Digitized Automation for a Changing World

Delta CANopen Communication Compact Drive VFD-EL-C Series User Manual

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*We reserve the right to change the information in this manual without prior notice.

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Limitation of Liability

Thank you for using Delta's compact built-in CAN communication drive VFD-EL-C series.

The VFD-EL-C series is manufactured using high-quality components, materials and incorporating the latest embedded control technology.

This product description provides users with precautions related to installation, parameter setting, abnormal diagnosis, troubleshooting and daily maintenance of the drive. In order to ensure correct installation and operation, please read this product manual carefully before installing the drive, and please keep it properly and hand it over to the user of the machine.

For the safety of the operator and mechanical equipment, it must be installed, tested and adjusted by professional electrical engineering personnel. There are symbols such as [Danger] and [Caution] in this product description. Please be sure to read it carefully. If you have any doubts, please contact our agents.

PLEASE READ PRIOR TO INSTALLATION FOR SAFETY.

DANGER	☑ Disconnect AC input power before connecting any wiring to the AC motor drive. ☑ Even if the power has been turned off, a charge may still remain in the DC-link capacitors with hazardous voltages before the POWER LED is OFF. Do not touch the internal circuits and components. ☑ There are highly sensitive MOS components on the printed circuit boards. These components are especially sensitive to static electricity. Take anti-static 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. ☑ This series is used to control the variable speed operation of three-phase induction motors, and cannot be used for single-phase motors or for other purposes. ☑ This series cannot be used in situations that endanger personal safety. ☑ Please prevent children or general irrelevant persons from approaching the drive.
CAUTION	☑ Never connect the AC motor drive output terminals U/T1, V/T2 and W/T3 directly to the AC mains circuit power supply. ☑ Do not perform withstand voltage test on the components inside the drive, the semiconductor used in the drive is easily damaged by high voltage breakdown. ☑ 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. ☑ Only qualified persons are allowed to install, wire and maintain the AC motor drives. ☑ When using an external terminal as the source of the running command, the motor may start to run immediately after the power is input. It may cause danger if there are people near the drive. ☑ Install the drive in a safe area to prevent high temperature and direct sunlight, and avoid splashing of moisture and water droplets. ☑ Please comply with the installation precautions when installing the drive. Unapproved use environment may cause fire, gas explosion, electric shock and other incidents.

☑ When the wiring between the drive and the motor is too long, the interlayer insulation of the motor may be damaged. Please use an AC motor dedicated to the drive, or install a reactor between the drive and the AC motor (refer to Appendix A) to avoid damage to the AC motor due to insulation damage.

☑ 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 230V models, the range is between 180–264 V.
For 460V models, the range is between 342–528 V.

☑ If the motor drive produces a leakage current of over AC 3.5mA or over DC 10mA, the minimum specifications required of the Protective Earthing conductor have to be a copper wire with a cross-sectional area of at least 10 mm^2, an aluminum wire with a cross-sectional area of 16 mm^2, or install an earth leakage circuit breaker.

NOTE:

● 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.

● 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.

● 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.

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Chapter 1 Use and Installation

The product should be in the box when customers received. If the machine is not used temporarily, for the safety of the maintenance during the warranty period of our company, be sure to pay attention to the following points when storing the machine:

⚠️ **CAUTION**	☑ The machine must be placed in a ventilated, dust-free and dry location.
	☑ The ambient temperature of the storage location must be in the range of -20°C to +60°C.
	☑ The relative humidity of the storage location must be in the range of 0% to 90% with no condensation.
	☑ Avoid storing the machine in environments containing corrosive gases or liquids.
	☑ Avoid placing the machine on the ground, but should place it on a suitable stand. And place a desiccant in the packaging bag if the surrounding environment is harsh.
	☑ Avoid installing the machine in places exposed to direct sunlight or vibrations.
	☑ Even if the humidity meets the specification requirements, condensation and freezing may occur when the temperature changes sharply which location should be avoided.
	☑ If the machine has been opened and used for more than 3 months, the ambient temperature of the storage environment should not be higher than 30°C. It is considered that when the electrolytic capacitor is stored without electricity, its characteristics are easily deteriorated when the ambient temperature is too high. Do not leave the machine unpowered for more than a year.
	☑ When the motor drive is installed in a device or control panel and is not in use (especially in a construction site or in a humid and dusty place), the drive should be removed and placed in a suitable environment meets the above-mentioned storage conditions.

1-1 Product Profile
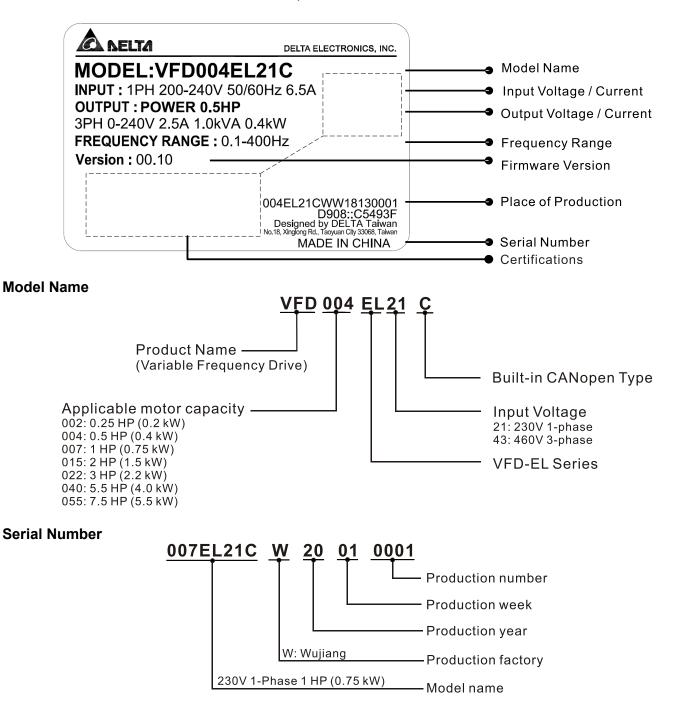
Each VFD-EL-C is subject to strict quality control and enhanced anti-collision packaging before shipment. After the customer unpacks the drive, please carry out the following inspection steps immediately.

☑ Check whether the drive has been damaged during transportation.

☑ After unpacking, check the model of the drive is consistent with the data in the outer box.

If there is any inconsistency with your ordering information or any questions about the product, please contact the agent or distributor.

Nameplate Information

Take 1 HP/0.4 kW 230V 1-Phase as an example

Model Name

Serial Number

Appearance

Frame A1

Input terminals
(R/L1, S/L2, T/L3)

Digital keypad

Control board cover

Output terminals
(U/T1, V/T2, W/T3)
Ground terminals

A: Digital keypad
B: Control terminals
C: CAN Connect 1
(RJ45)
D: CAN Connect 2
(RJ45)

Frame A2

Input terminals
(R/L1, S/L2, T/L3)

Digital keypad

Control board cover

Output terminals
(U/T1, V/T2, W/T3)
Ground terminals

A: Digital keypad
B: Control terminals
C: CAN Connect 1
(RJ45)
D: CAN Connect 2
(RJ45)

Frame B

Input terminals
(R/L1, S/L2, T/L3)

Digital keypad

Case

Control board cover

Output terminals
(U/T1, V/T2, W/T3)

Ground terminals

A: Digital keypad
B: Control terminals
C: CAN Connect 1
    (RJ45)
D: CAN Connect 2
    (RJ45)
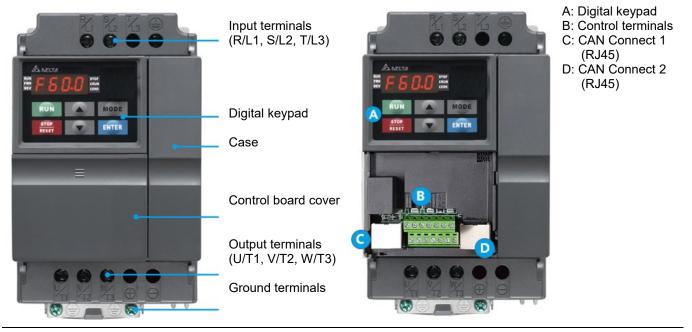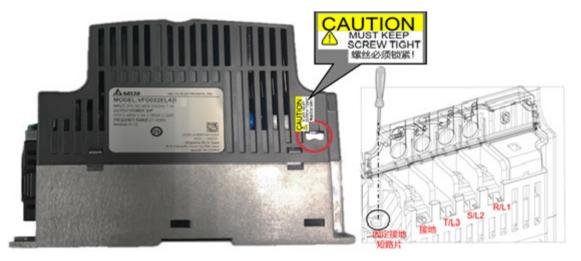
Frame	Capacity	Model
A1 Keypad Panel Mounting:	0.25–1 HP (0.2–0.75 kW)	VFD002EL21C, VFD004EL21C / 43C, VFD007EL21C / 43C
A2	2 HP (1.5 kW)	VFD015EL43C
B	2–5.5 HP (1.5–5.5 kW)	VFD015EL21C, VFD022EL21C / 43C, VFD040EL43C, VFD055EL43C

Table 1-1

RFI Jumper switch

NOTE:

If the grounding system is required or the leakage current is too large to cause the leakage protection device to trip, loosen the screws next to the input side of (R/L1, S/L2, T/L3) and remove the grounding short-circuit metal sheet.

Note: To re-tighten the loosened screws to keep the grounding well to prevent electric shock after removing the grounding shorting piece.

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) 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.

  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. Removing the RFI jumper disconnects the internal capacitors from ground to avoid damaging the internal circuits and to reduce the ground leakage current.

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 capacitors. Compliance with the EMC specifications is no longer guaranteed.

Reliable electrical isolation cannot be maintained if the ground shorts are removed. In other words, all control inputs and outputs can only be regarded as low-voltage terminals with basic electrical isolation. In addition, the electromagnetic compatibility of the frequency converter will be reduced by removing the grounding shorts.

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

☑ The short-circuit piece must be removed during the high voltage test, and be sure to tighten the screws securing the shorting strip after removing the shorting strip. When conducting a high voltage test to the entire facility, disconnect the mains power and the drive if the leakage current is too high.

☑ If the drive is installed in a non-grounded power system or a high-impedance grounded power system (over 30Ω) or a corner-grounded TN system, the grounding short must be removed to avoid the machine damage. After removing the jumper, the screws fix the jumper must be tightened.

Remove step

Remove the control terminal slide	Remove the fan
Press the control board terminal slide cover lightly as shown in Figure A first, and then slide it down as shown in Figure B to remove it easily.	Frame B Press the buckles on the left and right sides of the fan lightly and pull up to remove the fan.

Figure A

Figure B

1-2 Product Installation
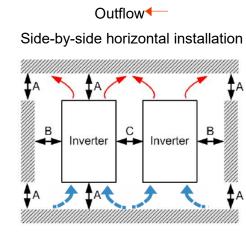
Please install the drive in the following environmental conditions to ensure the safety of the product:

Operating Environmental Conditions	Ambient temperature	-10°C–+50°C NOTE 1
	Rated Humidity	< 90%, no frosting
	Air Pressure	86–106 kPa
	Altitude	< 1000 m
	Vibration	1.0 mm, peak to peak value range from 2–13.2 Hz; 0.7–1.0 G range from 13.2–55 Hz; 1.0 G range from 55–512 Hz. Compliance with IEC 6006826
Storage / Transportation	Ambient temperature	-20°C–+60°C (-4°F–140°F)
	Rated Humidity	< 90%, no frosting
	Air Pressure	86–106 kPa
	Vibration	1.0 mm, peak to peak value range from 2–13.2 Hz; 0.7–1.0 G range from 13.2–55 Hz; 1.0 G range from 55–512 Hz. Compliance with IEC 6006826
Pollution Degree	Level 2: Suitable for low-to-medium pollution factory environments	

Table 1-2
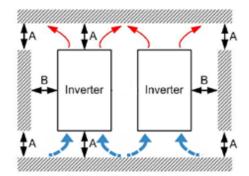
NOTE:

1. The VFD007EL21C needs to install the fan accessory MKEL-AFKM1, and the upper limit of the ambient temperature operation can reach 50°C.

Mounting Clearance

Inflow	Outflow	Distance
Single drive installation	Side-by-side horizontal installation	Zero stack installation

Model	Installation Method	Minimum distance (mm)			Ambient temperature (ºC)	
		A	B	C NOTE 1	Max. (Without derating)	Max. (derating)
VFD002EL21C VFD004EL21C VFD004EL43C	Single drive installation	120	50	-	50	60
	Side-by-side horizontal installation	120	50	30	50	60
	Zero stack installation	-	-	-	-	-
VFD007EL21C	Single drive installation	120	50	-	50 NOTE 4	60
	Side-by-side horizontal installation	120	50	30	50 NOTE 4	60
	Zero stack installation	-	-	-	-	-
VFD007EL43C VFD015EL43C	Single drive installation	120	50	-	50	60
	Side-by-side horizontal installation	120	50	30	50	60
	Zero stack installation	-	-	-	-	-
VFD015EL21C VFD022EL21C VFD022EL43C VFD040EL43C VFD055EL43C	Single drive installation	150	50	-	50	60
	Side-by-side horizontal installation	150	50	30	50	60
	Zero stack installation	150	50	0	40	50

Table 1-3

NOTE:
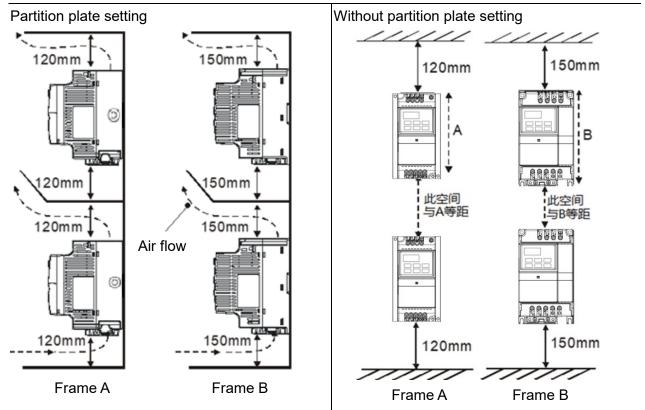
1. The shape of the heat sink of frame A1 / A2 protrudes from the left and right plastic shell bodies, therefore, the horizontal side-by-side installation distance C is calculated based on the position of the plastic shell of the drive.

2. Frame A1 / A2 does not support zero stack installation. Frame B supports zero stack installation.

3. When the ambient temperature exceeds the column of "Max. (without derating)", full load operation will shorten the service life of the drive.

4.   When the model VFD007EL21C is equipped with a fan accessory, the upper limit of the ambient operating temperature is as shown in the table above; when there is no fan accessory, the upper limit of the corresponding ambient operating temperature is 10ºC lower than the temperature value in the table (refer to Appendix B-3-3 for the installation of fan accessories).

☑ The drive should be installed vertically on a solid structure with screws. Do not install it upside down, obliquely or horizontally.

☑ Heat is generated when the drive is running. To ensure the passage of cooling air should be as shown. The design leaves a certain space that the heat generated can be dissipated upwards. Do not install it under the equipment which is not heat-resistant. It is necessary to consider ventilation and heat dissipation in the control panel to ensure the ambient temperature of the drive does not exceed the specified value. Do not install the drive in an airtight box with poor ventilation and heat dissipation, which may easily cause machine failure due to overheating

☑ When the drive is running, the temperature of the heatsink plate can rise up to nearly 90ºC. Therefore, the mounting surface on the back of the drive must be made of a metal material which can withstand higher temperatures and have good heat dissipation.

☑ To installing multiple drives in the same control panel, it is recommended to install them horizontally side by side in order to reduce mutual thermal influence. If upper and lower installations are required, a partition plate must be installed to reduce the effect of the heat generated in the lower part on the upper part.

Partition plate setting — Frame A — Frame B — Air flow

Without partition plate setting — Frame A — Frame B

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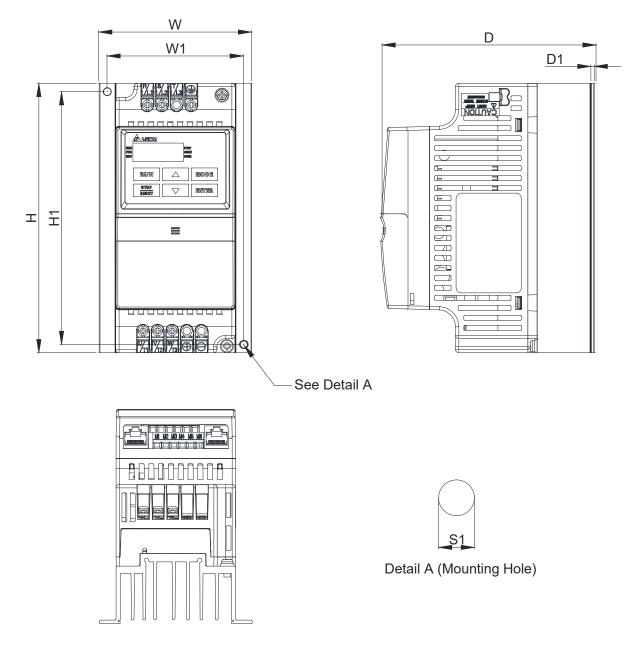
Prevent fiber particles, scraps of paper, shredded wood, sawdust, metal particles, etc. from adhering to the heat sink.

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.

1-3 Product Dimensions

Frame A1
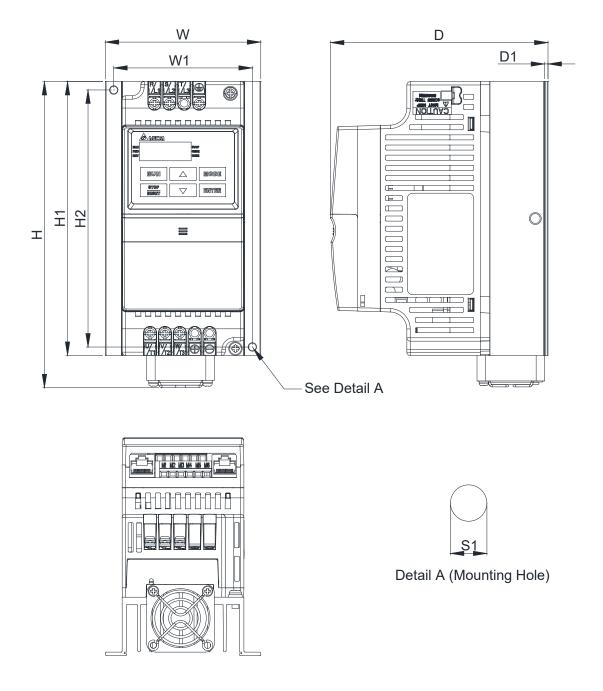
VFD002EL21C, VFD004EL21C, VFD004EL43C, VFD007EL21C, VFD007EL43C

See Detail A

Detail A (Mounting Hole)

Unit: mm [inch]

Frame	W	W1	H	H1	D	D1	S1
A1	92.0 [3.62]	82.0 [3.23]	162.0 [6.38]	152.0 [5.98]	128.7 [5.07]	2.0 [0.08]	5.4 [0.21]

Table 1-4

Frame A2

VFD015EL43C
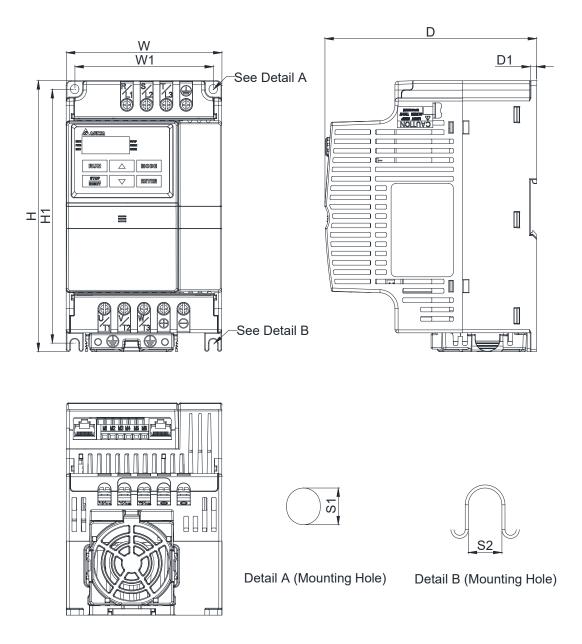
See Detail A

Detail A (Mounting Hole)

Unit: mm [inch]

Frame	W	W1	H	H1	H2	D	D1	S1
A2	92.0 [3.62]	82.0 [3.23]	180.5 [7.11]	162.0 [6.38]	152.0 [5.98]	128.7 [5.07]	2.0 [0.08]	5.4 [0.21]

Table 1-5

Frame B

VFD015EL21C, VFD022EL21C, VFD022EL43C, VFD040EL43C, VFD055EL43C

Detail A (Mounting Hole)   Detail B (Mounting Hole)

Unit: mm [inch]

Frame	W	W1	H	H1	D	D1	S1	S2
B	100.0 [3.94]	89.0 [3.50]	174.0 [6.85]	162.9 [6.42]	136.0 [5.35]	4.0 [0.16]	5.9 [0.23]	5.4 [0.21]

Table 1-6

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1-14

Chapter 2 Wiring

After removing the Input/output side terminal slide cover and control board terminal slide 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. In order to avoid danger, customers can wait at least 5 minutes before starting wiring after the digital panel display light goes out. If the AC motor drive does not fully discharge, and assemble the wiring with a residual voltage may cause personal injury, sparks and a short circuit. Ensure your safety to use AC motor drive with no voltage. ☑ 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 electric shock or fire accident and reduce noise interference. ☑ Tighten the screws of the main circuit terminals to prevent sparks caused by screws loosened due to vibration.
⚠ **CAUTION**	☑ For your safety, choose wires that comply with local 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?
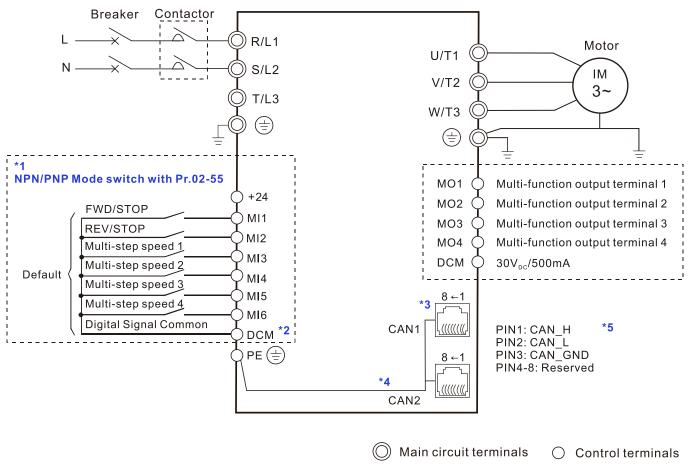
2-1 Wiring Instructions

The wiring is divided into the main circuit and the control circuit, the user must connect according to the following wiring circuits.

Recommended Wiring Diagram for VFD-EL-C

230V 1-PHASE

VFD002EL21C, VFD004EL21C, VFD007EL21C, VFD015EL21C, VFD022EL21C
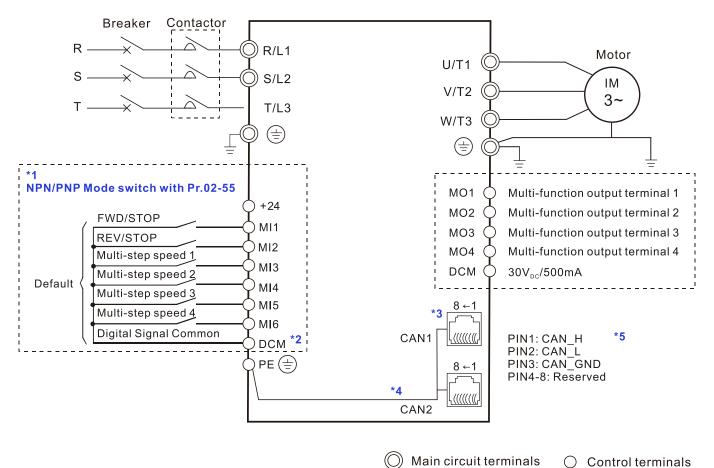
Figure 2-1

*1. The MI digital input terminal is switch with NPN/PNP mode. In addition to the correct wiring, it needs to be switched with Pr.02-55. The default setting Pr.02-55 is 0: NPN mode.

*2. The MI digital input terminal and the MO digital output terminal share the same ground, the terminal is DCM.

*3. CAN1/CAN2 terminals (two-way RJ45) internal lines are connected in parallel, logically they are the same way.

*4. RJ45 terminal metal shield shell internal connect with the PE terminal.

*5. RJ45 terminal PIN4 to 8 is reserved for on-site adjustment, please do not connect any cable to prevent abnormal function.

460V 3-PHASE:
VFD004EL43C, VFD007EL43C, VFD015EL43C, VFD022EL43C, VFD040EL43C, VFD055EL43C
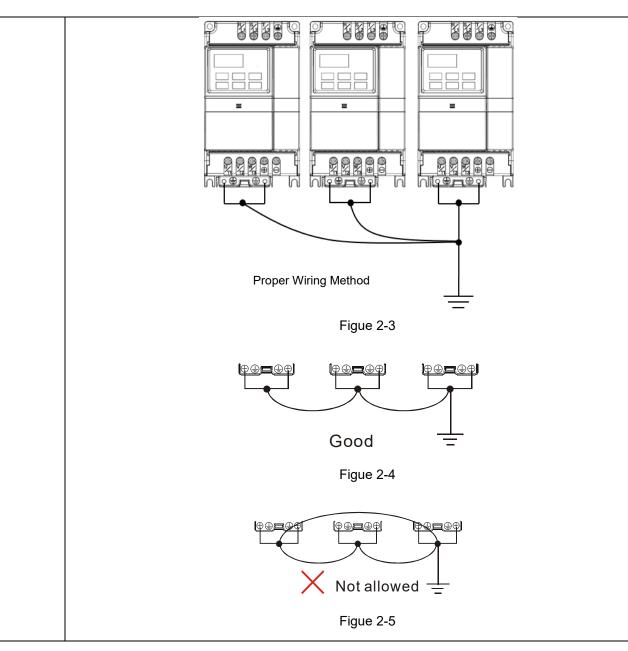
Figure 2-2

*1. The MI digital input terminal is switch with NPN/PNP mode. In addition to the correct wiring, it needs to be switched with Pr.02-55. The default setting Pr.02-55 is 0: NPN mode.

*2. The MI digital input terminal and the MO digital output terminal share the same ground, the terminal is DCM.

*3. CAN1/CAN2 terminals (two-way RJ45) internal lines are connected in parallel, logically they are the same way.

*4. RJ45 terminal metal shield shell internal connect with the PE terminal.

*5. RJ45 terminal PIN4 to 8 is reserved for on-site adjustment, please do not connect any cable to prevent abnormal function.

⚠️ **CAUTION**	☑ Separate the main circuit and control circuit wiring to prevent erroneous actions.
	☑ Use shielded wire for the control wiring and do not expose the peeled-off shield in front of the terminal.
	☑ Use shielded wire or conduit for the power wiring and ground the two ends of the shielded wire or conduit.
	☑ Usually control wires are not well insulated. Damaged insulation of wiring may cause personal injury or damage to circuits and equipment if it comes in contact with high voltage.
	☑ The AC motor drive, motor and wiring may cause interference. To prevent equipment damage, take care of interference between the surrounding sensors and the equipment.
	☑ Connect the AC drive output terminals U/T1, V/T2, and W/T3 to the motor terminals U/T1, V/T2, and W/T3, respectively. To permanently reverse the direction of motor rotation, switch over any of the two motor leads.
	☑ With long motor cables, high capacitive switching current peaks can cause over-current, high leakage current or lower current readout accuracy. To prevent this, the motor cable should be less than 20 m for 4.0 kW models and below. The cable should be less than 50 m for 5.5 kW models and above. For longer motor cables, use an AC output reactor.
	☑ The AC motor drives, electric welding machines and the larger horsepower motors should be grounded separately.
	☑ The VFD-EL-W series does not have a built-in brake unit, and no support for external brake unit and brake resistor.
	☑ When grounding, choose wires that comply with local regulations for your safety.
	☑ To prevent lightning strike and electric shock, the metal grounding wire of electrical equipment should be thick and short, and connected to the dedicated grounding terminal of the motor drive system.
	☑ You can install multiple VFD-EL-W units in one location. All the units should be grounded directly to a common ground terminal, as shown in the figure below. Ensure that there are no ground loops.

Proper Wiring Method

Figue 2-3

Good

Figue 2-4

✕ Not allowed

Figue 2-5
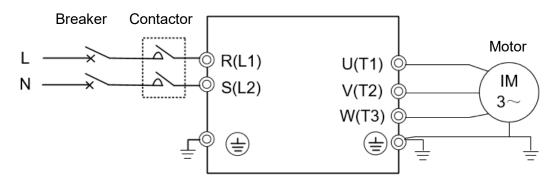
2-2 System Wiring Diagram

Power Input Terminal

Power input terminal	Please follow the specific power supply requirements in Chapter 4.
Fuse	There may be an inrush current during power-up. Please check the chart in Appendix A-1 and select the correct fuse for the rated current.
Magnetic 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)	Use to improve the input power factor, reduce harmonics and provide protection from AC line disturbances (such as surges, switching spikes, short interruptions). Install an AC line reactor when the power supply capacity is 500 kVA or more, or advanced capacity is activated. The wiring distance should be within 10 m. Refer to Appendix A-2-1 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 Appendix A-2-2 for details.
EMC Filter	Use to reduce electromagnetic interference.
AC reactor (output terminal)	Motor surge voltage amplitude depends on motor cable length. For applications with long motor cable (>20 m), install a reactor at the drive output side. Refer to Appendix A-2-1 for details.

Breaker

Contactor

AC reactor (input terminal)

Zero-Phase Reactor

EMC Filter

R/L1 S/L2 T/L3

U/T1 V/T2 W/T3

Zero-Phase Reactor

Input AC line reactor

Motor

Figue 2-6
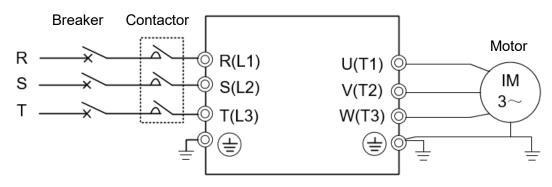
2-3 Main circuit terminal description

Main Circuit Diagram

230V 1-PHASE

Figue 2-7

460V 3-PHASE

Figue 2-8

Terminals	Descriptions
R/L1, S/L2, T/L3	Mains input terminals (one / three-phase)
U/T1, V/T2, W/T3	Motor drive output terminals for connecting three-phase induction motor
⏚	Ground connection. Please comply with local regulations.

Table 2-1

⚠️ CAUTION	Main input power terminals:
	☑ DO NOT connect a three-phase model to one-phase power. R/L1, S/L2 and T/L3 have no phase-sequence requirement; they can be connected in any sequence.
	☑ You must install a breaker between the three-phase power input terminals and the main circuit terminals (R/L1, S/L2, T/L3). Add a magnetic contactor (MC) to the power input wiring to cut off power quickly and reduce malfunctions when the AC motor drive protection function activates. Both ends of the MC should have an R-C surge absorber.
	☑ Tighten the screws in the main circuit terminal to prevent sparks caused by screws loosened due to vibration.
	☑ Use voltage and current within the specifications in Chapter 09. Refer to Appendix A for Standard Specifications.
	☑ When using a leak breaker for leakage fault protection, use a current sensor with sensitivity of 200 mA or above and not less than 0.1 second operation time to prevent the residual current circuit breaker from malfunctioning. When using a leak breaker, use a current sensor with sensitivity of 30 mA.
	Output terminals of the main circuit:
	☑ The default for the operation direction is running forward. Since the standard accessory of VFD-EL-C is a simple panel operation interface which cannot judge the direction directly. The method to control the running direction is to set by the communication parameters. Refer to the Parameter Group 09 for details.
	☑ 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.
	☑ Use a well-insulated motor to avoid the leakage.

Main Circuit Terminal Specifications

Frame A1   Frame A2   Frame B

Figue 2-9   Figue 2-10   Figue 2-11

Frame	Models	Main Circuit Terminals R/L1, S/L2, T/L3,U/T1, V/T2, W/T3, ⏚		
		Max. Wire Gauge	Min. Wire Gauge	Screw & Torque (±10%)
A1	VFD002EL21C	4 mm² [12 AWG]	2.5 mm² [14 AWG]	M4 15 kg-cm [13 lb-in] [1.47 Nm]
	VFD004EL21C			
	VFD004EL43C			
	VFD007EL21C		4 mm² [12 AWG]	
	VFD007EL43C		2.5 mm² [14 AWG]	
A2	VFD015EL43C			
B	VFD015EL21C	10 mm² [8 AWG]	10 mm² [8 AWG]	M4 13 kg-cm [11.4 lb-in] [1.3 Nm]
	VFD022EL21C			
	VFD022EL43C		2.5 mm² [14 AWG]	
	VFD040EL43C			
	VFD055EL43C			

Table 2-2

Note:

1. If you install at Ta 50°C environment, use copper wires that are temperature resistant to 75°C or 90°C. If you install at Ta 50°C above environment, use copper wires that are temperature resistant to 90°C or above.

2. For VFD007EL21C:
   If you install at Ta 40°C environment, use copper wires that are temperature resistant to 75°C or 90°C. If you install at Ta 40°C above environment, use copper wires that are temperature resistant to 90°C or above.

3. For VFDxxxEL21C: use copper wires that have a voltage rating of 300V_{AC} or above.
   For VFDxxxEL43C: use copper wires that have a voltage rating of 600V_{AC} or above.

2-4 Control circuit terminal description

Figue 2-12 Control Terminal Location Diagram

Terminal	Function Description	Default (NPN mode, Pr.02-55=0)
MI1	Multi-function Output (Default: no function)	External terminal control: MI1–MI3 supports the two / three-wire start function. Communication control: MI1–MI6 can be used as multi-function input options. ON: activation current is 6.0 mA (with 24V power)☐ OFF: cut-off voltage is 10 µA
MI2		
MI3		
MI4		
MI5		
MI6		
PE	Ground connection; comply with local regulations.	PE terminal is for shielded cable to grounding to decrease the interference when you use RS485 communication CAN1 and CAN2.
+24V	Digital control signal common (Source)	The total output capacity of the 24V power supply is 60 mA, 1) When using the MI terminal, the current capacity required for the terminal action should be deducted accordingly. 2) Do not overload to avoid damage to the internal circuit of the drive.
DCM	Digital control signal common (Sink)	
MO1	Multifunctional digital output terminal	The drive outputs various monitoring signals by MOSFET (Open Drain method). Such as running, frequency arrival, overload indication and other signals. Load capacity: 500 mA Maximum voltage: 30 V_{DC} Note: When the DO output drives the relay, the inverting diode freewheeling must be connected in parallel to avoid the MOSFET damage.
MO2	Multifunctional digital output terminal	
MO3	Multifunctional digital output terminal	
MO4	Multifunctional digital output terminal	
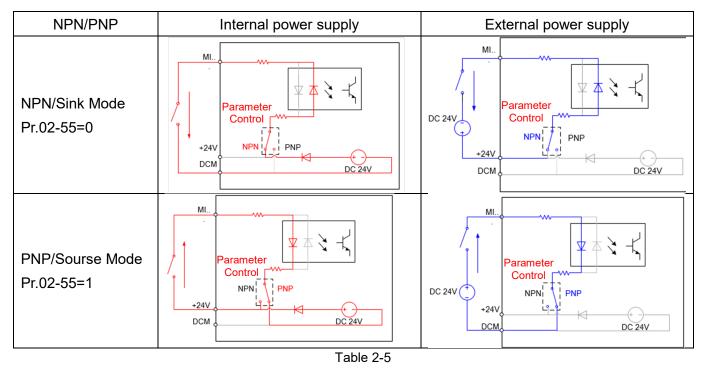
Table 2-3

Main Circuit Terminal Specifications

Frame	Model	Wire Gauge	Double row terminal torque (±10%)
A1	VFD002EL21C	24–18 AWG [0.2–0.8 mm^2]	2 kg-cm [1.7 lb-in] [0.2 Nm]
	VFD004EL21C		
	VFD004EL43C		
	VFD007EL21C		
	VFD007EL43C		
A2	VFD015EL43C		
B	VFD015EL21C		
	VFD022EL21C		
	VFD022EL43C		
	VFD040EL43C		
	VFD055EL43C		

Table 2-4

2-5 NPN and PNP mode

NPN/PNP	Internal power supply	External power supply
NPN/Sink Mode Pr.02-55=0		
PNP/Sourse Mode Pr.02-55=1		

Table 2-5

Note:

1. In NPN/PNP mode, in addition to the correct wiring according to the above figure, it is also necessary to match the Pr.02-55 setting for internal circuit switching (defaultis 0: NPN mode).

2. +24V-DCM internal 24V total power load capacity is 60 mA. For the output capability of other external loads, deduct the corresponding number of MI terminals current consumption (6 mA per MI terminal).

3. If the VFD007EL21C needs to install fan accessories which is powered from +24V-DCM. At this time, except for the normal use of the MI terminal, other external loads are not allowed to avoid overloading the +24V terminal and damage the motor drive.

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2-14

Chapter 3 Operation panel description and test run

3-1

3-1 Panel Description

3-2 Operation mode

3-3 Test run

CAUTION	☑ Please check the wiring again before running. Especially the output terminals U/T1, V/T2 and W/T3 cannot be connected to the input power supply, and the grounding terminal E is well grounded. ☑ Check the motor is not connected to the load mechanism. ☑ Do not operate the switch with wet hands. ☑ Check the digital panel displays F60.0 or F50.0 when the power is turned on.
DANGER	☑ If the operation of the drive and the motor is abnormal, stop the operation immediately and refer to "Troubleshooting" to check the cause of the abnormal. After the drive stops output, touching the output terminals U, V, W of the drive before disconnecting the main circuit power terminals L1/R, L2/S, L3/T may result in electric shock.

3-1 Panel Description

VFD-EL-C series operate and display functions through a digital operation panel.

❶ **Status Display**
  Display the drive's current status: RUN, STOP, FWD, REV, CAN RUN, CAN ERROR

❷ **LED Display**
  Indicates frequency, current, voltage, running direction, user-defined units, faults, etc.
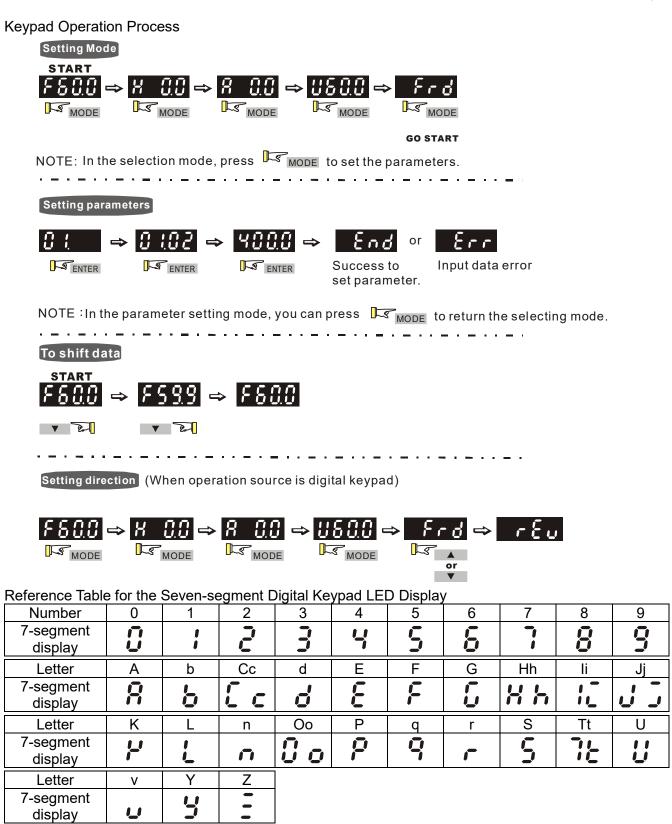
❸ **UP/DOWN Key**
  Select parameters and sets/changes parameter settings

There are four kinds of indicator lights on the panel.

● STOP   STOP indicator light: shows the operation is stopped.

● RUN   RUN indicator light: indicator will light up when the motor is set to RUN.

● FWD   Forward rotation indicator light: indicator will light up when the motor is running in forward direction.

● REV   Reverse rotation indicator light: indicator will light up when the motor is running in reverse direction.

● CRUN   CAN communication running indicator light: refer to Section 6, CANopen LED Indicator Display in Chapter 5.

● CERR   CAN communication error indicator light: refer to Section 6, CANopen LED Indicator Display in Chapter 5.

Descriptions of keypad functions

Displayed items	Descriptions
RUN FWD REV **F60.0** STOP	Displays the present frequency setting for the drive.
RUN FWD REV **H50.0** STOP	Displays the actual output frequency to the drive.
RUN FWD REV **U180** STOP	Displays the user-defined output of a physical quantity (U = F x Pr.00-05).
RUN FWD REV **A 5.0** STOP	Displays the load current.
RUN FWD REV **Frd** STOP	Forward command
RUN FWD REV **rEu** STOP	Reverse command
RUN FWD REV **c 20** STOP	Displays the count value.
RUN FWD REV **06.00** STOP	Displays a parameter item.
RUN FWD REV **10** STOP	Displays a parameter value.
RUN FWD REV **EF** STOP	Displays an external fault.
RUN FWD REV **End** STOP	Displays "End" for approximately one second if the data has been accepted and automatically stored in the register.
RUN FWD REV **Err** STOP	Displays if the setting data is not accepted or data value exceeds the allowed range.

Keypad Operation Process

Setting Mode

START

F60.0 ⇒ H 0.0 ⇒ A 0.0 ⇒ U60.0 ⇒ Frd

MODE · MODE · MODE · MODE · MODE

GO START

NOTE: In the selection mode, press MODE to set the parameters.

- - - - - - - - - - - - - - - -

Setting parameters

01. ⇒ 01.02 ⇒ 400.0 ⇒ End or Err

ENTER · ENTER · ENTER · Success to set parameter. · Input data error

NOTE：In the parameter setting mode, you can press MODE to return the selecting mode.

- - - - - - - - - - - - - - - -

To shift data

START

F60.0 ⇒ F59.9 ⇒ F60.0

▼ · ▼

- - - - - - - - - - - - - - - -

Setting direction (When operation source is digital keypad)

F60.0 ⇒ H 0.0 ⇒ A 0.0 ⇒ U60.0 ⇒ Frd ⇒ rEu

MODE · MODE · MODE · MODE · ▲ or ▼

Reference Table for the Seven-segment Digital Keypad LED Display

Number	0	1	2	3	4	5	6	7	8	9
7-segment display	O	I	2	3	4	5	6	7	8	9
Letter	A	b	Cc	d	E	F	G	Hh	Ii	Jj
7-segment display	A	b	Cc	d	E	F	G	Hh	Ii	JJ
Letter	K	L	n	Oo	P	q	r	S	Tt	U
7-segment display	Y	L	n	Oo	P	q	r	S	Tt	U
Letter	v	Y	Z							
7-segment display	u	y	Z							

3-2 Operation mode

To select digital operator, external control terminal, RS-485 communication or CANopen communication by Pr.00-20 and 00-21.

A: Digital keypad

B: Control terminals

C: CAN Connect 1

    (RJ45)
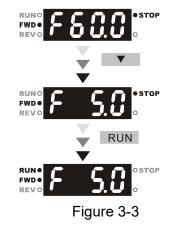
D: CAN Connect 2

    (RJ45)

Operation mode	Operation Command
Digital Keypad Pr.00-20 = 0	 Figure 3-1 RUN、STOP / RESET as shown in the figure
External control terminal Pr.00-20 = 1	 Figure 3-2 The default is NPN mode, MI1-DCM short-circuit is forward / stop, and MI2-DCM short-circuit is reverse / stop (default). Refer to Pr.02-00 in Chapter 6 Parameter Description for forward / reverse running direction.
RS-485 communication Pr.00-20 = 2	Refer to Group 09 RS-485 Communication Related Parameters in Chapter 6.
CANopen communication Pr.00-20 = 3 (default)	Refer to Chapter 5 CANopen communication applications for details.

3-3 Test run

The default of this product is to perform test run on the digital operation
panel, as follows:

☑   After turning on the power, confirm the digital keypad LED displays the
    frequency F 60.0 Hz.

☑   To modify the frequency command source (Pr.00-20) and the running
    command source (Pr.00-21) to 0 first, which means digital keypad
    operation.

☑   Press ▼ key to set the low frequency around 5 Hz.
    (Refer to Figure 3-3)

☑   To switch from forward to reverse: keep pressing MODE key to select
    FWD, then press the up or down key to select REV, the switch is
    completed.

☑   Check whether the motor rotation direction is correct and meets the
    user's needs; whether the motor rotates smoothly (no abnormal noise
    and vibration); whether the acceleration / deceleration is smooth.

Figure 3-3

If there is no abnormal situation, increase the operating frequency and continue the test run. After the
above test run with no abnormal condition, the motor can be officially put into operation.

Then modify the settings of Pr.00-20 and 00-21 according to the required frequency and operation
command source.

Schematic diagram of the running direction of the motor

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 rotation direction (viewed from the shaft end of the motor)
as shown in the figure below. 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 the figure below. 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.

Forward
running
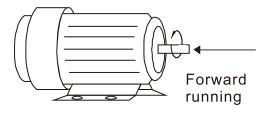
Figure 3-4

Chapter 4 Specification

4-1 230V 1φ Models

4-2 460V 3φ Models

4-3 General Specifications

4-4 Environmental Specifications

4-5 Operating ambient temperature and Carrier Derating

VFD-EL-C series includes 230V and 460V models. The 230V model is single-phase model, and the 460V model is three-phase model. Please refer to the following specification table.

4-1 230V 1φ Models

Model VFD□□□EL21C		002	004	007	015	022
Applicable Motor Output (kW)		0.2	0.4	0.75	1.5	2.2
Applicable Motor Output (HP)		0.25	0.5	1.0	2.0	3.0
Output	Rated Output Capacity (kVA)	0.6	1.0	1.6	2.9	4.2
	Rated Output Current (A)	1.6	2.5	4.2	7.5	11.0
	Max. Output Voltage (V)	Three-phase corresponding input voltage				
	Output Frequency (Hz)	0.1–400 Hz				
	Carrier Frequency (kHz)	2–9 kHz (Default: 2 kHz)				
Input	Input Current (A)	4.9	6.5	9.3	15.7	24.0
	Rated Voltage, Frequency	One-phase 200–240 V, 50 / 60 Hz				
	Voltage Range	±10% (180–264 V)				
	Frequency Range (Hz)	±5% (47–63 Hz)				
Cooling Method		Convective cooling			Fan cooling	
Weight (kg)		1.0	1.0	1.0	1.4	1.4

Table 4-1

4-2 460V 3φ Models

Model VFD□□□EL43C		004	007	015	022	040	055
Applicable Motor Output (kW)		0.4	0.75	1.5	2.2	4.0	5.5
Applicable Motor Output (HP)		0.5	1.0	2.0	3.0	5.5	7.5
Output	Rated Output Capacity (kVA)	1.2	2.0	3.3	4.4	7.4	10.4
	Rated Output Current (A)	1.5	2.5	4.2	5.5	9.0	13
	Max. Output Voltage (V)	Three-phase corresponding input voltage					
	Output Frequency (Hz)	0.1–400 Hz					
	Carrier Frequency (kHz)	2–9 kHz (Default: 2 kHz)					
Input	Input Current (A)	1.8	3.2	4.3	7.1	10.0	17.0
	Rated Voltage, Frequency	Three-phase 380–480 V, 50 / 60 Hz					
	Voltage Range	±10% (342–528 V)					
	Frequency Range (Hz)	±5% (47–63 Hz)					
Cooling Method		Convective cooling		Fan cooling			
Weight (kg)		1.0	1.0	1.0	1.4	1.4	1.5

Table 4-2

4-3 General Specifications

Performance		Descriptions
Control Characteristics	Control Method	Sine wave PWM method / (V/F control)
	Frequency Setting Resolution	0.01Hz
	Output Frequency Resolution	0.01Hz
	Torque	Torque compensation and slip compensation, reach 150% of the rated torque at 5.0 Hz
	Overload Capability	150% of rated output current for 60 seconds
	Skip Frequency	3 points can be set from 0.1–400.0 Hz
	Acceleration and Deceleration Time	0.1–600 seconds (2-stage acceleration / deceleration time can be set independently)
	Stall Prevention	The motor load characteristics can be set at 0–200% of the drive's rated current
	DC Brake	When stopped, it can operate from 0.1–400.0 Hz, the braking current is 0–100% of the rated current, the starting time is 0–60 seconds, and the stopping time is 0–60 seconds
	V/F Curve	Arbitrary V/F curve setting
Protection		Overvoltage, overcurrent, low voltage, external abnormal interruption, motor overload, drive overload, drive overheating
Built-in function		Built-in automatic voltage regulator output regulation Acceleration / deceleration S-curve setting Overvoltage and overcurrent stall prevention Fault record Disable reverse Restart after momentary power loss DC brake Torque offset Slip compensation Carrier frequency adjust Output frequency upper and lower limit settings Parameter reset External count Fault reset Restart after fault Energy-saving operation NPN / PNP mode selection
Digital Keypad		Contains 6 function keys, 4-digit 7-segment LED display, 4 LED status indicators, settable frequency, display actual output frequency, output current, user-defined position, parameter browsing and modification settings and parameter locking, abnormal fault display, execute run, stop, reset, forward / reverse.

Table 4-3

4-4 Environment

Performance		Descriptions
Environment	Protection Rating	IP20
	Degree of environmental pollution	2
	Location	Altitude below 1000 m, indoors (no corrosive gas, liquid, no dust)
	Operation Temperature	No condensation and no icing -10°C–+50°C NOTE 1
	Storage Temperature	-20°C–+60°C
	Humidity	Below 90% RH (no condensation)
	Vibration	1.0 mm, peak to peak value range from 2–13.2 Hz; 0.7–1.0 G range from 13.2–55 Hz; 1.0 G range from 55–512 Hz. Compliance with IEC 6006826
Certifications		CE, RoHS, GB 12668.3

Table 4-4

NOTE:

VFD007EL21C must be installed with fan accessories to reach 50°C the upper limit of the operating temperature. All EL-C series are installed closely side by side, and the upper limit of the operating temperature is +40°C.

4-5 Operating ambient temperature and Carrier Derating

Operating Environment Temperature Derating Curve

Figure 4-1

Model	Operating Environment Temperature Limits
VFD007EL21C	When operating at rated current, the ambient temperature should be between -10–40°C. The rated current needs to be reduced 2% for every 1°C increase when the ambient temperature exceeds 40°C, and the maximum ambient temperature can reach 50°C.
Other models of EL-C series[NOTE 1]	When operating at rated current, the ambient temperature should be between -10–50°C. The rated current needs to be reduced 2% for every 1°C increase when the ambient temperature exceeds 50°C, and the maximum ambient temperature can reach 60°C.

Table 4-5

Derating Curve for Carrier Frequency

Figure 4-2
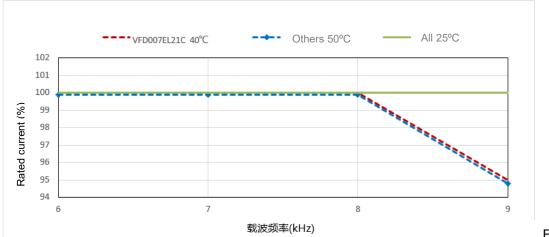
Model	Carrier frequency limit
VFD007EL21C	When the ambient temperature is 40°C, the carrier frequency needs to be set within 8 kHz when operating at rated current. When the carrier frequency needs to be higher than 8 kHz, the rated current needs to be reduced 5% for every 1 kHz increase, and the maximum carrier frequency can be up to 9 kHz.
Other models of EL-C series[NOTE 1]	When the ambient temperature is 50°C, the carrier frequency needs to be set within 8 kHz when operating at rated current. When the carrier frequency needs to be higher than 8 kHz, the rated current needs to be reduced 5% for every 1 kHz increase, and the maximum carrier frequency can be up to 9 kHz.

Table 4-6

NOTE:
When the VFD007EL21C is installed with the fan assembly MKEL-AFKM1, the specifications are the same as other models.

Chapter 5 CANopen Overview

The built-in CANopen function is a kind of remote control. You can control the AC motor drive using the CANopen protocol. CANopen is a CAN-based higher layer protocol that provides standardized communication objects, including real-time data (Process Data Objects, PDO), configuration data (Service Data Objects, SDO), and special functions (Time Stamp, Sync message, and Emergency message). It also has network management data, including Boot-up message, NMT message, and Error Control message. Refer to the CiA website http://www.can-cia.org.

Delta CANopen supported functions:
- Supports CAN2.0A Protocol
- Supports CANopen DS301 V4.02
- Supports DSP-402 V2.0

Delta CANopen supported services:
- PDO (Process Data Objects): PDO1–PDO4
- SDO (Service Data Objects):
  Initiate SDO Download;
  Initiate SDO Upload;
  Abort SDO;
  You can use the SDO message to configure the slave node and access the Object Dictionary in every node.
- SOP (Special Object Protocol): Supports default COB-ID in Predefined Master/Slave Connection Set in DS301 V4.02; Supports SYNC service; Supports Emergency service.
- NMT (Network Management): Supports NMT module control; Supports NMT Error control; Supports Boot-up.
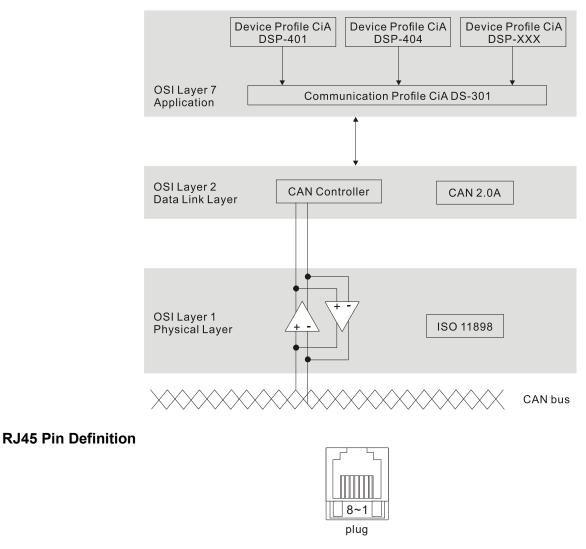
Delta CANopen does not support this service:
- Time Stamp service

5-1 CANopen Overview

CANopen Protocol

CANopen is a CAN-based higher layer protocol, and was designed for motion-oriented machine control networks such as handling systems. CANopen 301 (Version 4.02) is standardized as EN50325-4. The CANopen specifications cover the application layer and communication profile (CiA DS301), as well as a framework for programmable devices (CiA DS302), recommendations for cables and connectors (CiA DS303-1) and SI units and prefix representations (CiA DS303-2).

RJ45 Pin Definition

plug
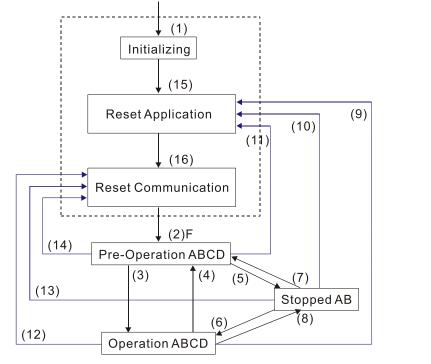
PIN	Signal	Fault Descriptions
1	CAN_H	CAN_H bus line (dominant high)
2	CAN_L	CAN_L bus line (dominant low)
3	CAN_GND	Ground / 0 V / V-

CANopen Communication Protocol contains the following services:

- NMT (Network Management Object)
- SDO (Service Data Objects)
- PDO (Process Data Objects)
- EMCY (Emergency Object)

NMT (Network Management Object)

The Network Management (NMT) follows a Master/Slave structure for executing NMT service. A network has only one NMT master, and the other nodes are slaves. All CANopen nodes have a present NMT state, and the NMT master can control the state of the slave nodes. The following shows the state diagram of a node:

(1) After power is applied, start in the auto-initialization state   A: NMT

(2) Automatically enter the pre-operational state   B: Node Guard

(3) (6) Start remote node   C: SDO

(4) (7) Enter the pre-operational state   D: Emergency

(5) (8) Stop remote node   E: PDO

(9) (10) (11) Reset node   F: Boot-up

(12) (13) (14) Reset communication

(15) Automatically enter the reset application state

(16) Automatically enter the reset communication state

	Initializing	Pre-Operational	Operational	Stopped
PDO			○	
SDO		○	○	
SYNC		○	○	
Time Stamp		○	○	
EMCY		○	○	
Boot-up	○			
NMT		○	○	○

SDO (Service Data Objects)

Use SDO to access the Object Dictionary in every CANopen node using the Client/Server model. One SDO has two COB-IDs (request SDO and response SDO) to upload or download data between two nodes. There is no data limit for SDOs to transfer data, but it must transfer data by segment when the data exceeds four bytes with an end signal in the last segment. However, EL-C series does not support transferring data by segment.

The Object Dictionary (OD) is a group of objects in a CANopen node, and every node has an OD in the system. An OD contains all parameters describing the device and its network behavior. The access path in the SOD is the index and sub-index. Each object has a unique index in the OD, and has a sub-index if necessary.

Type		Data 0								Data 1	Data 2	Data 3	Data 4	Data 5	Data 6	Data 7
		7	6	5	4	3	2	1	0	Index	Index	Index	Data	Data	Data	Data
		command								L	H	Sub	LL	LH	HL	HH
Domain	Client	0	0	1	-	N		E	S							
Download	Server	0	1	1	-	-	-	-	-							
Domain Upload	Client	0	1	0	-	-	-	-	-							
	Server	0	1	0	-	N		E	S							
Abort Domain	Client	1	0	0	-	-	-	-	-							
Transfer	Server	1	0	0	-	-	-	-	-							

N: Bytes not used; E: normal (0) / transferred (1); S: data size

PDO (Process Data Objects)

PDO communication can be described by the producer/consumer model. Each node of the network listens to the messages of the transmission node and distinguishes whether the message has to be processed or not after receiving the message. A PDO can be transmitted from one device to one another device or to many other devices. Every PDO has two PDO services: a TxPDO (transmitting) and an RxPDO (receiving). All transmission types are listed in the following table

Type Number	PDO				
	Cyclic	Acyclic	Synchronous	Asynchronous	RTR only
0		○	○		
1–240	○		○		
241–251	Reserved				
252			○		○
253				○	○
254				○	
255				○	

- Type number 0 indicates acyclic SYNC message between two PDO transmissions.
- Type number 1–240 indicates the number of SYNC message between two PDO transmissions.
- Type number 252 indicates the data is updated (but not sent) immediately after receiving SYNC.
- Type number 253 indicates the data is updated immediately after receiving RTR.
- Type number 254: Delta CANopen does not support this transmission format.
- Type number 255 indicates the data is an asynchronous transmission.
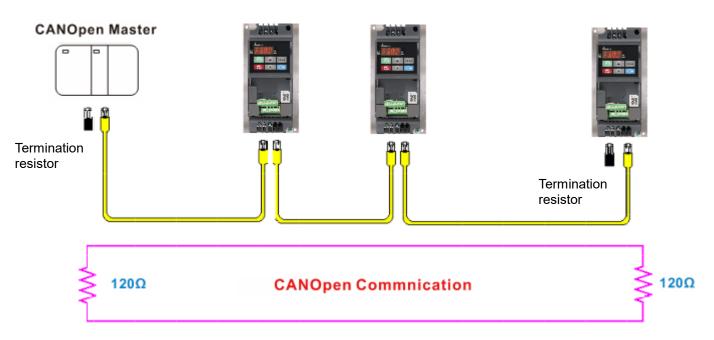
All PDO transmission data must be mapped to the index with Object Dictionary.

EMCY (Emergency Object)

When errors occur inside the hardware, an emergency object is triggered. An emergency object is only sent when an error occurs. As long as there is nothing wrong with the hardware, there is no emergency object warning of an error message.

5-2 Wiring for CANopen

CANopen wiring of the EL-C drive does not require a Hub. The connector from the drive adopts the two-way RJ45 with one-in and one-out. You must wire the two farthest ends with 120 Ω terminating resistors as shown in the picture below.

NOTE:

According to the EL-C EMS test results, it is recommended to insert the terminal resistor into the left RJ45 and the CAN cable into the right RJ45 for better communication immunity performance.

5-3 CANopen Communication Interface Descriptions

5-3-1 Control Method

There are two control modes for CANopen: the DS402 standard (Pr.09-40=1) is the default, and the Delta's standard setting (Pr.09-40=0). There are two control modes according to Delta's standard. One is the old control mode (Pr.09-30=0); this control mode can only control the motor drive under the frequency control. The other mode is a new standard (Pr.09-30=1); this new control mode allows the motor drive to be controlled under all kinds of modes. The EL-C currently supports the speed mode. For torque, position and home mode, refer to MH300 series.

CANopen Control Mode Selection	Control Mode	
	Speed	
	Index	Descriptions
DS402 Standard Pr.09-40=1	6042-00	Target rotating speed (rpm)
	-----	-----
Delta Standard (Old definition) Pr.09-40=0, Pr.09-30=0	2020-02	Target rotating speed (Hz)
Delta Standard (New definition) Pr.09-40=0, Pr.09-30=0	2060-03	Target rotating speed (Hz)
	2060-04	Torque limit (%)

CANopen Control Mode Selection	Operation Control	
	Index	Descriptions
DS402 Standard Pr.09-40=1	6040-00	Operation Command
	-----	-----
Delta Standard (Old definition) Pr.09-40=0, Pr.09-30=0	2020-01	Operation Command
Delta Standard (New definition EL-C series) Pr.09-40=0, Pr.09-30=0	2060-01	Operation Command
	-----	-----

CANopen Control Mode Selection	Others	
	Index	Descriptions
DS402 Standard Pr.09-40=1	605A-00	Quick stop processing mode
	605C-00	Disable operation processing mode
Delta Standard (Old definition) Pr.09-40=0, Pr.09-30=0	-----	-----
Delta Standard (New definition EL-C series) Pr.09-40=0, Pr.09-30=0	-----	-----
	-----	-----

You can use some indexes in either DS402 or Delta's standard when:

1. 1. Indexes that are defined as RO attributes.
2. Parameters Mapping Index (2000-00~200B-XX)
3. Acceleration/Deceleration Index: 604F 6050

5-3-2 DS402 Standard Control Mode

5-3-2-1 Related settings for an AC motor drive (following the DS402 standard)

If you want to use the DS402 standard to control the motor drive, follow these steps:

1. Wire the hardware (refer to Section 5-2 Wiring for CANopen).
2. Set the operation source: set Pr.00-21 to 3 for CANopen communication card control.
   Set the operation command source to CANopen settings (Run/stop, forward/reverse running, etc.).
3. Set the frequency source: set Pr.00-20 to 6. Choose the source for the Frequency command from the CANopen setting.
4. Set DS402 as the control mode: Pr.09-40=0
5. Set the CANopen station: set Pr.09-36; the range is between 1–127. When Pr.09-36 = 0, the CANopen slave function is disabled.
   Note: If an error appears (station address error CAdE or CANopen memory error CFrE) when you finish the station setting, set Pr.00-02 = 7 to reset.
6. Set the CANopen baud rate: set Pr.09-37 (CANBUS baud rate: 1 M (0), 500 K (1), 250 K (2), 125 K (3), 100 K (4) and 50 K (5))
7. Set the multiple input functions to Quick Stop. You can also choose to enable or disable; the default setting is disabled. If it is necessary to enable the function, set MI terminal to 53 in one of the following parameters: 02-01–02-08 or Pr.02-26–02-31.
   Note that this function is available in DS402 only.

5-3-2-2 The status of the motor drive (following the DS402 standard)

According to the DS402 definition, the motor drive is divided into 3 blocks and 9 statuses as described below.

3 blocks

Power Disable: without PWM output

Power Enable: with PWM output

Fault: one or more errors have occurred.

9 statuses

Start: power on

Not Ready to Switch On: the motor drive is initiating.

Switch On Disable: occurs when the motor drive finishes initiating.

Ready to Switch On: warning up before running.

Switch On: the motor drive has the PWM output, but the reference command is not effective.

Operation Enable: able to control normally.

Quick Stop Active: when there is a Quick Stop request, stop running the motor drive.

Fault Reaction Active: the motor drive detects conditions which might trigger error(s).

Fault: one or more errors have occurred in the motor drive.

When the motor drive turns on and finishes the initiation, it remains in Ready to Switch On status. To control the operation of the motor drive, change to Operation Enable status. To do this, set the control word's bit0–bit3 and bit7 of the Index 6040H and pair with Index Status Word (Status Word 0X6041). The control steps and index definition are described below.

Index 6040:

15–9	8	7	6–4	3	2	1	0
Reserved	Halt	Fault Reset	Operation	Enable operation	Quick Stop	Enable Voltage	Switch On

Index 6041:

15–14	13–12	11	10	9	8	7	6	5	4	3	2	1	0
Reserved	Operation	Internal limit active	Target reached	Remote	Reserved	Warning	Switch on disabled	Quick stop	Voltage enabled	Fault	Operation enable	Switch on	Ready to switch on

Set command 6040 = 0xE, and then set another command 6040 = 0xF. Then you can switch the motor drive to Operation Enable. The Index 605A determines the direction of the lines from Operation Enable when the control mode changes from Quick Stop Active. When the setting value is 1–3, both direction lines are active, but when the setting value of 605A is not 1–3, once the motor drive is switched to Quick Stop Active, it is not able to switch back to Operation Enable.

Index	Sub	Definition	Default	R/W	Size	Unit	PDO Map	Mode	Note
605Ah	0	Quick stop option code	2	RW	S16		No		0: Disable drive function 1: Slow down on slow down ramp 2: Slow down on quick stop ramp 5: Slow down on slow down ramp and stay in QUICK STOP 6: Slow down on quick stop ramp and stay in QUICK STOP 7: Slow down on the current limit and stay in Quick stop

When the control block switches from Power Enable to Power Disable, use 605C to define the stop method.

Index	Sub	Definition	Default	R/W	Size	Unit	PDO Map	Mode	Note
605Ch	0	Disable operation option code	1	RW	S16		No		0: Disable drive function 1: Slow down with slow down ramp; disable the drive function

5-3-2-3 Various mode control method (following the DS402 standard)

EL-C supports the speed control mode. The speed control mode is described below.

1. Set EL-C to the speed control mode: set Index6060 to 2.

2. Switch the mode to Operation Enable: Index 6040 can run at 0Hz by first assigning 0x7E and then 0x7F.

3. Set the target frequency: set target frequency for 6042. Since the operation unit of 6042 is rpm, a conversion is required.

$$n = f \times \frac{120}{p}$$

    n: rotation speed (rpm) (revolutions/minute)
    P: number of poles of the motor (Pole)
    f: rotation frequency (Hz)
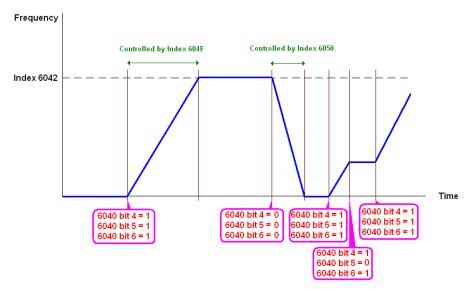
For example: Set 6042H = 1500 (rpm), if the number of poles for the drive is 4 (Pr.05-04, Pr.05-16, Pr.05-67 or Pr.05-73), then the motor drive's operation frequency is 1500 (120/4) = 50 Hz. The 6042 is defined as a signed operation. The plus or minus sign means to rotate clockwise or counter-clockwise.

4. To stop running: Index 6040 assign 0x7E.

5. To set acceleration and deceleration: use 604F (Acceleration) and 6050 (Deceleration).

6. Fault alarm and reset: It can be judged by whether Index 6041 bit 3 is 1, and the fault type can be judged by the specific value of Index 603F (for details, please refer to DS302 / 402 CANopen Error Code Definition). The panel alarm can be reset by assigning H0 first and then H80 through Index 6040.

7. Trigger an ACK signal: in the speed control mode, control the bit 6–4 of Index 6040. It is defined below.

	Index 6040			SUM	
Speed Mode (Index 6060 = 2)	bit 6	bit 5	bit 4		
	1	0	1	Locked at the current frequency.	
	1	1	1	Run to reach the target frequency.	
	Others			Decelerating to 0 Hz.	

NOTE:

1. Read 6043 to get the current rotation speed (unit: rpm)

2. Read bit 10 of 6041 to check if the rotation speed has reached the targeting value (0: Not reached; 1: Reached).

5-3-3 Using the Delta Standard (Old definition, only supports speed mode)

5-3-3-1 Related settings for an AC motor drive (following the Delta old standard)

If you want to use the Delta old standard to control the motor drive, follow these steps:

1. Wire the hardware (refer to Section 5-2 Wiring for CANopen).

2. Set the operation source: set Pr.00-21 to 3 for CANopen communication card control. Set the operation command source to CANopen settings (Run/stop, forward/reverse running, etc.).

3. Set the frequency source: set Pr.00-20 to 6. Choose the source for the Frequency command from the CANopen setting.
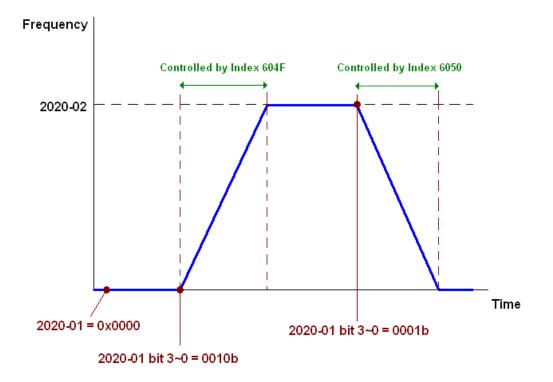
4. Set Delta Standard (Old definition, only supports speed mode) as the control mode: Pr.09-40 = 0 and Pr.09-30 = 0.

5. Set the CANopen station: set Pr.09-36; the range is between 1–127. When Pr.09-36=0, the CANopen slave function is disabled.

   Note that if an error appears (station address error CAdE, CANopen memory error CFrE, or index value error CIdE) when you finish the station setting, set Pr.00-02 = 7 to reset.

6. Set the CANopen baud rate: set Pr.09-37 (CANBUS baud rate: 1 M (0), 500 K (1), 250 K (2), 125 K (3), 100 K (4) and 50 K (5))

5-3-3-2 The control method under speed mode

1. Set the target frequency: set 2020-02, the unit is Hz, with 2 decimal places. For example, 1000 is 10.00 Hz.

2. Operation control: set 2020-01 = 0002H for running, and set 2020-01 = 0001H for stopping.

5-3-4 Using Delta Standard (New Definition)

5-3-4-1 Related settings for an AC motor drive (following the Delta new standard)

If you want to use the Delta old standard to control the motor drive, follow these steps:

1. Wire the hardware (refer to Section 5-2 Wiring for CANopen).
2. Set the operation source: set Pr.00-21 to 3 for CANopen communication card control. Set the operation command source to CANopen settings (Run/stop, forward/reverse running, etc.).
3. Set the frequency source: set Pr.00-20 to 6. Choose the source for the Frequency command from the CANopen setting.
4. Set Delta Standard (New definition) as the control mode: Pr.09-40 = 0 and 09-30 = 1.
5. Set the CANopen station: set Pr.09-36; the range is between 1–127. When Pr.09-36=0, the CANopen slave function is disabled.
   Note: If an error appears (station address error CAdE or CANopen memory error) when you finish the station setting, set Pr.00-02 = 7 to reset.
6. Set the CANopen baud rate: set Pr.09-37 (CANBUS baud rate: 1 M (0), 500 K (1), 250 K (2), 125 K (3), 100 K (4) or 50 K (5)).
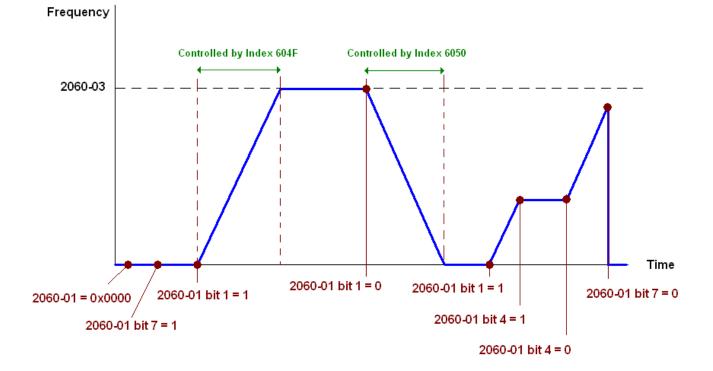
5-3-4-2 Various mode control method (Delta New Standard)

Speed Mode

1. Set EL-C to speed control mode: set index 6060 = 2.
2. Set the target frequency: set 2060-03, unit is Hz, with 2 decimal places. For example, 1000 is 10.00 Hz.
3. Operation control: set 2060-01 = 008H for server on, and set 2060-01 = 0081H for running.

5-3-5 Control DI/DO by CANopen

To control the DO of the motor drive through CANopen, follow these steps:

1. Define the DO to be controlled by CANopen.

    For example, set Pr.02-13–02-16 = 50 to control MO1–MO4.

2. Control the Index mapped by CANopen.

    To control DO by setting Index 2026-41 = 1, to control MO1 into ON by setting bit 0 of Index 2026-41 = 1, then MO1 outputs 1.

The mapping table of the CANopen DI/DO is shown in the following table:

DI:

Terminal	Related Parameters	Attribute	Mapping Index
MI1	==	RO	2026-01 bit 0
MI2	==	RO	2026-01 bit 1
MI3	==	RO	2026-01 bit 2
MI4	==	RO	2026-01 bit 3
MI5	==	RO	2026-01 bit 4
MI6	==	RO	2026-01 bit 5

DO:

Terminal	Related Parameters	Attribute	Mapping Index
MO1	Pr.02-13 = 50	RW	bit 0 of 2026-41 initial value 0x01
MO2	Pr.02-14 = 50	RW	bit 1 of 2026-41 initial value 0x01
MO3	Pr.02-15 = 50	RW	bit 2 of 2026-41 initial value 0x01
MO4	Pr.02-16 = 50	RW	bit 3 of 2026-41 initial value 0x01

5-4 CANopen Supported Index

EL-C Supported Parameter Index:

The parameter index corresponds as shown in this example:

Index	**sub-Index**
2000H + Group	member+1

For example: Pr.10-15 (Encoder Stall and Slip Error Action)

Group		**member**
10(0AH)	-	15(0FH)

Index = 2000H + 0AH = 200A

Sub-Index = 0FH + 1H = 10H

EL-C Supported Control Index:

Delta Standard Mode (Old Definition)

Index	Sub	Definition	Default	R/W	Size	Note	
	0	Number	3	R	U8		
2020H	1	Control word	0	RW	U16	bit 1–0	00B: No function
							01B: Stop
							10B: Run
							11B: JOG + RUN
						bit 3–2	Reserved
						bit 5–4	00B: No function
							01B: FWD direction
							10B: REV direction
							11B: Change direction
						bit 7–6	00B: 1st step accel./decel.
							01B: 2nd step accel./decel.
							10B: 3rd step accel./decel.
							11B: 4th step accel./decel.
						bit 11–8	0000B: Master speed
							0001B: 1st step speed
							0010B: 2nd step speed
							0011B: 3rd step speed
							0100B: 4th step speed
							0101B: 5th step speed
							0110B: 6th step speed
							0111B: 7th step speed
							1000B: 8th step speed
							1001B: 9th step speed
							1010B: 10th step speed
							1011B: 11th step speed
							1100B: 12th step speed
							1101B: 13th step speed
							1110B: 14th step speed
							1111B: 15th step speed
						bit12	1: Enable the function of bit 06–11
						bit 14–13	00B: No function
							01B: Operation command by the digital keypad
							10B: Operation command by Pr.00-21 setting
							11B: Switch the operation command source
						bit15	Reserve

Index	Sub	Definition	Default	R/W	Size	Note	
	2	Frequency command (XXX.XX Hz)	0	RW	U16		
	3	Other trigger	0	RW	U16	bit 0	1: E.F. (External Fault) ON
						bit 1	1: Reset command
						bit 2	1: Base Block (B.B) ON
						bit153	Reserve
2021H	0	Number	10	R	U8		
	1	Error code	0	R	U16	High byte: Warning Code Low Byte: Error Code	
	2	AC motor drive status	0	R	U16	bit 1–0	00B: The drive stops
							01B: The drive is decelerating
							10B: The drive is in standby status
							11B: The drive is operating
						bit 2	1: JOG command
						bit 4–3	00B: FWD running
							01B: From REV running to FWD running
							10B: From FWD running to REV running
							11B: REV running
						bit 7–5	Reserved
						bit 8	1: Master frequency controlled by the communication interface
						bit9	1: Master Frequency command controlled by analog signal input
						bit10	1: Operation command controlled by the communication interface
						bit11	1: Parameter lock
						bit12	1: Enable the digital keypad copy parameter function
						bit 15–13	Reserved
	3	Frequency command (XXX.XX Hz)	0	R	U16		
	4	Output frequency (XXX.XX Hz)	0	R	U16		
	5	Output current (XX.X A)	0	R	U16		
	6	DC bus voltage (XXX.X V)	0	R	U16		
	7	Output voltage (XXX.X V)	0	R	U16		
	8	The current step run by the multi-step speed command	0	R	U16		
	9	Reserved	0	R	U16		
	A	Display counter value (c)	0	R	U16		
	B	Output power factor angle (XX.X°)	0	R	U16		
	C	Output torque (XX.X%)	0	R	U16		
	D	Motor speed (rpm)	0	R	U16		
	E	Reserve					
	F	Reserve					
	10	Output power (X.XXX kW)	0	R	U16		
	17	Multi-function display (Pr.00-04)	0	R	U16		
2022H	0	Reserved	0	R	U16		
	1	Display the drive's output current	0	R	U16		
	2	Counter value	0	R	U16		
	3	Actual output frequency (XXX.XX Hz)	0	R	U16		
	4	DC bus voltage	0	R	U16		
	5	Output voltage (XXX.X V)	0	R	U16		
	6	Power factor angle (XX.X°)	0	R	U16		
	7	Display the output power of U, V, W in kW	0	R	U16		

Index	Sub	Definition	Default	R/W	Size	Note	
	8	Display the motor speed estimated by the drive or encoder feedback in rpm	0	R	U16		
	9	Display the positive / negative output torque estimated by the drive (+0.0: positive torque; -0.0: negative torque)	0	R	U16		
	A	Reserve					
	B	Display the PID feedback value after enabling the PID function in %	0	R	U16		
	C	Display the AVI analog input terminal signal, 0–10 V corresponds to 0.00–100.00% (see Explanation 1 in Pr.00-04)	0	R	U16		
	D	Display the ACI analog input terminal signal, 4–20 mA / 0–10 V corresponds to 0.00–100.00% (2.) (see Explanation 2 in Pr.00-04)	0	R	U16		
	F	IGBT temperature of the power module in oC	0	R	U16		
	11	The digital input status (ON / OFF), refer to Pr.02-12 (see Explanation 2 in Pr.00-04)	0	R	U16		
	12	The digital output status (ON / OFF), refer to Pr.02-18 (see Explanation 3 in Pr.00-04)	0	R	U16		
	13	Current step for the multi-step speed operation	0	R	U16		
	14	The corresponding CPU digital input pin status (d.) (see Explanation 3 in Pr.00-04)	0	R	U16		
	15	The corresponding CPU digital output pin status (O.) (see Explanation 4 in Pr.00-04)	0	R	U16		
	16	Reserved					
	18	Reserved					
	1A	Counter value of overload (0.00–100.00%)	0	R	U16		
	1C	DC bus voltage ripples (Unit: V_{DC}) (r.)	0	R	U16		
	1D	PLC register D1043 data	0	R	U16		
	1E	Magnetic field area of the synchronous motor	0	R	U16		
	1F	User page displays the value in physical measure	0	R	U16		
	20	Output value of Pr.00-05	0	R	U16		
	21	Reserved					
	22	Reserved					
	23	Reserved					
	24	Control mode of the drive 0: speed mode	0	R	U16		
	25	Carrier frequency of the drive	0	R	U16		
	26	Reserved					
	27	AC motor drive status					
	28	Output positive/negative torque of motor drive calculation					
	29	Reserved					
	2A	kWh display					

CANopen Remote IO Mapping

Index	Sub	R/W	Descriptions
2026h	01h	R	Each bit corresponds to different input terminals.
	02h	R	Reserve
	03h–40h	R	Reserve
	41h	RW	Each bit corresponds to different output terminals
	42h–60h	R	Reserve
	61h	R	Reserve
	62h	R	Reserve
	63h	R	Reserve
	64h–A0h	R	Reserve
	A1h	RW	Reserved

Index 2026-01	bit 0	bit 1	bit 2	bit 3	bit 4	bit 5	bit 6	bit 7	bit 8	bit 9	bit 10	bit 11	bit 12	bit 13	bit 14	bit 15
DI	MI1	MI2	MI3	MI4	MI5	MI6	-	-	-	-	-	-	-	-	-	-

Index 2026-41	bit 0	bit 1	bit 2	bit 3	bit 4	bit 5	bit 6	bit 7	bit 8	bit 9	bit 10	bit 11	bit 12	bit 13	bit 14	bit 15
DO	MO1	MO2	MO3	MO4	-	-	-	-	-	-	-	-	-	-	-	-

Delta Standard Mode (New Definition)

Index	sub	R/W	Size	bit	Definition	Priority	Speed Mode
2060h	00h	R	U8				
	01h	RW	U16	0	Ack	4	0: fcmd = 0 1: fcmd = Fset (Fpid)
				1	Dir	4	0: FWD command 1: REV command
				2			
				3	Halt	3	0: Drive runs until target speed is reached 1: Drive stops by deceleration setting
				4	Hold	4	0: Drive runs until target speed is reached 1: Frequency stops at current frequency
				5	JOG	4	0: JOG OFF Pulse 1: JOG RUN
				6	QStop	2	Quick Stop
				7	Power	1	0: Power OFF 1: Power ON
				8	Ext_md2	4	0→1: Absolute position cleared
				14–9			
				15	RST	4	Pulse 1: Fault code cleared
	02h	RW	U16		Mode Cmd		0: Speed mode
	03h	RW	U16				Speed command (unsigned decimal)
	04h	RW	U16				
	05h	RW	S32				
	06h	RW					
	07h	RW	S16				
	08h	RW	U16				
2061h	01h	R	U16	0	Arrive		Frequency command reached
				1	Dir		0: Motor FWD run 1: Motor REV run
				2	Warn		Warning occurs
				3	Error		Error detected
				4			

Index	sub	R/W	Size	Descriptions			Speed Mode
				bit	Definition	Priority	
				5	JOG		JOG
				6	QStop		Quick stop
				7	Power On		Switch ON
				15–8			
	02h	R					
	03h	R	U16				Actual output frequency (XXX.XX Hz)
	04h	R					
	05h	R	S32				Actual position (absolute)
	06h	R					
	07h	R	S16				Actual torque

DS402 Standard

Index	Sub	Definition	Default	R/W	Size	Unit	PDO Map	Mode	Note
6007h	0	Abort connection option code	2	RW	S16		Yes		0: No action 2: Disable voltage 3: Quick Stop
603Fh	0	Error code	0	RO	U16		Yes		
6040h	0	Control word	0	RW	U16		Yes		
6041h	0	Status word	0	RO	U16		Yes		
6042h	0	velocity mode target velocity	0	RW	S16	rpm	Yes	vl	
6043h	0	velocity mode velocity demand	0	RO	S16	rpm	Yes	vl	
6044h	0	velocity mode control effort	0	RO	S16	rpm	Yes	vl	
604Fh	0	velocity mode ramp function time	10000	RW	U32	1ms	Yes	vl	The minimum unit is 100 ms. For example, when it is set to 290 ms, it is regarded as 200 ms. When it is set to 10301 ms, it is regarded as 10300 ms. In addition, it cannot be set to zero.
6050h	0	velocity mode slow down time	10000	RW	U32	1ms	Yes	vl	
6051h	0	velocity mode quick stop time	1000	RW	U32	1ms	Yes	vl	
605Ah	0	Quick stop option code	2	RW	S16		No		0: Disable drive function 1: Slow down on slow down ramp 2: Slow down on quick stop ramp 5: Slow down on slow down ramp and stay in QUICK STOP 6: Slow down on quick stop ramp and stay in QUICK STOP
605Ch	0	Disable operation option code	1	RW	S16		No		0: Disable drive function 1: Slow down with slow down ramp; disable the drive function
6060h	0	Mode of operation	2	RW	S8		Yes		2: Velocity mode
6061h	0	Mode of operation display	2	RO	S8		Yes		Same as above

5-5 CANopen fault code

☑ Refer to settings for Pr.06-17–Pr.06–22 and Pr.12-70–Pr.12-73

☑ Refer to Chapter 08 Fault Codes for detailed descriptions.

ID*	Display	Fault code	Fault Descriptions	CANopen fault register (bit 0–7)	DS302 / 402 CANopen Fault Codes
1	ocA	0001H	Over-current during acceleration (ocA)	1	2213H
2	ocd	0002H	Over-current during deceleration (ocd)	1	2213H
3	ocn	0003H	Over-current during steady operation (ocn)	1	2314H
6	ocS	0006H	Over-current at stop (ocS)	1	2314H
7	ovA	0007H	Over-voltage during acceleration (ovA)	2	3210H
8	ovd	0008H	Over-voltage during deceleration (ovd)	2	3210H
9	ovn	009H	Over-voltage during constant speed (ovn)	2	3210H
10	ovS	000AH	Over-voltage at stop (ovS)	2	3210H
11	LvA	000BH	Low-voltage during acceleration (LvA)	2	3220H
12	Lvd	000CH	Low-voltage during deceleration (Lvd)	2	3220H
13	Lvn	000DH	Low-voltage at constant speed (Lvn)	2	3220H
14	LvS	000EH	Low-voltage at stop (LvS)	2	3220H
15	orP	000FH	Phase loss protection (orP)	2	3130H
16	oH1	0010H	IGBT overheating (oH1)	3	4310H
18	tH1o	0012H	IGBT temperature detection failure (tH1o)	3	FF00H
21	oL	0015H	Over load (oL)	1	2310H
22	EoL1	0016H	Electronic thermal relay protection 1 (EoL1)	1	2310H
26	ot1	001AH	Over torque 1 (ot1)	3	8311H
28	uC	001CH	Under current (uC)	1	8321H
31	cF2	001FH	EEPROM read error (cF2)	5	5530H
33	cd1	0021H	U-phase error (cd1)	1	FF04H
34	cd2	0022H	V-phase error (cd2)	1	FF05H
35	cd3	0023H	W-phase error (cd3)	1	FF06H
36	Hd0	0024H	cc hardware error (Hd0)	5	FF07H
37	Hd1	0025H	oc hardware error (Hd1)	5	FF08H
49	EF	0031H	External fault (EF)	5	9000H
50	EF1	0032H	Emergency stop (EF1)	5	9000H

ID*	Display	Fault code	Fault Descriptions	CANopen fault register (bit 0–7)	DS302 / 402 CANopen Fault Codes
51	bb	0033H	External base block (bb)	5	9000H
52	Pcod	0034H	Password is locked (Pcod)	5	FF26H
54	CE1	0036H	Illegal command (CE1)	4	7500H
55	CE2	0037H	Illegal data address (CE2)	4	7500H
56	CE3	0038H	Illegal data value (CE3)	4	7500H
57	CE4	0039H	Data is written to read-only address (CE4)	4	7500H
58	CE10	003AH	Modbus transmission time-out (CE10)	4	7500H
62	dEb	003EH	Deceleration energy backup error (dEb)	2	FF27H
79	Aoc	0050H	U-phase over-current before run (Aoc)	1	FF2BH
80	boc	0051H	V-phase over-current before run (boc)	1	FF2CH
81	coc	0050H	W-phase over-current before run (coc)	1	FF2DH
82	oPL1	0052H	Output phase loss U phase (OPHL)	2	2331H
83	oPL2	0053H	Output phase loss V phase (OPH2)	2	2332H
84	oPL3	0054H	Output phase loss W phase (OPH3)	2	2333H
87	oL3	0057H	87: Low frequency overload protection (oL3)	0	8A00H
101	CGdE	0065H	CANopen guarding error (CGdE)	4	8130H
102	CHbE	0066H	CANopen heartbeat error (CHbE)	4	8130H
104	CbFE	0068H	CANopen bus off error (CbFE)	4	8140H
105	CidE	0069H	CANopen index error (CidE)	4	8100H
106	CAdE	006AH	CANopen station address error (CAdE)	4	8100H
107	CFrE	006BH	CANopen index setting exceed limit (CFrE)	4	8100H
111	ictE	006FH	InrCOM time-out error (ictE)	4	7500H
121	CP20	007AH	Internal communication error (CP20)	7	FF36H
123	CP22	007CH	Internal communication error (CP22)	7	FF38H
124	CP32	007DH	Internal communication error (CP30)	7	FF39H
126	CP32	0080H	Internal communication error (CP32)	7	FF3BH
127	CP33	0081H	Internal communication error (CP33)	7	FF3CH

5-6 CANopen LED Function

There are two CANopen flash signs: CRUN and CERR.

❶ **Status Display**
   Display the drive's current status: RUN, STOP, FWD, REV, CAN RUN, CAN ERROR

❷ **LED Display**
   Indicates frequency, current, voltage, running direction, user-defined units, faults, etc.

❸ **UP/DOWN Key**
   Select parameters and sets/changes parameter settings

CRUN:

LED status	Condition/ State	CANopen Status
OFF	Keep lighting off	Initial
Blinking		Pre-operation
Single flash		Stopped
ON	Keep lighting on	Operation

CERR

LED status	Condition / State
OFF	No Error
Single flash	One message fail
Double flash	Guarding failure or heartbeat failure
Triple flash	SYNC fail
ON	Bus off

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Chapter 6 Descriptions of Parameter Settings

6-1 Summary of Parameter Settings

6-2 Descriptions of Parameter Settings

6-1 Summary of Parameter Settings

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. Refer to chapter 06 for the details of parameters.

2. Refer to Section 6-2 for the details of parameters.

00 Drive Parameters

	Pr.	Parameter Name	Settings	Default
	00-00	Ac Motor Drive Identity Code	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 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, 5.5 HP 408: 460V, 3Phase, 7.5HP	Read only
	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 7: Reset CANopen Slave index 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)	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) 4: DI / DO status	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

Pr.	Parameter Name	Settings	Default
		3: Display the drive's DC bus voltage (v) (Unit: V_{DC})	
		4: Display the drive's U, V, W 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)	
		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: %)	
		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)	
		36: Present operating carrier frequency of the drive (J.) (Unit: Hz)	
		38: Display the drive status (6.)	
		41: kWh display (J) (Unit: kWh)	
✗	00-05	Coefficient Gain in Actual Output Frequency	0.00–160.00	1.00
	00-06	Firmware Version	Read only	#.#
✗	00-07	Parameter Protection Password input	0–9998 0–4 (the number of password attempts)	0
✗	00-08	Parameter Protection Password Setting	0–9998 0: No password protection or password is entered correctly (Pr.00-07) 1: Password has been set	0
	00-10	Control Mode	0: Speed mode	0
	00-11	Speed Control Mode	0: VF (IM V/F control)	0
	00-16	Load Selection	1: Heavy load	1
	00-17	Carrier Frequency	Heavy load: 2–9 kHz	2
✗	00-20	Master Frequency Command Source (AUTO, REMOTE)	0: Digital keypad 1: RS-485 communication input 3: External UP / DOWN terminal 6: CANopen communication	6

Pr.	Parameter Name	Settings	Default
✗ 00-21	Operation Command Source (AUTO, REMOTE)	0 (Digital keypad) 1: External terminals 2: RS-485 communication input 3: CANopen communication	3
✗ 00-22	Stop Method	0: Ramp to stop 1: Coast to stop	0
✗ 00-23	Motor Direction Control	0: Enable forward / reverse 1: Disable reverse 2: Disable forward	0
00-24	Digital Operator (Keypad) Frequency Command Memory	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 6: CANopen communication	6
00-31	Operation Command Source (HAND, LOCAL)	0 (Digital keypad) 1: External terminals 2: RS-485 communication input 3: CANopen communication	3
✗ 00-32	Digital Keypad Stop Function	0: STOP key disabled 1: STOP key enabled	0
00-47	Output Phase Order Selection	0: Standard 1: Reverse the operation direction	0
✗ 00-48	Display Filter Time (Current)	0.001–65.535 sec.	0.100

Pr.	Parameter Name	Settings	Default
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	0.00–400.00 Hz	60.00 / 50.00
	01-01	Minimum Output Frequency of Motor 1	0.00–400.00 Hz	60.00 / 50.00
	01-02	Minimum Output Voltage of Motor 1	230V models: 0.0–255.0 V 460V models: 0.0–510.0 V	220.0 440.0
	01-03	Mid-Point Frequency 1 of Motor 1	0.00–400.00 Hz	3.00
✗	01-04	Mid-Point Voltage 1 of Motor 1	230V models: 0.0–240.0 V 460V models: 0.0–480.0 V	11.0 22.0
	01-05	Mid-Point Frequency 2 of Motor 1	0.00–400.00 Hz	1.5
✗	01-06	Mid-Point Voltage 2 of Motor 1	230V models: 0.0–240.0 V 460V models: 0.0–480.0 V	5.0 10.0
	01-07	Minimum Output Frequency of Motor 1	0.00–400.00 Hz	0.50
✗	01-08	Minimum Output Voltage of Motor 1	230V models: 0.0–240.0 V 460V models: 0.0–480.0 V	1.0 2.0
	01-09	Start-Up Frequency	0.00–400.00 Hz	0.50
✗	01-10	Output Frequency Upper Limit	0.00–400.00 Hz	400.00
✗	01-11	Output Frequency Lower Limit	0.00–400.00 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 10.0
✗	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 10.0
✗	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 10.0
✗	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 10.0
✗	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 10.0
✗	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 10.0
✗	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 10.0
✗	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 10.0

Pr.	Parameter Name	Settings	Default
✗ 01-20	Jog Acceleration Time	Pr.01-45 = 0: 0.00–600.00 sec.	10.00
		Pr.01-45 = 1: 0.0–6000.0 sec.	10.0
✗ 01-21	Jog Deceleration Time	Pr.01-45 = 0: 0.00–600.00 sec.	10.00
		Pr.01-45 = 1: 0.0–6000.0 sec.	10.0
✗ 01-22	Jog Frequency	0.00–400.00 Hz	6.00
✗ 01-23	Switch Frequency Between First and Fourth Accel./Decel.	0.00–400.00 Hz	0.00
✗ 01-24	S-Curve Acceleration Begin Time 1	Pr.01-45 = 0: 0.00–25.00 sec.	0.20
		Pr.01-45 = 1: 0.0–250.0 sec.	0.2
✗ 01-25	S-Curve Acceleration Arrival Time 2	Pr.01-45 = 0: 0.00–25.00 sec.	0.20
		Pr.01-45 = 1: 0.0–250.0 sec.	0.2
✗ 01-26	S-Curve Deceleration Begin Time 1	Pr.01-45 = 0: 0.00–25.00 sec.	0.20
		Pr.01-45 = 1: 0.0–250.0 sec.	0.2
✗ 01-27	S-Curve Deceleration Arrival Time 2	Pr.01-45 = 0: 0.00–25.00 sec.	0.20
		Pr.01-45 = 1: 0.0–250.0 sec.	0.2
01-28	Skip Frequency 1 (Upper Limit)	0.00–400.00 Hz	0.00
01-29	Skip Frequency 1 (Lower Limit)	0.00–400.00 Hz	0.00
01-30	Skip Frequency 2 (Upper Limit)	0.00–400.00 Hz	0.00
01-31	Skip Frequency 2 (Lower Limit)	0.00–400.00 Hz	0.00
01-32	Skip Frequency 3 (Upper Limit)	0.00–400.00 Hz	0.00
01-33	Skip Frequency 3 (Lower Limit)	0.00–400.00 Hz	0.00
01-34	Zero-Speed Mode	0: Output waiting 1: Zero-speed operation 2: Fmin (refer to Pr.01-07 and Pr.01-41)	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–Pr.01-21)	0

Pr.	Parameter Name	Settings	Default
01-45	Time Unit for Acceleration and Deceleration and S-Curve	0: Unit 0.01 sec. 1: Unit 0.1 sec.	0
01-46	Canopen Quick Stop Time	Pr.01-45 = 0: 0.00–6000.0 sec. Pr.01-45 = 1: 0.0–6000.0 sec.	1.00

02 Digital input / Output Parameters

Pr.	Parameter Name	Settings	Default

02-00	Two-Wire / Three-Wire Operation Control	0: No Function
		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)
			1

02-01	Multi-Function input Command 1 (MI1)	0: No Function 1: Multi-step speed command 1	0
02-02	Multi-Function input Command 2 (MI2)	2: Multi-step speed command 2 3: Multi-step speed command 3	0
02-03	Multi-Function input Command 3 (MI3)	4: Multi-step speed command 4 5: Reset	0
02-04	Multi-Function input Command 4 (MI4)	6: JOG command 7: Acceleration / deceleration speed inhibit	0
02-05	Multi-Function input Command 5 (MI5)	8: 1st and 2nd acceleration / deceleration time selection	0
02-06	Multi-Function input Command 6 (MI6)	9: 3rd and 4th acceleration / deceleration time selection	0
		10: External Fault (EF) input 11: Base Block (B.B.) input from external 12: Output stop 13: Cancel the setting of auto-acceleration / auto-deceleration time 18: force to stop (Pr.07-20) 19: Frequency up command 20: Frequency down command 22: Clear the counter 23: input the counter value (MI6) 24: FWD JOG command 25: REV JOG command 28: Emergency stop (EF1) 38: Disable writing EEPROM function 40: force coasting to stop 41: HAND switch 42: AUTO switch 49: Enable drive 56: Local / Remote selection	

Pr.	Parameter Name	Settings	Default
✗ 02-09	Up / Down Key Mode	0: UP / DOWN by the accel. / decel. time 1: UP / DOWN constant speed (Pr.02-10) 2: Pulse signal (Pr.02-10) 3: External terminals UP / DOWN key mode	0
✗ 02-10	Acceleration / Deceleration Speed of External Terminal UP / DOWN Key	0.001–1.000 Hz / ms	0.001
✗ 02-11	Multi-Function input Response Time	0.000–30.000 sec.	0.005
✗ 02-12	Multi-Function input Mode Selection	0000h–FFFFh (0: N.O.; 1: N.C.)	0000
✗ 02-13	Multi-Function Output 1 (MO1)	0: No Function 1: indication during RUN	50
✗ 02-14	Multi-Function Output 2 (MO2)	2: Operation speed reached 3: Desired frequency reached 1 (Pr.02-22)	50
✗ 02-15	Multi-Function Output 3 (MO3)	4: Desired frequency reached 2 (Pr.02-24) 5: Zero speed (Frequency command)	50
✗ 02-16	Multi-Function Output 4 (MO4)	6: Zero speed including STOP (Frequency command)	50
		7: Over-torque 1 (Pr.06-06–06-08) 9: Drive is ready 10: Low voltage warning (Lv) (Pr.06-00) 11: Malfunction indication 13: Overheat warning (Pr.06-15) 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 source 25: forward command 26: Reverse command 29: Output when frequency ≥ Pr.02-34 30: Output when frequency < Pr.02-34 33: Zero speed (actual output frequency) 34: Zero speed including STOP (actual output frequency)	

Pr.		Parameter Name	Settings	Default
			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)	
			43: Actual motor speed detection	
			44: Low current output (use with Pr.06-71–Pr.06-73)	
			46: Master dEb output	
			50: Output control for CANopen	
			51: Analog output control for RS-485 interface	
			75: forward RUN status	
			76: Reverse RUN status	
✗	02-18	Multi-Function Output Direction	0000h–FFFFh (0: N.O.; 1: N.C.)	0000
✗	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	0.00–400.00 Hz	60.00 / 50.00
✗	02-23	the Width of the Desired Frequency Reached 1	0.00–400.00 Hz	2.00
✗	02-24	Desired Frequency Reached 2	0.00–400.00 Hz	60.00 / 50.00
✗	02-25	the Width of the Desired Frequency Reached 2	0.00–400.00 Hz	2.00
✗	02-34	Output Frequency Setting for Multi-Function Output Terminal	0.00–400.00 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	Read only	Read only

Pr.	Parameter Name	Settings	Default
02-55	MI Terminal NPN / PNP Mode Selection	0: NPN (SINK) mode 1: PNP (SOURCE) Mode	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	0.00–400.0 Hz	60.00

03 Reserved

6-1-13

04 Multi-Step Speed Parameters

	Pr.	Parameter Name	Settings	Default
✗	04-00	1st Step Speed Frequency	0.00–400.00 Hz	0.00
✗	04-01	2nd Step Speed Frequency	0.00–400.00 Hz	0.00
✗	04-02	3rd Step Speed Frequency	0.00–400.00 Hz	0.00
✗	04-03	4th Step Speed Frequency	0.00–400.00 Hz	0.00
✗	04-04	5th Step Speed Frequency	0.00–400.00 Hz	0.00
✗	04-05	6th Step Speed Frequency	0.00–400.00 Hz	0.00
✗	04-06	7th Step Speed Frequency	0.00–400.00 Hz	0.00
✗	04-07	8th Step Speed Frequency	0.00–400.00 Hz	0.00
✗	04-08	9th Step Speed Frequency	0.00–400.00 Hz	0.00
✗	04-09	10th Step Speed Frequency	0.00–400.00 Hz	0.00
✗	04-10	11th Step Speed Frequency	0.00–400.00 Hz	0.00
✗	04-11	12th Step Speed Frequency	0.00–400.00 Hz	0.00
✗	04-12	13th Step Speed Frequency	0.00–400.00 Hz	0.00
✗	04-13	14th Step Speed Frequency	0.00–400.00 Hz	0.00
✗	04-14	15th Step Speed Frequency	0.00–400.00 Hz	0.00

05 Motor Parameters

Pr.	Parameter Name	Settings	Default
05-01	Full-Load Current for induction Motor 1 (A)	10–120% of the drive's rated current	Depending on the model power
✎ 05-02	Rated Power for induction Motor 1 (Kw)	0.00–655.35 kW	Depending on the model power
✎ 05-03	Rated Speed for induction Motor 1 (Rpm)	0–65535 1710 (60 Hz 4 poles); 1410 (50 Hz 4 poles)	Depending 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–Pr.05-01 default	Depending on the model power
05-26	Motor Accumulated Watt in Every Second (W-Sec.)	Read only	Read only
05-27	Motor Accumulated Watt in Every Second (W-Sec.)	Read only	Read only
05-28	Motor Accumulated Watt in Every Hour (W-Hour)	Read only	Read only
05-29	Accumulated Watt-Hour for A Motor in Low Word (Kw-Hour)	Read only	Read only
05-30	Accumulated Watt-Hour for A Motor in High Word (MW-Hour)	Read only	Read only
05-31	Accumulated Motor Operation Time (Minutes)	0–1439	0
05-32	Accumulated Motor Operation Time (Days)	0–65535	0

06 Protection Parameters (1)

Pr.	Parameter Name	Settings	Default
✗ 06-00	Low Voltage Level	115V / 230V models: 150.0–220.0 V$_{DC}$	180.0
		460V models: 300.0–440.0 V$_{DC}$	360.0
✗ 06-01	Over-Voltage Stall Prevention	0: No Function	
		230V models: 0.0–450.0 V$_{DC}$	380.0
		460V models: 0.0–900.0 V$_{DC}$	760.0
✗ 06-02	Selection for Over-Voltage Stall Prevention	0: Traditional over-voltage stall prevention	0
		1: Smart over-voltage stall prevention	
✗ 06-03	Over-Current Stall Prevention During Acceleration	0–250% (100% corresponds to the rated current of the drive)	180
✗ 06-04	Over-Current Stall Prevention During Operation	0–250% (100% corresponds to the rated current of the drive)	180
✗ 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
✗ 06-06	Over-Torque Detection Selection (Motor 1)	0: No function 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
✗ 06-07	Over-Torque Detection Level (Motor 1)	10–250% (100% corresponds to the rated current of the drive)	120
✗ 06-08	Over-Torque Detection Time (Motor 1)	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	0.0–110.0ºC	95.0
✗ 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	1: Over-current during acceleration (ocA)	0

Pr.	Parameter Name	Settings	Default
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	6: Over-current at stop (ocS)	0
06-22	Fault Record 6	7: Over-voltage during acceleration (ovA)	0
	Fault Record 7 (Pr.14-70)	8: Over-voltage during deceleration (ovd)	
	Fault Record 8 (Pr.14-71)	9: Over-voltage during constant speed (ovn)	
	Fault Record 9 (Pr.14-72)	10: Over-voltage at stop (ovS)	
	Fault Record 10 (Pr.14-73)	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 (oL)	
		22: Electronic thermal relay 1 protection (EoL1)	
		26: Over torque 1 (ot1)	
		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)	
		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)	
		62: Deceleration energy backup error (dEb)	
		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)	

Pr.	Parameter Name	Settings	Default
		87: Low frequency overload protection (oL3)	
		101: CANopen guarding error (CGdE)	
		102: CANopen heartbeat error (CHbE)	
		104: CANopen bus off error (CbFE)	
		105: CANopen index error (CidE)	
		106: CANopen station address error (CAdE)	
		107: CANopen index setting exceed limit (CFrE)	
		111: inrCOM time-out error (ictE)	
		121: internal communication error (CP20)	
		123: internal communication error (CP22)	
		124: internal communication error (CP30)	
		126: internal communication error (CP32)	
		127: internal communication error (CP33)	
✗ 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
06-31	Frequency Command at Malfunction	0.00–400.00 Hz	Read only
06-32	Output Frequency at Malfunction	0.00–400.00 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 ºC	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
06-42	Drive Status at Malfunction	0000h–FFFFh	Read only
✗ 06-45	Output Phase Loss Detection Action (Ophl)	0: Warn and continue operation 1: Warn and ramp to stop 2: Warn and coast to stop 3: No warning	3
✗ 06-46	Detection Time for Output Phase Loss	0.000–65.535 sec.	0.500

Pr.	Parameter Name	Settings	Default
✗ 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 Auto-Reset	0: Disabled 1: Enabled	0
✗ 06-53	input Phase Loss Detection Action (Orp)	0: Warn and ramp to stop 1: Warn and coast to stop	0
06-63	Operation Time of Fault Record 1 (Day)	0–65535 days	Read only
06-64	Operation Time of Fault Record 1 (Min.)	0–1439 min.	Read only
06-65	Operation Time of Fault Record 2 (Day)	0–65535 days	Read only
06-66	Operation Time of Fault Record 2 (Min.)	0–1439 min.	Read only
06-67	Operation Time of Fault Record 3 (Day)	0–65535 days	Read only
06-68	Operation Time of Fault Record 3 (Min.)	0–1439 min.	Read only
06-69	Operation Time of Fault Record 4 (Day)	0–65535 days	Read only
06-70	Operation Time of Fault Record 4 (Min.)	0–1439 min.	Read only
✗ 06-71	Low Current Setting Level	0.0–100.0%	0.0
✗ 06-72	Low Current Detection Time	0.00–360.00 sec.	0.00
✗ 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
06-90	Operation Time of Fault Record 5 (Day)	0–65535 days	Read only
06-91	Operation Time of Fault Record 5 (Min.)	0–1439 min.	Read only
06-92	Operation Time of Fault Record 6 (Day)	0–65535 days	Read only
06-93	Operation Time of Fault Record 6 (Min.)	0–1439 min.	Read only

07 Special Parameters

	Pr.	Parameter Name	Settings	Default
✗	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	0.00–400.00 Hz	0.00
✗	07-05	Voltage increasing Gain	1–200 %	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	0.0–5.0 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: No function 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
✗	07-16	Dwell Frequency at Acceleration	0.00–400.00 Hz	0.00
✗	07-17	Dwell Time at Deceleration	0.00–600.00 sec.	0.00
✗	07-18	Dwell Frequency at Deceleration	0.00–400.00 Hz	0.00

	Pr.	Parameter Name	Settings	Default
✗	07-19	Fan Cooling Control (Only Valid for Models With Fans)	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 60oC. 5: Fan is ON when the AC motor drive runs; fan is OFF when the AC motor drive stops. Fan is in stand-by mode at zero speed.	3
✗	07-20	Emergency Stop (Ef) & force To Stop Selection	0: Coast to stop 1: by the first deceleration time 2: by the second deceleration time 3: by the third deceleration time 4: by the fourth deceleration time 5: System deceleration 6: Automatic deceleration	0
✗	07-21	Automatic Energy-Saving Setting	0: Disabled 1: Enabled	0
✗	07-22	Energy-Saving Gain	10–1000	100
✗	07-23	Automatic Voltage Regulation (Avr) Function	0: Enable AVR 1: Disable AVR 2: Disable AVR during deceleration	0
✗	07-24	Torque Command Filter Time	0.001–10.000 sec.	0.050
✗	07-25	Torque Command Filter Time	0.001–10.000 sec.	0.100
✗	07-26	Torque Compensation Gain	0–10	1
✗	07-27	Slip Compensation Gain	0.00–10.00	0.00
✗	07-29	Slip Deviation Level	0.0–100.0 0: No detection	0
✗	07-30	Over-Slip Deviation Detection Time	0.0–10.0 sec.	1.0
✗	07-31	Over-Slip Deviation Treatment	0: Warn and continue operation 1: Warn and ramp to stop 2: Warn 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
✗	07-62	Deb Gain (Kp)	0–65535	8000
✗	07-63	Deb Gain (Ki)	0–65535	150

08 Reserved

6-1-22

09 Communication Parameters

	Pr.	Parameter Name	Settings	Default
✗	09-00	Communication Address	1–254	1
✗	09-01	Com1 Transmission Speed	4.8–19.2 Kbps	9.6
✗	09-02	COM1 Transmission Fault Treatment	0: Warn and continue operation 1: Warn and ramp to stop 2: Warn and coast to stop 3: No Warn and continue operation	3
✗	09-03	COM1 Time-Out Detection	0.0–100.0 sec.	0.0
✗	09-04	Com1 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	0.00–400.00 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
✗	09-21	Block Transfer 11	0–65535	0

	Pr.	Parameter Name	Settings	Default
✗	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
	09-36	Canopen Slave Address	0: Disable 1–127	0
	09-37	Canopen Speed	0: 1 Mbps 1: 500 Kbps 2: 250 Kbps 3: 125 Kbps 4: 100 Mbps (Delta Only) 5: 50 Kbps	0
	09-39	Canopen Warning Record	bit 0: CANopen software disconnection 1 　　　(CANopen Guarding Time-out) bit 1: CANopen software disconnection 2 　　　(CANopen Heartbeat Time-out) bit 3: CANopen SDO time-out bit 4: CANopen SDO buffer overflow bit 5: CANopen hardware disconnection warning 　　　(CANopen Bus OFF) bit 6: CANopen format error warning (Error 　　　protocol for CANopen)	0
	09-40	Canopen Decoding Method	0: Use Delta-defined decoding method 1: Use CANopen Standard DS402 protocol	1
	09-41	Canopen Communication Status	0: Node Reset State 1: Com Reset State 2: Boot up State 3: Pre-operation State 4: Operation State 5: Stop State	Read only

10 Speed Feedback Control Parameters

	Pr.	Parameter Name	Settings	Default
✗	10-29	Upper Limit of Frequency Deviation	0.00–200.00 Hz	20.00

11 Reserved

12 System control and CANopen function parameters

Pr.	Parameter Name	Settings	Default
12-00	System Control	bit 3: Dead time compensation closed bit 7: Save or do not save the frequency	0
12-01	Pwm Mode Selection	0: Two-phase modulation mode 2: Space vector modulation mode	2
✗ 12-02	System Control Flag	0000–FFFFh	0000
12-03	Canopen Cycle Time Setting	1–400 ms	50
12-04	Canopen Online Response Time	1–30000 ms	1000
12-05	Canopen Detects Master Time	1–30000 ms	1000
12-06	Canopen Detects Master Number	1–127	127
12-07	Canopen Protocol Selection	0: Standard CiA402 Protocol 1: Customization	0
12-08	Canopen MO1 Disconnection Disposal	0: MO1 output disconnected 1: MO1 output closed 2: MO1 output maintains the previous state	2
12-09	Canopen MO2 Disconnection Disposal	0: MO2 output disconnected 1: MO2 output closed 2: MO2 output maintains the previous state	2
12-10	Canopen MO3 Disconnection Disposal	0: MO3 output disconnected 1: MO3 output closed 2: MO3 output maintains the previous state	2
12-11	Canopen MO4 Disconnection Disposal	0: MO4 output disconnected 1: MO4 output closed 2: MO4 output maintains the previous state	2
12-12	Canopen TPDO Delay Time	0.0–100.0 %	20.0
12-50	Output Frequency at Fault 2	0.00–400.00 Hz	Read only
12-51	DC Bus Voltage at Malfunction 2	0.0–6553.5 V	Read only
12-52	Output Current at Malfunction 2	0.00–655.35 Amps	Read only
12-53	IGBT Temperature at Malfunction 2	-3276.7–3276.7 ºC	Read only
12-54	Output Frequency at Malfunction 3	0.00–400.00 Hz	Read only
12-55	DC Bus Voltage at Malfunction 3	0.0–6553.5 V	Read only

Pr.	Parameter Name	Settings	Default
12-56	Output Current at Malfunction 3	0.00–655.35 Amps	Read only
12-57	IGBT Temperature at Malfunction 3	-3276.7–3276.7 ºC	Read only
12-58	Output Frequency at Malfunction 4	0.00–400.00 Hz	Read only
12-59	DC Bus Voltage at Malfunction 4	0.0–6553.5 V	Read only
12-60	Output Current at Malfunction 4	0.00–655.35 Amps	Read only
12-61	IGBT Temperature at Malfunction 4	-3276.7–3276.7 ºC	Read only
12-62	Output Frequency at Malfunction 5	0.00–400.00 Hz	Read only
12-63	DC Bus Voltage at Malfunction 5	0.0–6553.5 V	Read only
12-64	Output Current at Malfunction 5	0.00–655.35 Amps	Read only
12-65	IGBT Temperature at Malfunction 5	-3276.7–3276.7 ºC	Read only
12-66	Output Frequency at Malfunction 6	0.00–400.00 Hz	Read only
12-67	DC Bus Voltage at Malfunction 6	0.0–6553.5 V	Read only
12-68	Output Current at Malfunction 6	0.00–655.35 Amps	Read only
12-69	IGBT Temperature at Malfunction 6	-3276.7–3276.7 ºC	Read only
12-70	Fault Record 7	Refer to fault record Pr.06-17–06-22	0
12-71	Fault Record 8	Refer to fault record Pr.06-17–06-22	0
12-72	Fault Record 9	Refer to fault record Pr.06-17–06-22	0
12-73	Fault Record 10	Refer to fault record Pr.06-17–06-22	0

13 Control Mode Parameter Macro Function

Pr.	Parameter Name	Settings	Default
13-00	Macro Selection	0: No Function 1: by user 2: I/O mode control 3: CANopen remote control and monitoring mode 4: I/O control and CANopen remote monitoring mode	0

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6.1-30

6-2 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.

230V Models - Single-phase					
Frame	A			B	
Power (kW)	0.2	0.4	0.75	1.5	2.2
Power (HP)	0.25	0.5	1	2	3
Identity Code	302	303	304	305	306
Rated Current	1.6	2.5	4.2	7.5	11.0

460V Models - Three-phase						
Frame	A			B		
Power (kW)	0.4	0.75	1.5	2.2	4.0	5.5
Power (HP)	0.5	1	2	3	5.5	7.5
Identity Code	403	404	405	406	407	408
Rated Current	1.5	2.5	4.2	5.5	9.0	13

00-02	Parameter Reset

Default: 0

Settings   0: No function

1: Write protection for parameters

5: Return kWh displays to 0

7: Reset CANopen Slave index

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)

📖 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.

  7: Reset the related settings of CANopen slave. Generally, it needs to be reset after setting Pr.12-07, 09-40, 09-30, etc., otherwise the CANopen network cannot be connected normally.

  8: RUN key on the keypad is invalid; the rest of the keys work normally. Set Pr.00-02 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 the setting of 9 and 10, 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)
    4: DI / DO status

  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 (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)
    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: %)
    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)
    36: Present operating carrier frequency of the drive (J.) (Unit: Hz)
    38: AC motor drive status (6.)
    41: kWh display (J) (Unit: kWh)

Explanation 1

If MI1 and MI4 are ON, the following table shows the status of the terminals.

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

Terminal	MI6	MI5	MI4	MI3	MI 2	MI 1
Status	0	1	0	0	0	1

● The value is 0000 0000 0000 0001 in binary. and 0011H in HEX. When Pr.00-04 is set to 16 or 9, 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 2

Example: Assume that MO: 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	MO2	MO3	MO4
Status	1	0	0	0

● 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 3

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

Explanation 4

● 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

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

00-06 Firmware Version

Default: #.#

Settings   Read only

✗ **00-07** Parameter Protection Password Input

Default: 0

Settings   0–9998

Display   0–4 (the number of 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
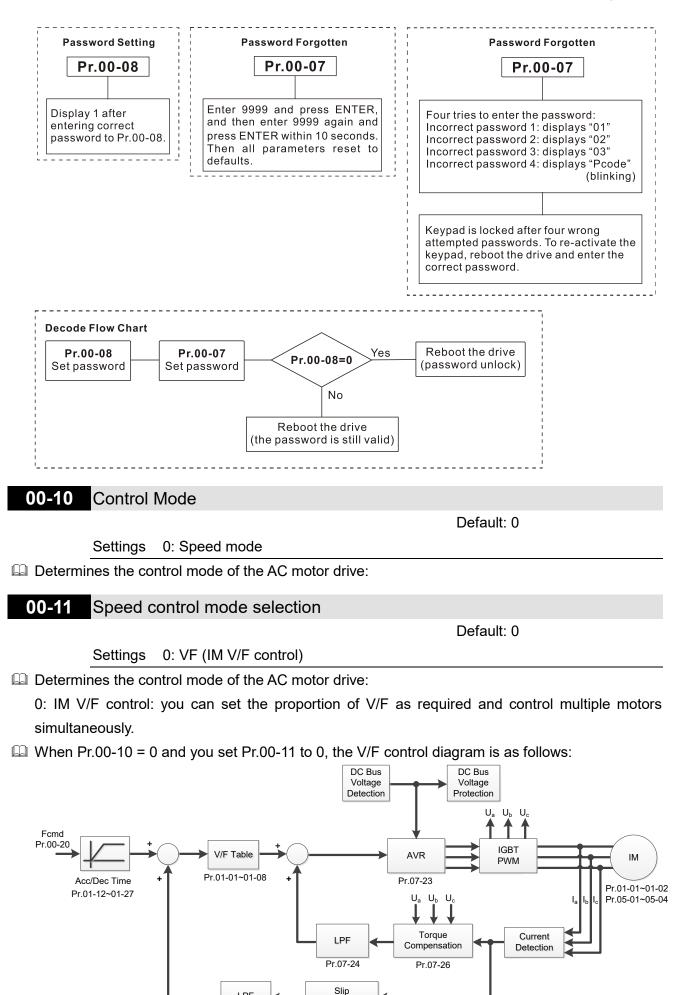
Default: 0

Settings   0–9998

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.

Password Setting

Pr.00-08

Display 1 after entering correct password to Pr.00-08.

Password Forgotten

Pr.00-07

Enter 9999 and press ENTER, and then enter 9999 again and press ENTER within 10 seconds. Then all parameters reset to defaults.

Password Forgotten

Pr.00-07

Four tries to enter the password:
Incorrect password 1: displays "01"
Incorrect password 2: displays "02"
Incorrect password 3: displays "03"
Incorrect password 4: displays "Pcode"
(blinking)

Keypad is locked after four wrong attempted passwords. To re-activate the keypad, reboot the drive and enter the correct password.

Decode Flow Chart

Pr.00-08
Set password

Pr.00-07
Set password

Pr.00-08=0 — Yes → Reboot the drive (password unlock)

No → Reboot the drive (the password is still valid)

00-10 Control Mode

Default: 0

Settings   0: Speed mode

📖 Determines the control mode of the AC motor drive:

00-11 Speed control mode selection

Default: 0

Settings   0: VF (IM V/F control)

📖 Determines 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.

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

00-16 Load selection

Default:1

Settings 1: Heavy load

  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.

  In Heavy Duty, the default setting of Pr.06-03 and Pr.06-04 is 180%, and the maximum is 200%. However, if DC voltage is higher than 700 V_{DC} (460V models) or 350 V_{DC} (230V models), then the maximum is 165%.

00-17 Carrier frequency

Default:2

Settings Heavy load: 2–9 kHz

  Determines the PWM carrier frequency for the AC motor drive.

Models	230V	460V
Model	0.25–3 HP [0.2–2.2 kW]	0.5–5 HP [0.4–4.0 kW]
Settings	2–9 kHz	
Default:	2 kHz	

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

  From the table, you see that the PWM carrier frequency has significant influences on the 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 chapter 4-5 for the related setting and details.

✗ 00-20 Master frequency command source (AUTO, REMOTE)

Default: 6

Settings 0: Digital keypad

1: RS-485 communication input

3: External UP / DOWN terminal

6: CANopen communication

  You can switch the HAND, LOCAL mode with the multi-function input terminal (MI) to set the master frequency source.

  Pr.00-20, 00-21 and 00-30, 00-31 are the frequency and operation source setting of AUTO and HAND respectively.

📕 The default for the frequency source or operation source is for AUTO mode. 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.

✗ **00-21** Operation command source (AUTO, REMOTE)

Default: 3

Settings 0: Digital keypad

1: External terminals

2: RS-485 communication input

3: CANopen communication

📕 Determines 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.

📕 When the operation command is controlled by CANopen, the CRUN function on the panel is valid.

✗ **00-22** Stop method
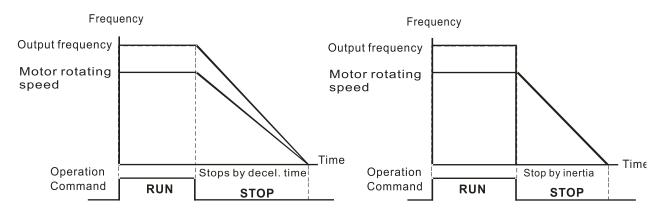
Default: 0

Settings 0: Ramp to stop

1: Coast to stop

📕 Determines how the motor is stopped when the drive receives the Stop command.

Ramp to Stop and Coast to Stop

1. Ramp to stop: the AC motor drive decelerates to 0 or the minimum output frequency (Pr.01-09) according to the set deceleration time, and then to stop (according to Pr.01-07).

2. Coast to stop: the AC motor drive stops output immediately, and the motor coasts to stop according to the load inertia.

☑ 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.

✗ **00-23** Motor direction control

Default: 0

Settings　0: Enable forward / reverse

1: Disable reverse

2: Disable forward

  📖 Enables 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.

00-29 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,that is, the Local / Remote function. LOC or REM. Set the REMOTE and LOCAL frequency and operation source with Pr.00-20, 00-21, 00-30, and 00-31. Set the multi-function input terminal (MI) = 56 to set the LOC / REM selection.

✗ **00-30** Master frequency command source (HAND, LOCAL)

Default: 6

Settings　0: Digital keypad

1: RS-485 communication input

3: External UP / DOWN terminal

6: CANopen communication

  📖 Determines the master frequency source in the "HAND, LOCAL" mode.

  📖 You can switch the HAND, LOCAL mode with 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.

00-31 Operation command source (HAND, LOCAL)

Default: 3

Settings 0: Digital keypad
1: External terminals
2: RS-485 communication input
3: CANopen communication

📖 Determines 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.

📖 When the operation command is controlled by CANopen, the CRUN function on the panel is valid.

✗ 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.

00-47 Output Phase Order Selection

Default: 0

Settings 0: Standard
1: Reverse the operation direction

📖 Without changing the output wiring of the motor drive, the actual running direction of the motor can be changed from forward to reverse and reverse to forward through this parameter, and the indicator signals (FWD, REV) on the keypad remain unchanged.

📖 When using this parameter with Pr.00-23 (Motor Direction Control), the output logic is to first judge whether there is a prohibited direction, and then whether to output the reverse direction. If a certain direction is prohibited, no action will be taken.

✗ 00-48 Display Filter Time (Current)

Default: 0.100

Settings 0.001–65.535 sec.

📖 Minimizes the current fluctuation displayed by the digital keypad.

✗ 00-49 Display Filter Time (Keypad)

Default: 0.100

Settings 0.001–65.535 sec.

📖 Minimizes the value fluctuation displayed by the digital keypad.

00-50	Software Version (Date)

<div align="right">Default: Read only</div>

Settings   Read only

📖 Displays the current drive software version by date.

01 Basic Parameters

✗ You can set this parameter during operation.

| 01-00 | Motor 1 Maximum Operation Frequency |

Default: 60.00 / 50.00

Settings 0.00–400.00 Hz

📖 Determines the AC motor drive's maximum operation frequency.

| 01-01 | Minimum output frequency of motor 1 |

Default: 60.00 / 50.00

Settings 0.00–400.00 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 | Minimum output voltage of motor 1 |

Default: 220.0 / 440.0
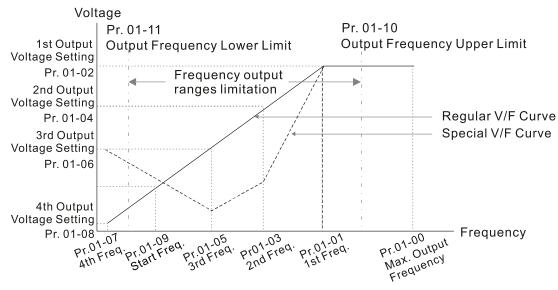
Settings 230V models: 0.0–255.0 V
460V models: 0.0–510.0 V

📖 Set this parameter according to the 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.

| 01-03 | Mid-point Frequency 1 of Motor 1 |

Default: 3.00

Settings 0.00–400.00 Hz

✗ | 01-04 | Mid-point Voltage 1 of Motor 1 |

Default: 11.0 / 22.0

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

| 01-05 | Mid-point frequency 2 of motor 1 |

Default: 1.5

Settings 0.00–400.00 Hz

✗ | 01-06 | Mid-point voltage 2 of motor 1 |

Default: 5.0 /10.0

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

| 01-07 | Minimum output frequency of motor 1 |

Default: 0.50

Settings 0.00–400.00 Hz

✗ | 01-08 | Minimum output voltage of motor 1 |

Default: 1.0 / 2.0

Settings 230V models: 0.0–240.0 V
460V models: 0.0–480.0 V
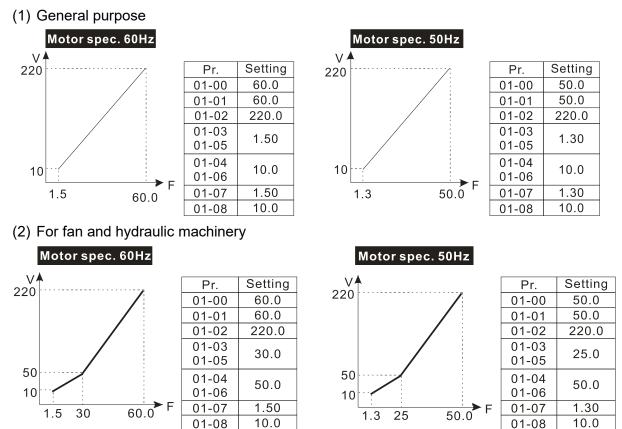
📖 You usually set the V/F curve according to the motor's allowable loading characteristics. Pay special attention to the motor's heat dissipation, dynamic balance, and bearing lubrication when the loading characteristics exceed the loading limit of the motor.
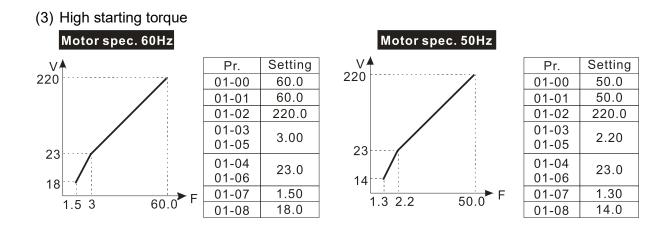
There is no limit for the voltage setting, but a high voltage at a low frequency may cause motor damage, overheating, and trigger the stall prevention or the over-current protection. Therefore, use low voltage at low frequency to prevent motor damage or drive error.

V/F Curve and The Related Parameters

📖 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   0.00–400.00 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 figure shown below:
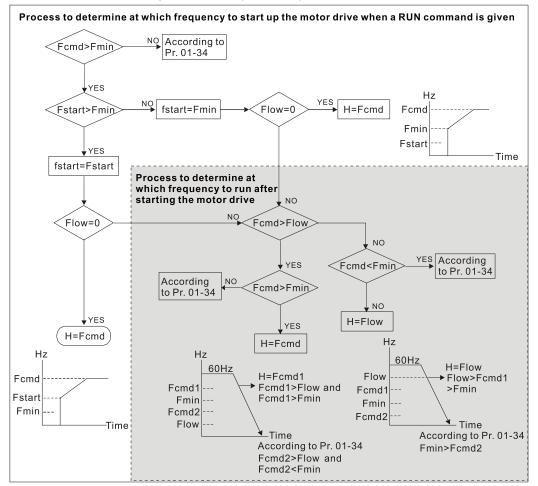
Fcmd = Frequency command;

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)
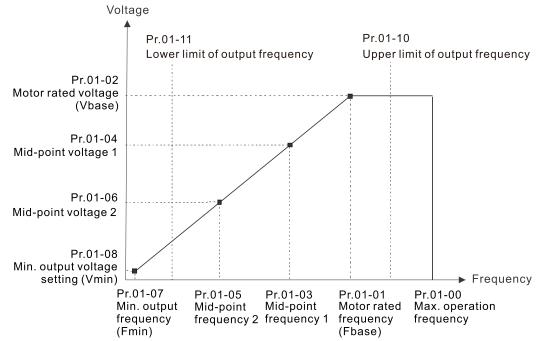
 📖 When Fcmd > Fmin and Fcmd < Fstart:

 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: 400.00

 Settings 0.00–400.00 Hz

✗ **01-11** Output Frequency Lower Limit

Default: 0.00

 Settings 0.00–400.00 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 frequency limit > lower frequency limit (Pr.01-10 setting value must be > Pr.01-11 setting value).

 📖 When the drive starts Pr.07-27 slip compensation, the output frequency may exceed the frequency command.
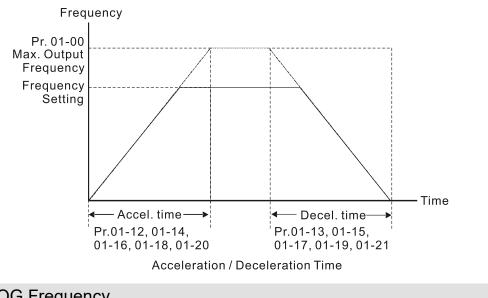
 📖 When the drive starts, it operates according to the V/F curve and accelerates from the minimum output frequency (Pr.01-07) to the setting frequency. It is not limited by the lower output frequency settings.

 📖 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 output frequency upper limit setting is 50 Hz and the frequency setting is 60 Hz, the maximum output frequency is 50 Hz.

📖 If the output 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 is in ready status without output.

✗	**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 /10.0

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 set the acceleration time too short may cause motor damage or trigger drive protection due to over-current during the drive's acceleration.

📖 Note that set 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.

📖 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.

Acceleration / Deceleration Time

01-22 JOG Frequency

Default: 6.00

Settings   0.00–400.00 Hz
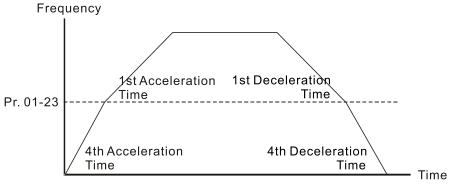
📖 You can use both the external terminal JOG and F1 key on the optional keypad KPC-CC01 (optional) to set the JOG function. When the JOG command is ON, the AC motor drive accelerates from 0 Hz to the JOG frequency (Pr.01-22). When the JOG command is OFF, the AC motor drive decelerates from the JOG frequency 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   0.00–400.00 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.

📖 When using this function, set the S-curve acceleration time to 0 if the fourth acceleration time is short.

1st/4th Acceleration/Deceleration Frequency Switching
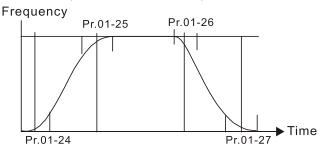
✗	**01-24**	S-curve acceleration begin time 1
✗	**01-25**	S-curve acceleration arrival time 2
✗	**01-26**	S-curve deceleration begin time 1
✗	**01-27**	S-curve deceleration arrival time 2
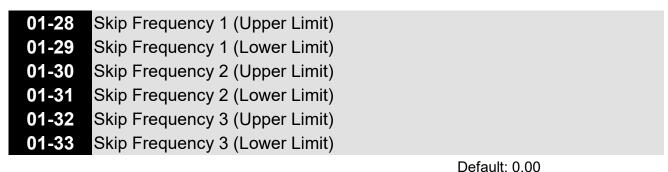
Default: 0.20

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   0.00–400.00 Hz
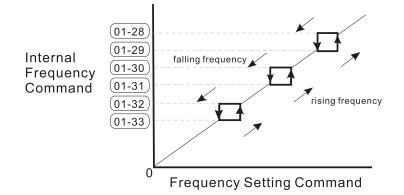
📖 Sets the AC motor drive's skip frequency. The drive's frequency setting skips these frequency ranges. However, the frequency output is continuous. There are no limits for these six parameters and you can combine them. Pr.01-28 does not need to be greater than Pr.01-29; Pr.01-30 does not need to be 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.
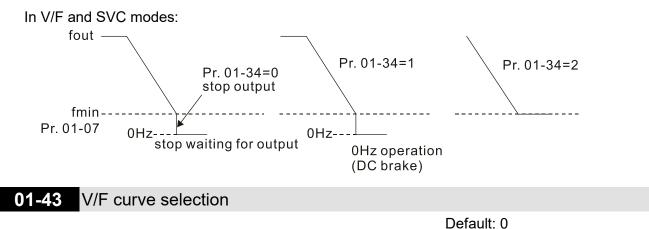
01-34 Zero-speed Mode

Default: 0

Settings 0: Output waiting

1: Zero-speed operation
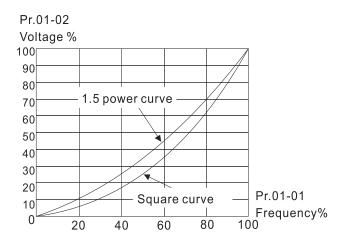
2: Fmin (refer to Pr.01-07 and Pr.01-41)

❑ 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, Pr.01-41) and Vmin (Pr.01-08, Pr.01-42) in V/F mode.

In V/F and SVC modes:

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.

❑ 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.
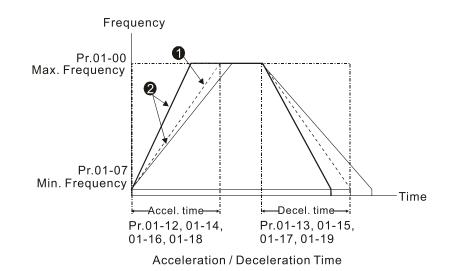
   📖 When you set the V/F curve to high power, it has lower torque at low frequency, and the drive is not suitable for rapid acceleration and deceleration. Do NOT use this parameter for rapid acceleration and deceleration.

Pr.01-02
Voltage %

01-44 Auto-acceleration and Auto-deceleration Setting
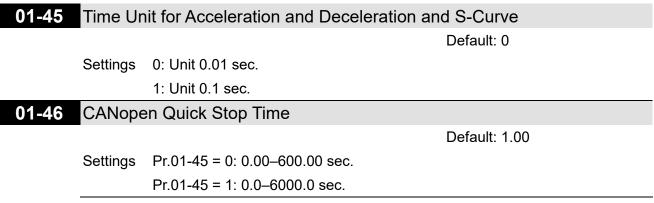
Default: 0

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 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 auto-tunes the acceleration and deceleration to effectively reduce the mechanical vibration during the load start-up and stop and make the auto-tuning process easier. 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–decelerating by the actual load): the drive auto-detects the load torque and automatically accelerates from the fastest acceleration time and smoothest start-up 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 deceleration–reference to the acceleration and deceleration time settings): if the acceleration and deceleration time are within a reasonable range, the actual acceleration and deceleration time refer to the Pr.01-12–01-19 settings. If the acceleration and deceleration time are too short, the actual acceleration and deceleration time are greater than the acceleration and deceleration time settings.

Acceleration / Deceleration Time

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.

01-46	CANopen Quick Stop Time

Default: 1.00

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

Pr.01-45 = 1: 0.0–6000.0 sec.

    Sets the time required to decelerate from the maximum operation frequency (Pr.01-00) to 0.00 Hz through the CANopen control.

02 Digital Input / Output Parameters

✗ You can set this parameter during operation.

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

Default: 1

Settings 0: No function

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)

This parameter sets the configuration of the external drive operation control and the Quick Start function. There are three different control modes listed in the following table.

Pr.02-00	External Terminal Control Circuits
Setting value: 1 Two-wire FWD / STOP REV / STOP	FWD / STOP — MI1 "OPEN": STOP / "CLOSE": FWD REV / STOP — MI2 "OPEN": STOP / "CLOSE": REV DCM — VFD-EL-C
Setting value: 2 Two-wire RUN / STOP REV / FWD	RUN / STOP — MI1 "OPEN": STOP / "CLOSE": RUN FWD / REV — MI2 "OPEN": FWD / "CLOSE": REV DCM — VFD-EL-C
Setting value: 3 Three-wire	STOP RUN — MI1 "CLOSE": RUN MI3 "OPEN": STOP REV / FWD — MI2 REV/FWD: "OPEN": FWD / "CLOSE": REV DCM — VFD-EL-C

02-01	Multi-function Input Command 1 (MI1)
02-02	Multi-function Input Command 2 (MI2)
02-03	Multi-function Input Command 3 (MI3)
02-04	Multi-function Input Command 4 (MI4)
02-05	Multi-function Input Command 5 (MI5)
02-06	Multi-function Input Command 6 (MI6)

Default: 0

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 command

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

11: Base Block (B.B.) input from external

12: Output stop

13: Cancel the setting of auto-acceleration / auto-deceleration time

18: Force to stop (Pr.07-20)

19: Frequency up command

20: Frequency down command

22: Clear the counter

23: Input the counter value (MI6)

24: FWD JOG command

25: REV JOG command

28: Emergency stop (EF1)

38: Disable writing EEPROM function

40: Force coasting to stop

41: HAND switch

42: AUTO switch

49: Enable drive

56: Local / Remote selection

  Use this parameter to set the function of multi-function terminals.

  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.

📖 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)

Settings	Functions	Descriptions
0	No function	
1	Multi-step speed command 1	You can set 15 steps of speed or 15 positions with the digital status of these four terminals. You can use 16-steps of speed if you include the master speed when setting as 15 steps of speed. (refer to Parameter Group 04 Multi-step Speed Parameters).
2	Multi-step speed command 2	
3	Multi-step speed command 3	
4	Multi-step speed command 4	
5	Reset	Use this terminal to reset the drive after clearing a drive fault.
6	JOG command	This function is valid when the source of the operation command is the external terminal. 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 is set to 1.
7	Acceleration / deceleration speed inhibit	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.

Settings	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. <table><tr><td>MIx = 8</td><td>MIx = 9</td><td>Accel. and decele. speed</td></tr><tr><td>OFF</td><td>OFF</td><td>1st accel./ decel. speed</td></tr><tr><td>ON</td><td>OFF</td><td>2nd accel./ decel. speed</td></tr><tr><td>OFF</td><td>ON</td><td>3rd accel./ decel. speed</td></tr><tr><td>ON</td><td>ON</td><td>4th accel./ decel. speed</td></tr></table>
9	3rd and 4th acceleration / deceleration time selection	
10	External Fault (EF) input (EF: External Fault)	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). The drive keeps running until the fault is cleared (terminal status restored) after 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 one of the 01–04 setting modes before using this function. When this function is enabled, OFF is for auto mode and ON is for linear acceleration / deceleration.
18	Force to stop	ON: the drive ramps to a stop according to the Pr.07-20 setting.
19	Frequency up command (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.
20	Frequency down command (Down Command)	The Frequency command returns to zero when the drive stops and the displayed frequency is 0.00 Hz. If you select Pr.12-00, bit 7 = 1, the frequency is not saved.
22	Clear the counter	ON: the current counter value is cleared and displays 0. The drive counts up when this function is disabled.

Settings	Functions	Descriptions
23	Input the counter value (MI6)	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 terminal. ON: the drive executes forward JOG. When executing the JOG command in torque mode, the drive automatically switches to speed mode. The drive returns to torque mode after the JOG command is complete.
25	REV JOG command	This function is valid when the source of the operation command is the external terminal. ON: the drive executes reverse JOG. When executing the JOG command in torque mode, the drive automatically switches to speed mode. The drive returns to torque mode after the JOG command is complete.
28	Emergency stop (EF1)	ON: the output of the drive stops immediately, displays "EF1" on the keypad, and the motor is in free run status. The drive keeps running until the external fault is cleared after you press RESET on the keypad. (EF: External Fault)
38	Disable writing EEPROM function	ON: writing to EEPROM is disabled. Changed parameters are not saved after powering off.
40	Force coasting to stop	ON: during operation, the motor coasts to stop.
41	HAND switch	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. The optional digital keypad KPC-CC01 displays the current status of the drive (HAND / OFF / AUTO).
42	AUTO switch	

	bit 1	bit 0
OFF	0	0
AUTO	0	1
HAND	1	0
OFF	1	1

Settings	Functions	Descriptions
49	Enable drive	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.
56	Local / Remote selection	Use Pr.00-29 to select LOCAL / REMOTE mode. (refer to Pr.00-29) |	bit 0
---	---
REMOTE	0
LOCAL	1	

✎ 02-09 UP / DOWN Key Mode
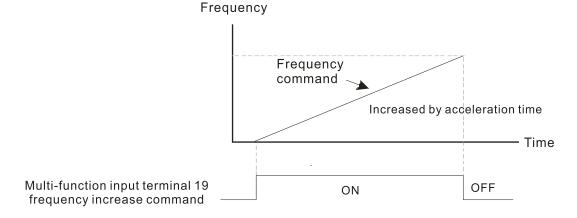
Default: 0

Settings　0: UP / DOWN by the acceleration / deceleration time

　　　　　1: UP / DOWN constant speed (Pr.02-10)

　　　　　2: Pulse signal (Pr.02-10)

　　　　　3: External terminals UP / DOWN key mode
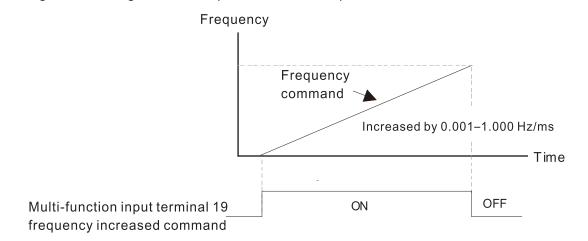
✎ 02-10 Acceleration / Deceleration Speed of External terminal UP / DOWN Key

Default: 0.001

Settings　0.001–1.000 Hz / ms

☷ Use when the multi-function input terminals are set to 19, 20 (Digital UP / DOWN command). The frequency increases or decreases 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, increasing or decreasing the Frequency command (F) by using the UP or DOWN key is valid only 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).

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–MI6.

   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: 0000

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

   This parameter is in hexadecimal.

   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 5 correspond to MI1–MI6.

   The default for bit 0 (MI1) is FWD terminal, and the default for bit 1 (MI2) is REV terminal. You cannot use this parameter to change the input mode when Pr.02-00 ≠ 0.

   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 terminal to run forward with the second step speed.

bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
MI6	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 (MO1)
✗	**02-14**	Multi-function Output 2 (MO2)
✗	**02-15**	Multi-function Output 3 (MO3)
✗	**02-16**	Multi-function Output 4 (MO4)

Default: 50

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)

9: Drive is ready

10: Low voltage warning (Lv) (Pr.06-00)

11: Malfunction indication

13: Overheat warning (Pr.06-15)

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 source

25: Forward command

26: Reverse command

29: Output when frequency ≥ Pr.02-34

30: Output when frequency < Pr.02-34

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)

43: Actual motor speed detection

44: Low current output (use with Pr.06-71–Pr.06-73)

46: Master dEb output

50: Output control for CANopen

51: Analog output control for RS-485 interface

75: Forward RUN status

76: Reverse RUN status

📖 Use this parameter to set the function of multi-function terminals.

Summary of Function Settings

(Take the normally open contact (N.O.) for example, closed: contacts are conducted)

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)	Activates when the desired frequency (Pr.02-24) is reached.
5	Zero speed (Frequency command)	Activates when Frequency command = 0 or stopped. (the drive must be in RUN status)
6	Zero speed including STOP (Frequency command)	Activates when Frequency command = 0 or stopped.
7	Over torque 1	Activates 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)
9	Drive is ready	Activates when the drive is ON with no error detected.
10	Low voltage warning (Lv)	Activates 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	Activates when fault occurs (except Lv stop).
13	Overheat warning	Activates when IGBT or heat sink overheats to prevent the drive from shutting down due to overheating. (Refer to Pr.06-15)
16	Slip error (oSL)	Activates when the slip error is detected.
17	Count value reached, does not return to 0 (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, returns to 0 (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	Activates when a warning is detected.
21	Over-voltage	Activates when over-voltage is detected.

Setting	Functions	Descriptions
22	Over-current stall prevention	Activates when the over-current stall prevention is detected.
23	Over-voltage stall prevention	Activates when over-voltage stall prevention is detected.
24	Operation source	Activates when the source of operation command is not controlled by the digital keypad (Pr.00-21 ≠ 0).
25	Forward command	Activates when the operation direction is forward.
26	Reverse command	Activates when the operation direction is reverse.
29	Outputs when frequency ≥ Pr.02-34	Activates when frequency is ≥ Pr.02-34 (actual output H ≥ Pr.02-34).
30	Outputs when frequency < Pr.02-34	Activates when frequency is < Pr.02-34 (actual output H < Pr.02-34).
33	Zero speed (actual output frequency)	Activates when the actual output frequency is 0 or stopped. (the drive must be in RUN status).
34	Zero speed including stop (actual output frequency)	Activates when the actual output frequency is 0 or stopped.
35	Error output selection 1	Activates when Pr.06-23 is ON.
36	Error output selection 2	Activates when Pr.06-24 is ON.
37	Error output selection 3	Activates when Pr.06-25 is ON.
38	Error output selection 4	Activates when Pr.06-26 is ON.
40	Speed reached (including Stop)	Activates when the drive's output frequency reaches the setting frequency or stopped.
43	The motor speed is less than Pr.02-47	Activates 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.
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.
50	Output control for CANopen	Control the multi-function output terminals through CANopen. Set Pr.02-13 = 50 to control MO1. The mapping table of the CANopen DO is shown in the following table: Refer to subsection 5-3-5 for more information.

Terminal	Related Parameters	Attribute	Mapping Index
MO1	Pr.02-13 = 50	RW	bit 0 of 2026-41 initial value 0x01
MO2	Pr.02-14 = 50	RW	bit 1 of 2026-41 initial value 0x01
MO3	Pr.02-15 = 50	RW	bit 2 of 2026-41 initial value 0x01
MO4	Pr.02-16 = 50	RW	bit 3 of 2026-41 initial value 0x01

Setting	Functions	Descriptions
51	Output control for RS-485	For RS-485 communication control output. Set Pr.02-13 = 51 to control MO1. The following is the RS485 mapping table. | Terminal	Related Parameters	Attribute	Mapping Index
---	---	---	---
MO1	Pr.02-13 = 51	RW	bit 0 of 2640H
MO2	Pr.02-14 = 51	RW	bit 1 of 2640H
MO3	Pr.02-15 = 51	RW	bit 2 of 2640H
MO4	Pr.02-16 = 51	RW	bit 3 of 2640H	
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.

✗ **02-18** Multi-function Output Direction

Default: 0000

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

📖 This parameter 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
MO4	MO3	MO2	MO1

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

Default: 0

Settings   0–65500
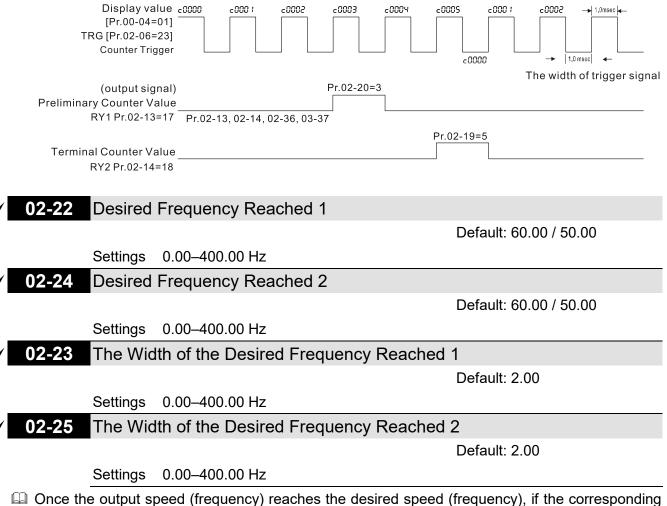
✗ **02-20** Preliminary Counting Value Reached (does not return to 0)

Default: 0
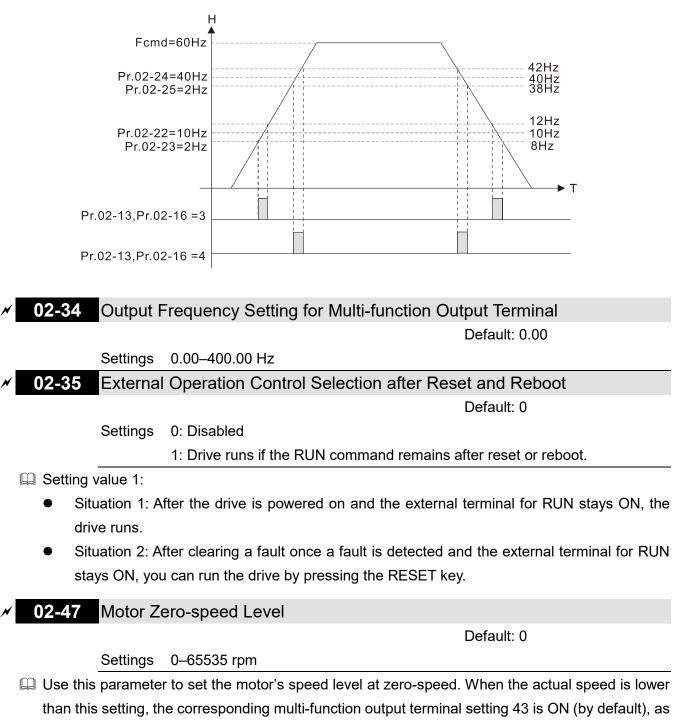
Settings   0–65500

📖 The counter can be triggered by multi-function input terminal MI6 ON / OFF state changes as the cumulative value of the counting value (Pr.02-06 is set to 23).

📖 The current counting value of the counter can be cleared by a multi-function input terminal MI1–MI5 any terminal (Pr.02-01–02-05 corresponding value is set to 22).

📖 Set the Pr.00-04 to 1: Display the value (C) (unit: CNT). Press the Mode button of the operating panel to switch the display value to the countor to check the current counting value. However, the panel display is limited by 4 digits, it's only for the value less than 999. It is recommended to use a communication method to check the count value when actual use. The mapping site is as follows.

1. Modbus communication check 2109H
2. Canopen (Delta Old Definition) Index 2022H-SUB02
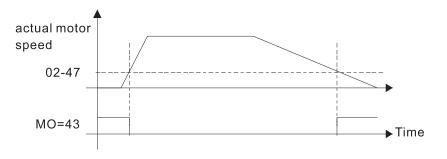
📖 The counting function is enabled when Pr.02-19 ≠ 0.

📖 The counting function is enabled when the setting of Pr.02-19 is greater than Pr.02-20.

📖 When the counter reaches Pr.02-19 or 02-20, the MO is activates according to the parameter settings.

1. Select the Pr.02-13–02-16 to be set to 18 as needed. When the counting value increase continually and reaches Pr.02-19, the corresponding multi-function output terminal MO1–MO4 contact to drive customer device connection, while the counting value will returns to zero. After the MI6 has a new count signal input, the count will be counted from 0 to enter the next circle.

2. Select the Pr.02-13–02-16 to be set to 17 as needed. When the counting value increase continually and reaches Pr.02-20, the corresponding multi-function output terminal MO1–MO4 contact to drive customer device connection, the counting value will not returns to zero. The value then counted after the MI6 input a new count signal, until the value reaches Pr.02-19 and value returns to zero.

3. The timing digram shows as follows:

02-22 Desired Frequency Reached 1

Default: 60.00 / 50.00

Settings   0.00–400.00 Hz

02-24 Desired Frequency Reached 2

Default: 60.00 / 50.00

Settings   0.00–400.00 Hz

02-23 The Width of the Desired Frequency Reached 1

Default: 2.00

Settings   0.00–400.00 Hz

02-25 The Width of the Desired Frequency Reached 2

Default: 2.00

Settings   0.00–400.00 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 and 02-16), this multi-function output terminal is "closed".

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

Default: 0.00

Settings   0.00–400.00 Hz

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.

📖 Setting value 1:

- 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
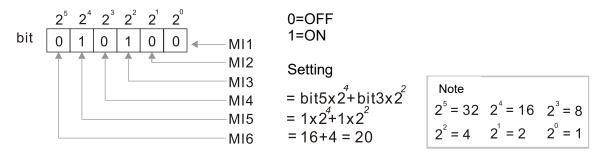
Default: Read only

Settings   Monitor the status of the Multi-function Input Terminal

```
      2⁵  2⁴  2³  2²  2¹  2⁰
bit  | 5 | 4 | 3 | 2 | 1 | 0 | ←── MI1
                               ──── MI2
0=OFF                          ──── MI3
1=ON                           ──── MI4
                               ──── MI5
                               ──── MI6
```

Note
$2^5 = 32$ $2^4 = 16$ $2^3 = 8$
$2^2 = 4$ $2^1 = 2$ $2^0 = 1$

📖 Example:
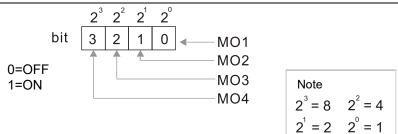
When Pr.02-50 displays 0014h (hex) (that is, the value is 20 (decimal) and 10100 (binary)), it means that MI3 and MI5 are ON.
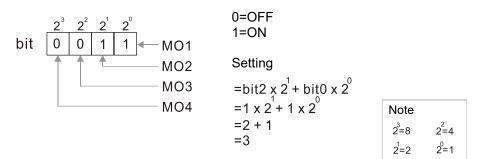
```
      2⁵  2⁴  2³  2²  2¹  2⁰
bit  | 0 | 1 | 0 | 1 | 0 | 0 | ←── MI1
                               ──── MI2
                               ──── MI3
                               ──── MI4
                               ──── MI5
                               ──── MI6
```

0=OFF
1=ON

Setting
$= bit5 \times 2^4 + bit3 \times 2^2$
$= 1 \times 2^4 + 1 \times 2^2$
$= 16 + 4 = 20$

Note
$2^5 = 32$ $2^4 = 16$ $2^3 = 8$
$2^2 = 4$ $2^1 = 2$ $2^0 = 1$

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

Default: Read only

Settings   Monitor the status of the Multi-function Output Terminal

```
      2³  2²  2¹  2⁰
bit  | 3 | 2 | 1 | 0 | ←── MO1
                       ──── MO2
0=OFF                  ──── MO3
1=ON                   ──── MO4
```

Note
$2^3 = 8$ $2^2 = 4$
$2^1 = 2$ $2^0 = 1$
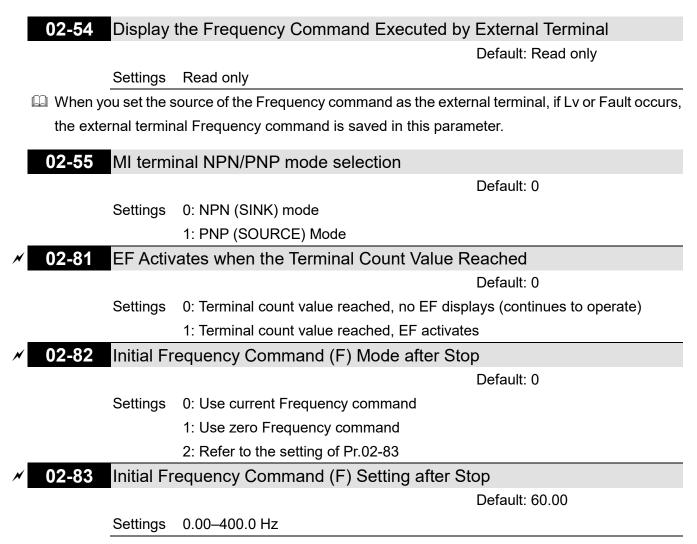
📖 Example:

When Pr.02-51 displays 0003h (hex) (that is, the value is 3 (decimal) and 0011 (binary)), it means that $2^0 + 2^1$ MO1 and MO2 are ON.

```
      2³  2²  2¹  2⁰
bit  | 0 | 0 | 1 | 1 | ←── MO1
                       ──── MO2
                       ──── MO3
                       ──── MO4
```

0=OFF
1=ON

Setting
$= bit2 \times 2^1 + bit0 \times 2^0$
$= 1 \times 2^1 + 1 \times 2^0$
$= 2 + 1$
$= 3$

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.

| **02-55** | MI terminal NPN/PNP mode selection |

Default: 0

Settings   0: NPN (SINK) mode
1: PNP (SOURCE) Mode

| ✗ **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 the setting of Pr.02-83

| ✗ **02-83** | Initial Frequency Command (F) Setting after Stop |

Default: 60.00

Settings   0.00–400.0 Hz

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6-2-0216

04 Multi-Step Speed Parameters

✗ You can set this parameter during operation.

✗	**04-00**	1st Step Speed
✗	**04-01**	2nd Step Speed
✗	**04-02**	3rd Step Speed
✗	**04-03**	4th Step Speed
✗	**04-04**	5th Step Speed
✗	**04-05**	6th Step Speed
✗	**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
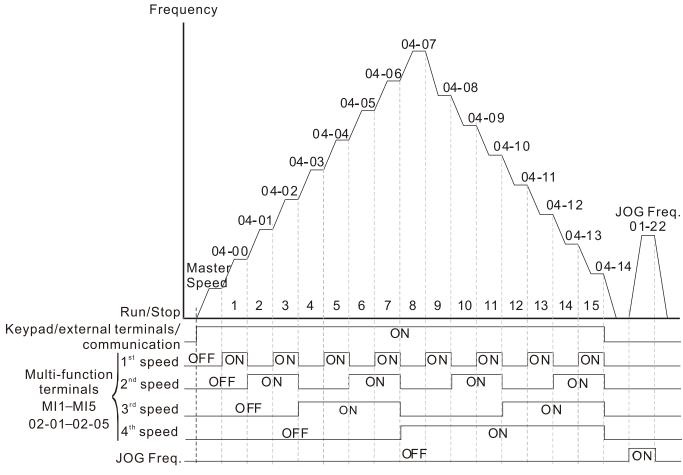
Settings   0.00–400.00 Hz
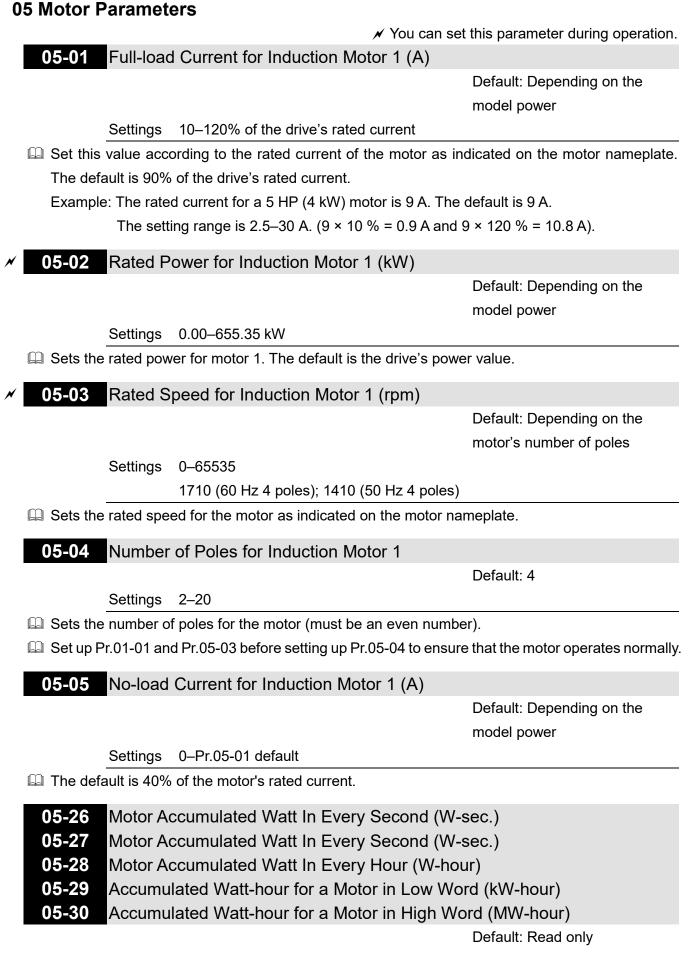
  Use the multi-function input terminals (refer to settings 1–4 of Pr.02-01–02-06 Multi-function Input Command) to select the multi-step speed command (the maximum is 15th step speed). Pr.04-00 to Pr.04-14 sets the multi-step speed (frequency) as shown in the following diagram.

  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 0.00–180.00 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.02-06: 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)
- Pr.02-06 multi-function input command 4 (MI6)

Speed selection via External Terminals

05 Motor Parameters

✗ You can set this parameter during operation.

05-01 Full-load Current for Induction Motor 1 (A)

Default: Depending 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 5 HP (4 kW) motor is 9 A. The default is 9 A.

The setting range is 2.5–30 A. (9 × 10 % = 0.9 A and 9 × 120 % = 10.8 A).

✗ **05-02** Rated Power for Induction Motor 1 (kW)

Default: Depending 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: Depending on the
motor's number of poles

Settings　0–65535

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

📖 Sets 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: Depending on the
model power

Settings　0–Pr.05-01 default

📖 The default is 40% of the motor's rated current.

05-26 Motor Accumulated Watt In Every Second (W-sec.)
05-27 Motor Accumulated Watt In Every Second (W-sec.)
05-28 Motor Accumulated Watt In Every Hour (W-hour)
05-29 Accumulated Watt-hour for a Motor in Low Word (kW-hour)
05-30 Accumulated Watt-hour for a Motor in High Word (MW-hour)

Default: Read only

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 (W-sec.)

  The accumulated total kilowatts of the motor per hour = Pr.05-30 x 65536 + Pr.05-29

Example: when Pr.05-29 = 3361.4 and Pr.05-30 = 11.2, the accumulated total kilowatts of the motor per hour = 11.2 x 65536 + 3361.4 = 734003.2 + 3361.4 = 737364.6 (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 0. An operation time shorter than 60 seconds is not recorded.

06 Protection Parameters (1)

✗ You can set this parameter during operation.
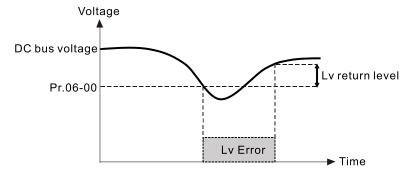
✗ **06-00** Low voltage level

Default: 180.0 / 360.0

Settings   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 coasts 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 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 (30V models), 60 V (230V models) or 60V (575 models).

✗ **06-01** Over-voltage Stall Prevention

Default: 380.0 / 760.0

Settings   0: No function

230V models: 0.0–450.0 V$_{DC}$
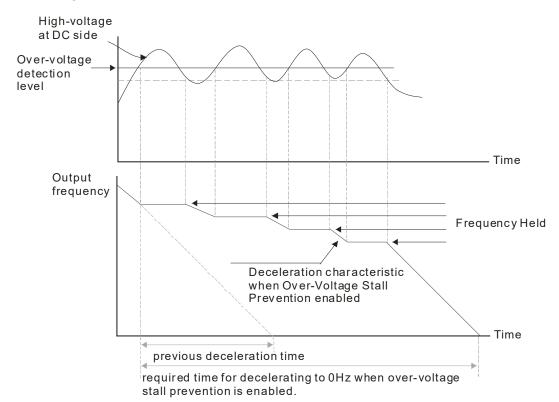
460V models: 0.0–900.0 V$_{DC}$

📖 Set Pr.06-01 to 0.0 disables the over-voltage stall prevention function (connected with braking unit or brake resistor).

📖 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.

📖 Related parameters: Pr.01-13, Pr.01-15, Pr.01-17, Pr.01-19 Deceleration Time 1–4, Pr.02-13 Multi-function Output (Relay), Pr.02-16 Multi-function Output (MO1), and Pr.06-02 Selection for Over-voltage Stall Prevention.

06-02 Selection for Over-voltage Stall Prevention
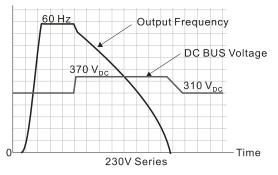
Default: 0

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.
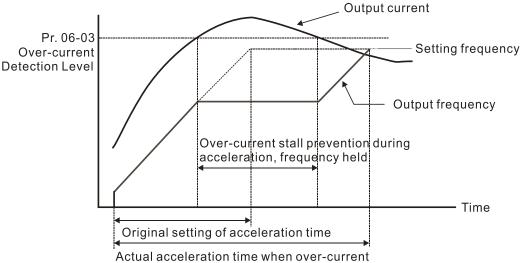
📖 When you enable the over-voltage stall prevention, the drive's deceleration time is longer than the setting.

📖 If the deceleration time affects your application, it is not recommended to use this function. The solution is to increase the deceleration time appropriately.

📖 Related parameters: Pr.01-13, Pr.01-15, Pr.01-17, Pr.01-19 Deceleration Time 1–4, Pr.02-13 Multi-function Output (Relay), Pr.02-16 Multi-function Output (MO1), and Pr.06-01 Over-voltage Stall Prevention.

✗ 06-03 Over-current Stall Prevention during Acceleration

Default: 180

Settings   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.

📖 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.

📖 If you encounter any problem with the acceleration time, refer to the following guides for troubleshooting.

1. Increase the deceleration time to a proper value.
2. Set Pr.01-44 Auto-Acceleration and Auto-Deceleration Setting to 1, 3 or 4. (auto-acceleration)
3. Related parameters:
    ● Pr.01-12, 01-14, 01-16, 01-18 (Acceleration Time 1–4)
    ● Pr.01-44 Auto-Acceleration and Auto-Deceleration Setting
    ● Pr.02-13–02-16 Multi-function Output 1 (MO1–MO4)
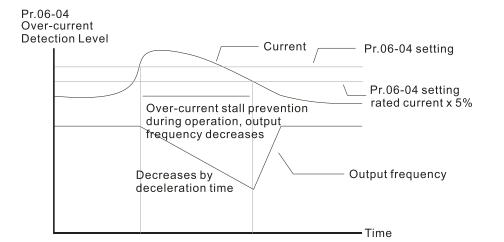
06-04 Over-current Stall Prevention during Operation

Default: 180

Settings   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. 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 Accel./Decel. Time Selection for Stall Prevention at Constant Speed

Default: 0
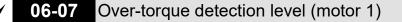
Settings   0: By current acceleration / deceleration time

          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)
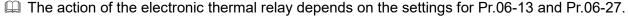
Default: 0

Settings   0: 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

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　0.1–60.0 sec.

06-13　Electronic Thermal Relay Selection 1 (Motor 1)

Default: 2

　　Settings　0: Inverter motor (with external forced cooling)
　　　　　　　1: Standard motor (motor with fan on the shaft)
　　　　　　　2: Disabled

 ☐ Prevents 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 is switched OFF, the electronic thermal relay protection is reset; therefore, even setting the parameter to 0 or 1 may not protect the motor well. 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)

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.

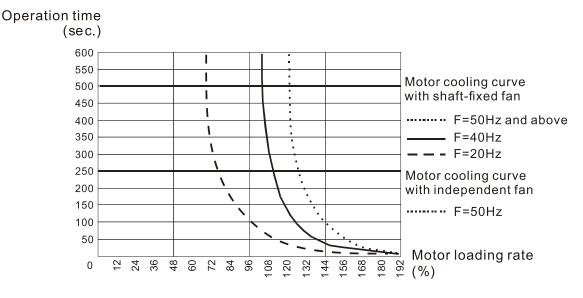 1.　Pr.06-13 or Pr.06-27 is set to 0 (using inverter motor):

   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.

✓ **06-15** Temperature Level Overheat (OH) Warning

Default: 95.0

Settings   0.0–110.0ºC

📖 The default value of this parameter is 105ºC. The drive will not displays an OH overheating warning if the setting is not lowered. When the temperature reaches 100ºC, the inverter will directly displays an IGBT overheating error and stop.

✓ **06-16** Stall prevention limit level

Default: 100

Settings   0–100% (Refer to Pr.06-03–Pr.06-04)

📖 This parameter only works in VF control mode.

📖 Sets the over-current stall prevention level when the motor's operation frequency is larger than Pr.01-01 (base frequency).

📖 Example: When Pr.06-03 = 150%, Pr.06-04 = 100% and Pr.06-16 = 80%.

The over-current stall prevention level during acceleration:

Pr.06-03 * Pr.06-16 = 150 x 80 % = 120%.

The over-current stall prevention level during operation:

Pr.06-04 * Pr.06-16 = 100 x 80 % = 80%.

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

Settings 0: No fault record

1: Over-current during acceleration (ocA)

2: Over-current during deceleration (ocd)

3: Over-current during steady operation (ocn)

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 (oL)

22: Electronics thermal relay 1 protection (EoL1)

26: Over torque 1 (ot1)

28: Under current (uC)

31: EEPROM read error (cF2)

33: U-phase error (od1)

34: V-phase error (od2)

35: W-phase error (od3)

36: cc hardware error   (Hd0)

37: oc hardware error (Hd1)

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)

62: Deceleration energy backup error (dEb)

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: U-phase output phase loss (oPHL)

83: V-phase output phase loss (oPHL)

84: W-phase output phase loss (oPHL)

87: Low frequency overload protection (oL3)

101: CANopen guarding error (CGdE)

102: CANopen heartbeat error (CHbE)

104: CANopen bus off error (CbFE)

105: CANopen index error (CidE)

106: CANopen station address error (CAdE)

107: CANopen index setting exceed limit (CFrE)

111: InrCOM time-out error (ictE)

121: Internal communication error (CP20)

123: Internal communication error (CP22)

124: Internal communication error (CP30)

126: Internal communication error (CP32)

127: Internal communication error (CP33)

  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 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 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)	●						

Fault Code	bit0	bit1	bit2	bit3	bit4	bit5	bit6
	current	Volt.	OL	SYS	FBK	EXI	CE
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 (oL)			●				
22: Electronics thermal relay 1 protection (EoL1)			●				
26: Over torque 1 (ot1)			●				
28: Under current (uC)	●						
31: EEPROM read error (cF2)				●			
33: U-phase error (od1)				●			
34: V-phase error (od2)				●			
35: W-phase error (od3)				●			
36: cc hardware error　(Hd0)				●			
37: oc hardware error (Hd1)				●			
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)							●
62: Deceleration energy backup error (dEb)		●					
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 (OPHL)	●						
83: Output phase loss V phase (OPH2)	●						
84: Output phase loss W phase (OPH3)	●						

Fault Code	bit0	bit1	bit2	bit3	bit4	bit5	bit6
	current	Volt.	OL	SYS	FBK	EXI	CE
87: Low frequency overload protection (oL3)			●				
101: CANopen guarding error (CGdE)							●
102: CANopen heartbeat error (CHbE)							●
104: CANopen bus off error (CbFE)							●
105: CANopen index error (CidE)							●
106: CANopen station address error (CAdE)							●
107: CANopen index setting exceed limit (CFrE)							●
111: InrCOM time-out error (ictE)							●
121: Internal communication error (CP20)							●
123: Internal communication error (CP22)							●
124: Internal communication error (CP30)							●
126: Internal communication error (CP32)							●
127: Internal communication error (CP33)							●

06-31　Frequency Command at Malfunction

Default: Read only

Settings　0.00–400.00 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

Settings　0.00–400.00 Hz

   📖 When a malfunction occurs, check the current output frequency. If the error happens again, this parameter overwrites the previous record.

06-33　Output Voltage at Malfunction

Default: Read only

Settings　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

Settings　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

Settings　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

Settings   -3276.7–3276.7 ºC

📖 When a malfunction occurs, check the current IGBT temperature. If the error happens again, this parameter overwrites the previous record.

06-38 Motor Speed at Malfunction

Default: Read only

Settings   -32767–32767 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

Settings   -32767–32767 %

📖 When a malfunction occurs, check the current 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

Settings   0000h–FFFFh

06-41 Status of the Multi-function Output Terminal at Malfunction

Default: Read only

Settings   0000h–FFFFh

📖 When a malfunction occurs, check the current 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

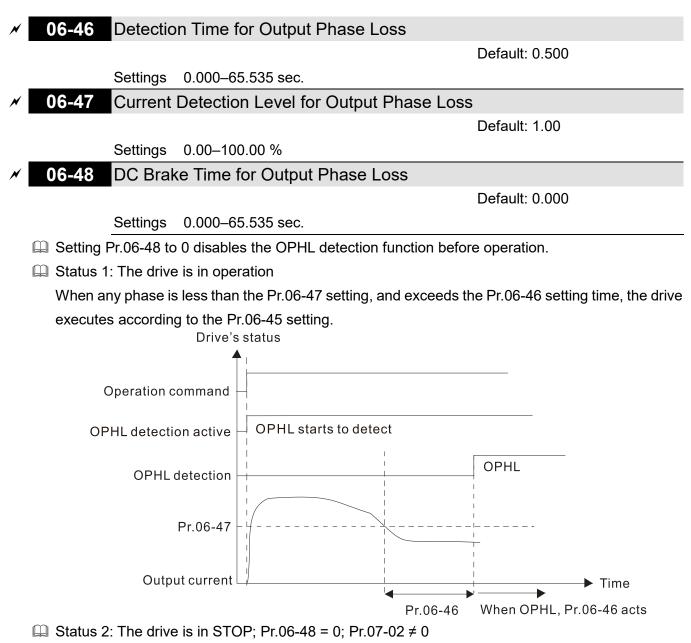Default: Read only

Settings   0000h–FFFFh

📖 When a malfunction occurs, check the current drive status (communication address 2101H). If the error happens again, this parameter overwrites the previous record.

06-45 Output Phase Loss Detection Action (OPHL)
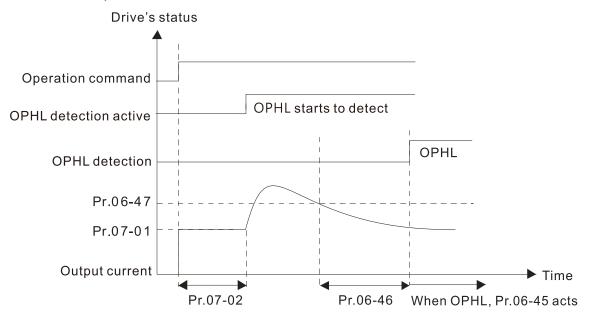
Default: 3

Settings   0: Warn and continue operation
            1: Warn and ramp to stop
            2: Warn 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.

☐ 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.

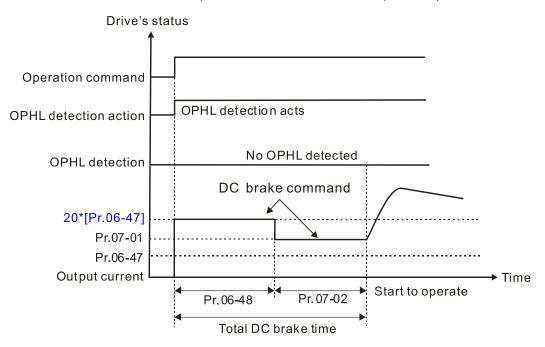☐ Status 2: The drive is in STOP; Pr.06-48 = 0; Pr.07-02 ≠ 0

After the drive starts, the DC brake operates according to Pr.07-01 and Pr.07-02. During this period, OPHL detection is not active. After the DC brake action is completed, the drive starts to run, and enables the OPHL protection as mentioned above for status 1.

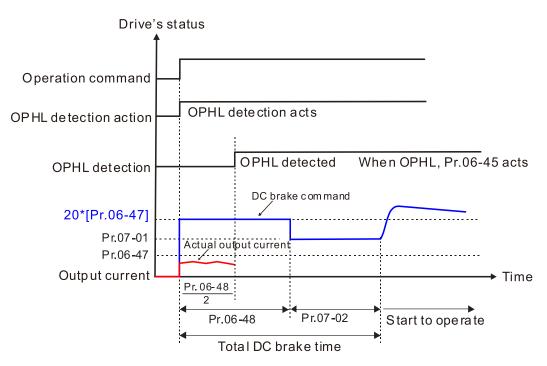Status 3: The drive is in STOP; Pr.06-48 ≠ 0; Pr.07-02 ≠ 0

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 3-1: Pr.06-48 ≠ 0; Pr.07-02 ≠ 0 (No OPHL detected before operation)

Status 3-2: Pr.06-48 ≠ 0; Pr.07-02 ≠ 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 4: 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 4-1: Pr.06-48 ≠ 0; Pr.07-02 = 0 (No OPHL detected before operation)

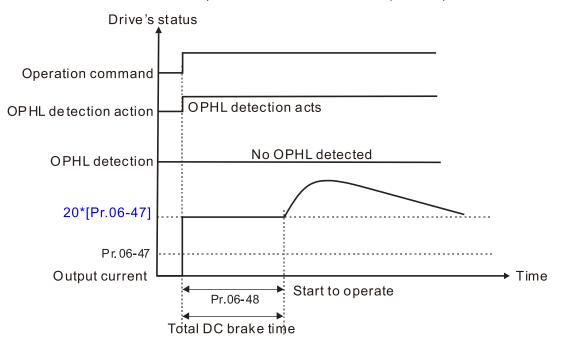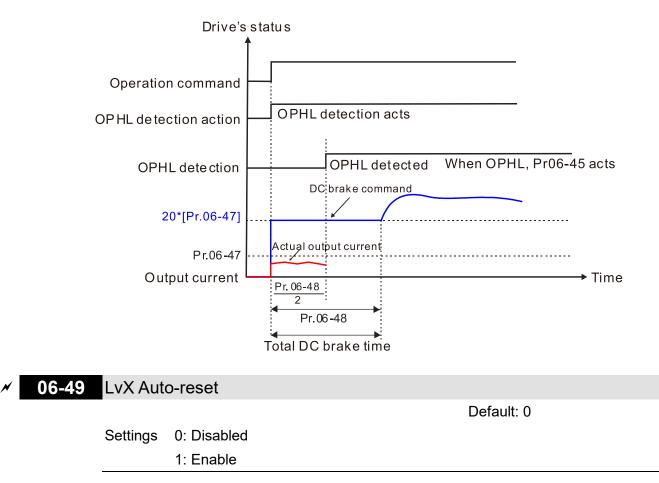Status 4-2: Pr.06-48 ≠ 0; Pr.07-02 = 0 (OPHL detected before operation)

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 Auto-reset

Default: 0

Settings   0: Disabled

              1: Enable

✗ **06-53** Input Phase Loss Detection Action (OrP)

Default: 0

Settings   0: Warn and ramp to stop

              1: Warn and coast to stop

📖 The drive executes the input phase loss protection according to Pr.06-53.

06-63	Operation Time of Fault Record 1 (Day)
06-65	Operation Time of Fault Record 2 (Day)
06-67	Operation Time of Fault Record 3 (Day)
06-69	Operation Time of Fault Record 4 (Day)
06-90	Operation Time of Fault Record 5 (Day)
06-92	Operation Time of Fault Record 6 (Day)

Default: Read only

Settings   0–65535 days

06-64	Operation Time of Fault Record 1 (Min.)
06-66	Operation Time of Fault Record 2 (Min.)
06-68	Operation Time of Fault Record 3 (Min.)
06-70	Operation Time of Fault Record 4 (Min.)
06-91	Operation Time of Fault Record 5 (Min.)
06-93	Operation Time of Fault Record 6 (Min.)

Default: Read only

Settings   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:

Parameters are recorded as follows:

	1st fault	2nd fault	3rd fault	4th fault	5th fault	6th fault
Pr.06-17	ocA	ocd	ocn	ocA	ocd	ocn
Pr.06-18	0	ocA	ocd	ocn	ocA	ocd
Pr.06-19	0	0	ocA	ocd	ocn	ocA
Pr.06-20	0	0	0	ocA	ocd	ocn
Pr.06-21	0	0	0	0	ocA	ocd
Pr.06-22	0	0	0	0	0	ocA
Pr.06-63	1000	560	120	1120	680	240
Pr.06-64	0	1	2	2	3	4
Pr.06-65	0	1000	560	120	1120	680

	1st fault	2nd fault	3rd fault	4th fault	5th fault	6th fault
Pr.06-66	0	0	1	2	2	3
Pr.06-67	0	0	1000	560	120	1120
Pr.06-68	0	0	0	1	2	2
Pr.06-69	0	0	0	1000	560	120
Pr.06-70	0	0	0	0	1	2

※ 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: Warn and coast to stop

2: Warn 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. Use this parameter 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.

07 Special Parameters

✎ You can set this parameter during operation.

07-01 DC Brake Current Level

Default: 0

Settings 0–100%

&& Sets 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 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.

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.

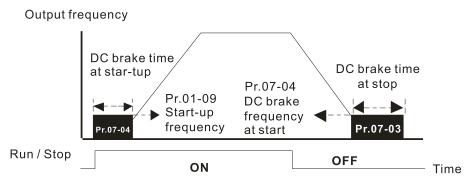### 07-03 DC brake time at STOP

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.

07-04 DC Brake Frequency at STOP

Default: 0.00

Settings 0.00–400.00 Hz

&& Determines 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 cranes or cutting machines.

✎ **07-05** Voltage Increasing Gain

Default: 100

Settings 1–200%

 📖 When using speed tracking, adjust Pr.07-05 to slow down the increasing voltage gain if there are errors such as oL or oc; however, the speed tracking time will be longer.

✎ **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

 📖 Determines 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 re-powered 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. It is recommended to 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. It is recommended to use this setting when there is little inertia and large resistance.

↗ 07-07 Allowed Power Loss Duration
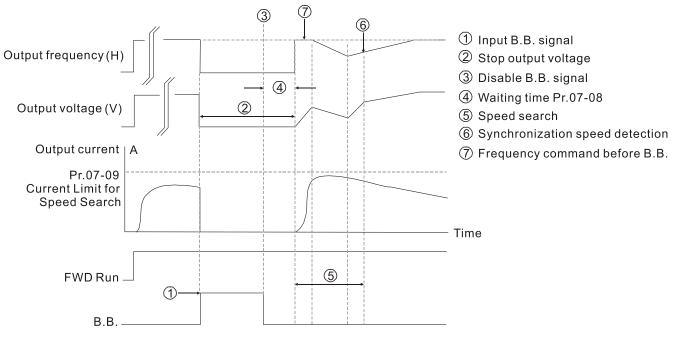
Default: 2.0

Settings   0.0–20.0 sec.

📖 Determines 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 is powered off due to overload, even if the maximum allowable power loss time is ≤ 20 seconds, the drive does not execute the operation mode you set for Pr.07-06. In that case it starts up normally.
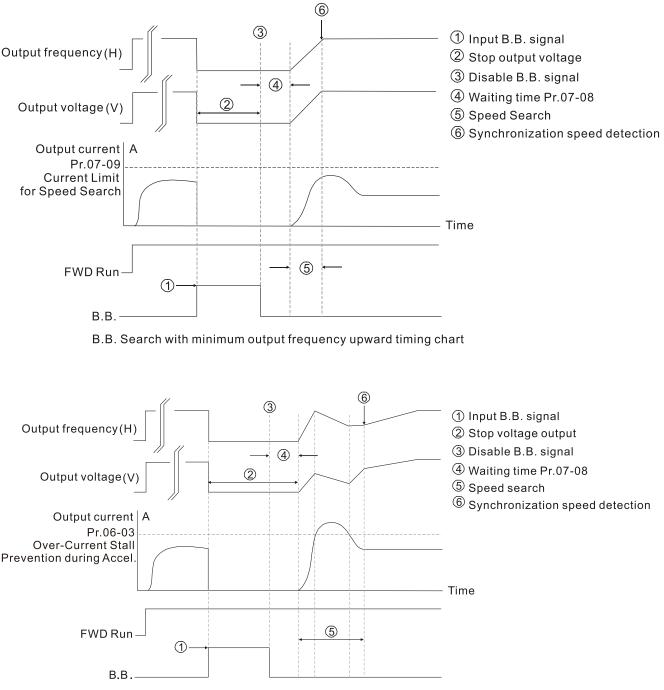
↗ 07-08 Base Block Time

Default: 0.5

Settings   0.0–5.0 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.

① Input B.B. signal
② Stop output voltage
③ Disable B.B. signal
④ Waiting time Pr.07-08
⑤ Speed search
⑥ Synchronization speed detection
⑦ Frequency command before B.B.

B.B. Search with last output frequency downward timing chart

Output frequency (H)

Output voltage (V)

Output current | A
Pr.07-09
Current Limit
for Speed Search

① Input B.B. signal
② Stop output voltage
③ Disable B.B. signal
④ Waiting time Pr.07-08
⑤ Speed Search
⑥ Synchronization speed detection

Time

FWD Run

B.B.

B.B. Search with minimum output frequency upward timing chart

Output frequency (H)

Output voltage (V)

Output current | A
Pr.06-03
Over-Current Stall
Prevention during Accel.

① Input B.B. signal
② Stop voltage output
③ Disable B.B. signal
④ Waiting time Pr.07-08
⑤ Speed search
⑥ Synchronization speed detection

Time

FWD Run

B.B.

Over-current stall prevention action chart

✎ **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: 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

📖 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: Disabled

1: dEb with auto-acceleration / auto-deceleration, the drive does not output the frequency after the power is restored.
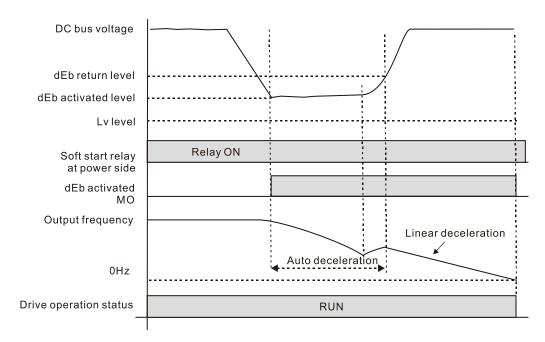
2: dEb with auto-acceleration / auto-deceleration, the drive outputs the frequency after the power is restored.

📖 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: Pr.06-00 + 60 V / 30 V (460V models: 60V, 230V models: 30V)

📖 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.

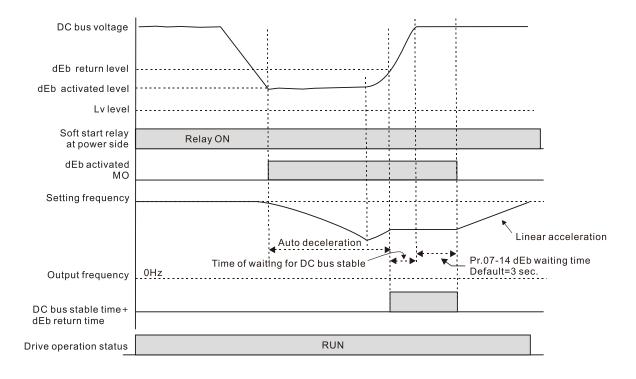Pr.07-13=1, "dEb active, DC bus voltage returns, output frequency does not return" and power recovers.

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.

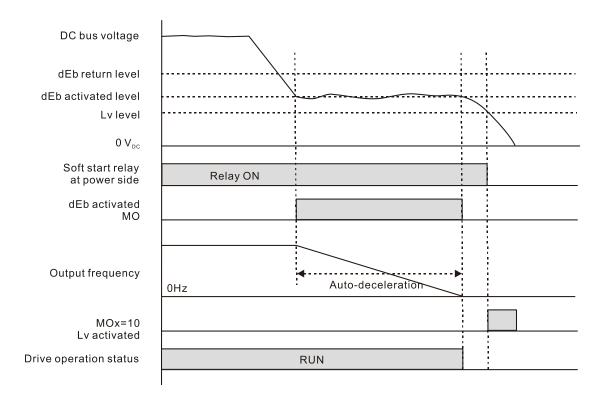Pr.07-13=2 "dEb active, DC bus voltage returns, output frequency returns" and power recovers.

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 clears automatically.

● Situation 3: Unexpected power shut down or power loss

Pr.07-13=1 "dEb active, DC bus voltage returns, the output frequency does not return" and the 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.
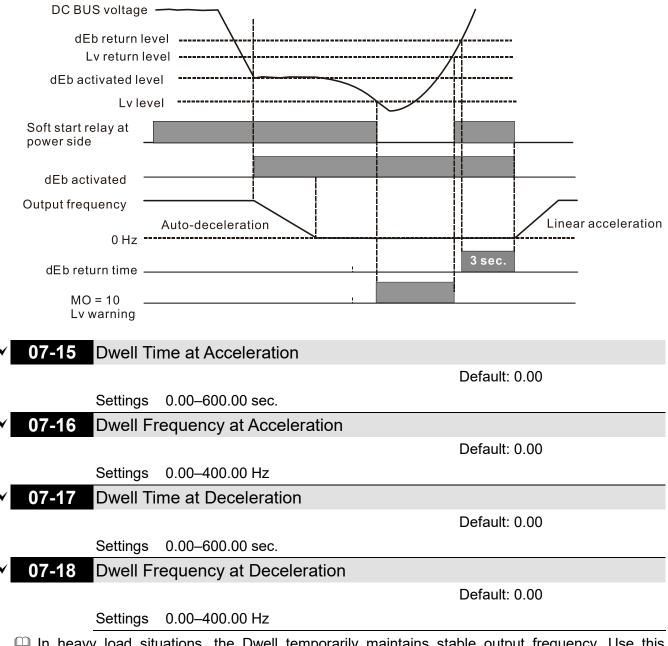
● Situation 4: Pr.07-13=2 "dEb active, DC bus voltage returns, the output frequency returns" and power does not recover.

   Same 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.
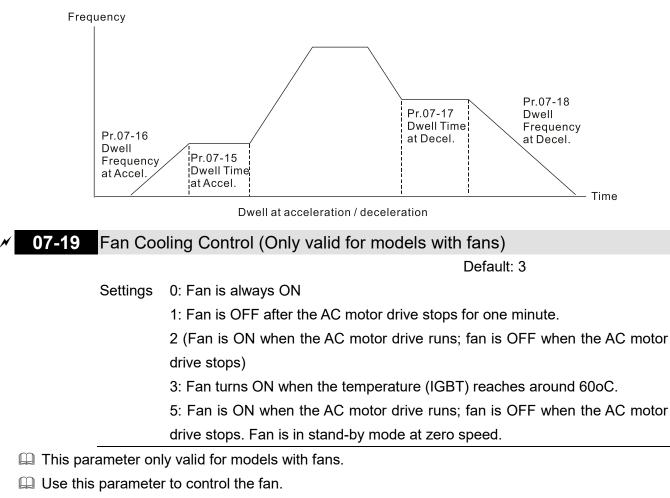
● Situation 5: Pr.07-13 = 2 and power recovers after the DC bus voltage is lower than the Lv level.

   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.

07-16 Dwell Frequency at Acceleration

Default: 0.00

Settings   0.00–400.00 Hz

07-17 Dwell Time at Deceleration

Default: 0.00

Settings   0.00–600.00 sec.

07-18 Dwell Frequency at Deceleration

Default: 0.00

Settings   0.00–400.00 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 avoid OV or OC protection.

Dwell at acceleration / deceleration

✎ **07-19** Fan Cooling Control (Only valid for models with fans)

Default: 3

Settings 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 60oC.

5: Fan is ON when the AC motor drive runs; fan is OFF when the AC motor drive stops. Fan is in stand-by mode at zero speed.

📖 This parameter only valid for models with fans.

📖 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 is OFF.

📖 2: Fan runs when the AC motor drive runs and stops immediately when the AC motor drive stops.

📖 3: When temperature of the IGBT or capacitance is higher than 60ºC, the fan runs. When both the temperature of the IGBT and capacitance are lower than 40ºC, the fan stops.

✎ **07-20** Emergency Stop (EF) & Force To Stop Selection

Default: 0

Settings 0: Coast to stop

1: By the first deceleration time

2: By the second deceleration time

3: By the third deceleration time

4: 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: Enable

   📖 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).

07-22 Energy-saving Gain

Default: 100

Settings   10–1000%

   📖 When Pr.07-21 is set to 1, use this parameter to adjust the energy-saving gain. The default is 100%. If the result is not satisfactory, adjust it by decreasing the setting value. If the motor oscillates, then increase the setting value.

   📖 In certain applications such as high speed spindles, the temperature rise in the motor is a major concern. When the motor is not in working state, reduce the motor current to a lower level. Reduce this parameter setting to meet this requirement.

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 220V motor is usually 200 V_{AC}, 60 Hz / 50 Hz, and the input voltage of the AC motor drive may vary from 180–264 V_{AC}, 50 Hz / 60 Hz. Therefore, when the AC motor drive is used 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 V_{AC}/ 50 Hz and the input voltage is at 200–264 V_{AC}, then the drive automatically reduces the output voltage to the motor to a maximum of 200 V_{AC}/ 50 Hz. If the input voltage is at 180–200 V_{AC}, 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.

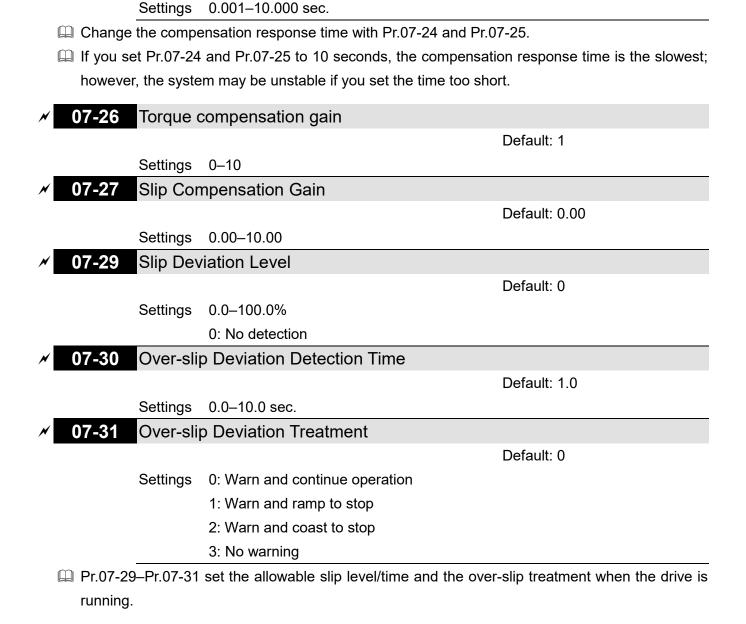### ✗ 07-24 Torque Command Filter Time

Default: 0.050

   Settings   0.001–10.000 sec.

  When the time constant setting is too large, the control is stable but the control response is slow. When the time constant setting is too small, the control response is faster but the control may be unstable. For optimal setting, adjust the setting based on the control stability or the control response.

✗ 07-25 Torque Command Filter Time

Default: 0.100

   Settings   0.001–10.000 sec.

  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

Default: 1

   Settings   0–10

✗ 07-27 Slip Compensation Gain

Default: 0.00

   Settings   0.00–10.00

✗ 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: Warn and ramp to stop

      2: Warn 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

 The drift current occurs in a specific zone of the motor and it causes serious motor vibration. Adjust this parameter could greatly improve this situation. (When running with high frequency or PG, set this parameter to 0. 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.

✗ **07-62** dEb Gain (Kp)

Default: 8000

Settings   0–65535

✗ **07-63** dEb Gain (Ki)

Default: 150

Settings   0–65535

 Sets 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.

09 Communication Parameters

✗ You can set this parameter during operation.

There are two RJ45 interfaces on the control board of the EL-C series, the definitions are as follows:

Figure	PIN	Left RJ45	Rigjt RJ45
8 ←1	1	CAN_H	CAN_H
	2	CAN_L	CAN_L
	3	GND	GND
	4	NC	SG-
	5	NC	SG+
	6	NC	NC
	7	NC	NC
	8	NC	Vcc

📕 NC stands for Not Connect

📕 Pin3 GND of the right RJ45 interface is the common ground for CAN and RS-485.

📕 The internal lines of the left RJ45 interface and the right RJ45 interface Pin1~3 are connected in parallel, logically they are only the same CAN interface.

✗ **09-00** Communication Address

Default: 1

Settings 1–254

📕 Sets the communication address for the drive if the AC motor drive is controlled through RS-485 serial communication. The communication address for each AC motor drive must be unique.
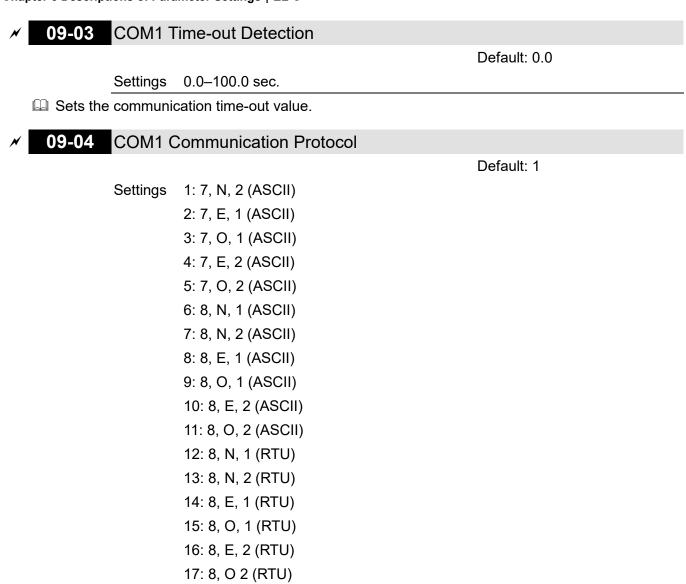
✗ **09-01** COM1 Transmission Speed

Default: 9.6

Settings 4.8–19.2 Kbps

📕 Sets the transmission speed between the computer and the AC motor drive.

📕 Options are 4.8 Kbps, 9.6 Kbps, 19.2 Kbps; otherwise, the transmission speed is set to the default 9.6 Kbps.

✗ **09-02** COM1 transmission fault handling

Default: 3

Settings 0: Warn and continue operation
1: Warn and ramp to stop
2: Warn and coast to stop
3: No Warn 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** COM1 Time-out Detection

Default: 0.0

Settings 0.0–100.0 sec.

📖 Sets the communication time-out value.

✎ **09-04** COM1 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.
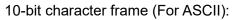
📖 Modbus ASCII (American Standard Code for Information Interchange): Each byte of data is the combination of two ASCII characters. For example, one byte of data: 64 Hex, shown as '64' in ASCII, consists of '6' (36Hex) and '4' (34Hex).
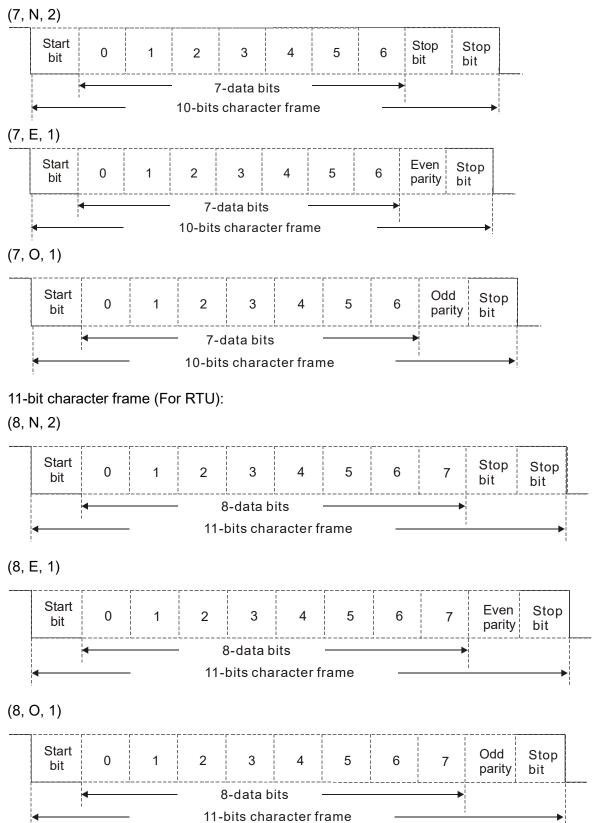
1. **Code Description**

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

2. **Data Format**

10-bit character frame (For ASCII):

(7, N, 2)

| Start bit | 0 | 1 | 2 | 3 | 4 | 5 | 6 | Stop bit | Stop bit |

7-data bits

10-bits character frame

(7, E, 1)

| Start bit | 0 | 1 | 2 | 3 | 4 | 5 | 6 | Even parity | Stop bit |

7-data bits

10-bits character frame

(7, O, 1)

| Start bit | 0 | 1 | 2 | 3 | 4 | 5 | 6 | Odd parity | Stop bit |

7-data bits

10-bits character frame

11-bit character frame (For RTU):

(8, N, 2)

| Start bit | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Stop bit | Stop bit |

8-data bits

11-bits character frame

(8, E, 1)

| Start bit | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Even parity | Stop bit |

8-data bits

11-bits character frame

(8, O, 1)

| Start bit | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Odd parity | Stop bit |

8-data bits

11-bits character frame

3. **Communication Protocol**

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 Check High	LRC checksum:
LRC Check 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	A silent interval of more than 10 ms
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:
CRC Check High	one 16-bit CRC checksum consists of 2 8-bit binary characters
END	A silent interval of more than 10 ms

Communication address

    00H: Broadcast to all AC motor drives

    01H: AC motor drive at address 01

    0FH: AC motor drive at address 15

    10H: AC motor drive at address 16, and so on up to 254 (FEH).

Function (Function code) and DATA (Data characters)

    03H: Read data from register

    06H: Write single register

Example: Reading two continuous data from register address 2102H. AMD address is 01H.

ASCII mode:

Command Message			Response Message	
STX	':'		STX	':'
Address	'0'		Address	'0'
	'1'			'1'
Function	'0'		Function	'0'
	'3'			'3'
Starting register	'2'		Number of register (count by byte)	'0'
	'1'			'4'
	'0'		Content of starting register 2102H	'1'
	'2'			'7'
Number of register (count by word)	'0'			'7'
	'0'			'0'
	'0'		Content of register 2103H	'0'
	'2'			'0'
LRC Check	'D'			'0'
	'7'			'0'
END	CR		LRC Check	'7'
	LF			'1'
			END	CR
				LF

RTU mode:

Command Message			Response Message	
Address	01H		Address	01H
Function	03H		Function	03H
Starting data register	21H		Number of register (count by byte)	04H
	02H			
Number of register (count by word)	00H		Content of register address 2102H	17H
	02H			70H
CRC Check Low	6FH		Content of register address 2103H	00H
CRC Check High	F7H			00H
			CRC Check Low	FEH
			CRC Check High	5CH

06H: Single write, write single data to a register

Example: Writing data 6000 (1770H) to register 0100H. AMD address is 01H.

ASCII mode:

Command Message			Response Message	
STX	':'		STX	':'
Address	'0'		Address	'0'
	'1'			'1'
Function	'0'		Function	'0'
	'6'			'6'
Target register	'0'		Target register	'0'
	'1'			'1'
	'0'			'0'
	'0'			'0'
Register content	'1'		Register content	'1'
	'7'			'7'
	'7'			'7'
	'0'			'0'
LRC Check	'7'		LRC Check	'7'
	'1'			'1'
END	CR		END	CR
	LF			LF

RTU mode:

Command Message			Response Message	
Address	01H		Address	01H
Function	06H		Function	06H
Target register	01H		Target register	01H
	00H			00H
Register content	17H		Register content	17H
	70H			70H
CRC Check Low	86H		CRC Check Low	86H
CRC Check High	22H		CRC Check High	22H

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			Response Message	
STX	':'		STX	':'
ADR 1	'0'		ADR 1	'0'
ADR 0	'1'		ADR 0	'1'
CMD 1	'1'		CMD 1	'1'

Command Message			Response Message	
CMD 0	'0'		CMD 0	'0'
Target register	'0'		Target register	'0'
	'5'			'5'
Target register	'0'		Target register	'0'
	'0'			'0'
Number of register (count by word)	'0'		Number of register (count by word)	'0'
	'0'			'0'
	'0'			'0'
	'2'			'2'
Number of register (count by byte)	'0'		LRC Check	'E'
	'4'			'8'
The first data content	'1'		END	CR
	'3'			LF
	'8'			
	'8'			
The second data content	'0'			
	'F'			
	'A'			
	'0'			
LRC Check	'9'			
	'A'			
END	CR			
	LF			

RTU mode:

Command Message			Response Message	
ADR	01H		ADR	01H
CMD	10H		CMD 1	10H
Target register	05H		Target register	05H
	00H			00H
Number of register (count by word)	00H		Number of register (count by word)	00H
	02H			02H
Quantity of data (byte)	04		CRC Check Low	41H
The first data content	13H		CRC Check High	04H
	88H			
The second data content	0FH			
	A0H			
CRC Check Low	'9'			
CRC Check High	'A'			

ASCII mode (LRC Check):

LRC (Longitudinal Redundancy Check) is calculated by summing up the values of the bytes from Address to the end of Data Content Take the above 3.3.1 Command Message for example: 01H + 03H + 21H + 02H + 00H + 02H = 29H, take complementary number of 2 = D7H

RTU mode (CRC Check):

CRC (Cyclical Redundancy Check) starts from Address to the end 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: Shift one CRC register to the right, and fill the high position with 0.

Step 4: Check the value shifted right, if it is 0, store the new value in step 3 into the CRC register, otherwise Exclusive OR A001H and the CRC register, and store the result into the CRC register.

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. Be share to check the code of the CRC must be exchanged and placed in the check code of the message command.

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
}
```

4. **Address list**

AC motor drive parameters

Modbus address	Function
GGnnH	GG is the parameter group, nn is the parameter number. For example, the address of Pr.04-10 is 040AH.

Control command (20xx)

Modbus address	Attribute	Function Description		
2000H	RW	bit1–0	00B: No function	
			01B: Stop	
			10B: Run	
			11B: JOG + RUN	
		bit3–2	Reserved	
		bit5–4	00B: No function	
			01B: FWD direction	
			10B: Direction reverse	
			11B: Change direction	
		bit7–6	00B: 1st accel. / decel.	
			01B: 2nd accel. / decel.	
			10B: 3rd accel. / decel.	
			11B: 4th accel. / decel.	
		bit11–8	0000B: Master speed	
			0001B: 1st step speed	
			0010B: 2nd step speed	
			0011B: 3rd step speed	
			0100B: 4th step speed	
			0101B: 5th step speed	
			0110B: 6th step speed	
			0111B: 7th step speed	
			1000B: 8th step speed	
			1001B: 9th step speed	
			1010B: 10th step speed	
			1011B: 11th step speed	
			1100B: 12th step speed	
			1101B: 13th step speed	
			1110B: 14th step speed	
			1111B: 15th step speed	
		bit12	1: Enable bit 06–11 function	
		bit14–13	00B: No function	

Modbus address	Attribute	Function Description	
			01B: Operation command by the digital keypad
			10B: Operation command by Pr.00-21 setting
			11B: Switch the operation command source
		bit15	Reserved
2001H	RW	Frequency command (XXX.XX Hz)	
2002H	RW	bit0	1: E.F. (External Fault) ON
		bit1	1: Reset command
		bit2	1: Base Block (B.B) ON
		bit15–3	Reserved

Status monitor read only (21xx)

Modbus address	Attribute	Function Description	
2100H	R	High byte: Warn Code Low byte: Error code	
2101H	R	bit1–0	AC motor drive operation status 00B: The drive stops 01B: The drive is decelerating 10B: The drive is in standby status 11B: The drive is operating
		bit2	1: JOG command
		bit4–3	Operation direction 00B: FWD running 01B: From REV running to FWD running 10B: From FWD running to REV running 11B: REV running
		bit 8	1: Master frequency controlled by the communication interface
		bit 9	1: Master frequency controlled by the analog / external terminal signal
		bit10	1: Operation command controlled by the communication interface
		bit11	1: Parameter lock
		bit12	1: Enable the digital keypad copy parameter function
		bit15–13	Reserved
2102H	R	Frequency command (XXX.XX Hz)	
2103H	R	Output frequency (XXX.XX Hz)	
2104H	R	Output current (XX.XX A). When current is higher than 655.35, it shifts the decimal as (XXX.X A) The decimal can refer to High byte of 211F.	
2105H	R	DC bus voltage (XXX.X V)	

Modbus address	Attribute	Function Description
2106H	R	Output voltage (XXX.X V)
2107H	R	Current step for the multi-step speed operation
2108H	R	Reserved
2109H	R	Counter value
210AH	R	Output power factor angle (XXX.X)
210BH	R	Output torque (XXX.X %)
210CH	R	Actual motor speed (XXXXX rpm)
210FH	R	Prompt Power output (X.XXX kW)
2116H	R	Multi-function display (Pr.00-04)
211BH	R	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.
211FH	R	High byte: the decimal place of current value (display)

Status monitor read only (22xx)

Modbus address	Attribute	Function Description
2200H	R	Display the drive's output current. When the current is higher than 655.35, it automatically shifts one decimal place as (XXX.X A). The decimal can refer to High byte of 211F.
2201H	R	Counter value
2202H	R	Actual output frequency (XXXXX Hz)
2203H	R	DC bus voltage (XXX.X V)
2204H	R	Output voltage (XXX.X V)
2205H	R	Power factor angle (XXX.X)
2206H	R	Display the output power of U, V, W (XXXX.X kW)
2207H	R	Display motor speed in rpm estimated by the drive (XXXXX rpm)
2208H	R	Display positive / negative output torque in %, estimated by the drive (XXX.X%)
220DH	R	Reserved
220EH	R	IGBT temperature of drive power module (XXX.X °C)
220FH	R	Reserved
2210H	R	The digital input status (ON / OFF), refer to Pr.02-12 (see Explanation 3 in Pr.00-04)

Modbus address	Attribute	Function Description
2211H	R	The digital output status (ON / OFF), refer to Pr.02-18 (see Explanation 4 in Pr.00-04)
2212H	R	Current step for the multi-step speed operation
2213H	R	The corresponding CPU digital input pin status (d.) (see Explanation 3 in Pr.00-04)
2214H	R	The corresponding CPU digital output pin status (O.) (see Explanation 4 in Pr.00-04)
2215H	R	Reserved
2216H	R	Reserved
2217H	R	Reserved
2218H	R	Reserved
2219H	R	Display times of counter overload (XXX.XX%)
221BH	R	DC bus voltage ripples (XXX.X V)
221CH	R	Reserved
221DH	R	Magnetic field area of the synchronous motor
221EH	R	User page displays the value in physical measure
221FH	R	Output value of Pr.00-05 (XXX.XX Hz)
2220H	R	The number of revolutions of the motor (retained when stopped, reset to zero before running)
2221H	R	The running position of the motor (retained when stopped, reset to zero before running)
2222H	R	Reserved
2223H	R	Control mode of the drive 0: speed mode
2224H	R	Carrier frequency of the drive (XX kHZ)
2225H	R	Reserved
2226H	R	Motor drive status
		bit1–0 00b: No direction / 01b: Forward / 10b: Reverse
		bit3–2 01b: Drive ready / 10b: Error
		bit4 0b: Motor drive does not output / 1b: Motor drive outputs
		bit 5 0b: No warning / 1b: Warning
2227H	R	Drive's estimated output torque (positive or negative direction) (XXXX Nt-m)
2228H	R	Reserved
2229H	R	Accumulate KWH display (XXXX.X)

Modbus address	Attribute	Function Description
222AH	R	Reserved
222BH	R	Reserved
222CH	R	Motor actual position low character
222DH	R	Motor actual position high character
222EH	R	Reserved
222FH	R	Reserved
2230H	R	Reserved
2231H	R	Reserved

Remote IO (26xx)

Modbus Address	Attribute		Function Description
2600H	R	bit0	MI1 is turned on = 1, MI1 is not turned on = 0
		bit1	MI2 is turned on = 1, MI2 is not turned on = 0
		bit2	MI3 is turned on = 1, MI3 is not turned on = 0
		bit3	MI4 is turned on = 1, MI4 is not turned on = 0
		bit4	MI5 is turned on = 1, MI51 is not turned on = 0
		bit 5	MI6 is turned on = 1, MI6 is not turned on = 0
2640H	RW	bit0	bit0 = 1, MO1 is forced to turn on. MO1 is not turned on when bit0 is cleared to 0.
		bit1	bit1 = 1, MO2 is forced to turn on. MO2 is not turned on when bit1 is cleared to 0.
		bit2	bit2 = 1, MO3 is forced to turn on. MO3 is not turned on when bit2 is cleared to 0.
		bit3	bit3 = 1, MO4 is forced to turn on. MO4 is not turned on when bit3 is cleared to 0.

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 "CEXX" 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 Check	'7'
	'7'
END	CR
	LF

RTU mode:

Address	01H
Function	86H
Exception code	02H
CRC Check Low	C3H
CRC Check High	A1H

The explanation of exception codes:
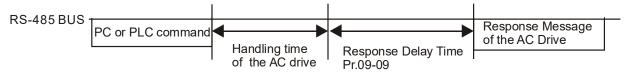
Error code	Fault Descriptions
1	Function code is not supported or unrecognized.
2	Address is not supported or unrecognized.
3	Data is not correct or unrecognized.
4	Failure to execute this function code

✗ **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.

09-10 Communication Main Frequency

Default: 60.00

Settings   0.00–400.00 Hz

 When Pr.00-20 is set to 1 (RS-485 serial 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.

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	Refer to address: 2000h–20FFh	Refer to address: 6000h–60FFh
	CANopen	Refer to index: 2020-01h–2020-FFh	Refer to index: 2060-01h–2020-FFh

09-36 CANopen Slave Address

Default: 0

Settings   0: Disable

          1–127

09-37 CANopen Speed

Default: 0

Settings   0: 1 Mbps

          1: 500 Kbps

          2: 250 Kbps

          3: 125 Kbps

          4: 100 Mbps (Delta Only)

          5: 50 Kbps

09-39 CANopen Warning Record

Default: 0

Settings   bit 0: CANopen Guarding Time-out

          bit 1: CANopen Heartbeat Time-out

          bit 3: CANopen SDO time-out

          bit 4: CANopen SDO buffer overflow

          bit 5: CANopen Bus OFF

          bit 6: Error protocol for CANopen

09-40 CANopen Decoding Method

Default: 1

Settings   0: Use Delta-defined decoding method

          1: Use CANopen Standard DS402 protocol

09-41 CANopen Communication Status

Default: Read only

Settings   0: Node Reset State

          1: Com Reset State

          2: Boot up State

          3: Pre-operation State

          4: Operation State

          5: Stop State

10 Speed Feedback Control Parameters

✗ You can set this parameter during operation.

10-29	Upper Limit of Frequency Deviation

Default: 20.00

Settings   0.00–200.00 Hz

🕮 Limits the maximum frequency deviation.

🕮 If you set this parameter too high, an abnormal feedback malfunction occurs.

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6-2-102
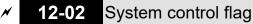
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12 System control and CANopen function parameters

✗ You can set this parameter during operation.

12-00　System control

Default: 0

Settings　bit 3: Dead time compensation closed

bit 7: Save or do not save the frequency

12-01　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.

✗ ### 12-02　System control flag

Default: 0000

Settings　0000–FFFFh

📖 　The bit setting function are as follows, please do not set the function as a reserved bit arbitrarily to avoid abnormal control and device damage.

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	

12-03　CANopen Cycle Time Setting

Default: 50

Settings　1–400 ms

12-04　CANopen Online Response Time

Default: 1000

Settings　1–30000 ms

12-05　CANopen Detects Master Time

Default: 1000

Settings　1–30000 ms

12-06　CANopen Detects Master Number

Default: 127

Settings　1–127

12-07 CANopen Protocol Selection

Default: 0

Settings   0: Standard CiA402 Protocol

1: Customization

  When Pr.12-07 = 0, the CANopen decoding method needs to be selected with Pr. 09-30 and 09-40.

  When Pr.12-07 = 1, the settings of Pr.09-30 and 09-40 are invalid.

12-08 CANopen MO1 Disconnection Disposal

Default: 2

Settings   0: MO1 output disconnected

1: MO1 output closed

2: MO1 output maintains the previous state

12-09 CANopen MO2 Disconnection Disposal

Default: 2

Settings   0: MO2 output disconnected

1: MO2 output closed

2: MO2 output maintains the previous state

12-10 CANopen MO3 Disconnection Disposal

Default: 2

Settings   0: MO3 output disconnected

1: MO3 output closed

2: MO3 output maintains the previous state

12-11 CANopen MO4 Disconnection Disposal

Default: 2

Settings   0: MO4 output disconnected

1: MO4 output closed

2: MO4 output maintains the previous state

  Pr.12-08–12-11 are valid only when Pr.12-07 = 1.

12-12 CANopen TPDO Delay Time

Default: 20.0

Settings   0.0–100.0%

  When the slave station receives the SYNC signal from the master station, after delaying the time of Pr.12-12, it starts to return the TPDO status to the master station.

  The delay time is calculated as: Pr.12-12 x Pr.12-03

Example: Pr.12-03 = 50 ms, Pr.12-12 = 20.0

The delay time = 50 ms÷100 x 20.0 = 500 us x 20.0 = 10 ms

12-50	Output Frequency at Malfunction 2
12-54	Output Frequency at Malfunction 3
12-58	Output Frequency at Malfunction 4
12-62	Output Frequency at Malfunction 5
12-66	Output Frequency at Malfunction 6

Default: Read only

Settings   0.00–400.00 Hz

  When a fault occurs, user can check the current output frequency. If the fault happens again, this parameter overwrites the previous record.

12-51	DC bus Voltage at Malfunction 2
12-55	DC bus Voltage at Malfunction 3
12-59	DC bus Voltage at Malfunction 4
12-63	DC bus Voltage at Malfunction 5
12-67	DC bus Voltage at Malfunction 6

Default: Read only

Settings   0.0–6553.5 V

  When a fault occurs, user can check the current DC bus voltage. If the fault happens again, this parameter overwrites the previous record.

12-52	Output Current at Malfunction 2
12-56	Output Current at Malfunction 3
12-60	Output Current at Malfunction 4
12-64	Output Current at Malfunction 5
12-68	Output Current at Malfunction 6

Default: Read only

Settings   0.00–655.35 Amps

  When a fault occurs, user can check the current output current value. If the fault happens again, this parameter overwrites the previous record.

12-53	IGBT Temperature at Malfunction 2
12-57	IGBT Temperature at Malfunction 3
12-61	IGBT Temperature at Malfunction 4
12-65	IGBT Temperature at Malfunction 5
12-69	IGBT Temperature at Malfunction 6

Default: Read only

Settings   -3276.7–3276.7 ºC

  When a fault occurs, user can check the current IGBT temperature. If the fault happens again, this parameter overwrites the previous record.

12-70	Fault Record 7
12-71	Fault Record 8
12-72	Fault Record 9
12-73	Fault Record 10

Default: 0

Settings
0: No fault record

1: Over-current during acceleration (ocA)

2: Over-current during deceleration (ocd)

3: Over-current during steady operation (ocn)

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 (oL)

22: Electronics thermal relay 1 protection (EoL1)

26: Over torque 1 (ot1)

28: Under current (uC)

31: EEPROM read error (cF2)

33: U-phase error (od1)

34: V-phase error (od2)

35: W-phase error (od3)

36: cc hardware error   (Hd0)

37: oc hardware error (Hd1)

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)

62: Deceleration energy backup error (dEb)

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: U-phase output phase loss (oPHL)

83: V-phase output phase loss (oPHL)

84: W-phase output phase loss (oPHL)

87: Low frequency overload protection (oL3)

101: CANopen guarding error (CGdE)

102: CANopen heartbeat error (CHbE)

104: CANopen bus off error (CbFE)

105: CANopen index error (CidE)

106: CANopen station address error (CAdE)

107: CANopen index setting exceed limit (CFrE)

111: InrCOM time-out error (ictE)

121: Internal communication error (CP20)

123: Internal communication error (CP22)

124: Internal communication error (CP30)

126: Internal communication error (CP32)

127: Internal communication error (CP33)

 📖 The parameters record when the fault occurs and forces a stop.

 📖 Low voltage Lv (LvS warning, not record) during stop. Low voltage Lv during operation (LvA, Lvd, Lvn fault will be 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.12-70–Pr.12-73 simultaneously.

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13 Control Mode Parameter Macro Function

✗ You can set this parameter during operation.

| 13-00 | Macro Selection |

Default: 0

Settings 0: No function

1: By user

2: I/O mode control

3: CANopen remote control and monitoring mode

4: I/O control and CANopen remote monitoring mode

◻ Setting 2: I/O mode control

Pr.	Parameter Name	ID*	Note
00-11	Speed control selections	Default setting	0 (IM V/F)
00-16	Load selection	Default setting	1 (Heavy load)
00-20	Master frequency command source	0	0 (Digital keypad)
00-21	Operation command source	1	1 (External terminals)
01-12	Acceleration Time 1	Default setting	10s
01-13	Deceleration Time 1	Default setting	10s
02-00	Two-wire / Three-wire Operation Control	Default setting	1 (two-wire mode 1, power on for operation control (M1: FWD / STOP, M2: REV / STOP))
02-01	Multi-function Input Command 1 (MI1)	Default setting	
02-02	Multi-function Input Command 2 (MI2)	Default setting	
02-03	Multi-function Input Command 3 (MI3)	1	1 (Multi-step speed command 1)
02-04	Multi-function Input Command 4 (MI4)	2	2 (Multi-step speed command 2)
02-05	Multi-function Input Command 5 (MI5)	3	3 (Multi-step speed command 3)
02-06	Multi-function Input Command 6 (MI6)	4	4 (Multi-step speed command 4)
02-13	Multi-function Output 1 (MO1)	11	11 (Malfunction indication)
02-14	Multi-function Output 2 (MO2)	1	1 (Indication during RUN)
02-15	Multi-function Output 3 (MO3)	0	No function

Pr.	Parameter Name	ID*	Note
02-16	Multi-function Output 4 (MO4)	0	No function

📖 Setting 3: CANopen remote control and monitoring mode

Pr.	Parameter Name	ID*	Note
00-11	Selections of control	Default setting	0 (IM V/F)
00-16	Load selection	Default setting	1 (Heavy load)
00-20	Master frequency command source	Default setting	6 (CANopen communication)
00-21	Operation command source	Default setting	3 (CANopen communication)
01-12	Acceleration Time 1	Default setting	10s
01-13	Deceleration Time 1	Default setting	10s
02-00	Two-wire / Three-wire Operation Control	Default setting	1 (two-wire mode 1, power on for operation control (M1: FWD / STOP, M2: REV / STOP))
02-01	Multi-function Input Command 1 (MI1)	Default setting	0 (DI terminal status is mapped to CANopen index 2026-01h)
02-02	Multi-function Input Command 2 (MI2)	Default setting	0 (DI terminal status is mapped to CANopen index 2026-01h)
02-03	Multi-function Input Command 3 (MI3)	Default setting	0 (DI terminal status is mapped to CANopen index 2026-01h)
02-04	Multi-function Input Command 4 (MI4)	Default setting	0 (DI terminal status is mapped to CANopen index 2026-01h)
02-05	Multi-function Input Command 5 (MI5)	Default setting	0 (DI terminal status is mapped to CANopen index 2026-01h)
02-06	Multi-function Input Command 6 (MI6)	Default setting	0 (DI terminal status is mapped to CANopen index 2026-01h)
02-13	Multi-function Output 1 (MO1)	Default setting	5 (DO terminal status is mapped to CANopen index 2026-41h)
02-14	Multi-function Output 2 (MO2)	Default setting	5 (DO terminal status is mapped to CANopen index 2026-41h)
02-15	Multi-function Output 3 (MO3)	Default setting	5 (DO terminal status is mapped to CANopen index 2026-41h)
02-16	Multi-function Output 4 (MO4)	Default setting	5 (DO terminal status is mapped to CANopen index 2026-41h)
09-37	CANopen Speed	2	CiA301 250kbps support line length 250m

 Setting 4: I/O control and CANopen remote monitoring mode

Pr.	Parameter Name	ID*	Note
00-11	Selections of control	Default setting	0 (IM V/F)
00-16	Load selection	Default setting	1 (Heavy load)
00-20	Master frequency command source	0	0 (Digital keypad)
00-21	Operation command source	1	1 (External terminals)
01-12	Acceleration Time 1	Default setting	10s
01-13	Deceleration Time 1	Default setting	10s
02-00	Two-wire / Three-wire Operation Control	Default setting	1 (two-wire mode 1, power on for operation control (M1: FWD / STOP, M2: REV / STOP))
02-01	Multi-function Input Command 1 (MI1)	Default setting	0 (DI terminal status is mapped to CANopen index 2026-01h)
02-02	Multi-function Input Command 2 (MI2)	Default setting	0 (DI terminal status is mapped to CANopen index 2026-01h)
02-03	Multi-function Input Command 3 (MI3)	Default setting	0 (DI terminal status is mapped to CANopen index 2026-01h)
02-04	Multi-function Input Command 4 (MI4)	Default setting	0 (DI terminal status is mapped to CANopen index 2026-01h)
02-05	Multi-function Input Command 5 (MI5)	Default setting	0 (DI terminal status is mapped to CANopen index 2026-01h)
02-06	Multi-function Input Command 6 (MI6)	Default setting	0 (DI terminal status is mapped to CANopen index 2026-01h)
02-13	Multi-function Output 1 (MO1)	Default setting	5 (DO terminal status is mapped to CANopen index 2026-41h)
02-14	Multi-function Output 2 (MO2)	Default setting	5 (DO terminal status is mapped to CANopen index 2026-41h)
02-15	Multi-function Output 3 (MO3)	Default setting	5 (DO terminal status is mapped to CANopen index 2026-41h)
02-16	Multi-function Output 4 (MO4)	Default setting	5 (DO terminal status is mapped to CANopen index 2026-41h)
09-37	CANopen Speed	2	CiA301 250kbps support line length 250m

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Chapter 7 Warning Codes

Summary of Warning Codes

ID*	Warning Name	ID*	Warning Name
1	Communication error 1 (CE1)	37	CANopen heartbeat error (CHbn)
2	Communication error 2 (CE2)	39	CANopen bus off error (CbFE)
3	Communication error 3 (CE3)	40	CANopen index error (CidE)
4	Communication error 4 (CE4)	41	CANopen station address error (CAdE)
5	Communication error 10 (CE10)	42	CANopen index setting exceed limit (CFrE)
9	IGBT over-heating warning (oH1)	43	CANopen SDO time-out (CSdn)
20	Over-torque 1 (ot1)	44	CANopen SDO receives register overflow (CSbn)
24	Over slip error (oSL)	45	CANopen start-up error warning (Cbtn)
28	Output phase loss (oPHL)	46	CANopen format error (CPtn)
36	CANopen guarding time-out (CGdn)		

ID No.	Display on LED Keypad	Warning Name	Fault Descriptions
1	⌐E¹	Communication error 1 (CE1)	RS-485 Modbus illegal function code
		Action and Reset	
Action level		When the function code is not 03, 06, 10, or 63.	
Action time		Immediately act	
Warning setting parameter		N/A	
Reset method		"Warning" occurs when Pr.09-02=0 and the motor drive keeps running. The drive resets automatically when receiving the correct function code.	
Reset condition		Immediately reset	
Record		No	
Cause		Corrective Actions	
Incorrect communication command from the 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.09-02 is the same as the setting for the upper unit.	
Disconnection or bad connection of the cable		Check the cable and replace it if necessary.	

ID No.	Display on LED Keypad	Warning Name	Fault Descriptions
2	$CE2$	Communication error 2 (CE2)	RS-485 Modbus illegal data address (00–254 H)

Action and Reset	
Action level	When the data address is incorrect.
Action time	Immediately act
Warning setting parameter	N/A
Reset method	"Warning" occurs when Pr.09-02=0 and the motor drive keeps running. The drive resets automatically when receiving the correct data address.
Reset condition	Immediately reset
Record	No

Cause	Corrective Actions
Incorrect communication command from the 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.09-02 is the same as the setting for the upper unit.
Disconnection or bad connection of the cable	Check the cable and replace it if necessary.

ID No.	Display on LED Keypad	Warning Name	Fault Descriptions
3	$\mathsf{CE3}$	Communication error 3 (CE3)	RS-485 Modbus illegal data value
Action and Reset			
Action level	When the data length is too long		
Action time	Immediately act		
Warning setting parameter	N/A		
Reset method	"Warning" occurs when Pr.09-02=0 and the motor drive keeps running. The drive resets automatically when receiving the correct communication data value.		
Reset condition	Immediately reset		
Record	No		
Cause	Corrective Actions		
Incorrect communication command from the 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.09-02 is the same as the setting for the upper unit.		
Disconnection or bad connection of the cable	Check the cable and replace it if necessary.		

ID No.	Display on LED Keypad	Warning Name	Fault Descriptions
4	ꞓ ꞓ ꞓ	Communication error 4 (CE4)	RS-485 Modbus data is written to read-only address

Action and Reset	
Action level	Data is written to read-only address
Action time	Immediately act
Warning setting parameter	N/A
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 reset
Record	No

Cause	Corrective Actions
Incorrect communication command from the 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.09-02 is the same as the setting for the upper unit.
Disconnection or bad connection of the cable	Check the cable and replace it if necessary.

ID No.	Display on LED Keypad	Warning Name	Fault Descriptions
5	CE 10	Communication error 10 (CE10)	RS-485 Modbus transmission time-out
Action and Reset			
Action level	When the communication time exceeds the detection time of Pr.09-03 communication time-out		
Action time	Pr.09-03		
Warning setting parameter	N/A		
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 reset		
Record	No		
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.09-02 is the same as the setting for the upper unit.		
Disconnection or bad connection of the cable	Check the cable and replace it if necessary.		

ID No.	Display on LED Keypad	Warning Name	Fault Descriptions
9	o H 1	IGBT over-heating warning (oH1)	The AC motor drive detects over-heating of IGBT, and over the protection level of oH1 warning. (When Pr.06-15 is higher than the IGBT over-heating level, the drive shows oH1 error without displaying oH1 warning.)

Action and Reset	
Action level	Pr.06-15
Action time	"oH1" warning occurs when IGBT temperature is higher than Pr.06-15 setting value.
Warning setting parameter	N/A
Reset method	Auto-reset
Reset condition	The drive auto-resets when IGBT temperature is lower than oH1 warning level minus (–) 5°C
Record	No

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 brake resistors, in the surroundings. 4. Install / add cooling fan or air conditioner to lower the temperature inside the cabinet.
Check if there is any obstruction on 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 wave 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.

ID No.	Display on LED Keypad	Warning Name	Fault Descriptions
20	ot 1	Over-torque 1 (ot1)	Over-torque 1 warning

Action and Reset	
Action level	Pr.06-07
Action time	Pr.06-08
Warning setting parameter	Pr.06-06 Over-torque Detection Selection (Motor 1) =1 or 3 0: No detection 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 is automatically cleared when the output current < (Pr.06-07 – 5%)
Reset condition	The warning is automatically cleared when the output current < (Pr.06-07 – 5%)
Record	No

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 or the working cycle are too short	Increase the setting value for Pr.01-12–01-19 (accel./decel. time)
V/F voltage is too high	Adjust the settings for 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 the motor with a larger capacity model.
Overload during low-speed operation.	Reduce the load during low-speed operation. Increase the motor capacity.
Torque compensation is too large	Readjust the torque compensation value (Pr.07-26 torque compensation gain) till the output current decreases 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.

ID No.	Display on LED Keypad	Warning Name	Fault Descriptions
24	o5L	Over slip error (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% Pr.07-29 = Pr.10-29.
		Action and Reset	
Action level		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: Warn and ramp to stop 2: Warn and coast to stop 3: No warning	
Reset method		When Pr.07-31=0 and when the drive outputs at constant speed, and F>H or F<H no longer exceeds the Pr.07-29 level, the oSL warning automatically clears.	
Reset condition		N/A	
Record		No	
Cause		Corrective Actions	
Any of the motor parameters in parameter group 5 may be incorrect		Check the motor parameter.	
The load is too large.		Decrease the loading.	
Any of the setting value of Pr.07-29, 07-30, and 10-29 is improper		Check the parameter settings for oSL protection.	

ID No.	Display on LED Keypad	Warning Name	Fault Descriptions
28	oPHL	Output phase loss (oPHL)	Output phase loss of the drive
Action and Reset			
Action level	Pr.06-47		
Action time	N/A		
Warning setting parameter	Pr.06-45 0: Warn and continue operation 1: Warn and ramp to stop 2: Warn and coast to stop 3: No warning		
Reset method	If Pr.06-45 is set to 0, the oPHL warning automatically clears after the drive stops.		
Reset condition	N/A		
Record	No		
Cause	Corrective Actions		
Unbalanced three-phase impedance of the motor	Replace the motor.		
The motor is wired incorrectly	Check the cable condition. Replace the cable.		
Using 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 fault still exists, 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.		
The drive capacity is much larger than the motor capacity	Make sure the capacity of the drive and motor match to each other.		

ID No.	Display on LCD Keypad	Warning Name	Fault Descriptions
36	CGdn	CANopen guarding time-out (CGdn)	CANopen guarding error

Action and Reset	
Action level	When CANopen Node Guarding detects that one of the slaves does not respond, the CGdE fault occurs. The upper unit sets the factor and time during configuration.
Action time	The time that upper unit sets during configuration
Warning setting parameter	N/A
Reset method	Manual reset
Reset condition	The upper unit sends a reset package to clear this warning.
Record	No

Cause	Corrective Actions
The guarding time is too short, or less detection times	Increase the guarding time (Index 100C) and detection times
Malfunction caused by interference	1. Verify the grounding and wiring 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. 2. Make sure the communication circuit is wired in series. 3. Use CANopen cable or add terminating resistance.

ID No.	Display on LCD Keypad	Warning Name	Fault Descriptions
37	CHbn	CANopen heartbeat error (CHbn)	CANopen heartbeat error
Action and Reset			
Action level	When CANopen Heartbeat detects that one of the slaves does not respond, the CHbE fault occurs. The upper unit sets the confirming time of producer and consumer during configuration.		
Action time	The upper unit sets the confirming time of producer and consumer during configuration.		
Warning setting parameter	N/A		
Reset method	Manual reset		
Reset condition	The upper unit sends a reset package to clear this warning.		
Record	When Pr.00-21≠3, CHbn is a "Warning", and the warning is not recorded.		
Cause	Corrective Actions		
The heartbeat time is too short	Increase heartbeat time (Index 1016)		
Malfunction caused by interference	1. Verify the grounding and wiring 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. 2. Make sure the communication circuit is wired in series. 3. Use CANopen cable or add terminating resistance.		
Disconnection or bad connection of the cable	Check the cable and replace it if necessary.		

ID No.	Display on LCD Keypad	Warning Name	Fault Descriptions
39	CbFn	CANopen bus off error (CbFE)	CANopen BUS off error
Action and Reset			

Action level	Hardware	When CANopen card is not installed, the CbFn warning occurs.
	Software	When the master receives wrong communication package, the CbFn warning occurs. Too much interference on BUS The master receives wrong package when the CAN_H and CAN_L communication cables are short, CbFn warning occurs.
Action time	Immediately act when the fault is detected	
Warning setting parameter	N/A	
Reset method	Manual reset	
Reset condition	Cycle the power	
Record	When Pr.00-21≠3, CbFn is a "Warning", and the warning is not recorded.	

Cause	Corrective Actions
Check if the CANopen speed is correct	Reset CANopen speed (Pr.09-37)
Malfunction caused by interference	1. Verify the grounding and wiring 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. 2. Make sure the communication circuit is wired in series. 3. Use CANopen cable or add terminating resistance.
Disconnection or bad connection of the cable	Check the cable and replace it if necessary.

ID No.	Display on LCD Keypad	Warning Name	Fault Descriptions
40	$\overline{\mathsf{C}}\overline{\mathsf{C}}\mathsf{d}\mathsf{n}$	CANopen index error (CidE)	CANopen index error

Action and Reset	
Action level	CANopen index error
Action time	Immediately act when the fault is detected
Warning setting parameter	N/A
Reset method	Manual reset
Reset condition	The upper unit sends a reset package to clear this warning.
Record	When Pr.00-21≠3, Cidn is a "Warning", and the warning is not recorded.

Cause	Corrective Actions
Incorrect setting of CANopen index	Reset CANopen Index (Pr.00-02=7)

ID No.	Display on LCD Keypad	Warning Name	Fault Descriptions
41	$\mathcal{C}$ $\mathcal{R}$ d n	CANopen station address error (CAdE)	CANopen station address error (only supports 1–127)
Action and Reset			
Action level	CANopen station address error		
Action time	Immediately act when the fault is detected		
Warning setting parameter	N/A		
Reset method	Manual reset		
Reset condition	Pr.00-02=7		
Record	When Pr.00-21≠3, CAdn is a "Warning", and the warning is not recorded.		
Cause	Corrective Actions		
Incorrect setting of CANopen station address	1. Disable CANopen (Pr.09-36=0) 2. Reset CANopen (Pr.00-02=7) 3. Reset CANopen station address (Pr.09-36)		

ID No.	Display on LCD Keypad	Warning Name	Fault Descriptions
42	CFrn	CANopen index setting exceed limit (CFrE)	CANopen memory error
Action and Reset			
Action level	When you update the firmware version of the control board, the FRAM internal data does not change, then CFrn warning occurs.		
Action time	Immediately act when the fault is detected		
Warning setting parameter	N/A		
Reset method	Manual reset		
Reset condition	Pr.00-02=7		
Record	When Pr.00-21≠3, CFrn is a "Warning", and the warning is not recorded.		
Cause	Corrective Actions		
CANopen internal memory error	1. Disable CANopen (Pr.09-36=0) 2. Reset CANopen (Pr.00-20=7) 3. Reset CANopen station address (Pr.09-36)		

ID No.	Display on LCD Keypad	Warning Name	Fault Descriptions
43	CSdn	CANopen SDO time-out (CSdn)	SDO transmission time-out (only shows on master station)

Action and Reset	
Action level	When the CANopen master transmits a SDO command, and the slave response "times-out", CSdn warning occurs.
Action time	Immediately act when the fault is detected
Warning setting parameter	N/A
Reset method	When the master resends a SDO command and receives the response, the warning automatically clears.
Reset condition	N/A
Record	No

Cause	Corrective Actions
Slave is not connected	Connect the slave and CANopen BUS.
The synchronous cycle is set too short	Increase the synchronous time (Index 1006)
Malfunction caused by interference	1. Verify the grounding and wiring 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. 2. Make sure the communication circuit is wired in series. 3. Use CANopen cable or add terminating resistance.
Disconnection or bad connection of the cable	Check the cable and replace it if necessary.

ID No.	Display on LCD Keypad	Warning Name	Fault Descriptions
44	[5 b n	CANopen SDO receives register overflow (CSbn)	CANopen SDO receives register overflow
Action and Reset			
Action level	The upper unit sends too much SDO at one time and causes buffer overflow		
Action time	Immediately act when the fault is detected		
Warning setting parameter	N/A		
Reset method	The upper unit sends a reset package to clear the warning.		
Reset condition	N/A		
Record	No		
Cause	Corrective Actions		
Too much SDO from the upper unit at one time	Check if the master sends too much SDO command. Make sure the master sends the SDO command according to the command format.		

ID No.	Display on LCD Keypad	Warning Name	Fault Descriptions	
45	⌐⌐⌐ (Cbtn)	CANopen start-up error warning (Cbtn)	CANopen start-up error warning	
Action and Reset				
Action level		When the amount of sent error messages reach 255		
Action time		N/A		
Warning setting parameter		Index 6007		
Reset method		Disable CANopen, and cycle the power after power-off		
Reset condition		N/A		
Record		No		
Cause		Corrective Actions		
Serious interference on hardware		Verify if the grounding, terminating resistance and bus line are properly installed.		
Incorrect setting for communication speed		Verify the setting for communication speed.		

ID No.	Display on LCD Keypad	Warning Name	Fault Descriptions
46	*[Ptn]*	CANopen format error (CPtn)	CANopen protocol format error
Action and Reset			
Action level	The slave detects that communication data from the upper unit cannot be recognized, and then CPtn warning occurs.		
Action time	Immediately act when the fault is detected		
Warning setting parameter	N/A		
Reset method	The upper unit sends a reset package to clear the warning.		
Reset condition	N/A		
Record	No		
Cause	Corrective Actions		
The upper unit sends incorrect communication packet	Make sure the master sends the packet based on CANopen DS301 standard command format.		

Chapter 8 Fault Codes

Summary of Fault Codes

ID*	Fault Name	ID*	Fault Name
1	Over-current during acceleration (ocA)	52	Password is locked (Pcod)
2	Over-current during deceleration (ocd)	54	Illegal command (CE1)
3	Over-current during steady operation (ocn)	55	Illegal data address (CE2)
6	Over-current at stop (ocS)	56	Illegal data value (CE3)
7	Over-voltage during acceleration (ovA)	57	Data is written to read-only address (CE4)
8	Over-voltage during deceleration (ovd)	58	Modbus transmission time-out (CE10)
9	Over-voltage during constant speed (ovn)	62	Deceleration energy backup error (dEb)
10	Over-voltage at stop (ovS)	79	U-phase over-current before run (Aoc)
11	Low-voltage during acceleration (LvA)	80	V-phase over-current before run (boc)
12	Low-voltage during deceleration (Lvd)	81	W-phase over-current before run (coc)
13	Low-voltage at constant speed (Lvn)	82	Output phase loss U phase (oPL1)
14	Low-voltage at stop (LvS)	83	Output phase loss V phase (oPL2)
15	Phase loss protection (orP)	84	Output phase loss W phase (oPL3)
16	IGBT overheating (oH1)	87	Low frequency overload protection (oL3)
18	IGBT temperature detection failure (tH1o)	101	CANopen guarding error (CGdE)
21	Over load (oL)	102	CANopen heartbeat error (CHbE)
22	Electronics thermal relay 1 protection (EoL1)	104	CANopen bus off error (CbFE)
26	Over torque 1 (ot1)	105	CANopen index error (CidE)
28	Under current (uC)	106	CANopen station address error (CAdE)
31	EEPROM read error (cF2)	107	CANopen index setting exceed limit (CFrE)
33	U-phase error (cd1)	111	InrCOM time-out error (ictE)
34	V-phase error (cd2)	121	Internal communication error (CP20)
35	W-phase error (cd3)	123	Internal communication error (CP22)
36	cc hardware error (Hd0)	124	Internal communication error (CP30)
37	oc hardware error (Hd1)	126	Internal communication error (CP32)
49	External fault (EF)	127	Internal communication error (CP33)
50	Emergency stop (EF1)	141	Short circuit before run (b4oc)
51	External base block (bb)		

ID*	Display on LED Keypad	Fault Name	Fault Descriptions
1	$oc A$	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 level	250% of the rated current
Action time	Immediately act
Fault treatment parameter	N/A
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. Use auto-acceleration and auto-deceleration setting (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.
Check for possible burnout or aging insulation of the motor	Check the motor insulation value with megger. Replace the motor if the insulation is poor.
The load 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.
Torque compensation is too large	Adjust the torque compensation value (Pr.07-26 torque compensation gain) till the output current decreases 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.

Cause	Corrective Actions
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.
The length of motor cable is too long	Increase the AC motor drive's 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: 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.

ID*	Display on LED Keypad	Fault Name	Fault Descriptions
2	o c d	Over-current during deceleration (ocd)	Output current exceeds 2.5 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 level	250% of the rated current
Action time	Immediately act
Fault treatment parameter	N/A
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. Use auto-acceleration and auto-deceleration setting (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.
Check for possible burnout or aging insulation of the motor	Check the motor insulation value with megger. Replace the motor if the insulation is poor.
The load 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.
Torque compensation is too large	Adjust the torque compensation value (Pr.07-26 torque compensation gain) till the output current decreases 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 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: 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.

ID*	Display on LED Keypad	Fault Name	Fault Descriptions
3	o c n	Over-current during steady operation (ocn)	Output current exceeds three times of the rated current during acceleration. 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 level	250% of the rated current
Action time	Immediately act
Fault treatment parameter	N/A
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.
Torque compensation is too large	Adjust the torque compensation value (Pr.07-26 torque compensation gain) till the output current decreases 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 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: B1 corresponds to U, V and W; DC- corresponds to U, V and W; ⏚ corresponds to U, V and W.

ID*	Display on LED Keypad	Fault Name	Fault Descriptions
6	o c 5	Over-current at stop (ocS)	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.

Action and Reset	
Action level	240% of the rated current
Action time	Immediately act
Fault treatment parameter	N/A
Reset method	Manual reset
Reset condition	Reset in five seconds after the fault is cleared
Record	Yes

Cause	Corrective Actions
Malfunction caused by interference	Verify the wiring of the control circuit and the wiring/grounding of the main circuit to prevent interference.
Hardware failure	Check if other error codes such as cd1–cd3 occur after cycling the power. If yes, return to the factory for repair.

ID*	Display on LED Keypad	Fault Name	Fault Descriptions
7	oūA	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 level	230V models: 410 V$_{DC}$ 460V models: 820 V$_{DC}$
Action time	Immediately act when the DC bus voltage is higher than the level
Fault treatment parameter	N/A
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 lifting load decreases acceleration time)	Decrease the acceleration time Use a braking unit or DC bus Replace the drive with a larger capacity model.
The setting for stall prevention level is smaller than no-load current	The setting for the stall prevention level should be larger 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 active power supply unit 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) Use auto-acceleration and auto-deceleration setting (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 and braking unit.
Malfunction caused by interference	Verify the wiring of the control circuit and the wiring/grounding of the main circuit to prevent interference.

ID*	Display on LED Keypad	Fault Name	Fault Descriptions
8	ovd	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 level	230V models: 410 V_{DC} 460V models: 820 V_{DC}
Action time	Immediately act when the DC bus voltage is higher than the level
Fault treatment parameter	N/A
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 COMMON DC bus to the drive. 3. Reduce the brake frequency. 4. Replace the drive with a larger capacity model. 5. Use S-curve acceleration/deceleration. 6. Use over-voltage stall prevention function (Pr.06-01) 7. Use auto-acceleration and auto-deceleration setting (Pr.01-44) 8. Adjust braking level (Pr.07-01).
The setting for stall prevention level is smaller than no-load current	The setting for the stall prevention level should be larger 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 active power supply unit 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.
Malfunction caused by interference	Verify the wiring of the control circuit and the wiring/grounding of the main circuit to prevent interference.

ID*	Display on LED Keypad	Fault Name	Fault Descriptions
9	ȯūn	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 level	230V models: 410 V_{DC} 460V models: 820 V_{DC}
Action time	Immediately act when the DC bus voltage is higher than the level
Fault treatment parameter	N/A
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 DC bus to the drive. 2. Reduce the load. 3. Replace the drive with a larger capacity model. 4. Adjust braking level (Pr.07-01).
The setting for stall prevention level is smaller than no-load current	The setting for the stall prevention level should be larger 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 active power supply unit 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.
Malfunction caused by interference	Verify the wiring of the control circuit and the wiring/grounding of the main circuit to prevent interference.

ID*	Display on LED Keypad	Fault Name	Fault Descriptions
10	ouS	Over-voltage at stop (ovS)	Over-voltage at stop

Action and Reset	
Action level	230V models: 410 V_{DC} 460V models: 820 V_{DC}
Action time	Immediately act when the DC bus voltage is higher than the level
Fault treatment parameter	N/A
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
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 active power supply unit acts in the same power system, the input voltage may surge abnormally in a short time. In this case, install an AC reactor.
Malfunction caused by interference	Verify the wiring of the control circuit and the wiring/grounding of the main circuit to prevent interference.
Hardware failure Hardware failure in voltage detection	Check if other error codes such as cd1–cd3 occur after cycling the power. If yes, return to the factory for repair.
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.

ID*	Display on LED Keypad	Fault Name	Fault Descriptions
11	$L\bar{u}A$	Low-voltage during acceleration (LvA)	DC bus voltage is lower than Pr.06-00 setting value during acceleration
		Action and Reset	
Action level	Pr.06-00 (Default = depending on the model)		
Action time	Immediately act when the DC bus voltage is lower than Pr.06-00		
Fault treatment parameter	N/A		
Reset method	Manual reset		
Reset condition	Reset when DC bus voltage is higher than Pr.06-00 + 30 V (230V model), Pr.06-00 + 60 V (460V model).		
Record	No		
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.		
The load is too large.	Reduce the load. Increase the drive capacity. Increase the acceleration time.		
DC bus	Install DC reactor(s).		
Check if there is short circuit plate or any DC reactor installed between terminal +1 and +2	Connect short circuit plate or DC reactor between terminal +1 and +2. If the error still exists, return to the factory for repair.		

ID*	Display on LED Keypad	Fault Name	Fault Descriptions
12	$L\bar{u}d$	Low-voltage during deceleration (Lvd)	DC bus voltage is lower than Pr.06-00 setting value during deceleration
		Action and Reset	
Action level		Pr.06-00 (Default = depending on the model)	
Action time		Immediately act when the DC bus voltage is lower than Pr.06-00	
Fault treatment parameter		N/A	
Reset method		Manual reset	
Reset condition		Reset when DC bus voltage is higher than Pr.06-00 + 30 V (230V model), Pr.06-00 + 60 V (460V model).	
Record		No	
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).	

ID*	Display on LED Keypad	Fault Name	Fault Descriptions
13	Lun	Low-voltage at constant speed (Lvn)	DC bus voltage is lower than Pr.06-00 setting value at constant speed
		Action and Reset	
Action level	Pr.06-00 (Default = depending on the model)		
Action time	Immediately act when the DC bus voltage is lower than Pr.06-00		
Fault treatment parameter	N/A		
Reset method	Manual reset		
Reset condition	Reset when DC bus voltage is higher than Pr.06-00 + 30 V (230V model), Pr.06-00 + 60 V (460V model).		
Record	No		
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).		

ID*	Display on LED Keypad	Fault Name	Fault Descriptions
14	LuS	Low-voltage at stop (LvS)	1. DC bus voltage is lower than Pr.06-00 setting value at stop 2. Hardware failure in voltage detection

Action and Reset	
Action level	Pr.06-00 (Default = depending on the model)
Action time	Immediately act when the DC bus voltage is lower than Pr.06-00
Fault treatment parameter	N/A
Reset method	Manual / Auto: 230V models: Lv level + 30 V_{DC} + 500 ms 460V models: Lv level + 60 V_{DC} + 500 ms
Reset condition	500 ms
Record	Yes

Cause	Corrective Actions
Power-off	Improve power supply condition.
Incorrect drive models	Check if the power specification matches the drive.
Power voltage changes	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.
Start up the motor with large capacity	Check the power system. Increase the capacity of power equipment.
DC bus	Install DC reactor(s).

ID*	Display on LED Keypad	Fault Name	Fault Descriptions
15	o r P	Phase loss protection (orP)	Phase loss of power input

Action and Reset	
Action level	When DC bus is lower than Pr.07-00 and the ripple is too high.
Action time	N/A
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 input power	Correctly install the wiring of the main circuit power.
Single phase power input to three-phase model	Choose the model whose power matches the voltage.
Power voltage changes	If the main circuit power works normally, verify the main circuit. 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 according to the torque described in the user manual.
The input cable of three-phase power is cut off	Wire correctly. Replace the cut off cable.
Unbalanced three-phase of input power	Check the power three-phase status.
Use Open Delta Connection system	Install reactors or use drives with higher power.

ID*	Display on LED Keypad	Fault Name	Fault Descriptions
16	oH1	IGBT overheating (oH1)	IGBT temperature exceeds the protection level. (Refer to Pr.06-15)

Action and Reset	
Action level	(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	N/A
Reset method	Manual reset
Reset condition	An IGBT overheating error occurs, and the drive stops. 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 control cabinet is too high, or if there is obstruction in the ventilation hole of the control cabinet.	Check 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 corresponding load	1. Reduce the load. 2. Reduce the carrier wave 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.

ID*	Display on LED Keypad	Fault Name	Fault Descriptions
18	$tH1o$	IGBT temperature detection failure (tH1o)	IGBT hardware failure in temperature detection

Action and Reset	
Action level	NTC broken or wiring failure
Action time	When the IGBT temperature is higher than the protection level, and detection time exceeds 100 ms, the tH1o protection activates.
Fault treatment parameter	N/A
Reset method	Manual reset
Reset condition	Immediately reset
Record	Yes

Cause	Corrective Actions
Hardware failure	Wait for 10 minutes, and then cycle the power. Check if tH1o protection still exists. If yes, return to the factory for repair.

ID*	Display on LED Keypad	Fault Name	Fault Descriptions
21	o L	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 level	Based on 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	N/A
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 or the working cycle are too short	Increase the setting value for Pr.01-12–01-19 (accel./decel. time)
V/F voltage is too high	Adjust the settings for 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.	Reduce the load during low-speed operation. Increase the drive capacity. Decrease the carrier frequency of Pr.00-17.
Torque compensation is too large	Readjust the torque compensation value (Pr.07-26 torque compensation gain) till the output current decreases 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.

ID*	Display on LED Keypad	Fault Name	Fault Descriptions
22	EoL 1	Electronics thermal relay 1 protection (EoL1)	Electronic thermal relay 1 protection. The drive coasts to stop once it activates.

Action and Reset	
Action level	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	N/A
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 or the working cycle are too short	Increase the setting value for Pr.01-12–01-19 (accel./decel. time)
V/F voltage is too high	Adjust the settings for 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. Replace the drive with a dedicated to VFD model. Increase the motor capacity.
When using VFD dedicated motor, Pr.06-13=0 (electronic thermal relay selection motor 1 = drive 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	Reset to the correct motor rated current.
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= disable, and install thermal relay on each motor.
Check if the setting for stall prevention is correct	Set the stall prevention to the proper value.
Torque compensation is too large	Adjust the torque compensation value (Pr.07-26 torque compensation gain) till the output current decreases 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.

ID*	Display on LED Keypad	Fault Name	Fault Descriptions
26	ot 1	Over torque 1 (ot1)	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.

Action and Reset	
Action level	Pr.06-07
Action time	Pr.06-08
Fault treatment parameter	Pr.06-06 0: No detection 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	Auto: When Pr.06-06=1 or 3, ot1 is a "Warning". The warning is automatically cleared when the output current < (Pr.06-07–5%) Manual: When Pr.06-06=2 or 4, ot1 is a "Fault". You must reset manually.
Reset condition	Immediately reset
Record	When Pr.06-06=2 or 4, ot1 is a "Fault", and the fault is recorded.

Cause	Corrective Actions
Incorrect parameter setting	Configure the settings for Pr.06-07 and Pr.06-08 again.
Mechanical failure (e.g. over-torque, mechanical lock)	Remove the causes of malfunction.
The load is too large.	Reduce the load. Replace the motor with a larger capacity model.
Accel./Decel. time or the working cycle are too short	Increase the setting value for Pr.01-12–01-19 (accel./decel. time)
V/F voltage is too high	Adjust the settings for 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 the motor with a larger capacity model.
Overload during low-speed operation.	Reduce the load during low-speed operation. Increase the motor capacity.
Torque compensation is too large	Adjust the torque compensation value (Pr.07-26 torque compensation gain) till the output current decreases 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.

ID*	Display on LED Keypad	Fault Name	Fault Descriptions
28	uC	Under current (uC)	Low current detection

Action and Reset	
Action level	Pr.06-71
Action time	Pr.06-72
Fault treatment parameter	Pr.06-73 0: Normal deceleration 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+0.1 A). Manual — When Pr.06-73=1 or 2, uC is a "Fault". You must reset manually.
Reset condition	Immediately reset
Record	When Pr.06-71=1 or 2, uC is a "Fault", and the fault is recorded.

Cause	Corrective Actions
Motor cable disconnection	Troubleshoot the connection between the motor and the load.
Improper setting of low-current protection	Reset Pr.06-71, Pr.06-72 and Pr.06-73 to proper settings.
The load is too low	Check the load status. Check if the motor capacity matches the load.

ID*	Display on LED Keypad	Fault Name	Fault Descriptions
31	cF2	EEPROM read error (cF2)	Internal EEPROM cannot be read

Action and Reset	
Action level	Firmware internal detection
Action time	cF2 acts immediately when the drive detects the fault
Fault treatment parameter	N/A
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 fault 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.

ID*	Display on LED Keypad	Fault Name	Fault Descriptions
33	c d 1	U-phase error (cd1)	U-phase current detection error when power is ON
		Action and Reset	
Action level	Hardware detection		
Action time	cd1 acts immediately when the drive detects the fault		
Fault treatment parameter	N/A		
Reset method	Power-off		
Reset condition	N/A		
Record	Yes		
Cause	Corrective Actions		
Hardware failure	Cycle the power. If fault code still exists, return to the factory for repair.		

ID*	Display on LED Keypad	Fault Name	Fault Descriptions
34	c d 2	V-phase error (cd2)	V-phase current detection error when power ON

Action and Reset	
Action level	Hardware detection
Action time	cd2 acts immediately when the drive detects the fault
Fault treatment parameter	N/A
Reset method	Power-off
Reset condition	N/A
Record	Yes

Cause	Corrective Actions
Hardware failure	Cycle the power. If fault code still exists, return to the factory for repair.

ID*	Display on LED Keypad	Fault Name	Fault Descriptions
35	c d 3	W-phase error (cd3)	W-phase current detection error when power ON

Action and Reset	
Action level	Hardware detection
Action time	cd3 acts immediately when the drive detects the fault
Fault treatment parameter	N/A
Reset method	Power-off
Reset condition	N/A
Record	Yes

Cause	Corrective Actions
Hardware failure	Cycle the power. If fault code still exists, return to the factory for repair.

ID*	Display on LED Keypad	Fault Name	Fault Descriptions
36	$Hd0$	cc hardware error (Hd0)	cc (current clamp) hardware protection error when power is ON

Action and Reset	
Action level	Hardware detection
Action time	Hd0 acts immediately when the drive detects the fault
Fault treatment parameter	N/A
Reset method	Power-off
Reset condition	N/A
Record	Yes

Cause	Corrective Actions
Hardware failure	Cycle the power. If fault code still exists, return to the factory for repair.

ID*	Display on LED Keypad	Fault Name	Fault Descriptions
37	*Hd1*	oc hardware error (Hd1)	oc hardware protection error when power is ON

Action and Reset	
Action level	Hardware detection
Action time	Hd1 acts immediately when the drive detects the fault
Fault treatment parameter	N/A
Reset method	Power-off
Reset condition	N/A
Record	Yes

Cause	Corrective Actions
Hardware failure	Cycle the power. If cd1 still exists, return to the factory for repair.

ID*	Display on LED Keypad	Fault Name	Fault 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 level	MIx=EF and the MI terminal is ON
Action time	Immediately act
Fault treatment parameter	Pr.07-20 0 (Coast to stop) 1: By the first deceleration time 2: By the second deceleration time 3: By the third deceleration time 4: By the fourth deceleration time 5: System deceleration 6: Automatic deceleration (Pr.01-46)
Reset method	Manual reset
Reset condition	Manual reset only after the external fault is cleared (terminal status is recovered)
Record	Yes

Cause	Corrective Actions
External fault	Press RESET key after the fault is cleared.

ID*	Display on LED Keypad	Fault Name	Fault 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 level	MIx=EF1 and the MI terminal is ON		
Action time	Immediately act		
Fault treatment parameter	N/A		
Reset method	Manual reset		
Reset condition	Manual reset only after the external fault is cleared (terminal status is recovered)		
Record	Yes		
Cause	Corrective Actions		
When MIx=EF1 activates	Verify if the system is back to normal condition, and then press "RESET" key to go back to the default.		

ID*	Display on LED Keypad	Fault Name	Fault Descriptions
51	ᑲ ᑲ	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 level	MIx=bb and the MI terminal is ON		
Action time	Immediately act		
Fault treatment parameter	N/A		
Reset method	The display "bb" is automatically cleared after the fault is cleared.		
Reset condition	N/A		
Record	No		
Cause	Corrective Actions		
When MIx=bb activates	Verify if the system is back to normal condition, and then press "RESET" key to go back to the default.		

ID*	Display on LED Keypad	Fault Name	Fault Descriptions
52	$Pcod$	Password is locked (Pcod)	Entering the wrong password three consecutive times

Action and Reset	
Action level	Entering the wrong password three consecutive times
Action time	Immediately act
Fault treatment parameter	N/A
Reset method	Manual reset
Reset condition	Power-off
Record	Yes

Cause	Corrective Actions
Incorrect password input through Pr.00-07	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.

ID*	Display on LED Keypad	Fault Name	Fault Descriptions
54	CE1	Illegal command (CE1)	Communication command is illegal

Action and Reset	
Action level	When the function code is not 03, 06, 10, or 63.
Action time	Immediately act
Fault treatment parameter	N/A
Reset method	Manual reset
Reset condition	Immediately reset
Record	No

Cause	Corrective Actions
Incorrect communication command from the upper unit	Check if the communication command is correct.
Malfunction caused by interference	Verify the grounding and wiring 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.09-02 is the same as the setting for the upper unit.
Disconnection or bad connection of the cable	Check the cable and replace it if necessary.

ID*	Display on LED Keypad	Fault Name	Fault Descriptions
55	[E2	Illegal data address (CE2)	Data address is illegal

Action and Reset	
Action level	When the data address is incorrect.
Action time	Immediately act
Fault treatment parameter	N/A
Reset method	Manual reset
Reset condition	Immediately reset
Record	No

Cause	Corrective Actions
Incorrect communication command from the upper unit	Check if the communication command is correct.
Malfunction caused by interference	Verify the grounding and wiring 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.09-02 is the same as the setting for the upper unit.
Disconnection or bad connection of the cable	Check the cable and replace it if necessary.

ID*	Display on LED Keypad	Fault Name	Fault Descriptions
56	ᶜᴱ3	Illegal data value (CE3)	Data value is illegal

Action and Reset	
Action level	When the data length is too long
Action time	Immediately act
Fault treatment parameter	N/A
Reset method	Manual reset
Reset condition	Immediately reset
Record	No

Cause	Corrective Actions
Incorrect communication command from the upper unit	Check if the communication command is correct.
Malfunction caused by interference	Verify the grounding and wiring 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.09-02 is the same as the setting for the upper unit.
Disconnection or bad connection of the cable	Check the cable and replace it if necessary.

ID*	Display on LED Keypad	Fault Name	Fault Descriptions
57	$\mathsf{CE4}$	Data is written to read-only address (CE4)	Data is written to read-only address

Action and Reset	
Action level	Data is written to read-only address
Action time	Immediately act
Fault treatment parameter	N/A
Reset method	Manual reset
Reset condition	Immediately reset
Record	No

Cause	Corrective Actions
Incorrect communication command from the upper unit	Check if the communication command is correct.
Malfunction caused by interference	Verify the grounding and wiring 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.09-02 is the same as the setting for the upper unit.
Disconnection or bad connection of the cable	Check the cable and replace it if necessary.

ID*	Display on LED Keypad	Fault Name	Fault Descriptions
58	CE10	Modbus transmission time-out (CE10)	Modbus transmission time-out occurs

Action and Reset	
Action level	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: Warn and ramp to stop 2: Warn and coast to stop 3: No Warn 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 grounding and wiring 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.09-02 is the same as the setting for the upper unit.
Disconnection or bad connection of the cable	Check the cable and replace it if necessary.

ID*	Display on LED Keypad	Fault Name	Fault Descriptions
62	dEb	Deceleration energy backup error (dEb)	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.

Action and Reset		
Action level	When Pr.07-13 is not 0, and the DC bus voltage is lower than the level of dEb.	
Action time	Immediately act	
Fault treatment parameter	N/A	
Reset method	Auto	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.
	Manual	When Pr.07-13=1 (dEb, 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.
Reset condition	Auto: The fault is automatically cleared. Manual: When the drive decelerates to 0 Hz.	
Record	Yes	

Cause	Corrective Actions
Unstable power source or the power is off	Check the power system.
There is any other large load operates in the power system	Replace power system with a larger capacity. Use a different power system from the large load system.

ID*	Display on LED Keypad	Fault Name	Fault 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 level	240% of the rated current
Action time	Immediately act
Fault treatment parameter	N/A
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 UVW 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 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: 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.

ID*	Display on LED Keypad	Fault Name	Fault 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 level	240% of the rated current
Action time	Immediately act
Fault treatment parameter	N/A
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 UVW 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 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: 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.

ID*	Display on LED Keypad	Fault Name	Fault Descriptions
81	c o c	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 level	240% of the rated current
Action time	Immediately act
Fault treatment parameter	N/A
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 UVW 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 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: 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.

ID*	Display on LED Keypad	Fault Name	Fault Descriptions
82	oPL 1	Output phase loss U phase (oPL1)	U phase output phase loss

Action and Reset	
Action level	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: Warn and ramp to stop 2: Warn and coast to stop 3: No warning
Reset method	Manual reset
Reset condition	Immediately reset
Record	Pr.06-45=1 or 2 is "Fault", and the fault is recorded.

Cause	Corrective Actions
Unbalanced three-phase impedance of the motor	Replace the motor.
The motor is wired incorrectly	Check the cable condition. Replace the cable. Check the motor's internal wiring. If the fault still exists, replace the motor.
Using a single-phase motor	Choose a three-phase motor
Check if the current sensor is broken.	Check the flat cable of the control board. Re-do the wiring and test again if the flat cable is loose. If the fault still exists, 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.
The drive capacity is much larger than the motor capacity	Make sure the capacity of the drive and motor match to each other.

ID*	Display on LED Keypad	Fault Name	Fault Descriptions
83	oPL2	Output phase loss V phase (oPL2)	V phase output phase loss

Action and Reset	
Action level	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: Warn and ramp to stop 2: Warn and coast to stop 3: No warning
Reset method	Manual reset
Reset condition	Immediately reset
Record	Pr.06-45=1 or 2 is "Fault", and the fault is recorded.

Cause	Corrective Actions
Unbalanced three-phase impedance of the motor	Replace the motor.
The motor is wired incorrectly	Check the cable condition. Replace the cable. Check the motor's internal wiring. If the fault still exists, replace the motor.
Using a single-phase motor	Choose a three-phase motor
Check if the current sensor is broken.	Check the flat cable of the control board. Re-do the wiring and test again if the flat cable is loose. If the fault still exists, 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.
The drive capacity is much larger than the motor capacity	Make sure the capacity of the drive and motor match to each other.

ID*	Display on LED Keypad	Fault Name	Fault Descriptions
84	oPL3	Output phase loss W phase (oPL3)	W phase output phase loss

Action and Reset	
Action level	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: Warn and ramp to stop 2: Warn and coast to stop 3: No warning
Reset method	Manual reset
Reset condition	Immediately reset
Record	Pr.06-45=1 or 2 is "Fault", and the fault is recorded.

Cause	Corrective Actions
Unbalanced three-phase impedance of the motor	Replace the motor.
The motor is wired incorrectly	Check the cable condition. Replace the cable. Check the motor's internal wiring. If the fault still exists, replace the motor.
Using a single-phase motor	Choose a three-phase motor
Check if the current sensor is broken.	Check the flat cable of the control board. Re-do the wiring and test again if the flat cable is loose. If the fault still exists, 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.
The drive capacity is much larger than the motor capacity	Make sure the capacity of the drive and motor match to each other.

ID*	Display on LED Keypad	Fault Name	Fault Descriptions
87	oL3	87: Low frequency overload protection (oL3)	Low frequency and high current protection
Action and Reset			
Action level	Software detection		
Action time	Immediately act		
Fault treatment parameter	N/A		
Reset method	Manual reset		
Reset condition	Immediately reset		
Record	Yes		
Cause	Corrective Actions		
The drive operates at a frequency below 15 Hz, and output current is too large.	1. Enhance the heat dissipation capacity for the cabinet. 2. Lower the carrier frequency (Pr.00-17). 3. Decrease the voltage settings that correspond to frequency below 15 Hz in the V/F curve. 4. Change Pr.00-11 to general control mode. 5. Replace the drive with a larger power model.		

ID*	Display on LED Keypad	Fault Name	Fault Descriptions
101	*CGdE*	CANopen guarding error (CGdE)	CANopen guarding error 1

Action and Reset	
Action level	When CANopen Node Guarding detects that one of the slaves does not respond, the CGdE fault occurs. The upper unit sets the factor and time during configuration.
Action time	The time that the upper unit sets during configuration
Fault treatment parameter	N/A
Reset method	Manual reset
Reset condition	The upper unit sends a reset package to clear this fault.
Record	Yes

Cause	Corrective Actions
The guarding time is too short, or less detection times	Increase the guarding time (Index 100C) and detection times
Malfunction caused by interference	1. Verify the grounding and wiring 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. 2. Make sure the communication circuit is wired in series. 3. Use CANopen cable or add terminating resistance.
Disconnection or bad connection of the cable	Check the cable and replace it if necessary.

ID*	Display on LED Keypad	Fault Name	Fault Descriptions
102	[H b E	CANopen heartbeat error (CHbE)	CANopen heartbeat error 2
Action and Reset			
Action level	When CANopen Heartbeat detects that one of the slaves does not respond, the CHbE fault occurs. The upper unit sets the confirming time of producer and consumer during configuration.		
Action time	The upper unit sets the confirming time of producer and consumer during configuration.		
Fault treatment parameter	N/A		
Reset method	Manual reset		
Reset condition	The upper unit sends a reset package to clear this fault.		
Record	Yes		
Cause	Corrective Actions		
The heartbeat time is too short	Increase heartbeat time (Index 100C)		
Malfunction caused by interference	1. Verify the grounding and wiring 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. 2. Make sure the communication circuit is wired in series. 3. Use CANopen cable or add terminating resistance.		
Disconnection or bad connection of the cable	Check the cable and replace it if necessary.		

ID*	Display on LED Keypad	Fault Name	Fault Descriptions
104	$\mathcal{C}bFE$	CANopen bus off error (CbFE)	CANopen bus off error
Action and Reset			

Action level	Hardware	When CANopen card is not installed, the CbFn warning occurs.
	Software	When the master receives wrong communication package, the CbFE fault occurs. Too much interference on BUS The master receives wrong package when the CAN_H and CAN_L communication cables are short, CbFE fault occurs.
Action time	Immediately act	
Fault treatment parameter	N/A	
Reset method	Manual reset	
Reset condition	Cycle the power	
Record	Yes	

Cause	Corrective Actions
Check if the CANopen speed is correct	Reset CANopen speed (Pr.09-37)
Malfunction caused by interference	1. Verify the grounding and wiring 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. 2. Make sure the communication circuit is wired in series. 3. Use CANopen cable or add terminating resistance.
Disconnection or bad connection of the cable	4. Check the cable and replace it if necessary.

ID*	Display on LED Keypad	Fault Name	Fault Descriptions
105	*CidE*	CANopen index error (CidE)	CANopen index error
Action and Reset			
Action level	Software detection		
Action time	Immediately act		
Fault treatment parameter	N/A		
Reset method	Manual reset		
Reset condition	The upper unit sends a reset package to clear this fault.		
Record	Yes		
Cause	Corrective Actions		
Incorrect setting of CANopen index	Reset CANopen Index (Pr.00-02=7)		

ID*	Display on LED Keypad	Fault Name	Fault Descriptions
106	$CAdE$	CANopen station address error (CAdE)	CANopen station address error (only supports 1–127)

Action and Reset	
Action level	Software detection
Action time	Immediately act
Fault treatment parameter	N/A
Reset method	Manual reset (Pr.00-02=7)
Reset condition	N/A
Record	Yes

Cause	Corrective Actions
Incorrect setting of CANopen station address	1. Disable CANopen (Pr.09-36=0) 2. Reset CANopen (Pr.00-02=7) 3. Reset CANopen station address (Pr.09-36)

ID*	Display on LED Keypad	Fault Name	Fault Descriptions
107	$CFrE$	CANopen index setting exceed limit (CFrE)	CANopen memory error

Action and Reset	
Action level	When you update the firmware version of the control board, the FRAM internal data does not change, then CFrE fault occurs.
Action time	Immediately act
Fault treatment parameter	N/A
Reset method	Manual reset
Reset condition	Pr.00-02=7
Record	Pr.00-21=3, the fault is recorded

Cause	Corrective Actions
CANopen internal memory error	1. Disable CANopen (Pr.09-36=0) 2. Reset CANopen (Pr.00-02=7) 3. Reset CANopen station address (Pr.09-36)

ID*	Display on LED Keypad	Fault Name	Fault Descriptions
111	ㄷㄷㅌㅌ	InrCOM time-out error (ictE)	Internal communication time-out

Action and Reset	
Action level	Pr.09-31 = -1~ -10 (there is no -9), when the internal communication between Slave and Master is abnormal, IctE fault occurs.
Action time	Immediately act
Fault treatment parameter	N/A
Reset method	Automatically reset after the internal communication is normal
Reset condition	N/A
Record	Yes

Cause	Corrective Actions
Malfunction caused by interference	Verify the grounding and wiring 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.09-02 is the same as the setting for the upper unit.
Disconnection or bad connection of the cable	Check the cable and replace it if necessary.

ID*	Display on LED Keypad	Fault Name	Fault Descriptions
121	*CP20*	Internal communication error (CP20)	Internal communication time-out
Action and Reset			
Action level	Software detection		
Action time	Immediately act		
Fault treatment parameter	N/A		
Reset method	N/A		
Record	Yes		
Cause	Corrective Actions		
Internal communication error	Contact local agent or Delta		

ID*	Display on LED Keypad	Fault Name	Fault Descriptions
123	$\mathit{CP22}$	Internal communication error (CP22)	Abnormal internal communication
Action and Reset			
Action level	Software detection		
Action time	Immediately act		
Fault treatment parameter	N/A		
Reset method	N/A		
Record	Yes		
Cause	Corrective Actions		
Internal communication error	Contact local agent or Delta		

ID*	Display on LED Keypad	Fault Name	Fault Descriptions
124	*C P 3 2*	Internal communication error (CP30)	Internal communication time-out
Action and Reset			
Action level	Software detection		
Action time	Immediately act		
Fault treatment parameter	N/A		
Reset method	N/A		
Record	Yes		
Cause	Corrective Actions		
Internal communication error	Contact local agent or Delta		
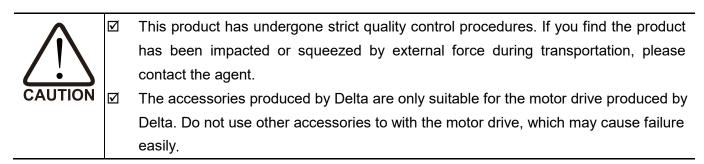
ID*	Display on LED Keypad	Fault Name	Fault Descriptions
126	*CP32*	Internal communication error (CP32)	Abnormal internal communication
Action and Reset			
Action level	Software detection		
Action time	Immediately act		
Fault treatment parameter	N/A		
Reset method	N/A		
Record	Yes		
Cause	Corrective Actions		
Internal communication error	Contact local agent or Delta		

ID*	Display on LED Keypad	Fault Name	Fault Descriptions
127	$CP33$	Internal communication error (CP33)	Abnormal internal communication
Action and Reset			
Action level	Software detection		
Action time	Immediately act		
Fault treatment parameter	N/A		
Reset method	N/A		
Record	Yes		
Cause	Corrective Actions		
Internal communication error	Contact local agent or Delta		

ID*	Display on LED Keypad	Fault Name	Fault Descriptions
141	b4oc	Short circuit before run (b4oc)	A short circuit is detected before the drive runs
		Action and Reset	
Action level	240% of the rated current		
Action time	Immediately act		
Fault treatment parameter	N/A		
Reset method	N/A		
Record	Yes		
Cause	Corrective Actions		
Incorrect wiring for the motor	Check if the motor's internal wiring and the UVW 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.		
The internal circuit of the drive is abnormal	Contact your local distributor or Delta.		

Appendix A. Optional Accessories

⚠️ **CAUTION**	☑ This product has undergone strict quality control procedures. If you find the product has been impacted or squeezed by external force during transportation, please contact the agent. ☑ The accessories produced by Delta are only suitable for the motor drive produced by Delta. Do not use other accessories to with the motor drive, which may cause failure easily.

A-1 Circuit Breaker

The rated current of the breaker shall be 2–4 times of the maximum rated input current of the AC motor drive.

Single-phase	
Model	Suggested current [A]
VFD002EL21C	10
VFD004EL21C	15
VFD007EL21C	20
VFD015EL21C	30
VFD022EL21C	50

Three-phase	
Model	Suggested current [A]
VFD004EL43C	5
VFD007EL43C	5
VFD015EL43C	10
VFD022EL43C	15
VFD040EL43C	20
VFD055EL43C	30

Fuse Specification Chart (Fuse specifications lower than the table shown below are allowed.)

Model	Input Current (A)	Output Current (A)	Line Fuse	
			I (A)	Bussmann P/N
VFD002EL21C	4.9	1.6	10	JJN-10
VFD004EL21C	6.5	2.5	15	JJN-15
VFD004EL43C	1.8	1.5	5	JJS-6
VFD007EL21C	9.3	4.2	20	JJN-20
VFD007EL43C	3.2	2.5	5	JJS-6
VFD015EL21C	15.7	7.5	30	JJN-30
VFD015EL43C	4.3	4.2	10	JJS-10
VFD022EL21C	24.0	11.0	50	JJN-50
VFD022EL43C	7.1	5.5	15	JJS-15
VFD040EL43C	10.0	9.0	20	JJS-20
VFD055EL43C	17.0	13.0	30	JJS-30

A-2 AC Reactor

A-2-1 AC Reactor

AC Input Reactor

230V, 50 / 60 Hz, Single-phase

kW	HP	Basic Amps	Maximum continuous Amps	Inductance (mH) 3–5% Impedance
0.2	0.25	4	6	6.5
0.4	0.5	5	7.5	3
0.75	1	8	12	1.5
1.5	2	12	18	1.25
2.2	3	18	27	0.8

460V, 50 / 60 Hz, Three-phase

kW	HP	Basic Amps	Maximum continuous Amps	Inductance (mH)	
				3% Impedance	5% Impedance
0.4	0.5	2	3	20	32
0.75	1	4	6	9	12
1.5	2	4	6	6.5	9
2.2	3	8	12	5	7.5
4.0	5.5	8	12	3	5
5.5	7.5	12	18	2.5	4.2

AC Output Reactor

230V, 50 / 60 Hz, Three-phase

kW	HP	Basic Amps	Maximum continuous Amps	Inductance (mH)	
				3% Impedance	5% Impedance
0.2	0.25	4	6	9	12
0.4	0.5	4	6	6.5	9
0.75	1	8	12	3	5
1.5	2	8	12	1.5	3
2.2	3	12	18	1.25	2.5

460V, 50 / 60 Hz, Three-phase

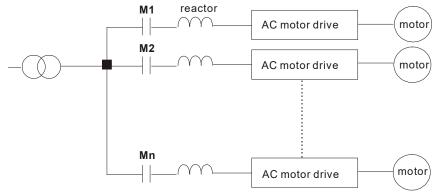| kW	HP	Basic Amps	Maximum continuous Amps	Inductance (mH)	
				3% Impedance	5% Impedance
0.4	0.5	2	3	20	32
0.75	1	4	6	9	12
1.5	2	4	6	6.5	9
2.2	3	8	12	5	7.5
4.0	5.5	12	18	3	5
5.5	7.5	18	27	1.5	2.5

AC reactor application

Connected in input circuit

Application–1

The same power supply is connected to multiple drives and the drive is running, a certain drive power supply is turned on.

Causes / problems: In the same power system, when the solenoid valve of the drive is turned on, the charging current of the capacitor will cause voltage ripples, and the DC side voltage of other drives will fluctuate too much at the same time.
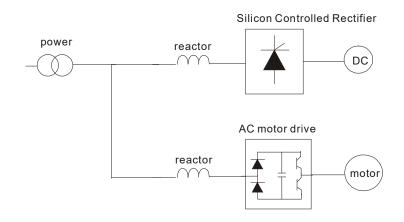
The correct wiring:

Application–2

The silicon rectifier (such as DC motor drive, etc.) and the drive are both connected to the same power supply.

Causes / problems: Since the silicon rectifier is a switching element, there will be a surge at the moment of ON/OFF, which may cause damage to the main circuit protection action.
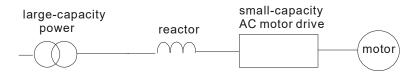
The correct wiring:

Application–3

When the power supply capacity is greater 10 times of the capacity of the dual-frequency device.

Causes / problems: When the power supply capacity is large, the charging current is too large due to the small power supply impedance, which may easily cause high temperature or damage to the commutator of the main circuit.
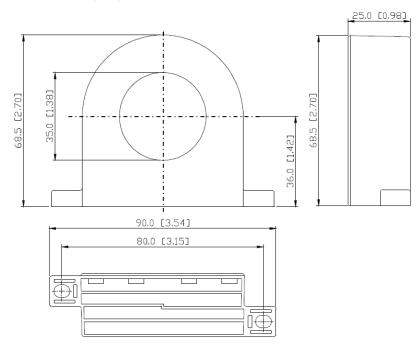
The correct wiring:
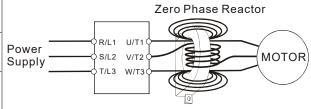
A-2-2 Zero phase reactor

RF220X00A   UNIT: mm [inch]

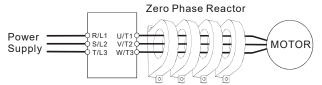| Cable type[Note]	Recommended Wire Size (mm^2)			Qty.	Wiring Method
	*AWG	mm^2	Nominal (mm^2)		
Single-core	≤10	≤5.3	≤5.5	1	Figure A
	≤2	≤33.6	≤38	4	Figure B
Three-core	≤12	≤3.3	≤3.5	1	Figure A
	≤1	≤42.4	≤50	4	Figure B

NOTE:

600V insulated power lines.

1. The above table is for reference only, please use the appropriate cable type and diameter; in short, the cable must be suitable for passing through the center of the zero-phase reactor.

2. Do not pass through the ground cable when wiring, only pass through the motor cable or power cable.

3. When using a long motor output cable, it may be necessary to use a zero-phase reactor to reduce radiation.

Figure A

Each line needs four turns when passing through the zero-phase reactor.

This reactor should be as close as possible to the drive.

Figure B

Please pass the cables through the four parallel zero-phase reactors directly.

A-3 Remote Operation Keypad

A-3-1 VFD-PU08V Keypad

Main display area
Frequency, current, voltage, user- define, fault code, etc. display

Status display area
Indicate frequency status: run, stop, forward, reverse, enable / disable the frequency setting knob.

Direction function key (Up)
Adjust the parameters or the values

Run
Start VFD operation

Stop/Reset
Stop or reset VFD

Mode
To change the different mode selection step by step

Enter
1. To enter the settings page
2. To confirm the parameter setting

Direction function key (Down & left)
Adjust the parameters or the values / Long press MODE button to switch between down or left button

Frequency setting knob
Input the main frequency

A-3-2 VFD-PU08V status, key and digital dial function

1. Status Descriptions

Status displayed	Note
	RUN: VFD is running
	FWD: VFD is running forwardly
	REV: VFD is running reversely
	STOP: VFD is stopped
	STOP Flashing: VFD is stopping
	VR light on: VFD potentiometer function is enabled
	VR light off: Up and Down direction function is enabled

2. Keypad Function Descriptions

The following VFD-PU08V keys support mode switching, and the operation of other keys is the same as that of the drive

MODE	Mode switch	Press MODE botton for 2 seconds, when "X" flashing, < ▼ , the direction function key " < " is enabled and the direction function key "▼ " is disabled. When the direction function key " < " is enabled, long press MODE botton again, the "X" stop flashing and the direction function key "▼ " is enabled.
< ▼	Decrease / Shift	decrease the value, shift the set value and parameter and the digits of the value setting moving

3. Variable Resistor (VR)

(1) 3. Variable Resistor function

A. When the function is enabled, •VR ⊘ is always on, and the drive running frequency command F can be adjusted.

B.   If the power is turned off and on again, the default function is enabled

(2)   Function enable

When the power supply of VFD-PU08V is normal, and the drive matches the communication protocol and model setting of VFD-PU08V, the preset will affect.

(3)   Function switch

A.   When •VR ⊘ is always on, press the MODE + ENTER compound key to switch to the up

key ▲ and <SHIFT> / down key </▼ to adjust the drive frequency command, and

•VR ⊘ will be off at the same time.

B.   If you press the MODE+ENTER composite key again when •VR ⊘ is off, it will switch back to the state where the frequency is adjusted by the variable resistor and •VR ⊘ light up.

C.   •VR ⊘ is off, the frequency is adjusted by the up and down keys, and will not be maintained when the power is off. When the VFD-PU08 is powered on again, it is still adjusted by the variable resistor and •VR ⊘ lights up.

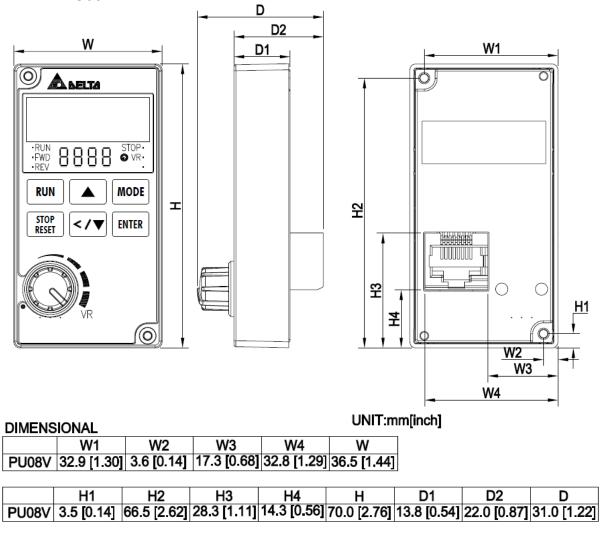## A-3-3 Extension cable and interface definition for connecting to the drive

VFD-PU08V does not include extension cables, users need to choose extension cables according to their needs.

Figure	PIN	PU08V pin function
8 ←1 RS-485	1	NC
	2	NC
	3	DGND
	4	SG-
	5	SG+
	6	NC
	7	NC
	8	Vcc

Note: NC stands for Not Connect

A-3-4 VFD-PU08V Dimensions

UNIT:mm[inch]

DIMENSIONAL

	W1	W2	W3	W4	W
PU08V	32.9 [1.30]	3.6 [0.14]	17.3 [0.68]	32.8 [1.29]	36.5 [1.44]

	H1	H2	H3	H4	H	D1	D2	D
PU08V	3.5 [0.14]	66.5 [2.62]	28.3 [1.11]	14.3 [0.56]	70.0 [2.76]	13.8 [0.54]	22.0 [0.87]	31.0 [1.22]

A-4 The Assembly of Fan Kit

After the VFD007EL21C is installed with a cooling fan, the upper limit of the ambient operating temperature is increased to 50°C without derating. If the fan is not installed, the upper limit of the ambient operating temperature is 40°C without derating.

The power supply of the fan is 24V which can be powered from the drive control terminal +24V / DCM. After using the fan, only MI terminal can be normal used, other loads are not allowed to be connected to prevent the +24V terminal from being overloaded and causing damage to the drive.

Models	Applicable model	Fan Kit
KEL-AFKM1	VFD007EL21C	

Note: The length of the fan cable is about 150mm.

Fan installation

Step	Figure
1. As shown in the figure on the right, according to the direction of the arrow, remove the front cover first.	
2. Place the fan according to the diagram on the right to makes the arrow on the fan points to the heat sink, and assemble the fan net and fan on the heat sink with screws. Positive electrode of the fan: connect the red cable to the +24V terminal. Negative electrode of the fan: connect the black cable to the DCM terminal.	
3. Reinstall the front cover, and the fan installation is complete.	

A-5 CANopen Acessories

A-5-1 CANopen junction box

Model	Description
TAP-CN01	1 point 2, built-in 121Ω terminal resistance
TAP-CN02	1 point 4, built-in 121Ω terminal resistance
TAP-CN03	1 point 4, RJ45 connector, built-in 121Ω terminal resistance

Unit: mm [inch]

TAP-CN01   66 [2.6]

TAP-CN02   87 [3.4]

TAP-CN03   66.5 [2.6]

A-5-2 TAP-TR01 terminal resistor

A-5-3 Standard extension cable

No	Models	L	
		mm	inch
1	UC-CMC003-01A	300	11.8
2	UC-CMC005-01A	500	19.6
3	UC-CMC010-01A	1000	39.0
4	UC-CMC015-01A	1500	59.0
5	UC-CMC020-01A	2000	78.7
6	UC-CMC030-01A	3000	118.1
7	UC-CMC050-01A	5000	196.8

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