (Motor 1, Pr.01-01–01-08), especially the setting value for the mid-point voltage (if the mid-point voltage is set too low, the load capacity decreases at low speed).
Check if the motor rated current matches that on the motor nameplate.	Configure the correct rated current value of the motor again.
Check if the PTC is properly set and wired	Check the connection between PTC thermistor and the heat protection.
Check if the setting for stall prevention is correct	Set the stall prevention to the proper value.
Unbalanced three-phase impedance of the motor	Replace the motor.
Harmonics is too high	Use remedies to reduce harmonics.

No.	Display on LED Keypad	Fault Name	Descriptions
24_2	oH3	Motor overheating (oH3) PT100	Motor overheating (PT100) (Pr.03-00–Pr.03-02=11 PT100). When PT100 input > Pr.06-57 (default = 7 V), the fault treatment acts according to Pr.06-29.

Action and Reset	
Action Condition	PT100 input value > Pr.06-57 setting (default = 7 V)
Action Time	Immediately
Fault Treatment Parameter	Pr.06-29 0: Warn and continue operation 1: Fault and ramp to stop 2: Fault and coast to stop 3: No warning
Reset method	When Pr.06-29 = 0 and the temperature < Pr.06-56, oH3 is automatically cleared. When Pr.06-29 = 1 or 2, oH3 is a “Fault”. You must reset it manually.
Reset Condition	Immediately reset
Record	When Pr.06-29 = 1 or 2, oH3 is a “Fault”, and the fault will be recorded.

Cause	Corrective Actions
Motor locked	Remove the shaft lock.
The load is too large	Reduce the load. Increase the motor capacity.
Ambient temperature is too high	Change the installed place if there are heating devices in the surroundings. Install / add a cooling fan or an air conditioner to lower the ambient temperature.
Motor cooling system error	Check the cooling system to make it work normally.
Motor fan error	Replace the fan.
Operates at low-speed too long	Decrease low-speed operation time. Change to dedicated motor for the drive. Increase the motor capacity.
Accel./Decel. time and working cycle is too short	Increase setting values for Pr.01-12–01-19 (accel./decel. time).
V/F voltage is too high	Adjust the V/F curve (Motor 1, Pr.01-01–01-08), especially the setting value for the mid-point voltage (if the mid-point voltage is set too low, the load capacity decreases at low speed).
Check if the motor rated current matches that on the motor nameplate.	Configure the correct rated current value of the motor again.
Check if the PT100 is properly set and wired	Check the connection between PT100 thermistor and the heat protection.
Check if the setting for stall prevention is correct	Set the stall prevention to the proper value.
Unbalanced three-phase impedance of the motor	Replace the motor.
Harmonics is too high	Use remedies to reduce harmonics.

<table>
<tr><th>No.</th><th>Display on LED Keypad</th><th>Fault Name</th><th colspan="2">Descriptions</th></tr>
<tr><td>26</td><td>ot1</td><td>Over-torque 1
(ot1)</td><td colspan="2">When the output current exceeds the over-torque detection level (Pr.06-07) and exceeds over-torque detection time (Pr.06-08), and when Pr.06-06 or Pr.06-09 is set to 2 or 4, the ot1 error displays.</td></tr>
<tr><th colspan="5">Action and Reset</th></tr>
<tr><td colspan="2">Action Condition</td><td colspan="3">Pr.06-07</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="3">Pr.06-08</td></tr>
<tr><td colspan="2">Fault Treatment Parameter</td><td colspan="3">Pr.06-06
0: Disabled
1: Continue operation after over-torque detection during constant speed operation
2: Stop after over-torque detection during constant speed operation
3: Continue operation after over-torque detection during RUN
4: Stop after over-torque detection during RUN</td></tr>
<tr><td colspan="2" rowspan="2">Reset method</td><td>Auto</td><td colspan="2">When Pr.06-06 = 1 or 3, ot1 is a “Warning”. The warning is automatically cleared when the output current < (Pr.06-07 – 5%)</td></tr>
<tr><td>Manual</td><td colspan="2">When Pr.06-06=2 or 4, ot1 is a “Fault”. You must reset it manually.</td></tr>
<tr><td colspan="2">Reset Condition</td><td colspan="3">Immediately reset</td></tr>
<tr><td colspan="2">Record</td><td colspan="3">When Pr.06-06 = 2 or 4, ot1 is a “Fault”, and the fault will be recorded.</td></tr>
<tr><th colspan="2">Cause</th><th colspan="3">Corrective Actions</th></tr>
<tr><td colspan="2">Incorrect parameter setting</td><td colspan="3">Configure the settings for Pr.06-07 and Pr.06-08 again.</td></tr>
<tr><td colspan="2">Mechanical error (e.g. mechanical lock due to over-torque)</td><td colspan="3">Remove the causes of malfunction.</td></tr>
<tr><td colspan="2">The load is too large</td><td colspan="3">Reduce the load.
Replace the motor with a larger capacity model.</td></tr>
<tr><td colspan="2">Accel./Decel. time and working cycle is too short</td><td colspan="3">Increase setting values for Pr.01-12–01-19 (accel./decel. time).</td></tr>
<tr><td colspan="2">V/F voltage is too high</td><td colspan="3">Adjust the V/F curve (Motor 1, Pr.01-01–01-08), especially the setting value for the mid-point voltage (if the mid-point voltage is set too low, the load capacity decreases at low speed).</td></tr>
<tr><td colspan="2">The motor capacity is too small</td><td colspan="3">Replace with a motor with larger capacity.</td></tr>
<tr><td colspan="2">Overload during low-speed operation</td><td colspan="3">Decrease the loading during low-speed operation.
Increase the motor capacity.</td></tr>
<tr><td colspan="2">The torque compensation is too large</td><td colspan="3">Adjust the torque compensation (refer to Pr.07-26 torque compensation gain) until the current reduces and the motor does not stall.</td></tr>
<tr><td colspan="2">Improper parameter settings for the speed tracking function (including restart after momentary power loss and restart after fault)</td><td colspan="3">Correct the parameter settings for speed tracking.
Start the speed tracking function.
Adjust the maximum current for Pr.07-09 speed tracking.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Display on LED Keypad</th><th>Fault Name</th><th colspan="2">Descriptions</th></tr>
<tr><td>27</td><td>ot2</td><td>Over-torque 2
(ot2)</td><td colspan="2">When the output current exceeds the over-torque detection level (Pr.06-10) and exceeds over-torque detection time (Pr.06-11), and when Pr.06-09 is set to 2 or 4, the ot2 error displays.</td></tr>
<tr><th colspan="5">Action and Reset</th></tr>
<tr><td colspan="2">Action Condition</td><td colspan="3">Pr.06-10</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="3">Pr.06-11</td></tr>
<tr><td colspan="2">Fault Treatment Parameter</td><td colspan="3">Pr.06-09
0: Disabled
1: Continue operation after over-torque detection during constant speed operation
2: Stop after over-torque detection during constant speed operation
3: Continue operation after over-torque detection during RUN
4: Stop after over-torque detection during RUN</td></tr>
<tr><td colspan="2" rowspan="2">Reset method</td><td>Auto</td><td colspan="2">When Pr.06-09 = 1 or 3, ot2 is a “Warning”. The warning is automatically cleared when the output current < (Pr.06-10 – 5%).</td></tr>
<tr><td>Manual</td><td colspan="2">When Pr.06-09 = 2 or 4, ot2 is a “Fault”. You must reset it manually.</td></tr>
<tr><td colspan="2">Reset Condition</td><td colspan="3">Immediately reset</td></tr>
<tr><td colspan="2">Record</td><td colspan="3">When Pr.06-09 = 2 or 4, ot2 is a “Fault”, and the fault will be recorded.</td></tr>
<tr><th colspan="2">Cause</th><th colspan="3">Corrective Actions</th></tr>
<tr><td colspan="2">Incorrect parameter setting</td><td colspan="3">Configure the settings for Pr.06-10 and Pr.06-11 again.</td></tr>
<tr><td colspan="2">Mechanical error (e.g. mechanical lock due to over-torque)</td><td colspan="3">Remove the causes of malfunction.</td></tr>
<tr><td colspan="2">The load is too large</td><td colspan="3">Reduce the load.
Replace the motor with a larger capacity model.</td></tr>
<tr><td colspan="2">Accel./Decel. time and working cycle is too short</td><td colspan="3">Increase setting values for Pr.01-12–01-19 (accel./decel. time).</td></tr>
<tr><td colspan="2">V/F voltage is too high</td><td colspan="3">Adjust the V/F curve (Motor 2, Pr.01-35–01-42), especially the setting value for the mid-point voltage (if the mid-point voltage is set too low, the load capacity decreases at low speed).</td></tr>
<tr><td colspan="2">The motor capacity is too small</td><td colspan="3">Replace with a motor with larger capacity.</td></tr>
<tr><td colspan="2">Overload during low-speed operation</td><td colspan="3">Decrease the loading during low-speed operation.
Increase the motor capacity.</td></tr>
<tr><td colspan="2">The torque compensation is too large</td><td colspan="3">Adjust the torque compensation (refer to Pr.07-26 torque compensation gain) until the current reduces and the motor does not stall.</td></tr>
<tr><td colspan="2">Improper parameter settings for the speed tracking function (including restart after momentary power loss and restart after fault)</td><td colspan="3">Correct the parameter settings for speed tracking.
Start the speed tracking function.
Adjust the maximum current for Pr.07-09 speed tracking.</td></tr>
</table>

No.	Display on LED Keypad	Fault Name	Descriptions
28	uC	Under current (uC)	Low current

Action and Reset		
Action Condition	Pr.06-71	
Action Time	Pr.06-72	
Fault Treatment Parameter	Pr.06-73 0: No Function 1: Fault and coast to stop 2: Fault and ramp to stop by the 2nd deceleration time 3: Warn and continue operation	
Reset method	Auto	When Pr.06-73 = 3, uC is a “Warning”. The warning is automatically cleared when the output current > (Pr.06-71 + 0.1A).
	Manual	When Pr.06-73 = 1 or 2, uC is a “Fault”. You must reset it manually.
Reset Condition	Immediately reset	
Record	When Pr.06-71 = 1 or 2, uC is a “Fault”, and the fault will be recorded.	

Cause	Corrective Actions
Broken motor cable	Remove the connection issue of the motor and its load.
Improper setting for the low current protection	Set Pr.06-71, Pr.06-72 and Pr.06-73 to proper settings.
Low load	Check the loading status. Make sure the loading matches the motor capacity.

No.	Display on LED Keypad	Fault Name	Descriptions
31	cF2	EEPROM read error (cF2)	Internal EEPROM cannot be read

Action and Reset	
Action Condition	Firmware internal detection
Action Time	cF2 acts immediately when the drive detects the fault
Fault Treatment Parameter	None
Reset method	Manual reset
Reset Condition	Immediately reset
Record	Yes

Cause	Corrective Actions
Internal EEPROM cannot be read	Press RESET key. If cF2 error still displays on the keypad, return to the factory for repair. Reset the parameter to the default setting. If cF2 error still displays on the keypad, return to the factory for repair. Cycle the power, if cF2 error still exists, return to the factory for repair.

<table>
<tr><th>No.</th><th>Display on LED Keypad</th><th>Fault Name</th><th>Descriptions</th></tr>
<tr><td>33</td><td>cd1</td><td>U-phase error (cd1)</td><td>U-phase current detection error when power is ON</td></tr>
<tr><th colspan="4">Action and Reset</th></tr>
<tr><td colspan="2">Action Condition</td><td colspan="2">Hardware detection</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="2">cd1 acts immediately when the drive detects the fault</td></tr>
<tr><td colspan="2">Fault Treatment Parameter</td><td colspan="2">None</td></tr>
<tr><td colspan="2">Reset method</td><td colspan="2">Power-off</td></tr>
<tr><td colspan="2">Reset Condition</td><td colspan="2">None</td></tr>
<tr><td colspan="2">Record</td><td colspan="2">Yes</td></tr>
<tr><th colspan="2">Cause</th><th colspan="2">Corrective Actions</th></tr>
<tr><td colspan="2">Hardware failure</td><td colspan="2">Cycle the power.
If cd1 still exists, return to the factory for repair.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Display on LED Keypad</th><th>Fault Name</th><th>Descriptions</th></tr>
<tr><td>34</td><td>cd2</td><td>V-phase error (cd2)</td><td>V-phase current detection error when power ON</td></tr>
<tr><th colspan="4">Action and Reset</th></tr>
<tr><td colspan="2">Action Condition</td><td colspan="2">Hardware detection</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="2">cd2 acts immediately when the drive detects the fault</td></tr>
<tr><td colspan="2">Fault Treatment Parameter</td><td colspan="2">None</td></tr>
<tr><td colspan="2">Reset method</td><td colspan="2">Power-off</td></tr>
<tr><td colspan="2">Reset Condition</td><td colspan="2">None</td></tr>
<tr><td colspan="2">Record</td><td colspan="2">Yes</td></tr>
<tr><th colspan="2">Cause</th><th colspan="2">Corrective Actions</th></tr>
<tr><td colspan="2">Hardware failure</td><td colspan="2">Cycle the power.
If cd1 still exists, return to the factory for repair.</td></tr>
</table>

No.	Display on LED Keypad	Fault Name	Descriptions
35	cd3	W-phase error (cd3)	W-phase current detection error when power ON
Action and Reset			
Action Condition	Hardware detection		
Action Time	cd3 acts immediately when the drive detects the fault		
Fault Treatment Parameter	None		
Reset method	Power-off		
Reset Condition	None		
Record	Yes		
Cause	Corrective Actions		
Hardware failure	Cycle the power. If cd1 still exists, return to the factory for repair.		

No.	Display on LED Keypad	Fault Name	Descriptions
36	Hd0	cc hardware error (Hd0)	cc (current clamp) hardware protection error when power is ON
Action and Reset			
Action Condition		Hardware detection	
Action Time		Hd0 acts immediately when the drive detects the fault	
Fault Treatment Parameter		None	
Reset method		Power-off	
Reset Condition		None	
Record		Yes	
Cause		Corrective Actions	
Hardware failure		Cycle the power. If cd1 still exists, return to the factory for repair.	

No.	Display on LED Keypad	Fault Name	Descriptions
37	Hd1	oc hardware error (Hd1)	oc hardware protection error when power is ON

Action and Reset	
Action Condition	Hardware detection
Action Time	Hd1 acts immediately when the drive detects the fault
Fault Treatment Parameter	None
Reset method	Power-off
Reset Condition	None
Record	Yes

Cause	Corrective Actions
Hardware failure	Cycle the power. If cd1 still exists, return to the factory for repair.

<table>
<tr><th>No.</th><th>Display on LED Keypad</th><th>Fault Name</th><th>Descriptions</th></tr>
<tr><td>38</td><td>Hd2</td><td>ov hardware error (Hd2)</td><td>ov hardware protection error when power is ON</td></tr>
<tr><th colspan="4">Action and Reset</th></tr>
<tr><td colspan="2">Action Condition</td><td colspan="2">Hardware detection</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="2">Hd2 acts immediately when the drive detects the fault</td></tr>
<tr><td colspan="2">Fault Treatment Parameter</td><td colspan="2">N/A</td></tr>
<tr><td colspan="2">Reset method</td><td colspan="2">Power-off</td></tr>
<tr><td colspan="2">Reset Condition</td><td colspan="2">N/A</td></tr>
<tr><td colspan="2">Record</td><td colspan="2">Yes</td></tr>
<tr><th colspan="2">Cause</th><th colspan="2">Corrective Actions</th></tr>
<tr><td colspan="2">Hardware failure</td><td colspan="2">Cycle the power.
If Hd2 still occurs, return to the factory for repair.</td></tr>
</table>

No.	Display on LED Keypad	Fault Name	Descriptions
40	AUE	Auto-tuning error (AUE)	Motor auto-tuning error

Action and Reset	
Action Condition	Hardware detection
Action Time	Immediately
Fault Treatment Parameter	None
Reset method	Manual reset
Reset Condition	Immediately reset
Record	Yes

Cause	Corrective Actions
Press “STOP” key during auto-tuning	Re-execute auto-tuning.
Incorrect motor capacity (too large or too small) and parameter setting	Check motor capacity and related parameters. Set the correct parameters, that is Pr.01-01–Pr.01-02. Set Pr.01-00 larger than the motor rated frequency.
Incorrect motor wiring	Check the wiring.
Motor locked	Remove the causes of motor locked.
The electromagnetic contactor is ON at output side (U / V / W) of the drive	Make sure the electromagnetic valve is OFF.
The load is too large	Decrease the loading. Replace with a motor with larger capacity.
Accel./Decel. time is too short	Increase setting values for Pr.01-12–01-19 (accel./decel. time).

No.	Display on LED Keypad	Fault Name	Descriptions
41	AFE	PID loss ACI (AFE)	PID feedback loss (analog feedback signal is only valid when the PID function is enabled)
Action and Reset			
Action Condition		When the analog input is lower than 4 mA (only detects analog input 4–20 mA)	
Action Time		Pr.08-08	
Fault Treatment Parameter		Pr.08-09 0: Warn and continue operation 1: Fault and ramp to stop 2: Fault and coast to stop 3: Warn and operate at last frequency	
Reset method		Auto	When Pr.08-09 = 3 or 4, AFE is a "Warning". When the feedback signal is > 4 mA, the "Warning" is automatically cleared.
		Manual	When Pr.08-09 = 1 or 2, AFE is a "Fault". You must reset it manually.
Reset Condition		Immediately reset	
Record		When Pr.08-09 = 1 or 2, AFE is a "Fault", and the fault will be recorded; when Pr.08-09 = 3 or 4, AFE is a "Warning", and the warning will not be recorded.	
Cause		Corrective Actions	
Loose or broken PID feedback wiring		Tighten the terminals again. Replace with a new cable.	
Feedback device malfunction		Replace with a new feedback device.	
Hardware failure		Check all the wiring. If AFE fault still exists, return to the factory for repair.	

<table>
<tr><th>No.</th><th>Display on LED Keypad</th><th colspan="2">Fault Name</th><th>Descriptions</th></tr>
<tr><td>48</td><td>ACE</td><td colspan="2">ACI loss
(ACE)</td><td>Analog input current loss (including all analog 4–20 mA signals)</td></tr>
<tr><th colspan="5">Action and Reset</th></tr>
<tr><td colspan="2">Action Condition</td><td colspan="3">When the analog input is lower than 4 mA (only detects analog input 4–20 mA)</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="3">Immediately</td></tr>
<tr><td colspan="2">Fault Treatment Parameter</td><td colspan="3">Pr.03-19
0: Disable
1: Continue operation at the last frequency (warning, keypad displays AnL)
2: Decelerate to 0 Hz (warning, keypad displays AnL)
3: Stop immediately and display “ACE”</td></tr>
<tr><td colspan="2" rowspan="2">Reset method</td><td>Auto</td><td colspan="2">When Pr.03-19 = 1 or 2, ACE is a “Warning”. When analog input signal is > 4 mA, the warning is automatically cleared.</td></tr>
<tr><td>Manual</td><td colspan="2">When Pr.03-19 = 3, ACE is a “Fault”. You must reset it manually.</td></tr>
<tr><td colspan="2">Reset Condition</td><td colspan="3">Immediately reset</td></tr>
<tr><td colspan="2">Record</td><td colspan="3">When Pr.03-19=3, ACE is a “Fault”, and the fault will be recorded; when Pr.03-19 = 1 or 2, ACE is a “Warning”, and the warning will not be recorded.</td></tr>
<tr><th colspan="2">Cause</th><th colspan="3">Corrective Actions</th></tr>
<tr><td colspan="2">Loose or broken ACI wiring</td><td colspan="3">Tighten the terminals again.
Replace with a new cable.</td></tr>
<tr><td colspan="2">External device error</td><td colspan="3">Replace with a new device.</td></tr>
<tr><td colspan="2">Hardware failure</td><td colspan="3">Check all the wiring. If ACE still exists, return to the factory for repair.</td></tr>
</table>

No.	Display on LED Keypad	Fault Name	Descriptions
49	EF	External Fault (EF)	External fault. When the drive decelerates based on the setting of Pr.07-20, the EF fault displays on the keypad.
Action and Reset			
Action Condition		MI = EF and the MI terminal is conducted	
Action Time		Immediately	
Fault Treatment Parameter		Pr.07-20 0: Coast to stop 1: Stop by the first deceleration time 2: Stop by the second deceleration time 3: Stop by the third deceleration time 4: Stop by the fourth deceleration time 5: System deceleration (according to the original deceleration time) 6: Automatic deceleration (Pr.01-46)	
Reset method		Manual reset	
Reset Condition		Reset manually only after the external fault is cleared (terminal status is recovered)	
Record		Yes	
Cause		Corrective Actions	
External fault		Press RESET key after the fault is cleared.	

No.	Display on LED Keypad	Fault Name	Descriptions
50	EF1	Emergency stop (EF1)	When the contact of MI = EF1 is ON, the output stops immediately and displays EF1 on the keypad. The motor is in free running.
Action and Reset			
Action Condition	MI = EF and the MI terminal is conducted		
Action Time	Immediately		
Fault Treatment Parameter	None		
Reset method	Manual reset		
Reset Condition	Reset manually only after the external fault is cleared (terminal status is recovered)		
Record	Yes		
Cause	Corrective Actions		
MI terminal = EF1	Verify if the system is back to normal condition, and then press “RESET” key to go back to the default.		

No.	Display on LED Keypad	Fault Name	Descriptions
51	bb	External base block (bb)	When the contact of MI = bb is ON, the output stops immediately and displays bb on the keypad. The motor is in free running.

Action and Reset	
Action Condition	MI = bb and the MI terminal is conducted
Action Time	Immediately
Fault Treatment Parameter	None
Reset method	The display “bb” is automatically cleared after the fault is cleared.
Reset Condition	None
Record	N/A

Cause	Corrective Actions
MI terminal = bb	Verify if the system is back to normal condition, and then press “RESET” key to go back to the default.

<table>
<tr><th>No.</th><th>Display on LED Keypad</th><th>Fault Name</th><th>Descriptions</th></tr>
<tr><td>52</td><td>Pcod</td><td>Enter wrong password three times and locked (Pcod)</td><td>Entering the wrong password three consecutive times</td></tr>
<tr><th colspan="4">Action and Reset</th></tr>
<tr><td colspan="2">Action Condition</td><td colspan="2">Entering the wrong password three consecutive times</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="2">Immediately</td></tr>
<tr><td colspan="2">Fault Treatment Parameter</td><td colspan="2">None</td></tr>
<tr><td colspan="2">Reset method</td><td colspan="2">Manual reset</td></tr>
<tr><td colspan="2">Reset Condition</td><td colspan="2">Power-off</td></tr>
<tr><td colspan="2">Record</td><td colspan="2">Yes</td></tr>
<tr><th colspan="2">Cause</th><th colspan="2">Corrective Actions</th></tr>
<tr><td colspan="2">Incorrect password input through Pr.00-07</td><td colspan="2">1. Input the correct password after rebooting the motor drive.
2. If you forget the password, enter 9999.
3. Press ENTER, and then enter 9999 again.
4. You must finish pressing ENTER within 10 seconds. If not, you must repeat the entering. After you successfully unlock the password, the parameter settings return to the default.</td></tr>
</table>

No.	Display on LED Keypad	Fault Name	Descriptions
53	ccod	SW Code Error (ccod)	This fault code occurs when the firmware version and the control board ID# don't match.
Action and Reset			
Action Condition	N/A		
Action Time	N/A		
Fault Treatment Parameter	N/A		
Reset method	N/A		
Reset Condition	N/A		
Record	N/A		
Cause	Corrective Actions		
The firmware version may be wrong. For example: Firmware of C2000 series is burned into control board of CH2000 series.	Return to the factory for repair.		

<table>
<tr><th>No.</th><th>Display on LED Keypad</th><th>Fault Name</th><th>Descriptions</th></tr>
<tr><td>54</td><td>CE1</td><td>Illegal command (CE1)</td><td>Illegal command</td></tr>
<tr><th colspan="4">Action and Reset</th></tr>
<tr><td colspan="2">Action Condition</td><td colspan="2">When the function code is not 03, 06, 10 and 63</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="2">Immediately</td></tr>
<tr><td colspan="2">Fault Treatment Parameter</td><td colspan="2">None</td></tr>
<tr><td colspan="2">Reset method</td><td colspan="2">Manual reset</td></tr>
<tr><td colspan="2">Reset Condition</td><td colspan="2">Immediately reset</td></tr>
<tr><td colspan="2">Record</td><td colspan="2">N/A</td></tr>
<tr><th colspan="2">Cause</th><th colspan="2">Corrective Actions</th></tr>
<tr><td colspan="2">Incorrect communication command from upper unit</td><td colspan="2">Check if the communication command is correct.</td></tr>
<tr><td colspan="2">Malfunction caused by interference</td><td colspan="2">Verify the wiring and grounding of the communication circuit. It is recommended to separate the communication circuit from the main circuit, or wire in 90 degree for effective anti-interference performance.</td></tr>
<tr><td colspan="2">Different communication setting from the upper unit</td><td colspan="2">Check if the setting for Pr.09-01 and Pr.09-04 are the same as the setting for the upper unit.</td></tr>
<tr><td colspan="2">Disconnection or bad connection of the cable</td><td colspan="2">Check the cable and replace it if necessary.</td></tr>
</table>

No.	Display on LED Keypad	Fault Name	Descriptions
55	CE2	Illegal data address (CE2)	Data address is illegal

Action and Reset	
Action Condition	When the input data address is incorrect
Action Time	Immediately
Fault Treatment Parameter	None
Reset method	Manual reset
Reset Condition	Immediately reset
Record	N/A

Cause	Corrective Actions
Incorrect communication command from upper unit	Check if the communication command is correct.
Malfunction caused by interference	Verify the wiring and grounding of the communication circuit. It is recommended to separate the communication circuit from the main circuit, or wire in 90 degree for effective anti-interference performance.
Different communication setting from the upper unit	Check if the setting for Pr.09-01 and Pr.09-04 are the same as the setting for the upper unit.
Disconnection or bad connection of the cable	Check the cable and replace it if necessary.

No.	Display on LED Keypad	Fault Name	Descriptions
56	CE3	Illegal data value (CE3)	Data value is illegal

Action and Reset	
Action Condition	When the length of communication data is too long
Action Time	Immediately
Fault Treatment Parameter	None
Reset method	Manual reset
Reset Condition	Immediately reset
Record	N/A

Cause	Corrective Actions
Incorrect communication command from upper unit	Check if the communication command is correct.
Malfunction caused by interference	Verify the wiring and grounding of the communication circuit. It is recommended to separate the communication circuit from the main circuit, or wire in 90 degree for effective anti-interference performance.
Different communication setting from the upper unit	Check if the setting for Pr.09-01 and Pr.09-04 are the same as the setting for the upper unit.
Disconnection or bad connection of the cable	Check the cable and replace it if necessary.

No.	Display on LED Keypad	Fault Name	Descriptions
57	CE4	Data is written to read-only address (CE4)	When the data is written to read-only address

Action and Reset	
Action Condition	When the data is written to read-only address
Action Time	Immediately
Fault Treatment Parameter	None
Reset method	Manual reset
Reset Condition	Immediately reset
Record	N/A

Cause	Corrective Actions
Incorrect communication command from upper unit	Check if the communication command is correct.
Malfunction caused by interference	Verify the wiring and grounding of the communication circuit. It is recommended to separate the communication circuit from the main circuit, or wire in 90 degree for effective anti-interference performance.
Different communication setting from the upper unit	Check if the setting for Pr.09-01 and Pr.09-04 are the same as the setting for the upper unit.
Disconnection or bad connection of the cable	Check the cable and replace it if necessary.

No.	Display on LED Keypad	Fault Name	Descriptions
58	CE10	Modbus transmission time-out (CE10)	Modbus transmission time-out

Action and Reset	
Action Condition	When the communication time exceeds the detection time for Pr.09-03 communication time-out.
Action Time	Pr.09-03
Fault Treatment Parameter	Pr.09-02 0: Warn and continue operation 1: Fault and ramp to stop 2: Fault and coast to stop 3: No warning, no fault, and continue operation
Reset method	Manual reset
Reset Condition	Immediately reset
Record	Yes

Cause	Corrective Actions
The upper unit does not transmit the communication command within Pr.09-03 setting time	Check if the upper unit transmits the communication command within the setting time for Pr.09-03.
Malfunction caused by interference	Verify the wiring and grounding of the communication circuit. It is recommended to separate the communication circuit from the main circuit, or wire in 90 degree for effective anti-interference performance.
Different communication setting from the upper unit	Check if the setting for Pr.09-01 and Pr.09-04 are the same as the setting for the upper unit.
Disconnection or bad connection of the cable	Check the cable and replace it if necessary.

<table>
<tr><th>ID No.</th><th>Display on LCD Keypad</th><th>Fault Name</th><th>Descriptions</th></tr>
<tr><td>61</td><td>ydc</td><td>Y-connection / Δ-connection switch error (ydc)</td><td>An error occurs when Y-Δ switches</td></tr>
<tr><th colspan="4">Action and Reset</th></tr>
<tr><td colspan="2">Action Condition</td><td colspan="2">1. ydc occurs when the confirmation signals of Y-connection and Δ-connection are conducted at the same time.
2. If any of confirmation signals is not conducted within Pr.05-25, ydc occurs.</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="2">Pr.05-25</td></tr>
<tr><td colspan="2">Fault Treatment Parameter</td><td colspan="2">None</td></tr>
<tr><td colspan="2">Reset method</td><td colspan="2">Manual reset</td></tr>
<tr><td colspan="2">Reset Condition</td><td colspan="2">Can be reset only when the confirmation signal of Y-connection is conducted if it is Y-connection, or when the confirmation signal of Δ-connection is conducted if it is Δ-connection.</td></tr>
<tr><td colspan="2">Record</td><td colspan="2">Yes</td></tr>
<tr><th colspan="2">Cause</th><th colspan="2">Corrective Actions</th></tr>
<tr><td colspan="2">The electromagnetic valve operates incorrectly during Y-Δ switch.</td><td colspan="2">Check if the electromagnetic valve works normally.
If not, replace it.</td></tr>
<tr><td colspan="2">Incorrect parameter setting</td><td colspan="2">Check if related parameters are all set up and set correctly.</td></tr>
<tr><td colspan="2">The wiring of Y-Δ switch function is incorrect</td><td colspan="2">Check the wiring.</td></tr>
</table>

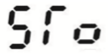
<table>
<tr><th>ID No.</th><th>Display on LCD Keypad</th><th colspan="2">Fault Name</th><th>Descriptions</th></tr>
<tr><td>62</td><td>dEb</td><td colspan="2">Deceleration energy backup error (dEb)</td><td>When Pr.07-13 is not 0, and the power is suddenly off, causing the DC bus voltage lower than the dEb action level, the dEb function acts and the motor ramps to stop. Then dEb displays on the keypad.</td></tr>
<tr><th colspan="5">Action and Reset</th></tr>
<tr><td colspan="2">Action Condition</td><td colspan="3">When Pr.07-13 is not 0, and the DC bus voltage is lower than the level of dEb.</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="3">Immediately</td></tr>
<tr><td colspan="2">Fault Treatment Parameter</td><td colspan="3">None</td></tr>
<tr><td colspan="2" rowspan="2">Reset method</td><td>Auto</td><td colspan="2">When Pr.07-13=2 (dEb with auto-acceleration / auto-deceleration, the drive outputs the frequency after the power is restored): dEb is automatically cleared.</td></tr>
<tr><td>Manual</td><td colspan="2">When Pr.07-13 = 1 (dEb with auto-acceleration / auto-deceleration, the drive does not output the frequency after the power is restored): The drive stops when dEb acts and the rotation speed becomes 0 Hz, then the drive can be reset manually.</td></tr>
<tr><td colspan="2">Reset Condition</td><td colspan="3">Auto: The fault is automatically cleared.
Manual: When the drive decelerates to 0 Hz.</td></tr>
<tr><td colspan="2">Record</td><td colspan="3">Yes</td></tr>
<tr><th colspan="2">Cause</th><th colspan="3">Corrective Actions</th></tr>
<tr><td colspan="2">Unstable power source or the power is off</td><td colspan="3">Check the power system.</td></tr>
<tr><td colspan="2">There is any other large load operates in the power system</td><td colspan="3">Replace power system with a larger capacity.
Use a different power system from the large load system.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Display on LED Keypad</th><th>Fault Name</th><th colspan="2">Descriptions</th></tr>
<tr><td>63</td><td>oSL</td><td>Over slip error
(oSL)</td><td colspan="2">On the basis of the maximum slip limit set via Pr.10-29, the speed deviation is abnormal. When the motor drive outputs at constant speed, F>H or F<H exceeds the level set via Pr.07-29, and it exceeds the time set via Pr.07-30, oSL shows. oSL occurs in induction motors only.</td></tr>
<tr><th colspan="5">Action and Reset</th></tr>
<tr><td colspan="2">Action Condition</td><td colspan="3">Pr.07-29 (100% of Pr.07-29 = the maximum limit of the slip frequency (Pr.10-29))</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="3">Pr.07-30</td></tr>
<tr><td colspan="2">Fault Treatment Parameter</td><td colspan="3">Pr.07-31
0: Warn and continue operation
1: Fault and ramp to stop
2: Fault and coast to stop
3: No warning</td></tr>
<tr><td colspan="2" rowspan="2">Reset method</td><td>Auto</td><td colspan="2">Pr.07-31 = 0, oSL is a warning.
When the motor drive outputs at constant speed, and F>H or F<H does not exceed the level set via Pr.07-29 anymore, oSL warning will be cleared automatically.</td></tr>
<tr><td>Manual</td><td colspan="2">When Pr.07-31 = 1 or 2, oSL is a “Fault”. You must reset it manually.</td></tr>
<tr><td colspan="2">Reset Condition</td><td colspan="3">Immediately reset</td></tr>
<tr><td colspan="2">Record</td><td colspan="3">Pr.07-31 = 1 or 2, oSL is a “Fault”, and the fault will be recorded.</td></tr>
<tr><th colspan="2">Cause</th><th colspan="3">Corrective Actions</th></tr>
<tr><td colspan="2">Check if the motor parameter is correct</td><td colspan="3">Check the motor parameters</td></tr>
<tr><td colspan="2">The load is too large</td><td colspan="3">Decrease the load</td></tr>
<tr><td colspan="2">Check if the settings for Pr.07-29, Pr.07-30 and Pr.10-29 are properly set</td><td colspan="3">Check the setting of oSL protection function related parameters</td></tr>
</table>

No.	Display on LED Keypad	Fault Name	Descriptions
72		S1 internal loop error is detected (STL1)	STO1–SCM1 internal loop error is detected (for STO models only)

Action and Reset	
Action Condition	Hardware detection
Action Time	Immediately
Fault Treatment Parameter	None
Reset method	Re-power ON after powering OFF
Reset Condition	None
Record	Yes

Cause	Corrective Actions
STO jumper cap is not installed or fell off	Install the jumper cap.
The short-circuit wire between S1 and +24V of the external STO card is not connected	Check the wiring of the S1 and +24V terminal.
External STO card is installed incorrectly or pin fractures.	Check if STO card is correctly installed.
Insufficient external input voltage	Check that the input voltage maintains at least 11V.
False trigger	Reset the switch (ON: conducted) and re-power ON
Hardware failure	Power ON again after you make sure all the wiring is correct, if STL1 fault still exists, returns to the factory for repair.

No.	Display on LED Keypad	Fault Name	Descriptions
76		Safe Torque Off (STO)	Safe Torque Off function activates (for STO models only)

Action and Reset		
Action Condition	Hardware detection	
Action Time	Immediately	
Fault Treatment Parameter	None	
Reset method	Auto	When Pr.06-44 = 1 and after STO fault is cleared, it automatically resets.
	Manual	When Pr.06-44 = 0 and after STO fault is cleared, reset it manually.
Reset Condition	Reset only after STo error is cleared.	
Record	Yes	

Cause	Corrective Actions
The switch of S1/+24V and S2/+24V activate (OPEN: open loop)	Check the wiring of the S1 and S2 terminal.
External STO card is installed incorrectly or pin fractures.	Check if STO card is correctly installed.
False trigger	Reset the switch (ON: conducted) and re-power ON
Insufficient external input voltage	Check that the input voltage maintains at least 11V.
Hardware failure	Power ON again after you make sure all the wiring is correct, if STO fault still exists, returns to the factory for repair.

No.	Display on LED Keypad	Fault Name	Descriptions
77		S2 internal loop error is detected (STL2)	STO2–SCM2 internal loop detection error (for STO models only)

Action and Reset	
Action Condition	Hardware detection
Action Time	Immediately
Fault Treatment Parameter	None
Reset method	Hardware failure, and cannot reset. Cycle the power.
Reset Condition	None
Record	Yes

Cause	Corrective Actions
STO jumper cap is not installed or fell off	Install the jumper cap.
The short-circuit wire between S1 and +24V of the external STO card is not connected	Check the wiring of the S1 and +24V terminal.
External STO card is installed incorrectly or pin fractures.	Check if STO card is correctly installed.
Insufficient external input voltage	Check that the input voltage maintains at least 11V.
False trigger	Reset the switch (ON: conducted) and re-power ON
Hardware failure	Power ON again after you make sure all the wiring is correct, if STL2 fault still exists, returns to the factory for repair.

No.	Display on LED Keypad	Fault Name	Descriptions
78	STL3	Internal loop error is detected (STL3)	Internal loop error is detected (for STO models only)

Action and Reset	
Action Condition	Hardware detection
Action Time	Immediately
Fault Treatment Parameter	None
Reset method	Hardware failure, and cannot reset. Cycle the power.
Reset Condition	None
Record	Yes

Cause	Corrective Actions
STO jumper cap is not installed or fell off	Install the jumper cap.
Incorrect wiring of STO card	Check all the wiring of STO card.
External STO card is installed incorrectly or pin fractures.	Check if STO card is correctly installed.
False trigger	Reset the switch (ON: conducted) and re-power ON
Hardware failure	Power ON again after you make sure all the wiring is correct, if STL3 fault still exists, returns to the factory for repair.

No.	Display on LED Keypad	Fault Name	Descriptions
79	Aoc	U-phase over-current before run (Aoc)	U-phase short circuit detected when the output wiring detection is performed before the drive runs.

Action and Reset	
Action Condition	300% of the rated current
Action Time	Immediately
Fault Treatment Parameter	None
Reset method	Manual reset
Reset Condition	Reset in five seconds after the fault is cleared
Record	Yes
Cause	**Corrective Actions**
Incorrect wiring for the motor	Check if the motor’s internal wiring and the U / V / W wiring of the drive output terminal are correct.
Short-circuit at motor output due to poor insulation wiring	Check the motor cable and remove causes of the short circuits, or replace the cable before turning on the power.
Check for possible burnout or aging insulation of the motor	Check the motor insulation value with megger. Replace the motor if the insulation is poor.
Malfunction caused by interference	Verify the wiring of the control circuit, and the wiring/grounding of the main circuit to prevent interference.
The length of motor cable is too long	Increase the drive capacity. Install AC reactor(s) on the output side (U / V / W).
Hardware failure	The Aoc occurs due to the short circuit or ground fault at the output side of the drive. Check for possible short circuits between terminals with the electric meter: B1 corresponds to U, V and W; DC- corresponds to U, V and W; ⏚ corresponds to U, V and W. If short circuit occurs, return to the factory for repair.

No.	Display on LCD Keypad	Fault Name	Descriptions
80	boc	V-phase over-current before run (boc)	V-phase short circuit detected when the output wiring detection is performed before the drive runs.

Action and Reset	
Action Condition	300% of the rated current
Action Time	Immediately
Fault Treatment Parameter	None
Reset method	Manual reset
Reset Condition	Reset in five seconds after the fault is cleared
Record	Yes

Cause	Corrective Actions
Incorrect wiring for the motor	Check if the motor’s internal wiring and the U / V / W wiring of the drive output terminal are correct.
Short-circuit at motor output due to poor insulation wiring	Check the motor cable and remove causes of the short circuits, or replace the cable before turning on the power.
Check for possible burnout or aging insulation of the motor	Check the motor insulation value with megger. Replace the motor if the insulation is poor.
Malfunction caused by interference	Verify the wiring of the control circuit, and the wiring/grounding of the main circuit to prevent interference.
The length of motor cable is too long	Increase the drive capacity. Install AC reactor(s) on the output side (U / V / W).
Hardware failure	The boc occurs due to the short circuit or ground fault at the output side of the drive. Check for possible short circuits between terminals with the electric meter: B1 corresponds to U, V and W; DC- corresponds to U, V and W; ⏚ corresponds to U, V and W. If short circuit occurs, return to the factory for repair.

No.	Display on LCD Keypad	Fault Name	Descriptions
81	coc	W-phase over-current before run (coc)	W-phase short circuit detected when the output wiring detection is performed before the drive runs.

Action and Reset	
Action Condition	300% of the rated current
Action Time	Immediately
Fault Treatment Parameter	None
Reset method	Manual reset
Reset Condition	Reset in five seconds after the fault is cleared
Record	Yes

Cause	Corrective Actions
Incorrect wiring for the motor	Check if the motor's internal wiring and the U / V / W wiring of the drive output terminal are correct.
Short-circuit at motor output due to poor insulation wiring	Check the motor cable and remove causes of the short circuits, or replace the cable before turning on the power.
Check for possible burnout or aging insulation of the motor	Check the motor insulation value with megger. Replace the motor if the insulation is poor.
Malfunction caused by interference	Verify the wiring of the control circuit, and the wiring/grounding of the main circuit to prevent interference.
The length of motor cable is too long	Increase the drive capacity. Install AC reactor(s) on the output side (U / V / W).
Hardware failure	The coc occurs due to the short circuit or ground fault at the output side of the drive. Check for possible short circuits between terminals with the electric meter: B1 corresponds to U, V and W; DC- corresponds to U, V and W; ⏚ corresponds to U, V and W. If short circuit occurs, return to the factory for repair.

<table>
<tr><th>No.</th><th>Display on LED Keypad</th><th>Fault Name</th><th>Descriptions</th></tr>
<tr><td>82</td><td>oPL1</td><td>Output phase loss U phase (oPL1)</td><td>U phase output phase loss</td></tr>
<tr><td colspan="4">Action and Reset</td></tr>
<tr><td colspan="2">Action Condition</td><td colspan="2">Pr.06-47</td></tr>
<tr><td colspan="2">Action Time</td><td colspan="2">Pr.06-46
Pr.06-48: Use the setting value of Pr.06-48 first. If DC braking function activates, use that of Pr.06-46.</td></tr>
<tr><td colspan="2">Fault Treatment Parameter</td><td colspan="2">Pr.06-45
0: Warn and continue operation
1: Fault and ramp to stop
2: Fault and coast to stop
3: No warning</td></tr>
<tr><td colspan="2">Reset method</td><td colspan="2">Manual reset</td></tr>
<tr><td colspan="2">Reset Condition</td><td colspan="2">Immediately reset</td></tr>
<tr><td colspan="2">Record</td><td colspan="2">Pr.06-45 = 1 or 2 is a “Fault”, and the fault will be recorded.</td></tr>
<tr><td colspan="2">Cause</td><td colspan="2">Corrective Actions</td></tr>
<tr><td colspan="2">Unbalanced three-phase impedance of the motor</td><td colspan="2">Replace the motor.</td></tr>
<tr><td colspan="2">Check if the wiring is incorrect</td><td colspan="2">Check the cable. Replace the cable.</td></tr>
<tr><td colspan="2">Check if the motor is a single-phase motor</td><td colspan="2">Choose a three-phase motor.</td></tr>
<tr><td colspan="2">Check if the current sensor is broken.</td><td colspan="2">Check if the control board cable is loose. If yes, reconnect the cable and run the drive to test. If the error still occurs, return to the factory for repair.
Check if the three-phase current is balanced with a current clamp meter. If the current is balanced and the OPHL error still shows on the display, return to the factory for repair.</td></tr>
<tr><td colspan="2">Check if capacity of the drive is larger than the motor</td><td colspan="2">Choose a drive’s capacity matches a motor’s.</td></tr>
</table>

No.	Display on LED Keypad	Fault Name	Descriptions
83	oPL2	Output phase loss V phase (oPL2)	V phase output phase loss

Action and Reset	
Action Condition	Pr.06-47
Action Time	Pr.06-46 Pr.06-48: Use the setting value of Pr.06-48 first. If DC braking function activates, use that of Pr.06-46.
Fault Treatment Parameter	Pr.06-45 0: Warn and continue operation 1: Fault and ramp to stop 2: Fault and coast to stop 3: No warning
Reset method	Manual reset
Reset Condition	Immediately reset
Record	Pr.06-45 = 1 or 2 is a "Fault", and the fault will be recorded.

Cause	Corrective Actions
Unbalanced three-phase impedance of the motor	Replace the motor.
Check if the wiring is incorrect	Check the cable. Replace the cable.
Check if the motor is a single-phase motor	Choose a three-phase motor.
Check if the current sensor is broken.	Check if the control board cable is loose. If yes, reconnect the cable and run the drive to test. If the error still occurs, return to the factory for repair. Check if the three-phase current is balanced with a current clamp meter. If the current is balanced and the OPHL error still shows on the display, return to the factory for repair.
Check if capacity of the drive is larger than the motor	Choose a drive's capacity matches a motor's.

No.	Display on LED Keypad	Fault Name	Descriptions
84	oPL3	Output phase loss W phase (oPL3)	W phase output phase loss

Action and Reset	
Action Condition	Pr.06-47
Action Time	Pr.06-46 Pr.06-48: Use the setting value of Pr.06-48 first. If DC braking function activates, use that of Pr.06-46.
Fault Treatment Parameter	Pr.06-45 0: Warn and continue operation 1: Fault and ramp to stop 2: Fault and coast to stop 3: No warning
Reset method	Manual reset
Reset Condition	Immediately reset
Record	Pr.06-45 = 1 or 2 is a “Fault”, and the fault will be recorded.

Cause	Corrective Actions
Unbalanced three-phase impedance of the motor	Replace the motor.
Check if the wiring is incorrect	Check the cable. Replace the cable.
Check if the motor is a single-phase motor	Choose a three-phase motor.
Check if the current sensor is broken.	Check if the control board cable is loose. If yes, reconnect the cable and run the drive to test. If the error still occurs, return to the factory for repair. Check if the three-phase current is balanced with a current clamp meter. If the current is balanced and the OPHL error still shows on the display, return to the factory for repair.
Check if capacity of the drive is larger than the motor	Choose a drive’s capacity matches a motor’s.

No.	Display on LED Keypad	Fault Name	Descriptions
87	oL3	Power module overload (oL3)	The load almost reaches the upper limit of the power module

Action and Reset	
Action Condition	Software detection
Action Time	Immediately
Fault Treatment Parameter	None
Reset method	Manual reset
Reset Condition	Immediately reset
Record	Yes

Cause	Corrective Actions
The power module overloads	1. Decrease the drive's load. 2. Lower the carrier frequency (Pr.00-17). 3. Lower the drive's operation ambient temperature 4. Lower the current limit 5. Replace the drive with a larger power model. 6. Increase the acceleration time 7. Decrease the output voltage for low-frequency operation in V/F control mode.

No.	Display on LCD Keypad	Fault Name	Descriptions
89	roPd	Rotor position detection error (roPd)	Rotor position detection error protection

Action and Reset	
Action Condition	Software detection
Action Time	Immediately
Fault Treatment Parameter	None
Reset method	Manual reset
Reset Condition	Immediately reset
Record	Yes

Cause	Corrective Actions
Check if the motor cable is abnormal or broken	Check or replace the cable.
Motor coil error	Replace the motor.
Hardware failure	IGBT broken. Return to the factory for repair.
Drive's current feedback line error	Cycle the power. If roPd still occurs during operation, return to the factory for repair.

No.	Display on LCD Keypad	Fault Name	Descriptions
140	Hd6	oc hardware error (Hd6)	GFF hardware protection error when power is ON.
Action and Reset			
Action Condition	Hardware detection		
Action Time	Immediately act when the fault is detected		
Fault Treatment Parameter	None		
Reset method	Power-off		
Reset Condition	None		
Record	Yes		
Cause	Corrective Actions		
Hardware failure	Cycle the power. If cd1 still exists, return to the factory for repair.		

No.	Display on LCD Keypad	Fault Name	Descriptions
141		GFF occurs before run (b4GFF)	The ground short circuit detected when the output wiring detection is performed before the drive runs.

Action and Reset	
Action Condition	250% of the rated current
Action Time	Immediately
Fault Treatment Parameter	None
Reset method	Manual reset
Reset Condition	Reset in five seconds after the fault is cleared
Record	Yes

Cause	Corrective Actions
Incorrect wiring for the motor	Check if the motor's internal wiring and the U / V / W wiring of the drive output terminal are correct.
Short-circuit at motor output due to poor insulation wiring	Check the motor cable and remove causes of the short circuits, or replace the cable before turning on the power.
Check for possible burnout or aging insulation of the motor	Check the motor insulation value with megger. Replace the motor if the insulation is poor.

No.	Display on LED Keypad	Fault Name	Descriptions
142	AuE1	Auto-tuning error 1 (AUE1)	No feedback current error when the motor parameter automatically detects

Action and Reset	
Action Condition	Software detection
Action Time	Immediately
Fault Treatment Parameter	None
Reset method	Manual reset
Reset Condition	Immediately reset
Record	Yes

Cause	Corrective Actions
Motor is not wired	Wire the motor correctly
The electromagnetic contactor is ON at output side (U / V / W) of the drive	Check if the electromagnetic valve is closed.

No.	Display on LED Keypad	Fault Name	Descriptions
143	AuE2	Auto-tuning error 1 (AUE2)	Motor phase loss error when the motor parameter automatically detects
Action and Reset			
Action Condition		Software detection	
Action Time		Immediately	
Fault Treatment Parameter		None	
Reset method		Manual reset	
Reset Condition		Immediately reset	
Record		Yes	
Cause		Corrective Actions	
Incorrect motor wiring		Check the wiring.	
Motor error		Check if the motor works normally.	
The electromagnetic contactor is ON at output side (U / V / W) of the drive		Verify that the three-phases of the electromagnetic valve are all closed.	
Motor U / V / W wire error		Check if the wires are broken.	

No.	Display on LED Keypad	Fault Name	Descriptions
144	AuE3	Auto-tuning error 1 (AuE3)	No load current I_0 measurement error when the motor parameter automatically detects.

Action and Reset	
Action Condition	Software detection
Action Time	Immediately
Fault Treatment Parameter	None
Reset method	Manual reset
Reset Condition	Immediately reset
Record	Yes

Cause	Corrective Actions
Incorrect settings for the motor parameter (rated current)	Check the settings for Pr.05-01 / Pr.05-13 / Pr.05-34.
Motor error	Check if the motor works normally.

No.	Display on LED Keypad	Fault Name	Descriptions
149	AuE5	Auto-tuning error 5 (AUE5)	The rotor resistance measuring error when the motor parameter automatically detects.

Action and Reset	
Action Condition	Software detection
Action Time	Immediately
Fault Treatment Parameter	None
Reset method	Manual reset
Reset Condition	Immediately reset
Record	Yes

Cause	Corrective Actions
Motor error	Check if the motor works normally.

No.	Display on LED Keypad	Fault Name	Descriptions
150	AuE6	No-load current I_0 measurement fault (AUE6)	Fault on measuring no-load current I_0
Action and Reset			
Action Condition		Software detection	
Action Time		Immediately	
Fault Treatment Parameter		None	
Reset method		Manual reset	
Reset Condition		Immediately reset	
Record		Yes	
Cause		Corrective Actions	
Motor error		Check if the motor works normally.	

No.	Display on LED Keypad	Fault Name	Descriptions
151	AuE7	dq axis inductance measurement fault (AUE7)	Fault on measuring dq axis inductance

Action and Reset	
Action Condition	Software detection
Action Time	Immediately
Fault Treatment Parameter	None
Reset method	Manual reset
Reset Condition	Immediately reset
Record	Yes

Cause	Corrective Actions
Motor error	Check if the motor works normally.

No.	Display on LED Keypad	Fault Name	Descriptions
152	AuE8	High frequency injection measurement fault (AUE8)	Fault on measuring high frequency injection

Action and Reset	
Action Condition	Software detection
Action Time	Immediately
Fault Treatment Parameter	None
Reset method	Manual reset
Reset Condition	Immediately reset
Record	Yes
Cause	**Corrective Actions**
Motor error	Check if the motor works normally.

No.	Display on LED Keypad	Fault Name	Descriptions
157		Pump PID feedback error (dEv)	Pump PID feedback error
Action and Reset			
Action Condition		Feedback value < target value × (1 - Pr.08-13)	
Action Time		Pr.08-14	
Fault Treatment Parameter		Pr.08-62	
Reset method		Self-recovery or manual reset	
Reset Condition		Set as Warning: Feedback value ≥ target value (1 - Pr.08-13) automatic recovery Set as Fault: Immediately reset	
Record		Yes	
Cause		Corrective Actions	
Unreasonable parameter settings		Extend the time setting in Pr.08-14	
Motor error		Check if the motor works normally.	

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Chapter 15 Safe Torque Off Function

15-1 Basic Function Description

ME300 series provides Safe Torque Off (STO) function. Turn OFF the IGBT switch by inputting dual-channel S1 and S2 signals, further preventing it from generating motor torque, to achieve the goal of safe stop. Refer to Figure 15-1 for the Safe Torque Off function circuit diagram.

ME300 series STO function meets the following international standards:

- ISO 13849-1: 2015 Category 3 PL d
- IEC 61508 SIL2
- EN 62061 SIL CL 2
- EN 60204-1 Category 0

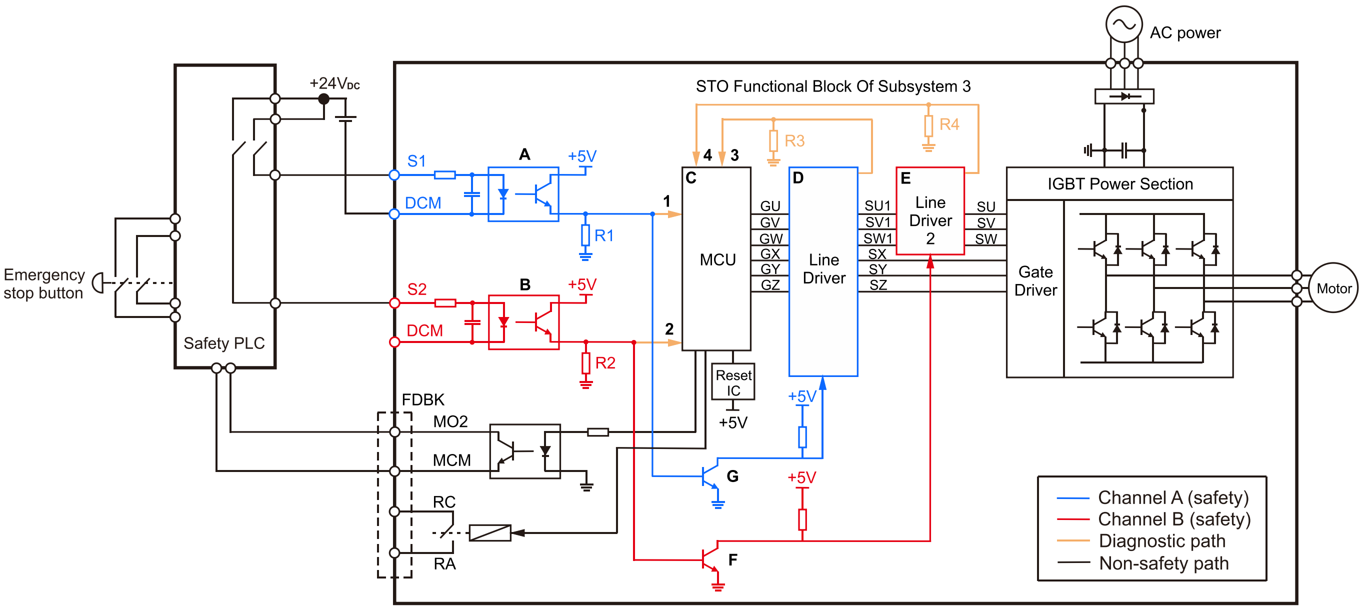


Figure 15-1 The circuit diagram for STO function

15-2 Safe Torque Off Terminal Function Description

Descriptions of STO function related terminals.

Terminal Name	Terminal function	Descriptions
+24V	When the STO function is not used, you can disable the STO function by shorting S1 and S2 with + 24 V.	Output voltage range: +24 V ± 10% Output voltage capacity: 100 mA
S1	Signal input for STO function channel 1	**S1–DCM / S2–DCM** Rated input voltage: +24 V_{DC} ± 10%; maximum input voltage: +30 V_{DC} ± 10% Rated input current: 6.67 mA ± 10% **STO activation mode** Input voltage level: 0 V_{DC} < S1–DCM < 5 V_{DC} or 0 V_{DC} < S2–DCM < 5 V_{DC} STO response time: ≤ 20 ms (time required for S1 / S2 to operate until the drive stops outputting) **STO cut-off mode** Input voltage level: 11 V_{DC} < S1–DCM < 30 V_{DC} and 11 V_{DC} < S2–DCM < 30 V_{DC}
S2	Signal input for STO function channel 2	
DCM	Reference ground for S1 and S2 signal	

Table 15-1

The action logic and keypad display after inputting the S1 / S2 signals.

Signal	Status			
S1–DCM	ON	ON	OFF	OFF
S2–DCM	ON	OFF	ON	OFF
Drive output	Ready to output	STL2 mode (Torque output off)	STL1 mode (Torque output off)	STO mode (Torque output off)
Error displayed on the keypad	No error displayed	STL2	STL1	STO

Table 15-2

- STO means channel 1 and 2 operate simultaneously and enter Safe Torque Off.
- STL1 means channel 1 operates.
- STL2 means channel 2 operates.
- STL3 means there is an error detected in the internal loop of the channel 1 or channel 2.
- S1–DCM / S2–DCM ON (conducted): this means a > 11 V_{DC} power inputs S1–DCM / S2–DCM.
- S1–DCM / S2–DCM ON (open-loop): this means a < 5 V_{DC} power inputs S1–DCM / S2–DCM.

15-3 Wiring Diagram

15-3-1 See Figure 15-2 for the internal circuit diagram of the safe control loop.

15-3-2 The terminals of the safe control loop + 24V-S1-S2 are short-circuited together with the jumper wire at the factory, see Figure 15-2.

15-3-3 The safe control loop wiring diagram is as follows:

1. Remove the jumper wire from +24V-S1-S2.
2. The wiring is shown in Figure 15-3 below. Normally, you must close the ESTOP contact switch, so the drive can output without displaying an error.
3. In STO mode, turns the switch ESTOP ON. The drive stops outputting and the keypad displays STO.

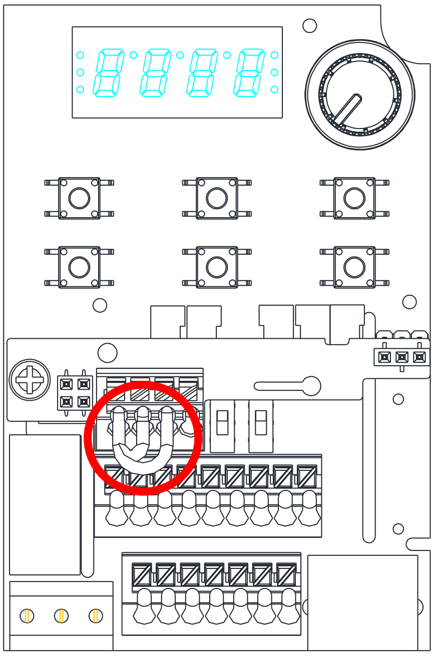


Figure 15-2

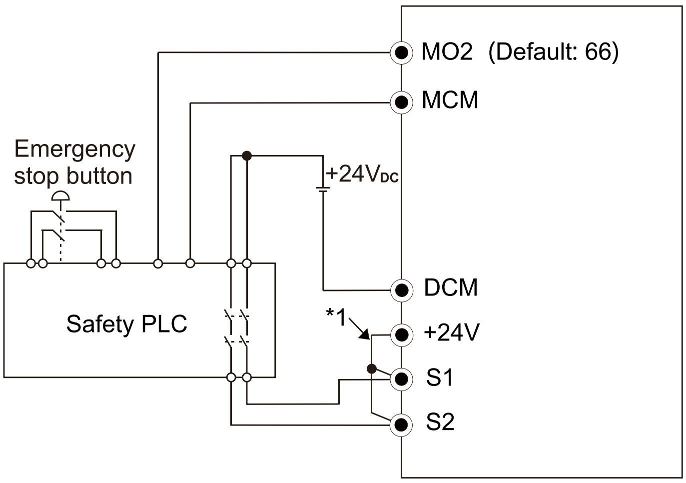


Figure 15-3

Note

*1 is factory jumper wire shorting +24V-S1-S2. To use the Safety function, remove this jumper wire. To disable the Safety function, short-circuit +24V-S1-S2 with a jumper wire.

15-4 Failure Rate of the Drive Safety Function

Refer to Table 15-3 for the relevant safe loop parameters.

Item	Definition	Standard	Performance
SFF	Safe failure fraction	IEC61508	S1–DCM = 88.35% S2–DCM = 88.2%
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	1.36×10^{-9}
PFD_{av}	Probability of dangerous failure on demand	IEC61508	5.99×10^{-6}
PTI	Proof test interval	IEC61508	1 year
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

Table 15-3

15-5 Reset the Parameter Settings

Use Pr.06-44 to specify the reset method when an STO alarm occurs.

06-44	STO Latch Selection (for STO models only)

Default: 0

Settings 0: STO Latch

1: STO No Latch

- Pr.06-44 = 0: this means once STO occurs, the drive needs to be reset after the state restores.
- Pr.06-44 = 1: this means once STO occurs, STO waning will be automatically cleared after the state restores.
- All of the STL1–STL3 errors are “Alarm Latch” mode (in STL1–STL3 mode, Pr.06-44 function is not available).

15-6 Timing Diagram Description

The following timing diagrams show the status of relevant signals under different conditions.

15-6-1 Normal operation status

When S1–DCM and S2–DCM are ON (STO function is not required), the drive operates according to RUN command. See Figure 15-4.

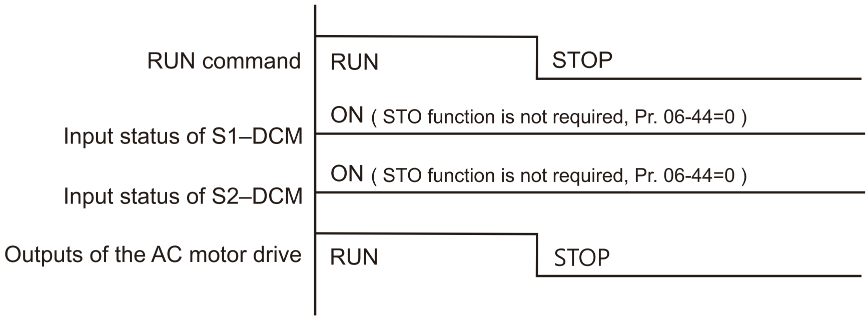


Figure 15-4

15-6-2 STO status

15-6-2-1 STO, Pr.06-44 = 0, Pr.02-35 = 0

(External control operation after reset / power ON, 0 = not valid)

When both S1–DCM and S2–DCM are OFF during operation (STO function is required), the drive stops outputting when it enters safe mode regardless of whether the RUN command is in ON or OFF status. See Figure 15-5.

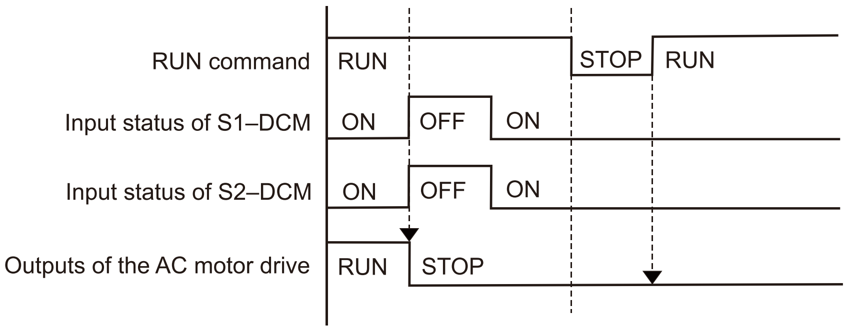


Figure 15-5

15-6-2-2 STO, Pr.06-44 = 0, Pr.02-35 = 1

(External control operation after reset / power ON, 1= drive runs if the RUN command remains after reset)

The action is the same as in Figure 15-5; however, because Pr.02-35=1, if the RUN command remains after reset, the drive immediately executes the RUN command again. See Figure 15-6.

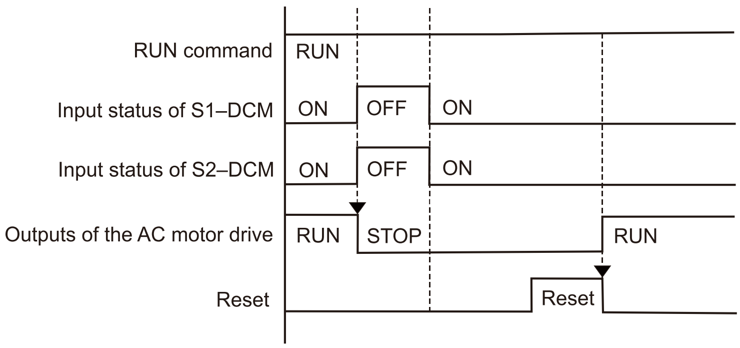


Figure 15-6

15-6-3 STO, Pr.06-44 = 1

When both of S1–DCM and S2–DCM are OFF during operation (STO function is required), the drive stops outputting. When the S1 / S2 status are restored (ON), the STO warning will be automatically cleared. The drive outputs when the RUN command is given again. See Figure 15-7.

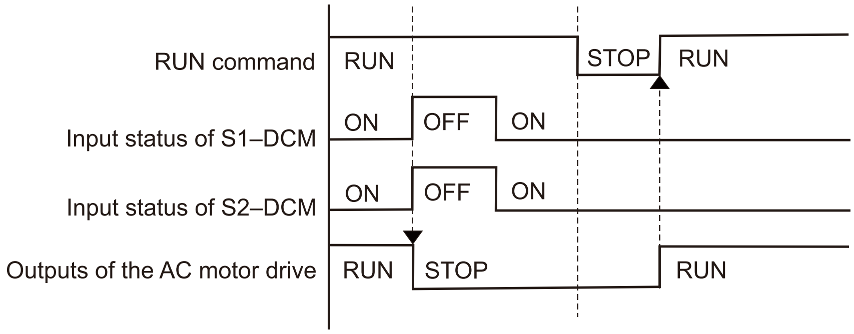


Figure 15-7

15-6-4 STL1, Pr.06-44 = 1 or 1

When S1–DCM is OFF during operation (STO function is required) and S2–DCM is ON (STO function is not required), the drive stops outputting and the keypad shows the STL1 error. You cannot reset the STL1 error even if the S1 status is restored (ON) regardless of the parameter setting. See Figure 15-8. You must cycle the power to reset and to restore the drive to the normal standby state.

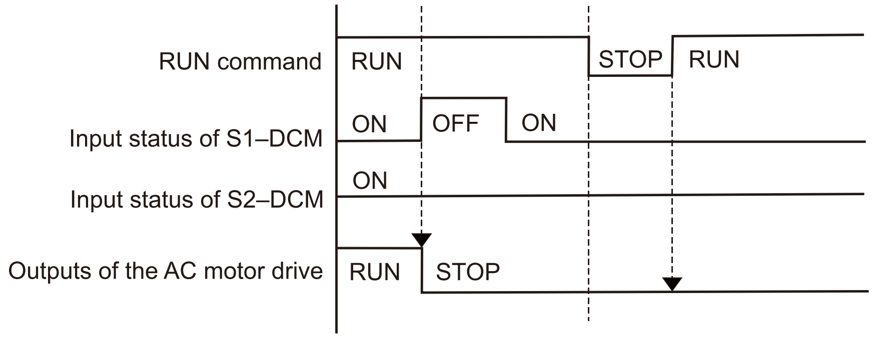


Figure 15-8

15-6-5 STL2, Pr.06-44 = 0 or 1

When S1–DCM is ON during operation (STO function is not required) and S2–DCM is OFF (STO function is required), the drive stops outputting and the keypad shows the STL2 error. You cannot reset the STL2 error even if the S2 status is restored (ON) regardless of the parameter setting. See Figure 15-9. You must cycle the power to reset and to restore the drive to the normal standby state.

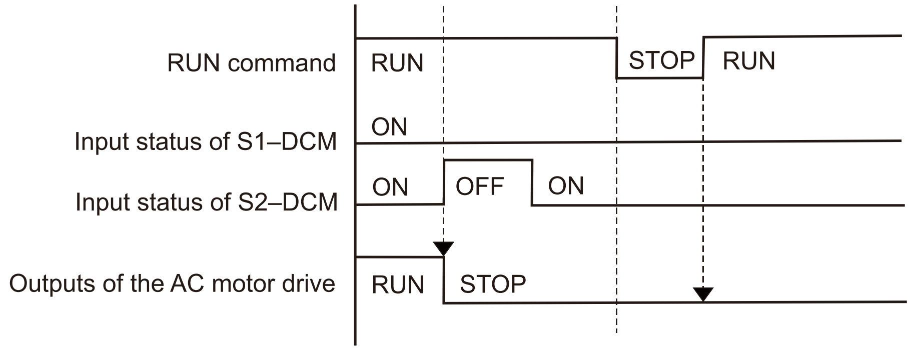


Figure 15-9

15-7 Fault Codes and Troubleshooting Instructions

15-7-1 Error Code Description

Refer to Pr.06-17–Pr.06-22 for the fault record; the relevant STO error code are 72 / 76 / 77 / 78. (For STO models only)

06-17	Fault Record 1
06-18	Fault Record 2
06-19	Fault Record 3
06-20	Fault Record 4
06-21	Fault Record 5
06-22	Fault Record 6

Display

72: S1 internal loop detection error (STL1) (for STO models only)

76: STO (STo) (for STO models only)

77: S2 internal loop detection error (STL2) (for STO models only)

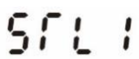
78: Internal loop detection error (STL3) (for STO models only)

Exception Code	Name	Descriptions
72 (STL1)	S1 internal loop error is detected	STO1–SCM1 internal loop error is detected
76 (STo)	Safe Torque Off	Safe Torque Off function activates
77 (STL2)	S2 internal loop error is detected	STO2–SCM2 internal loop error is detected
78 (STL3)	Internal loop error is detected	STO1–SCM1 and STO2–SCM2 internal loop error are detected

Table 15-4

15-7-2 Troubleshooting Instructions

When STO / STL1 / STL2 / STL3 display on the keypad, refer to the following table for troubleshooting (or refer to Chapter 14 Fault Codes for details).

No.	Display on Keypad	Cause	Corrective Actions
72		STO jumper cap is not installed or fell off	Install the jumper cap.
		The short-circuit wire between S1 and +24V of the external STO card is not connected	Check the wiring of the S1 and +24V terminal.
		External STO card is installed incorrectly or pin fractures.	Check if STO card is correctly installed.
		Insufficient external input voltage	Check that the input voltage maintains at least 11V.
		False trigger	Reset the emergency switch (ON: conducted) and power ON again.
		Hardware failure	Power ON again after you make sure all the wiring is correct, if STL1 fault still exists, returns to the factory for repair.

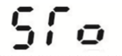
No.	Display on Keypad	Cause	Corrective Actions
76		The switch of S1/+24V and S2/+24V activate (OPEN: open loop)	Check the wiring of the S1 and S2 terminal.
		External STO card is installed incorrectly or pin fractures.	Check if STO card is correctly installed.
		False trigger	Reset the emergency switch (ON: conducted) and power ON again.
		Insufficient external input voltage	Check that the input voltage maintains at least 11V.
		Hardware failure	Power ON again after you make sure all the wiring is correct, if STO fault still exists, returns to the factory for repair.
77		STO jumper cap is not installed or fell off	Install the jumper cap.
		The short-circuit wire between S1 and +24V of the external STO card is not connected	Check the wiring of the S1 and +24V terminal.
		External STO card is installed incorrectly or pin fractures.	Check if STO card is correctly installed.
		Insufficient external input voltage	Check that the input voltage maintains at least 11V.
		False trigger	Reset the emergency switch (ON: conducted) and power ON again.
		Hardware failure	Power ON again after you make sure all the wiring is correct, if STL2 fault still exists, returns to the factory for repair.
78		STO jumper cap is not installed or fell off	Install the jumper cap.
		Incorrect wiring of STO card	Check all the wiring of STO card.
		External STO card is installed incorrectly or pin fractures.	Check if STO card is correctly installed.
		False trigger	Reset the emergency switch (ON: conducted) and power ON again.
		Hardware failure	Power ON again after you make sure all the wiring is correct, if STL3 fault still exists, returns to the factory for repair.

Table 15-5

15-8 Test and Fault Confirmation

After wiring the STO circuit in accordance with Section 15-3 Wiring Diagram, follow the steps below to verify that the STO and related detection functions work normally.

1. When the drive is powered on, make sure that the S1–DCM and S2–DCM voltage falls between 11–30 V_{DC}. At this time, the drive should enter Standby mode and wait for RUN command. There is no error displayed on the keypad.
2. Press RUN on the keypad and use the emergency button or other method to make the S1–DCM and S2–DCM voltage fall between 0–5 V_{DC}. At the same time, after the output frequency is reached, the drive should enter Torque Stop mode STO and stop outputting voltage. The keypad displays the STO error, and the response time of the S1 and S2 signals to cause the drive to stop outputting voltage should be ≤ 20 ms. Then restore the S1–DCM and S2–DCM voltage to 11–30 V_{DC}, and press RESET button on the keypad to clear the STO error. The drive should enter Standby mode and wait for RUN command.
3. Press RUN on the keypad and use the emergency button or other method to make the S1–DCM voltage fall between 0–5 V_{DC}, and the S2–DCM voltage remain between 11–30 V_{DC} after the output frequency is reached. At this time, the drive should enter Torque Stop mode STL1 and stop outputting voltage. The keypad displays the STL1 error, and the response time of S1 signals to cause the drive to stop outputting voltage should be ≤ 20 ms. Then restore the S1–DCM voltage to 11–30 V_{DC}. However, pressing RESET button on the keypad cannot clear the STL1 error. You must cycle the power to the drive. Make sure that the S1–DCM and S2–DCM voltage falls between 11–30 V_{DC} and then cycle the power to the drive, then the STL1 error is cleared. The drive should enter Standby mode and wait for RUN command.
4. Press RUN on the keypad and use the emergency button or other method to make the S2–DCM voltage fall between 0–5 V_{DC}, and the S1–DCM voltage remain between 11–30 V_{DC} after the output frequency is reached. At this time, the drive should enter Torque Stop mode STL2 and stop outputting voltage. The keypad displays the STL2 error, and the response time of the S2 signals to cause the drive to stop outputting voltage should be ≤ 20 ms. Then restore the S2–DCM voltage to 11–30 V_{DC}. However, pressing RESET button on the keypad cannot clear the STL2 error. You must cycle the power to the drive. Make sure that the S1–DCM and S2–DCM voltage falls between 11–30 V_{DC} and then cycle the power to the drive, then the STL2 error is cleared. The drive should enter Standby mode and wait for RUN command.
5. If you can conduct these four steps normally in sequence with no other error, then the Safe Torque Off function loop is normal, as shown in Table 15-6 below. However, if a situation that differs from these four steps, or if STL3 occurs, then the Safe Torque Off function loop does not work normally. Refer to Section 15-7 Error Code and Troubleshooting Instructions for details.

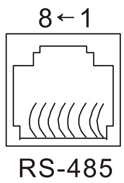
Signal	Status			
S1–DCM	ON	ON	OFF	OFF
S2–DCM	ON	OFF	ON	OFF
Drive output	Ready to output	STL2 mode (Torque output off)	STL1 mode (Torque output off)	STO mode (Torque output off)
Error displayed on the keypad	No error displayed	STL2	STL1	STO
Response time	N.A	≤ 20 ms		
RESET mechanism	N.A	Cycle power to the drive	Cycle power to the drive	Press RESET directly

Table 15-6

- STO means channel 1 and 2 operate simultaneously and enter Safe Torque Off.
- STL1 means channel 1 operates.
- STL2 means channel 2 operates.
- STL3 means there is an error detected in the internal loop of the channel 1 or channel 2.
- S1–DCM / S2–DCM ON (conducted): this means a > 11 V_{DC} power inputs S1–DCM / S2–DCM.
- S1–DCM / S2–DCM ON (open-loop): this means a < 5 V_{DC} power inputs S1–DCM / S2–DCM.

Appendix A. Modbus Protocol

- This appendix helps users to control by computers and monitor drive parameters and status through Modbus by using RS-485 serial communication interface.
- When using the communication interface, the diagram on the right shows the communication port pin definitions. We recommend that you connect the AC motor drive to your PC by using Delta IFD6530 orIFD6500 as a communication converter. The COM port shows on the right side refers to RJ45 terminal on the bottom right corner of the wiring in Chapter 4.



Modbus RS-485
Pin 1, 2, 6: Reserved
Pin 3, 7: GND2
Pin 4: SG-
Pin 5: SG+
Pin 8: D+10V

- The default communication formats for communication port:
  1. Modbus ASCII mode
  2. 9600 bps serial communication baud rates
  3. 7-bit data character
  4. No calibration
  5. 2 stop bit
- Modbus ASCII (American Standard Code for Information Interchange): Each byte of data is the combination of two ASCII characters. For example, one byte of data: 64 Hex, shown as ‘64’ in ASCII, consists of ‘6’ (36Hex) and ‘4’ (34Hex).

A-1. Code Description

The communication protocol is in hexadecimal, ASCII: “0” … “9”, “A” … “F”, every hexadecimal value represents an ASCII code. Example:

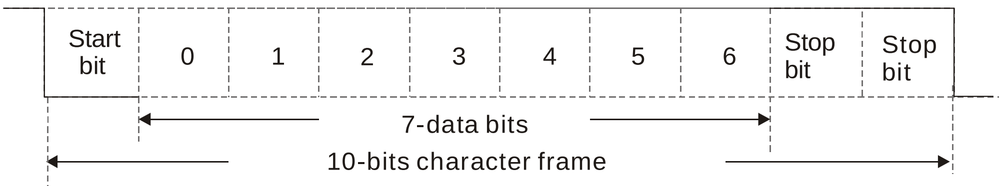
Character	‘0’	‘1’	‘2’	‘3’	‘4’	‘5’	‘6’	‘7’
ASCII code	30H	31H	32H	33H	34H	35H	36H	37H

Character	‘8’	‘9’	‘A’	‘B’	‘C’	‘D’	‘E’	‘F’
ASCII code	38H	39H	41H	42H	43H	44H	45H	46H

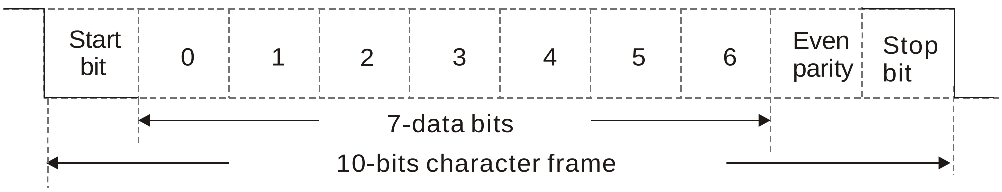
A-2. Data Format

1. 10-bit character frame (For ASCII):

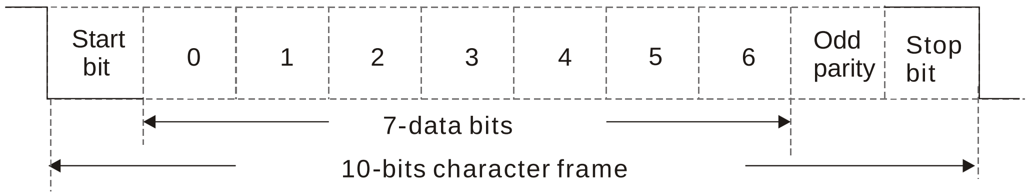
(7, N, 2)



(7, E, 1)

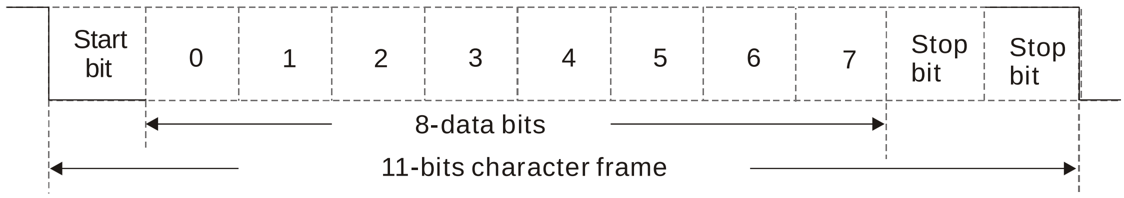


(7, O, 1)

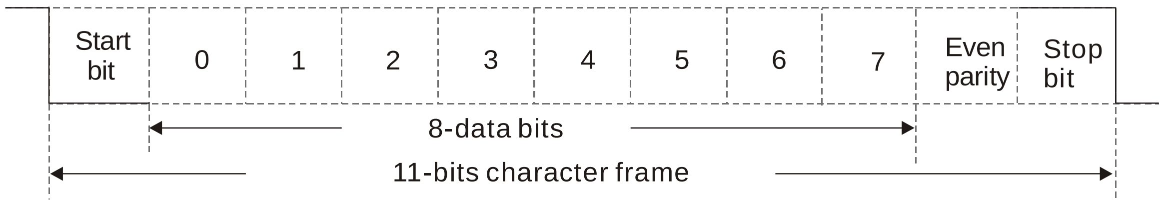


2. 11-bit character frame (For RTU):

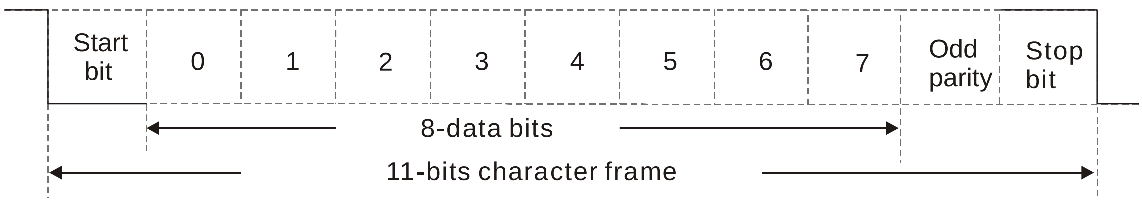
(8, N, 2)



(8, E, 1)



(8, O, 1)



A-3. Communication Protocol

1. Communication Data Frame

ASCII mode:

STX	Start character = ‘ : ’ (3AH)
Address High	Communication address:
Address Low	one 8-bit address consists of 2 ASCII codes
Function High	Command code:
Function Low	one 8-bit command consists of 2 ASCII codes
DATA (n-1)	Contents of data:
…….	n x 8-bit data consists of 2n ASCII codes
DATA 0	n ≤ 16, maximum of 32 ASCII codes (20 sets of data)
LRC CHK High	LRC checksum:
LRC CHK Low	one 8-bit checksum consists of 2 ASCII codes
END High	End characters:
END Low	END High = CR (0DH), END Low = LF (0AH)

RTU mode:

START	Defined by a silent interval of greater than / equal to 3.5 char
Address	Communication address: 8-bit binary address
Function	Command code: 8-bit binary command
DATA (n-1)	Contents of data: n × 8-bit data, n ≤ 16
…….	
DATA 0	
CRC Check Low	CRC checksum: one 16-bit CRC checksum consists of 2 8-bit binary characters
CRC Check High	
END	Defined by a silent interval of greater than / equal to 3.5 char

2. Communication address (Address):

   00H: broadcast to all AC motor drives (Broadcast)

   01H: AC motor drive at address 01

   0FH: AC motor drive at address 15

   10H: AC motor drive at address 16

   :

   FEH: AC motor drive at address 254

3. Function (Function code) and data (Data characters)

   (1) 03H: read data from a register

   Example: Reading two continuous data from register address 2102H. AMD address is 01H.

   ASCII mode:

Request Message

STX	‘:’
Address	‘0’
	‘1’
Function	‘0’
	‘3’
Starting register	‘2’
	‘1’
	‘0’
	‘2’
Number of register (count by word)	‘0’
	‘0’
	‘0’
	‘2’
LRC Check	‘D’
	‘7’
END	CR
	LF

Response Message

STX	‘:’
Address	‘0’
	‘1’
Function	‘0’
	‘3’
Number of register (count by byte)	‘0’
	‘4’
Content of starting register 2102H	‘1’
	‘7’
	‘7’
	‘0’
Content of register 2103H	‘0’
	‘0’
	‘0’
	‘0’
LRC Check	‘7’
	‘1’
END	CR
	LF

RTU mode:

Request Message

Address	01H
Function	03H
Starting data register	21H
	02H
Number of register (count by word)	00H
	02H
CRC Check Low	6FH
CRC Check High	F7H

Response Message

Address	01H
Function	03H
Number of register (count by byte)	04H
Content of register address 2102H	17H
	70H
Content of register address 2103H	00H
	00H
CRC Check Low	FEH
CRC Check High	5CH

(2) 06H: Single write, write single data to a register

Example: Writing data 6000 (1770H) to register 0100H. AMD address is 01H.

ASCII mode:

Request Message

STX	':'
Address	'0'
	'1'
Function	'0'
	'6'
Target register	'0'
	'1'
	'0'
	'0'
Register content	'1'
	'7'
	'7'
	'0'
LRC Check	'7'
	'1'
END	CR
	LF

Response Message

STX	':'
Address	'0'
	'1'
Function	'0'
	'6'
Target register	'0'
	'1'
	'0'
	'0'
Register content	'1'
	'7'
	'7'
	'0'
LRC Check	'7'
	'1'
END	CR
	LF

RTU mode:

Request Message

Address	01H
Function	06H
Target register	01H
	00H
Register content	17H
	70H
CRC Check Low	86H
CRC Check High	22H

Response Message

Address	01H
Function	06H
Target register	01H
	00H
Register content	17H
	70H
CRC Check Low	86H
CRC Check High	22H

(3) 10H: write multiple registers (can write at most 20 sets of data simultaneously).

Example: set the multi-step speed of an AC motor drive (address is 01H): Pr.04-00 = 50.00 (1388H), Pr.04-01 = 40.00 (0FA0H)

ASCII mode:

Command Message

STX	‘:’
ADR 1	‘0’
ADR 0	‘1’
CMD 1	‘1’
CMD 0	‘0’
Target register	‘0’
	‘5’
	‘0’
	‘0’
Number of register (count by word)	‘0’
	‘0’
	‘0’
	‘2’
Number of register (count by Byte)	‘0’
	‘4’
The first data content	‘1’
	‘3’
	‘8’
	‘8’
The second data content	‘0’
	‘F’
	‘A’
	‘0’
LRC Check	‘9’
	‘A’
END	CR
	LF

Response Message

STX	‘:’
ADR 1	‘0’
ADR 0	‘1’
CMD 1	‘1’
CMD 0	‘0’
Target register	‘0’
	‘5’
	‘0’
	‘0’
Number of register (count by word)	‘0’
	‘0’
	‘0’
	‘2’
LRC Check	‘E’
	‘8’
END	CR
	LF

RTU mode:

Command Message

ADR	01H
CMD	10H
Target register	05H
	00H
Number of register (count by word)	00H
	02H
Quantity of data (byte)	04
The first data content	13H
	88H
The second data content	0FH
	A0H
CRC Check Low	‘9’
CRC Check High	‘A’

Response Message

ADR	01H
CMD 1	10H
Target register	05H
	00H
Number of register (count by word)	00H
	02H
CRC Check Low	41H
CRC Check High	04H

4. Checksum

   (1) ASCII mode (LRC Check):

   The check code (LRC Check) is the value added from Address to the end of Data Content, and then takes the complement of 2 + 1. For example: the check code of the request message listed in 3. (1) on page 4: 01H + 03H + 21H + 02H + 00H + 02H = 29H, taking the complement of 2 + 1 = D7H.

   (2) RTU mode (CRC Check):

   CRC (Cyclical Redundancy Check) starts from Address and ends at Data Content. It is calculated by 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, and put the result in the CRC register.

   Step 3: Examine the LSB of CRC register.

   Step 4: If the LSB of CRC register is 0, shift the CRC register one bit to the right, fill MSB with zero, then repeat step 3. If the LSB of CRC register is 1, shift the CRC register one bit to the right, fill MSB with zero, Exclusive OR the CRC register with the polynomial value A001H, then repeat step 3.

   Step 5: Repeat step 3 and 4 until you perform eight shifts. This processes a complete 8-bit byte.

   Step 6: Repeat step 2 through 5 for the next 8-bit byte of the command message. Continue doing this until all bytes are processed. The final contents of the CRC register are the CRC value. When transmitting the CRC value in the message, the upper and lower bytes of the CRC value must be swapped, that is, the lower order byte is transmitted first.

5. 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

   The function returns the CRC value as a type of unsigned integer. 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 CRC
    }
```

A-4. Address List

1. ASCII
   (1) Read one or more parameter values: 3Ah (start bit‘ : ’) + 30h 31h (station address 01) + 30h 33h (function code 03h) + 30h 30h xxh xxh–32h 36h xxh xxh (Modbus address 00xxh–26xxh) + xxh xxh xxh xxh (reading length 1) + LRC (checksum) + CR/LF
   (2) Write one parameter value: 3Ah (start bit‘ : ’) + 30h 31h (station address 01) + 30h 36h (function code 06h) + 30h 30h xxh xxh–32h 36h xxh xxh(Modbus address 00xxh–26xxh) + xxh xxh xxh xxh (writing value) + LRC (checksum) + CR/LF
   (3) Write 20 parameter values: 3Ah (start bit‘ : ’) + 30h 31h (station address 01) + 31h 30h (function code 10h) + 30h 30h xxh xxh–32h 36h xxh xxh (Modbus address 00xxh–26xxh) + 30h 30h 31h 34h (word data length) + 30h 30h 32h 38h(byte data length) + xxh xxh xxh xxh (the first writing value) + ... + xxh xxh xxh xxh (the 20th writing value) + LRC (checksum) + CR/LF

2. RTU
   (1) Read one or more parameter values: 01h (station address 01) + 03h (function code 03h) + 00xxh–26xxh (Modbus address) + xxxxh (reading length) + CRC (checksum)
   (2) Write one parameter value: 01h (station address 01) + 06h (function code 06h) + 00xxh–26xxh (Modbus address) + xxxxh (writing value) + CRC (checksum)
   (3) Write 20 parameter values: 01h (station address 01) + 10h (function code 10h) + 00xxh–26xxh (Modbus address) + 0014h (data length, count by word) + 0028h (data length, count by byte) + xxxxh (the first writing value) + ... + xxxxh (the 20th writing value) + CRC (checksum)

3. AC motor drive parameters (GGnnH): communication station address is Pr.09-00 setting value

Modbus Address	Attribute (Function Code)	Description
GGnnH	R(03H) / W(06H, 10H)	GG means parameter group, nn means parameter number. For example, the Modbus address of Pr.04-10 is 040AH when reading by Delta VFDsoft.

4. Control command (20xx): communication station address is Pr.09-00 setting value

<table>
<tr><th>Function Name</th><th>Modbus Address</th><th>Attribute (Function Code)</th><th>Size</th><th colspan="3">Description</th></tr>
<tr><td rowspan="8">Operation command</td><td rowspan="8">2000H</td><td rowspan="8">R(03H) / W(06H, 10H)</td><td rowspan="8">U16</td><td rowspan="4">bit1–0</td><td>00B: No function</td><td rowspan="8">1. Remains the status specified by a first command until a second command is received.
2. Valid only when operation command source is set to communication (Pr.00-03 = 2).</td></tr>
<tr><td>01B: Stop</td></tr>
<tr><td>10B: Run</td></tr>
<tr><td>11B: JOG + RUN</td></tr>
<tr><td rowspan="4">bit5–4</td><td>00B: No function</td></tr>
<tr><td>01B: FWD command</td></tr>
<tr><td>10B: REV command</td></tr>
<tr><td>11B: Change direction</td></tr>
</table>

Function Name	Modbus Address	Attribute (Function Code)	Size	Description		
			U16	bit7–6	00B: 1st accel. / decel.	Valid only when 2000h bit12 is set to 1. Obtain the current running speed by read 2107h
					01B: 2nd accel. / decel.	
					10B: 3rd accel. / decel.	
					11B: 4th accel. / decel.	
				bit11–8	000B: Master speed	
					0001B: 1st step speed frequency	
					0010B: 2nd step speed frequency	
					0011B: 3rd step speed frequency	
					0100B: 4th step speed frequency	
					0101B: 5th step speed frequency	
					0110B: 6th step speed frequency	
					0111B: 7th step speed frequency	
					1000B: 8th step speed frequency	
					1001B: 9th step speed frequency	
					1010B: 10th step speed frequency	
					1011B: 11th step speed frequency	
					1100B: 12th step speed frequency	
					1101B: 13th step speed frequency	
					1110B: 14th step speed frequency	
					1111B: 15th step speed frequency	
				bit12	1: Enable bit 06–11 function	
Frequency command	2001H	R(03H) / W(06H, 10H)		Frequency command (XXX.XX Hz) There are two decimal places for general-purpose drives; one decimal place for high-speed drives.		
Fault / control command source	2002H	R(03H) / W(06H, 10H)		bit0	1: External Fault (E.F.) ON	To trigger an external fault to the drive to make it stop running. Drive's stop method can be set through drive parameters.

Function Name	Modbus Address	Attribute (Function Code)	Size	Description		
			U16	bit1	1: Reset	To clear the fault status.
				bit2	1: Base Block (B.B) ON	To trigger an external base block to the drive to suspend the operation. When bit = 0 and clear BB situation, the drive returns to the previous operation.
				bit5	1: Enable fire mode	To trigger an external base block to the drive to suspend the operation.
PID reference	2003H	R(03H) / W(06H, 10H)		bit15–0	-10000– +10000 corresponds to -100.00% – +100.00%	

5. When bit = 0 and clear BB situation, the drive returns to the previous operation.

Function Name	Modbus Address	Attribute (Function Code)	Size	Description	
Fault status	2100H	R(03H)	U16	bit7–0: Fault code bit15–8: Warning code	
Drive operation status	2101H	R(03H)		bit1–0	Status of RUN / STOP 00B: Drive fully stops (RUN indicator is OFF / STOP indicator is ON) 01B: Drive is stopping (RUN indicator flashes / STOP indicator is ON) 10B: Drive is in standby status (RUN indicator is ON / STOP indicator flashes) 11B: Drive is running (RUN indicator is ON / STOP indicator is OFF)
				bit2	1: JOG command
				bit4–3	Operation direction 00B: FWD (REV indicator is OFF / FWD indicator is ON) 01B: from REV to FWD (REV indicator flashes / FWD indicator is ON) 10B: from FWD to REV (REV indicator is ON / FWD indicator flashes) 11B: REV (REV indicator is ON / FWD indicator is OFF)
				bit8	1: Master frequency controlled by communication interface

Function Name	Modbus Address	Attribute (Function Code)	Size	Description	
			U16	bit9	1: Master frequency controlled by analog / external terminal signal
				bit10	1: Operation command controlled by communication interface
				bit11	1: Parameter locked
				bit15–13	Status of operation command source of HOA and LOC/REM modes. 000b (0): HOA mode OFF 001b (1): HOA mode HAND-ON 010b (2): HOA mode AUTO-ON 011b (3): LOC/REM mode LOC-ON 100b (4): LOC/REM mode REM-ON
Frequency command	2102H	R(03H)		Frequency command (XXX.XX Hz) 1: Speed mode Speed command 2: Torque mode Speed limit	
Output frequency (Hz)	2103H	R(03H)		Drive's output frequency (XXX.XX Hz)	
Output current	2104H	R(03H)		When the current is higher than 655.35, it automatically shifts one decimal place as XXX.X A. Decimal places can be referred by the high byte of 211F.	
DC bus voltage	2105H	R(03H)		DC bus voltage (XXX.X V)	
Output voltage	2106H	R(03H)		Output voltage (XXX.X V)	
Multi-step speed status	2107H	R(03H)		Drive's current running speed step given by multi-step speed command (0 is main speed)	
Counter value	2109H	R(03H)		The present value of MI	
Output power factor angle	210AH	R(03H)		Drive's output power factor angle (XXX.X°) (0.0 180.0°)	
Output torque	210BH	R(03H)		Output torque (XXX.X %)	
Actual motor speed	210CH	R(03H)		Actual motor speed (XXXXX rpm)	
Power output	210FH	R(03H)		Drive's output power (X.XXX kW)	
Multi-function display	2116H	R(03H)		Display the low word value (Pr.00-04) of user-defined items, the value is low 16 bits data.	
Maximum User-Defined Value	211BH	R(03H)		Maximum Operation Frequency (Pr.01-00) or Maximum User-defined Value (Pr.00-26) ● When Pr.00-26 is 0, this value is equal to Pr.01-00 setting ● When Pr.00-26 is not 0, and the command source is keypad, this value = Pr.00-24 × Pr.00-26 / Pr.01-00 ● When Pr.00-26 is not 0, and the command source is 485, this value = Pr.09-10 × Pr.00-26 / Pr.01-00	

Function Name	Modbus Address	Attribute (Function Code)	Size	Description
Output current digit	211FH	R(03H)	U16	High byte: Current digit (display)

6. Status monitor read only (22xx): communication station address is Pr.09-00 setting value

Function Name	Modbus Address	Attribute (Function Code)	Size	Description
Output current	2200H	R(03H)	U16	Display output current (A). When current is higher than 655.35, it shifts the decimal as XXX.X A. Refer to the high byte of 211F for information on the decimal places.
Counter value	2201H	R(03H)		Counter value
Output frequency (Hz)	2202H	R(03H)		Actual output frequency (XXXXX Hz)
DC bus voltage	2203H	R(03H)		DC bus voltage (XXX.X V)
Output voltage (XXX.X V)	2204H	R(03H)		Output voltage of U, V, W (XXXX.X V)
Power factor angle (XX.X°)	2205H	R(03H)		Power angle (XXX.X)
Power output	2206H	R(03H)		Output power of U, V, W (XXXX.X kW)
Motor actual speed	2207H	R(03H)		Display motor speed in rpm estimated by the drive or encoder feedback (XXXXX rpm)
Output torque	2208H	R(03H)		Display positive/negative output torque in %, estimated by the drive (+0.0: positive torque, -0.0: negative torque) (XXX.X %)
PID feedback value	220AH	R(03H)		Display the PID feedback value after enabling PID function (XXX.XX%)
AVI analog input	220BH	R(03H)		Display the corresponding 0.00–100.0% for the signal value 0–10V of AI analog input terminal when Pr.03-28 = 0.
ACI analog input	220CH	R(03H)		Display the corresponding 0.00–100.0% for the signal value 0 (4)–20mA of AI analog input terminal when Pr.03-28 = 1 or 2.
IGBT temperature	220EH	R(03H)		IGBT temperature of the power module (XXX.X °C)
Capacitor temperature	220FH	R(03H)		Drive's capacitor temperature
Digital input status	2210H	R(03H)		The digital input status (ON / OFF), refer to Pr.02-12 (see Explanation 3 in Pr.00-04)
Digital output status	2211H	R(03H)		The digital output status (ON / OFF), refer to Pr.02-18 (see Explanation 4 in Pr.00-04)
Multi-step speed	2212H	R(03H)		Current step for the multi-step speed operation

<table>
<tr><th>Function Name</th><th>Modbus Address</th><th>Attribute (Function Code)</th><th>Size</th><th colspan="2">Description</th></tr>
<tr><td>The corresponding CPU pin status of digital input</td><td>2213H</td><td>R(03H)</td><td rowspan="19">U16</td><td colspan="2">The corresponding CPU pin status of digital input (d.) (see Explanation 3 in Pr.00-04)</td></tr>
<tr><td>The corresponding CPU pin status of digital output</td><td>2214H</td><td>R(03H)</td><td colspan="2">The corresponding CPU pin status of digital output (O.) (see Explanation 4 in Pr.00-04)</td></tr>
<tr><td>Pulse input frequency</td><td>2216H</td><td>R(03H)</td><td colspan="2">Pulse input frequency (XXX.XX Hz)</td></tr>
<tr><td>Overload counter</td><td>2219H</td><td>R(03H)</td><td colspan="2">Display times of counter overload (XXX.XX %)</td></tr>
<tr><td>GFF, ground fault</td><td>221AH</td><td>R(03H)</td><td colspan="2">GFF (XXX.XX %)</td></tr>
<tr><td>DC bus voltage ripples</td><td>221BH</td><td>R(03H)</td><td colspan="2">Display DC bus voltage ripples (XXX.X V)</td></tr>
<tr><td>Magnetic pole zone</td><td>221DH</td><td>R(03H)</td><td colspan="2">Magnetic field area of the synchronous motor</td></tr>
<tr><td>Display of user-defined output</td><td>221EH</td><td>R(03H)</td><td colspan="2">User page displays the value in physical measure</td></tr>
<tr><td>Pr.00-05 gain value</td><td>221FH</td><td>R(03H)</td><td colspan="2">Output value of Pr.00-05 (XXX.XX Hz)</td></tr>
<tr><td>Control Mode</td><td>2223H</td><td>R(03H)</td><td colspan="2">Control mode of the drive 0: speed mode</td></tr>
<tr><td>Carrier Frequency</td><td>2224H</td><td>R(03H)</td><td colspan="2">Carrier frequency of the drive (XX kHZ)</td></tr>
<tr><td rowspan="5">Drive status</td><td rowspan="5">2226H</td><td rowspan="5">R(03H)</td><td colspan="2">Drive status</td></tr>
<tr><td>bit1–0</td><td>00b: No direction
01b: Forward
10b: Reverse</td></tr>
<tr><td>bit3–2</td><td>01b: Drive is ready
10b: Error</td></tr>
<tr><td>bit4</td><td>0b: Motor drive does not output
1b: Motor drive outputs</td></tr>
<tr><td>bit5</td><td>0b: No warning
1b: Warning</td></tr>
<tr><td>Positive / negative torque</td><td>2227H</td><td>R(03H)</td><td colspan="2">Drive’s estimated output torque (positive or negative direction) (XXXX Nt-m)</td></tr>
<tr><td>kWh</td><td>2229H</td><td>R(03H)</td><td colspan="2">kWh display (XXXX.X)</td></tr>
<tr><td>PID target value</td><td>222EH</td><td>R(03H)</td><td colspan="2">PID target reference (XXX.XX %)</td></tr>
</table>

Function Name	Modbus Address	Attribute (Function Code)	Size	Description
PID Compensation	222FH	R(03H)	U16	PID offset (XXX.XX %)
PID output frequency	2230H	R(03H)		PID output frequency (XXX.XX Hz)
Auxiliary frequency	2232H	R(03H)		Display the auxiliary frequency
Master frequency	2233H	R(03H)		Display the master frequency
Frequency value after addition and subtraction of master and auxiliary frequency	2234H	R(03H)		Display the frequency after adding and subtracting of the master and auxiliary frequencies.

A-5. Exception Response

When the drive is using the communication connection, if an error occurs, the drive responds to the error code and sets the highest bit (bit 7) of the command code to 1 (function code AND 80H) then responds to the control system to signal that an error occurred. If the keypad displays “CE-XX” as a warning message, “XX” is the error code at that time. Refer to the table of error codes for communication error for reference.

Example:

ASCII mode:

STX	‘:’
Address	‘0’
	‘1’
Function	‘8’
	‘6’
Exception code	‘0’
	‘2’
LRC CHK	‘7’
	‘7’
END	CR
	LF

RTU mode:

Address	01H
Function	86H
Exception code	02H
CRC CHK Low	C3H
CRC CHK High	A1H

The explanation of exception codes:

Exception Code	Descriptions
1	Function code is not supported or unrecognized.
2	Address is not supported or unrecognized.
3	Data is not correct or unrecognized.
4	Failure to execute this function code

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Appendix B. Revision History

New Information	
Description	Affected Chapter / Section
Add a new title above the figure of removing RFI jumper to indicate the models without built-in EMC filter and models with built-in EMC filter respectively.	Chapter 1
Add description for using +24V terminal in parallel	Chapter 6
Add weight for reactors	Chapter 7
Add applicable voltage range for capacitive filter	Chapter 7
Add website address of download center for certifications and Declaration of Conformity (DoC)	Chapter 9
New parameters and functions: ● Group 00: Pr.00-47 ● Group 03: Pr.03-19 ● Group 05: Pr.05-00	Chapter 11, Chapter 12
Add summary for warning codes and fault codes	Chapter 13, Chapter 14
Capture Modbus related content from Pr.09-04, and add more information about it	Appendix A.

Modified Information	
Description	Affected Chapter / Section
Update the fifth explanation of **Important points regarding ground connection**	Chapter 1
Move the installation method-ambient temperature derating curves originally placed in Chapter 3 to Chapter 9	Chapter 3, Chapter 9
Update the specification of the heat shrink tubing	Chapter 5
Update the resolution for ACI and AFM	Chapter 6
Update the torque value of M5 screw for EMC filter	Chapter 7
Update the cooling method for 230V 1.5kW models	Chapter 9
Update the pollution level for the operating standards	Chapter 9
Update parameter settings and descriptions: ● Group 00: Pr. 00-02, Pr.00-20, Pr.00-27, Pr.00-30, Pr.00-33, Pr.00-34, Pr.00-36 ● Group 02: Pr.02-00, Pr.02-01–Pr.02-05 (setting value: 1–4, 6, 28, 94, 95), Pr.02-12 ● Group 03: Pr.03-19, Pr.03-20 (setting value: 5) ● Group 05: Pr,05-26–Pr.05-30 ● Group 06: Pr.06-01, Pr.06-16, Pr.06-81, Pr.06-88 ● Group 07: Pr.07-08, Pr.07-13 ● Group 08: Pr.08-23 ● Group 09: Pr,09-04, Pr.09-30 ● Group 10: Pr.10-16	Chapter 11, Chapter 12
Update motor adjustment procedures of PMSVC	Section 12-2
Update 87_oL3, 15_orP	Chapter 14
Update the descriptions for S1, S2, DCM	Chapter 15

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