

Industrial Automation Headquarters Delta Electronics, Inc. Taoyuan Technology Center No.18, Xinglong Rd., Taoyuan City, Taoyuan County 33068, Taiwan TEL: 886-3326-3301 / FAX: 886-3-371-6301

Asia Delta Electronics (Jiangsu) Ltd. Wujiang Plant 3 1688 Jiangxing East Road, Wujiang Economic Development Zone Wujiang City, Jiang Su Province, People's Republic of China (Post code: 215200) TEL: 86-512-6340-3008 / FAX: 86-769-6340-7290

Delta Greentech (China) Co., Ltd. 238 Min-Xia Road, Pudong District, ShangHai, P.R.C. Post code : 201209 TEL: 86-21-58635678 / FAX: 86-21-58630003

Delta Electronics (Japan), Inc. Tokyo Ofice 2-1-14 Minato-ku Shibadaimon, Tokyo 105-0012, Japan TEL: 81-3-5733-1111 / FAX: 81-3-5733-1211

Delta Electronics (Korea), Inc. 1511, Byucksan Digital Valley 6-cha, Gasan-dong, Geumcheon-gu, Seoul, Korea, 153-704 TEL: 82-2-515-5303 / FAX: 82-2-515-5302

Delta Electronics Int'I (S) Pte Ltd 4 Kaki Bukit Ave 1, #05-05, Singapore 417939 TEL: 65-6747-5155 / FAX: 65-6744-9228

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

Americas Delta Products Corporation (USA) Raleigh Ofice P.O. Box 12173,5101 Davis Drive, Research Triangle Park, NC 27709, U.S.A. TEL: 1-919-767-3800 / FAX: 1-919-767-8080

Delta Greentech (Brasil) S.A Sao Paulo Ofice Rua Itapeva, 26 - 3° andar Ediicio Itapeva One-Bela Vista 01332-000-São Paulo-SP-Brazil TEL: +55 11 3568-3855 / FAX: +55 11 3568-3865

Europe Deltronics (The Netherlands) B.V. Eindhoven Ofice De Witbogt 15, 5652 AG Eindhoven, The Netherlands TEL: 31-40-2592850 / FAX: 31-40-2592851

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# Delta Classical Field Oriented Control AC Motor Drive C2000 Series User Manual



www.deltaww.com

#### PLEASE READ PRIOR TO INSTALLATION FOR SAFETY.



- $\square$  AC input power must be disconnected before any wiring to the AC motor drive is made.
- ☑ 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. Please do not touch the internal circuit and components.
- ☑ There are highly sensitive MOS components on the printed circuit boards. These components are especially sensitive to static electricity. Please do not touch these components or the circuit boards before taking anti-static measures. Never reassemble internal components or wiring.
- Ground the AC motor drive using the ground terminal. The grounding method must comply with the laws of the country where the AC motor drive is to be installed.
- ☑ DO NOT install the AC motor drive in a place subjected to high temperature, direct sunlight and inflammables.



- ☑ Never connect the AC motor drive output terminals U/T1, V/T2 and W/T3 directly to the AC mains circuit power supply.
- ☑ Only qualified persons are allowed to install, wire and maintain the AC motor drives.
- ☑ Even if the 3-phase AC motor is stop, a charge may still remain in the main circuit terminals of the AC motor drive with hazardous voltages.
- ☑ If the AC motor drive is stored in no charge condition for more than 3 months, the ambient temperature should not be higher than 30 °C. Storage longer than one year is not recommended, it could result in the degradation of the electrolytic capacitors.
- ☑ Pay attention to the following when transporting and installing this package (including wooden crate, wood stave and carton box)
  - 1. If you need to sterilize, deform the wooden crate or carton box, please do not use steamed smoking sterilization or you will damage the VFD.
  - 2. Please use other ways to sterilize or deform.
  - 3. You may use high temperature to sterilize or deform. Leave the packaging materials in an environment of over 56°C for 30 minutes.
  - 4. It is strictly forbidden to use steamed smoking sterilization. The warranty does not covered VFD damaged by steamed smoking sterilization.

#### 

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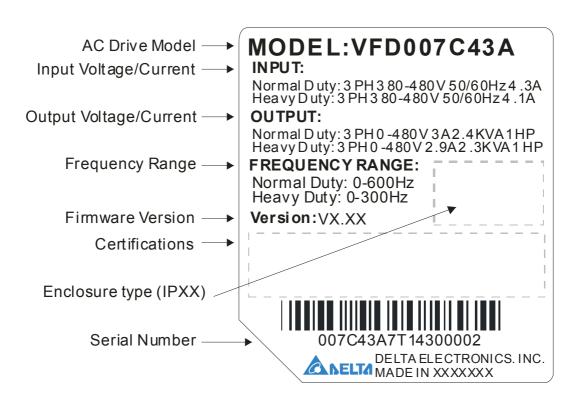
Application Control BD V1.20; Keypad V1.04;

# **Chapter 1 Introduction**

# 1-1 Receiving and Inspection

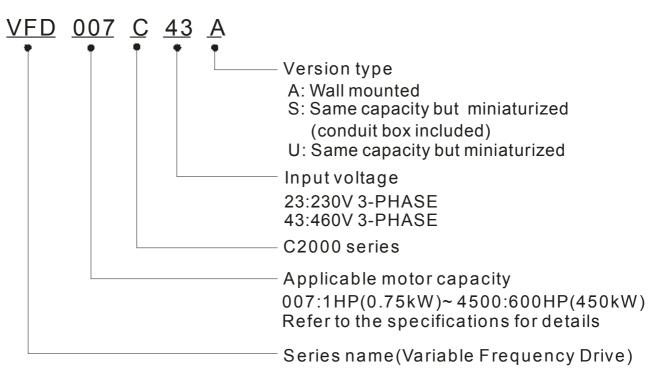
After receiving the AC motor drive, please check for the following:

- 1. Please inspect the unit after unpacking to assure it was not damaged during shipment. Make sure that the part number printed on the package corresponds with the part number indicated on the nameplate.
- 2. Make sure that the voltage for the wiring lie within the range as indicated on the nameplate. Please install the AC motor drive according to this manual.
- 3. Before applying the power, please make sure that all the devices, including power, motor, control board and digital keypad, are connected correctly.
- 4. When wiring the AC motor drive, please make sure that the wiring of input terminals "R/L1, S/L2, T/L3" and output terminals"U/T1, V/T2, W/T3" are correct to prevent drive damage.
- 5. When power is applied, select the language and set parameter groups via the digital keypad (KPC-CC01). When executes trial run, please begin with a low speed and then gradually increases the speed untill the desired speed is reached.

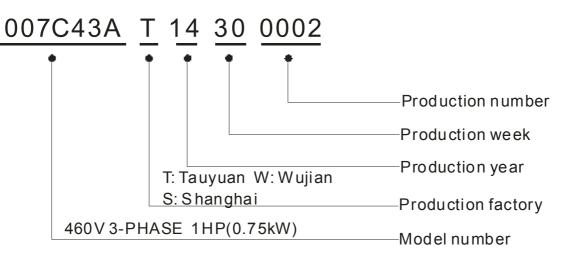


## **1-2 Nameplate Information**

## 1-3 Model Name



#### **1-4 Serial Number**



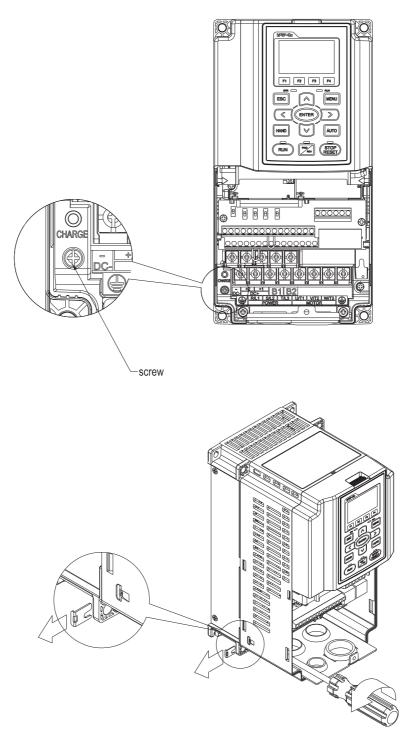
# 1-5 RFI Jumper

RFI Jumper: The AC motor drive may emit the electrical noise. The RFI jumper is used to suppress the interference (Radio Frequency Interference) on the power line.

Frame A~C

Screw Torque: 8~10kg-cm(6.9-8.7 lb -in.)

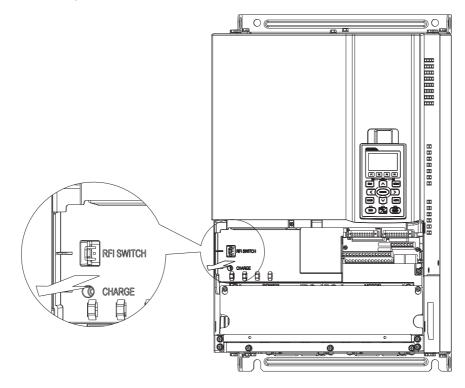
Loosen the screws and remove the MOV-PLATE. Fasten the screws back to the original position after MOV-PLATE is removed.



#### Chapter 1 Introduction | C2000 Series

#### Frame D0~H

Remove the MOV-PLATE by hands, no screws need to be loosen.

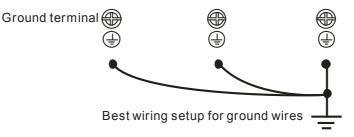


Isolating main power from ground:

When the power distribution system of the Power Regenerative Unit is a floating ground system (IT) or an asymmetric ground system (TN), the RFI short short-circuit cable must be cut off. Cutting off the short-circuit cable cuts off the internal RFI capacitor (filter capacitor) between the system's frame and the central circuits to avoid damaging the central circuits and (according to IEC 61800-3) reduce the ground leakage current.

Important points regarding ground connection

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



Pay particular attention to the following points:

- After turning on the main power, do not cut the RFI short-circuit cable while the power is on.
- $\square$  Make sure the main power is turned off before cutting the RFI short-circuit cable.
- ☑ Cutting the RFI short-circuit cable will also cut off the conductivity of the capacitor. Gap discharge may occur once the transient voltage exceeds 1000V.

If the RFI short-circuit cable is cut, there will no longer be reliable electrical isolation. In other words, all controlled input and outputs can only be seen as low-voltage terminals with basic electrical isolation. Also, when the internal RFI capacitor is cut off, the Power Regenerative Unit will no longer be electromagnetic compatible.

- ☑ The RFI short-circuit cable may not be cut off if the main power is a grounded power system.
- ☑ The RFI short-circuit cable may not be cut off while conducting high voltage tests. When conducting a high voltage test to the entire facility, the main power and the motor must be disconnected if leakage current is too high.

#### Floating Ground System(IT Systems)

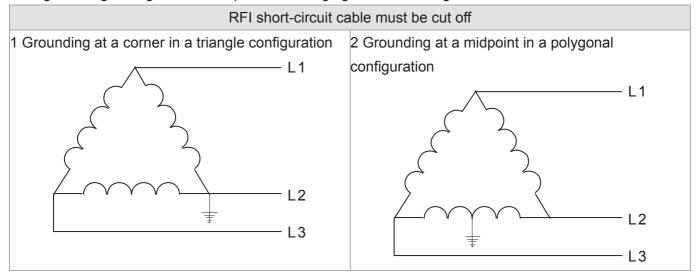
A floating ground system is also called IT system, ungrounded system, or high impedance/resistance (greater than  $30\Omega$ ) grounding system.

- $\ensuremath{\boxtimes}$   $\ensuremath{\,\square}$  Disconnect the ground cable from the internal EMC filter.
- In situations where EMC is required, check whether there is excess electromagnetic radiation affecting nearby low-voltage circuits. In some situations, the adapter and cable naturally provide enough suppression. If in doubt, install an extra electrostatic shielded cable on the power supply side between the main circuit and the control terminals to increase security.
- ☑ Do not install an external RFI/EMC filter, the EMC filter will pass through a filter capacitor, thus connecting power input to ground. This is very dangerous and can easily damage the Power Regenerative Unit.

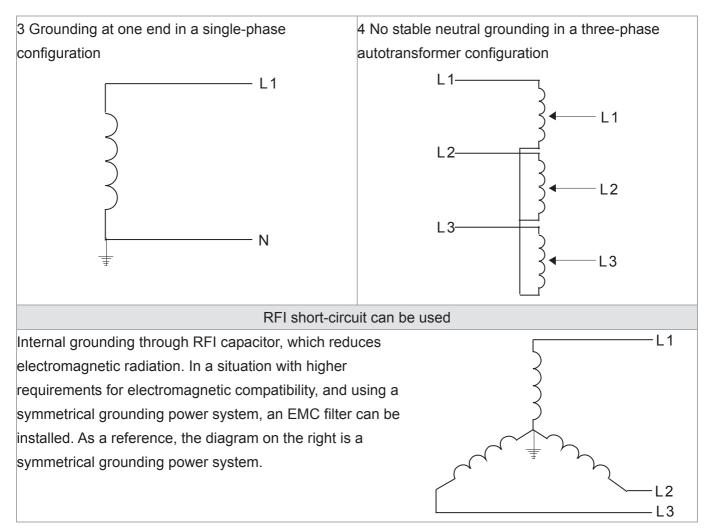
#### Asymmetric Ground System(Corner Grounded TN Systems)

Caution: Do not cut the RFI short-circuit cable while the input terminal of the Power Regenerative Unit carries power.

In the following four situations, the RFI short-circuit cable must be cut off. This is to prevent the system from grounding through the RFI capacitor, damaging the Power Regenerative Unit.



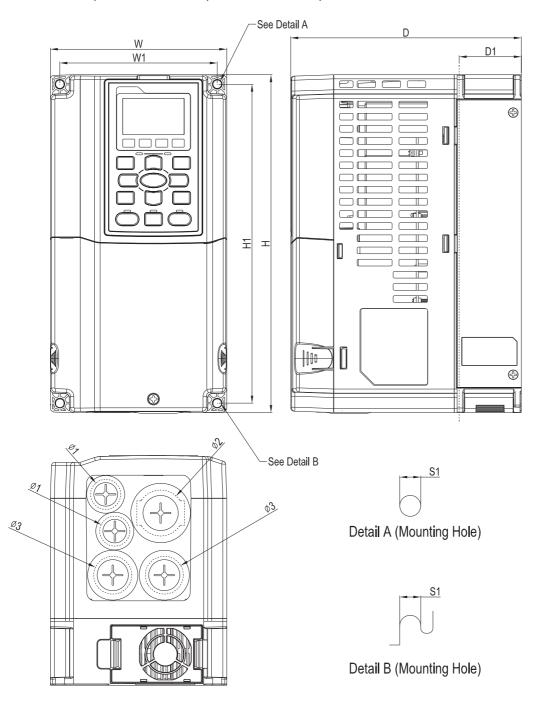
#### Chapter 1 Introduction | C2000 Series



# **1-6 Dimensions**

Frame A

VFD007C23A; VFD007C43A/E; VFD015C23A; VFD015C43A/E; VFD022C23A; VFD022C43A/E; VFD037C23A; VFD037C43A/E; VFD040C43A/E; VFD055C43A/E

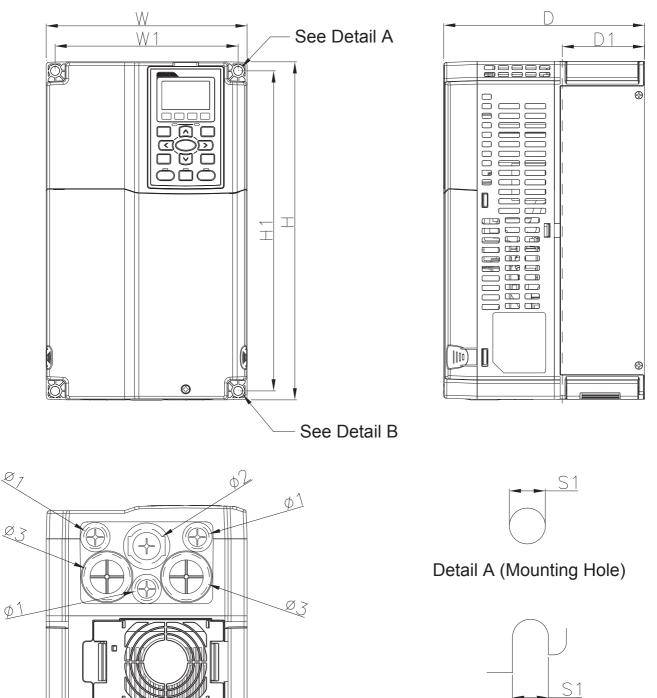


Unit <sup>.</sup>	mm	[inch]
Orne.		Intern

Frame	W	Н	D	W1	H1	D1*	S1	Ф1	Ф2	Ф3
A1	130.0	250.0	170.0	116.0	236.0	45.8	6.2	22.2	34.0	28.0
	[5.12]	[9.84]	[6.69]	[4.57]	[9.29]	[1.80]	[0.24]	[0.87]	[1.34]	[1.10]
			•		•					as mounting

#### Frame B

VFD055C23A; VFD075C23A; VFD075C43A/E; VFD110C23A; VFD110C43A/E; VFD150C43A/E



Detail B (Mounting Hole)

Unit: mm [inch]

Frame	W	Н	D	W1	H1	D1*	S1	Φ1	Ф2	Ф3
D1	190.0	320.0	190.0	173.0	303.0	77.9	8.5	22.2	34.0	43.8
B1	[7.48]	[12.60]	[7.48]	[6.81]	[11.93]	[3.07]	[0.33]	[0.87]	[1.34]	[1.72]

Frame C

Ø7

Ø3

¢2

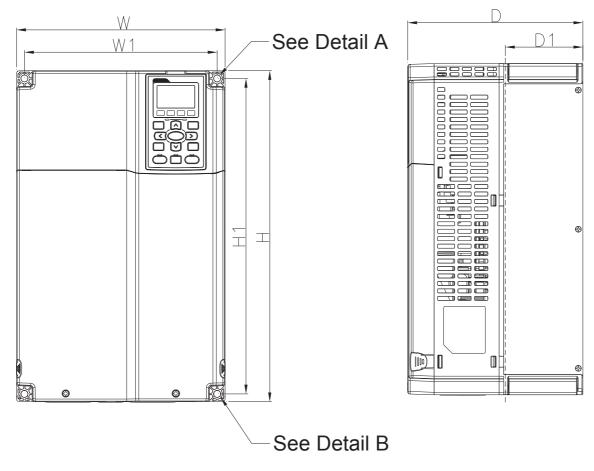
φ

 $\phi 1$ 

 $\phi$ 1

Ø3

VFD150C23A; VFD185C23A; VFD185C43A/E; VFD220C23A; VFD220C43A/E; VFD300C43A/E





# Detail A (Mounting Hole)



Detail B (Mounting Hole)

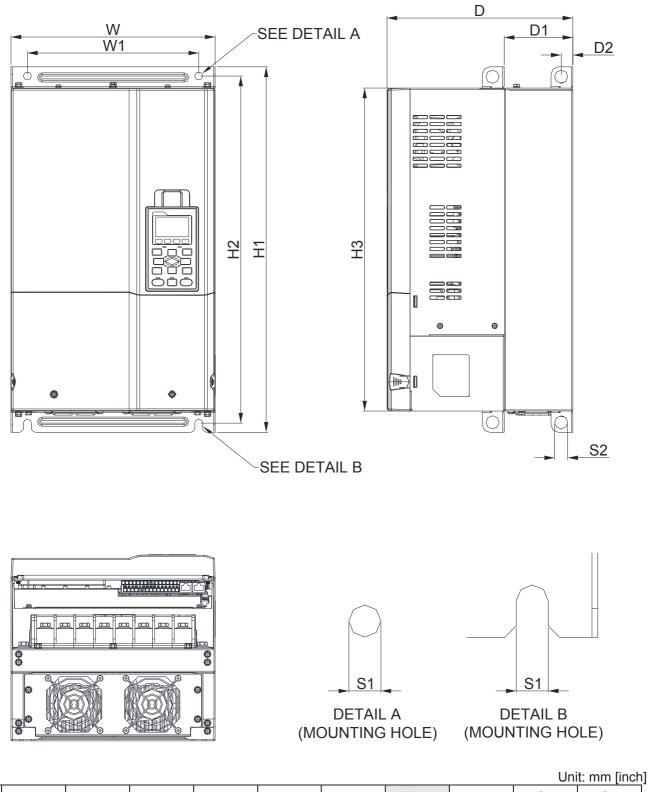
Unit:	mm	[inch]
		L - J

F	Frame	W	Н	D	W1	H1	D1*	S1	Φ1	Ф2	Ф3
	C1	250.0	400.0	210.0	231.0	381.0	92.9	8.5	22.2	34.0	50.0
	CT	[9.84]	[15.75]	[8.27]	[9.09]	[15.00]	[3.66]	[0.33]	[0.87]	[1.34]	[1.97]

Chapter 1 Introduction | C2000 Series

#### Frame D0

D0-1: VFD370C43S; VFD450C43S;

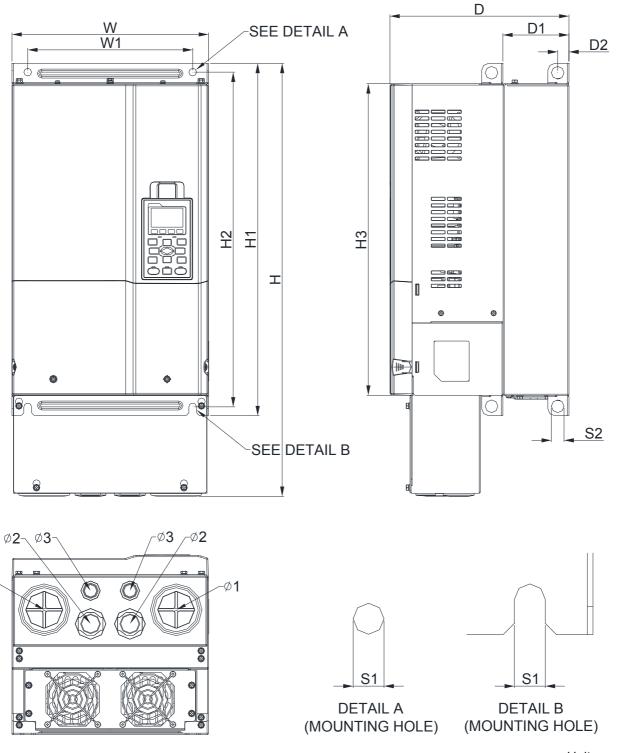


Frame	W	H1	D	W1	H2	H3	D1*	D2	S1	S2	
D0-1	280.0	500.0	255.0	235.0	475.0	442.0	94.2	16.0	11.0	18.0	
00-1	[11.02]	[19.69]	[10.04]	[9.25]	[18.70]	[17.40]	[3.71]	[0.63]	[0.43]	[0.71]	
D1*: Flange mou											

1-10

#### Frame D0 D0-2: VFD370C43U; VFD450C43U;

Ø**1**-

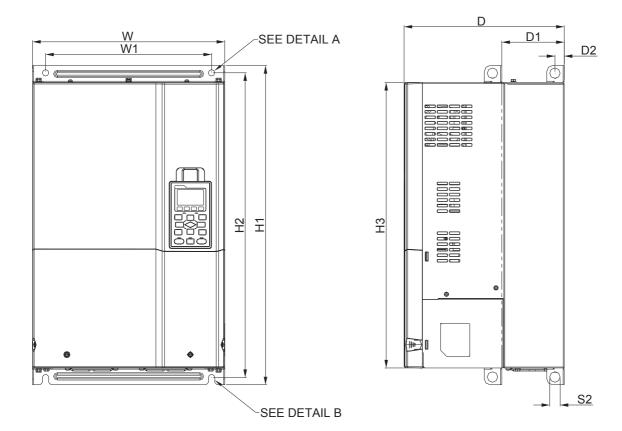


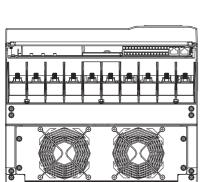
Unit: mm [inch]

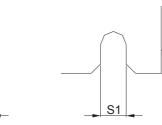
Frame	W	Н	D	W1	H1	H2	H3	D1*	D2	S1	S2	Φ1	Φ2	Ф3
D0-2	280.0	614.4	255.0	235.0	500.0	475.0	442.0	94.2	16.0	11.0	18.0	62.7	34.0	22.0
D0-2	[11.02]	[24.19]	[10.04]	[9.25]	[19.69]	[18.70]	[17.40]	[3.71]	[0.63]	[0.43]	[0.71]	[2.47]	[1.34]	[0.87]
· · · · · ·	D1* Elango mounti												mounting	

#### Frame D

D1: VFD300C23A; VFD370C23A; VFD550C43A; VFD750C43A







DETAIL A (MOUNTING HOLE)

S1

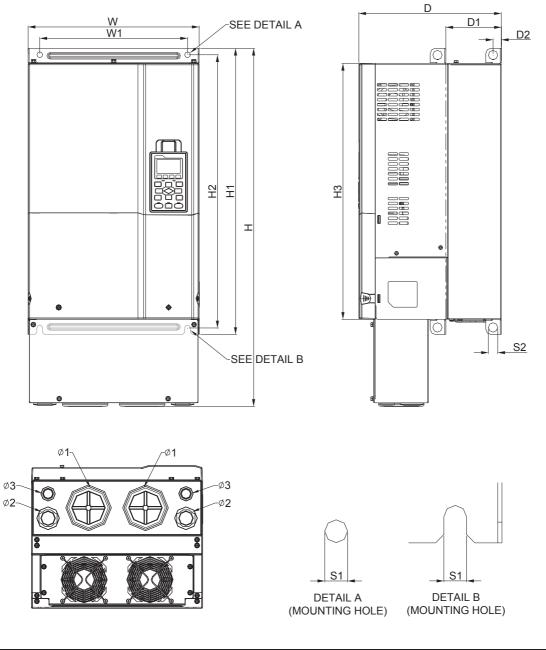
DETAIL B (MOUNTING HOLE)

Unit: mm [inch]

Frame	W	Н	D	W1	H1	H2	H3	D1*	D2	S1	S2	Φ1	Ф2	Ф3
D1	330.0	-	275.0	285.0	550.0	525.0	492.0	107.2	16.0	11.0	18.0			
	[12.99]		[10.83]	[11.22]	[21.65]	[20.67]	[19.37]	[4.22]	[0.63]	[0.43]	[0.71]	-	-	-

#### Frame D

D2: VFD300C23E; VFD370C23E; VFD550C43E; VFD750C43E

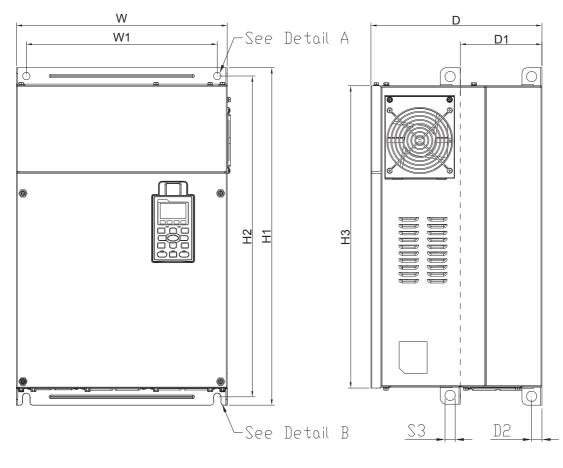


Unit: mm [inch]

Fra	ame	W	Н	D	W1	H1	H2	H3	D1*	D2	S1	S2	Φ1	Ф2	Ф3
	02	330.0	688.3	275.0	285.0	550.0	525.0	492.0	107.2	16.0	11.0	18.0	76.2	34.0	22.0
	52	[12.99]	[27.10]	[10.83]	[11.22]	[21.65]	[20.67]	[19.37]	[4.22]	[0.63]	[0.43]	[0.71]	[3.00]	[1.34]	[0.87]

#### Frame E

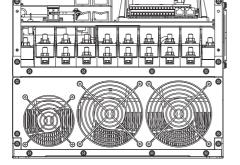
#### E1: VFD450C23A; VFD550C23A; VFD750C23A; VFD900C43A; VFD1100C43A







Detail B (Mounting Hole)

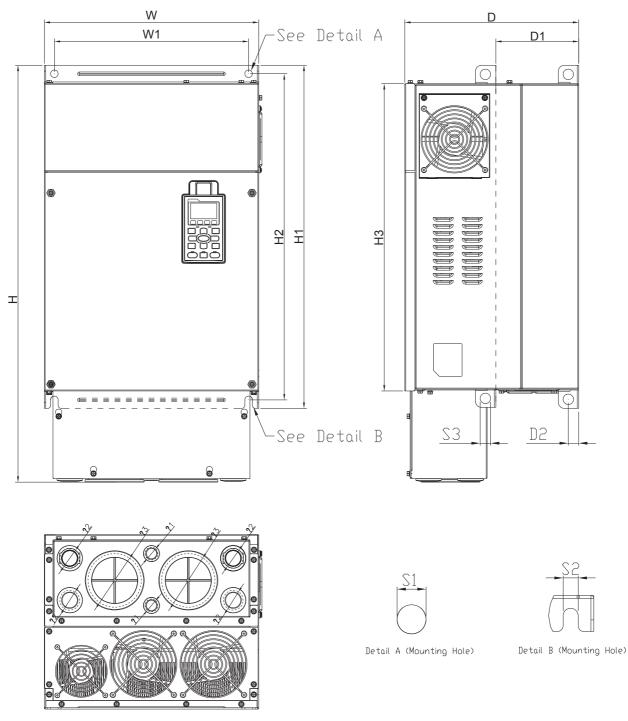


Unit: mm [inch]

Frame	W	Н	D	W1	H1	H2	H3	D1*	D2	S1, S2	S3	Φ1	Ф2	Ф3
E1	370.0		300.0	335.0	589	560.0	528.0	143.0	18.0	13.0	18.0	-	-	-
	[14.57]	-	[11.81]	[13.19	[23.19]	[22.05]	[20.80]	[5.63]	[0.71]	[0.51]	[0.71]			

Frame E

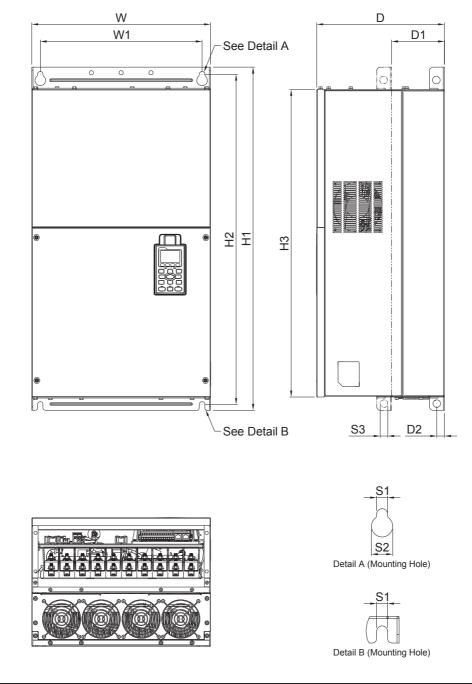
E2: VFD450C23E; VFD550C23E; VFD750C23E; VFD900C43E; VFD1100C43E



Fr	rame	W	Н	D	W1	H1	H2	H3	D1*	D2	S1, S2	S3	Φ1	Ф2	Ф3
	ГQ	370.0	715.8	300.0	335.0	589	560.0	528.0	143.0	18.0	13.0	18.0	22.0	34.0	92.0
	E2	[14.57]	[28.18]	[11.81]	[13.19	[23.19]	[22.05]	[20.80]	[5.63]	[0.71]	[0.51]	[0.71]	[0.87]	[1.34]	[3.62]

#### Frame F

#### F1: VFD900C23A; VFD1320C43A; VFD1600C43A

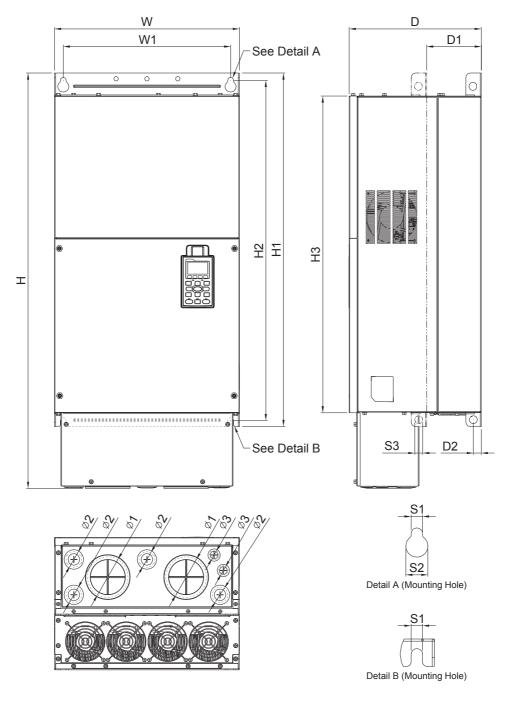


Unit: mm [inch]

Frame	W	Н	D	W1	H1	H2	H3	D1*	D2	S1	S2	S3
F1	420.0	-	300.0	380.0	800.0	770.0	717.0	124.0	18.0	13.0	25.0	18.0
• •	[16.54]		[11.81]	[14.96]	[31.50]	[30.32]	[28.23]	[4.88]	[0.71]	[0.51]	[0.98]	[0.71]

#### Frame F

F2: VFD900C23E; VFD1320C43E; VFD1600C43E



Unit: mm [inch]

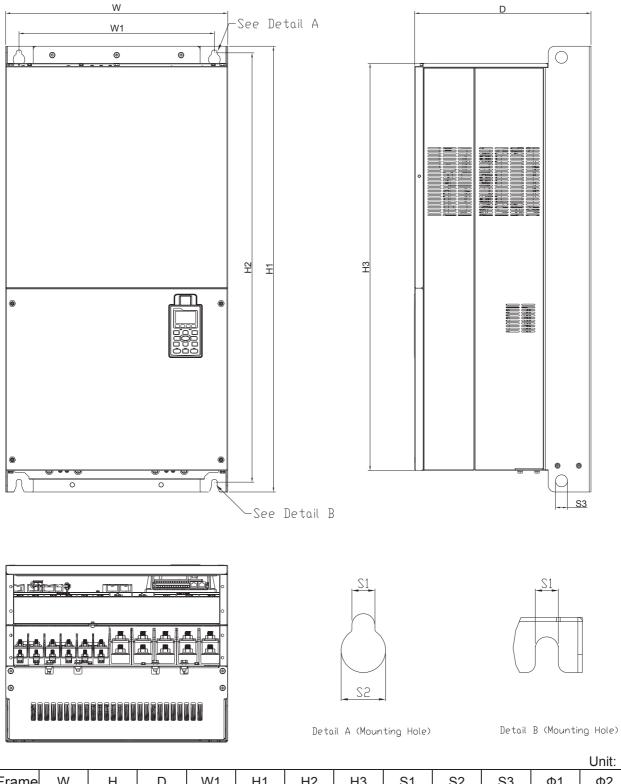
F	rame	W	Н	D	W1	H1	H2	H3	D1*	D2	S1	S2	S3
Γ	ED	420.0	940.0	300.0	380.0	800.0	770.0	717.0	124.0	18.0	13.0	25.0	18.0
	ΓZ	[16.54]	[37.00]	[11.81]	[14.96]	[31.50]	[30.32]	[28.23]	[4.88]	[0.71]	[0.51]	[0.98]	[0.71]

Frame	Φ1	Ф2	Ф3
F2	92.0	35.0	22.0
	[3.62]	[1.38]	[0.87]

#### Chapter 1 Introduction | C2000 Series

#### Frame G

#### G1: VFD1850C43A; VFD2200C43A

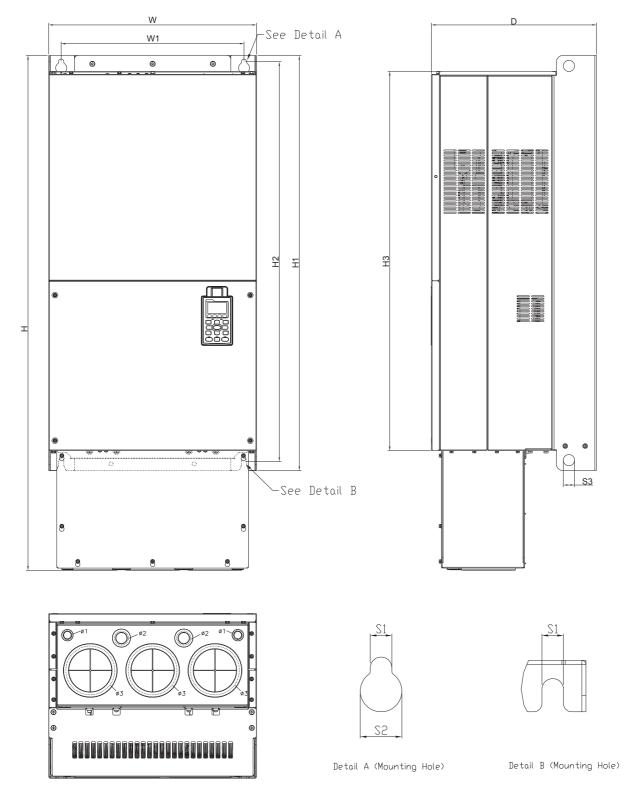


Unit:	mm	[inch]

Fr	ame	W	Н	D	W1	H1	H2	H3	S1	S2	S3	Φ1	Ф2	Ф3
	04	500.0		397.0	440.0	1000.0	963.0	913.6	13.0	26.5	27.0			
'	G1	[19.69]	-	[15.63]	[217.32]	[39.37]	[37.91]	[35.97]	[0.51]	[1.04]	[1.06]	-	-	-

### Frame G

#### G2: VFD1850C43E; VFD2200C43E



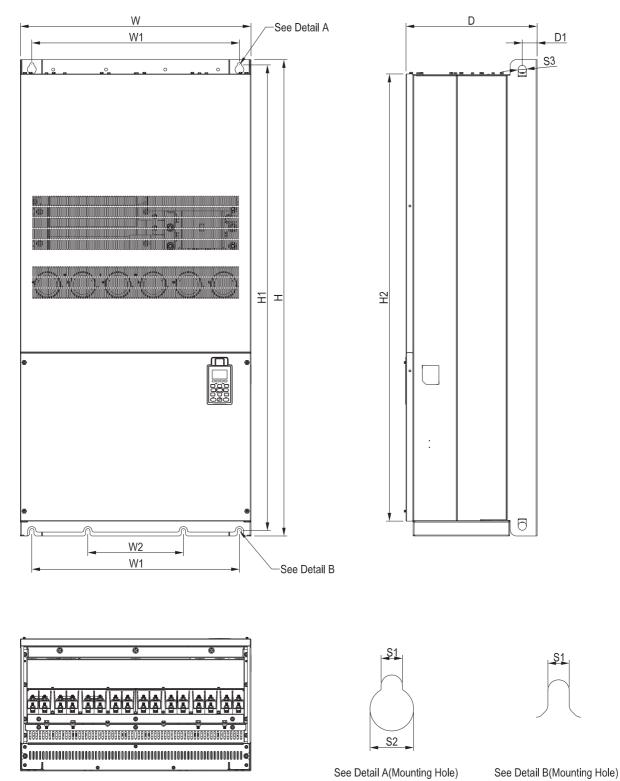
Unit <sup>.</sup>	mm	[inch]
Unit.		lincin

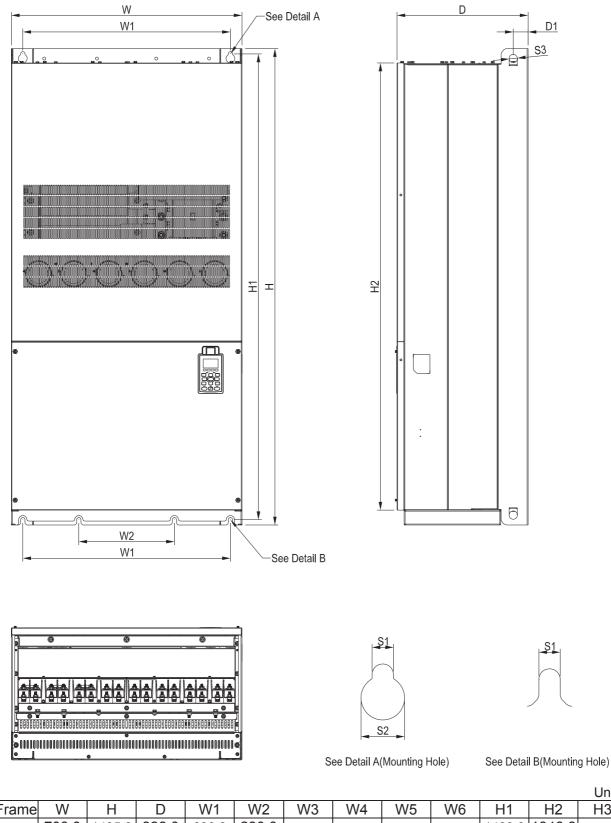
F	rame	W	Н	D	W1	H1	H2	H3	S1	S2	S3	Φ1	Ф2	Φ3
		500.0	1240.2	397.0	440.0	1000.0	963.0	913.6	13.0	26.5	27.0	22.0	34.0	117.5
	G2	[19.69]	[48.83]	[15.63]	[217.32]	[39.37]	[37.91]	[35.97]	[0.51]	[1.04]	[1.06]	[0.87]	[1.34]	[4.63]

#### Chapter 1 Introduction | C2000 Series

#### Frame H

#### H1: VFD2800C43A; VFD3150C43A; VFD3550C43A; VFD4500C43A

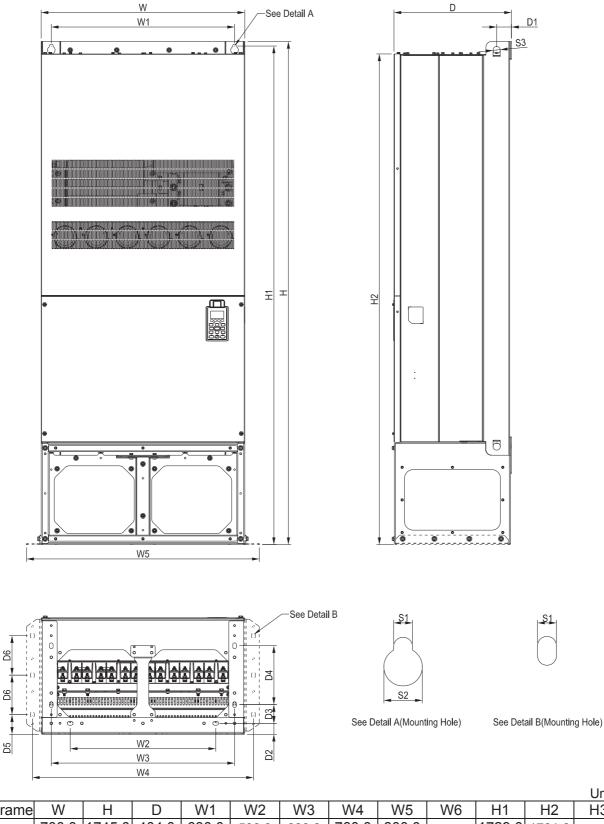




												Unit: ı	mm [inch]
Frame	W	Н	D	W1	W2	W3	W4	W5	W6	H1	H2	H3	H4
H1	700.0 [27.56]	1435.0 [56.5]		630.0 [24.8]	290.0 [11.42]	-	-	-	-		1346.6 [53.02]	-	-
Frame	H5	D1	D2	D3	D4	D5	D6	S1	S2	S3	Φ1	Ф2	Ф3
H1	-	45.0 [1.77]	-	-	-	-	-	13.0 [0.51]	26.5 [1.04]	25.0 [0.98]	-	-	-

#### Frame H

H2: VFD2800C43E-1; VFD3150C43E-1; VFD3550C43E-1

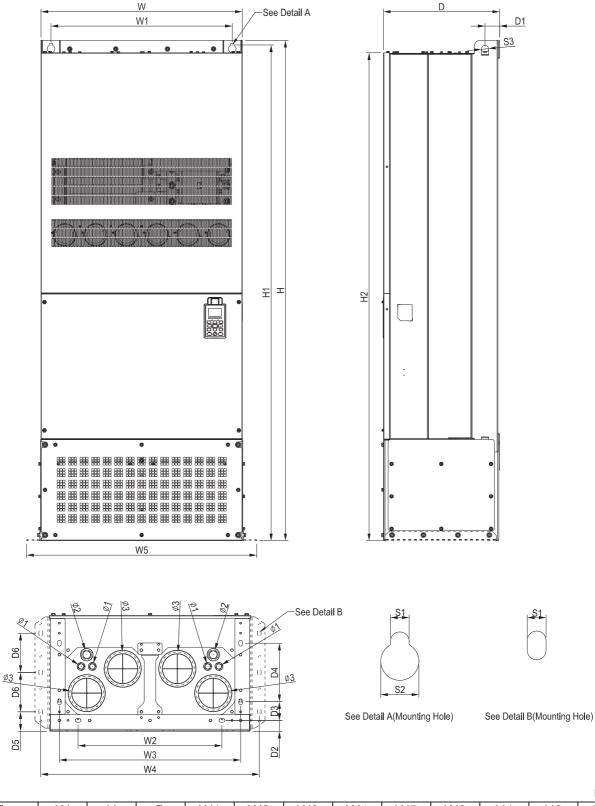


Unit:	mm	[inch]

Frame	W	Н	D	W1	W2	W3	W4	W5	W6	H1	H2	H3	H4
H2		1745.0			500.0	630.0	760.0				1701.6		_
112	[27.56]	[68.70]	[15.91]	[24.8]	[19.69]	[24.8]	[29.92]	[31.5]	-	[68.07]	[66.99]	-	-
										r			
Frame	H5	D1	D2	D3	D4	D5	D6	S1	S2	S3	Φ1	Ф2	ФЗ
110	-	51.0	38.0	65.0	204.0	68.0	137.0	13.0	26.5	25.0			
H2		[2.01]	[1.50]	[2.56]	[8.03]	[2.68]	[5.39]	[0.51]	[1.04]	[0.98]	-	-	-

#### Frame H

H3: VFD2800C43E; VFD3150C43E; VFD3550C43E

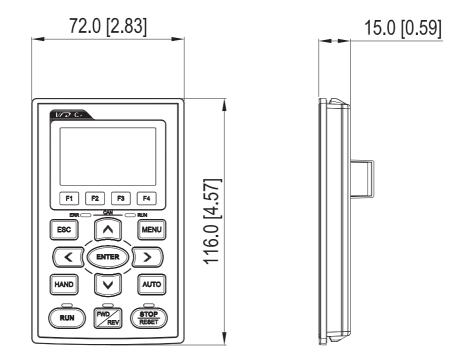


Unit:	mm	[inch]

Frame	W	Н	D	W1	W2	W3	W4	W5	W6	H1	H2	H3	H4
H3	700.0	1745.0	404.0	630.0	500.0	630.0	760.0	800.0		1729.0	1701.6		
пэ	[27.56]	[68.70]	[15.91]	[24.8]	[19.69]	[24.8]	[29.92]	[31.5]	-	[68.07]	[66.99]	-	-
Frame	H5	D1	D2	D3	D4	D5	D6	S1	S2	S3	Φ1	Ф2	ФЗ
ЦЭ	-	51.0	38.0	65.0	204.0	68.0	137.0	13.0	26.5	25.0	22.0	34.0	117.5
H3		[2.01]	[1.50]	[2.56]	[8.03]	[2.68]	[5.39]	[0.51]	[1.04]	[0.98]	[0.87]	[1.34]	[4.63]

Chapter 1 Introduction | C2000 Series

Digital Keypad KPC-CC01



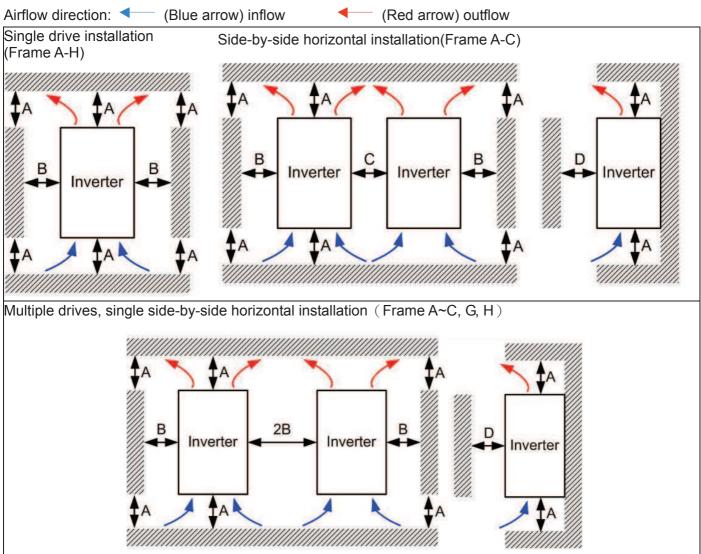
# **Chapter 2 Installation**

# 2-1 Minimum Mounting Clearance and Installation

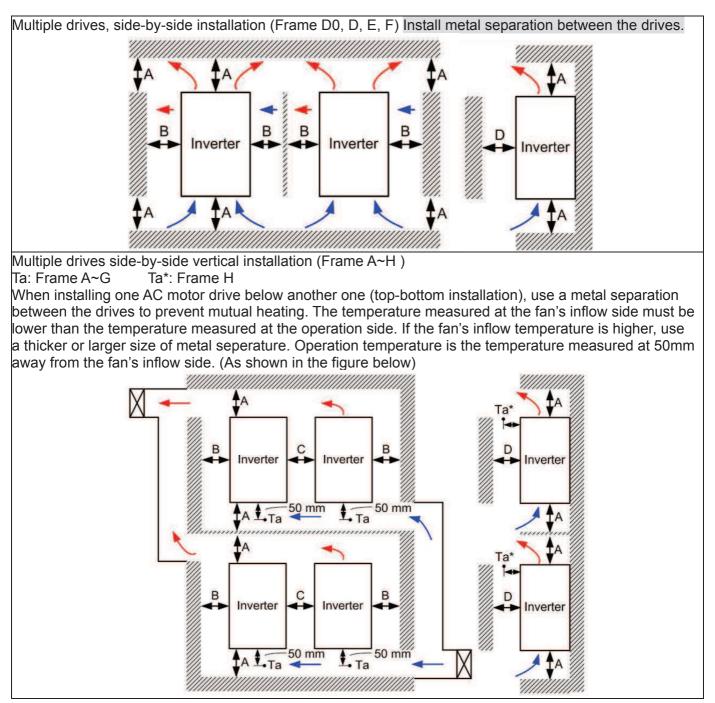
### 

- ☑ Prevent fiber particles, scraps of paper, shredded wood saw dust, metal particles, etc. from adhereing to the heat sink
- ☑ Install the AC motor drive in a metal cabinet. When installing one drive below another one, use a metal separation between the AC motor drives to prevent mutual heating and to prevent the risk of fire accident.
- Install the AC motor drive in Pollution Degree 2 environments only: normallyl only nonconductive pollution occurs and temporary conductivity caused by condensation is expected.

The appearances shown in the following figures are for reference only.



#### Chapter 2 Installation | C2000 Series



#### 2-2 Minimum mounting clearance

Frame	A (mm)	B (mm)	C (mm)	D (mm)								
A~C	60 30 10 0											
D0~F	100	0 50 - 0										
G	200	100	-	0								
Н	350	0	0	200 (100, Ta=Ta*=40℃)								
Frame A VFD007C23A; VFD007C43A/E; VFD015C23A; VFD015C43A/E; VFD022C23A; VFD022C43A/E; VFD037C23A; VFD037C43A/E; VFD040C43A/E; VFD055C43A/E;												
Frame B	VFD055C23A; VFD75C23A; VFD075C43A/E; VFD110C23A; VFD110C43A/E; VFD150C43A/E;											
Frame C	VFD150C23A; VFD185C23A; VFD185C43A/E; VFD220C23A; VFD220C43A/E; VFD300C43A/E;											
Frame D0	VFD370C43S; VFD450C43S; VFD370C43U; VFD450C43U;											
Frame D	VFD300C23A/E; V	'FD370C23A/E; VF										

 Frame E
 VFD450C23A/E; VFD550C23A/E; VFD750C23A/E; VFD900C43A/E; VFD1100C43A/E;

 Frame F
 VFD900C23A/E; VFD1320C43A/E; VFD1600C43A/E;

 Frame G
 VFD1850C43A; VFD1320C43A; VFD1850C43E; VFD2200C43E;

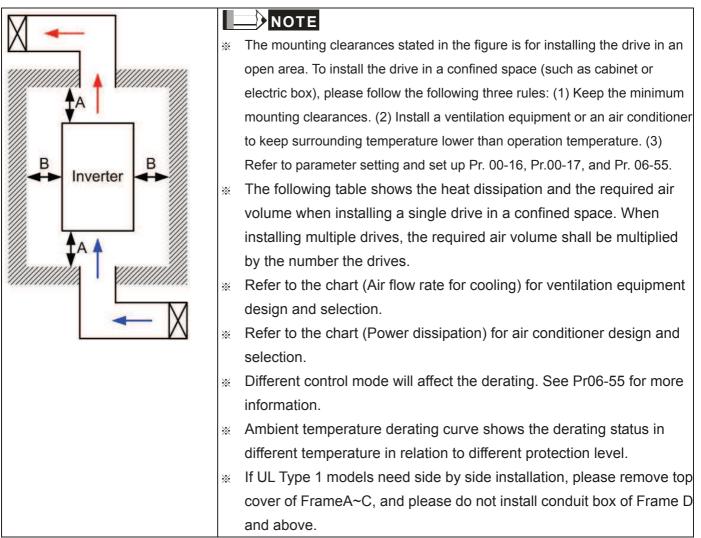
 VFD2800C43A; VFD3150C43A; VFD1850C43E; VFD4500C43A; VFD2800C43E-1;

 Frame H
 VFD3150C43E-1; VFD3550C43E-1; VFD4500C43E-1; VFD2800C43E; VFD3150C43E;

 VFD3550C43E; VFD4500C43E

#### 

1. The minimum mounting clearances stated in the table above applies to AC motor drives frame A to D. A drive fails to follow the minimum mounting clearances may cause the fan to malfunction and heat dissipation problem.

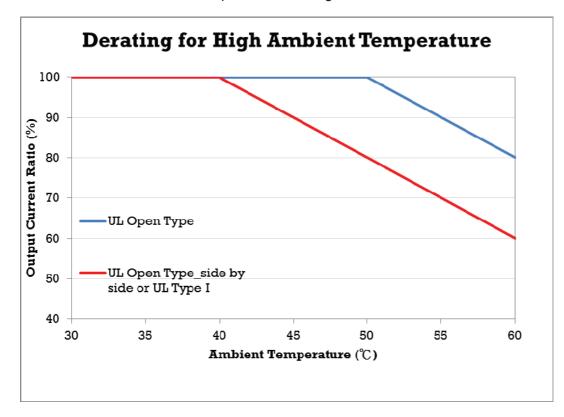


	Aiı	Power dissipa	ation of A drive	C motor						
Model No.	Flov	w Rate (c	fm)	Flow	/ Rate (m	<sup>3</sup> /hr)	Power Dissipation			
	External	Internal	Total	External	Internal	Total	Loss External (Heat sink)	Internal	Total	
VFD007C23A	-	-	-	-	-	-	33	27	61	
VFD015C23A	14	-	14	24	-	24	56	31	88	
VFD022C23A	14	-	14	24	-	24	79	36	115	
VFD037C23A	10	-	10	17	-	17	113	46	159	
VFD055C23A	40	14	54	68	24	92	197	67	264	
VFD075C23A	66	14	80	112	24	136	249	86	335	
VFD110C23A	58	14	73	99	24	124	409	121	529	
VFD150C23A	166	12	178	282	20	302	455	161	616	
VFD185C23A	166	12	178	282	20	302	549	184	733	
VFD220C23A	166	12	178	282	20	302	649	216	865	

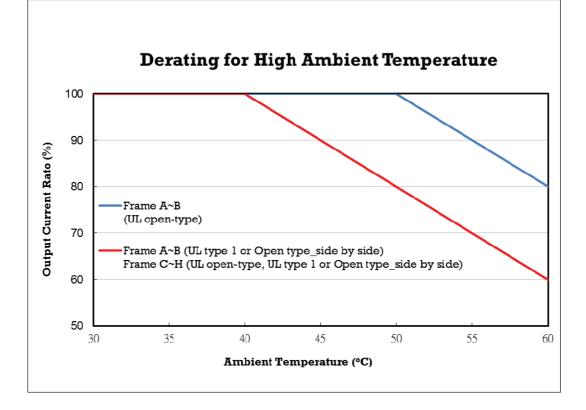
	Aii	Power dissip	ation of A drive	C motor						
	Flov	w Rate (c	fm)	Flow Rate (m <sup>3</sup> /hr)			Power Dissipation			
Model No.	External	Internal	Total	External	Internal	Total	Loss External (Heat sink)	Internal	Total	
VFD300C23A/E	179	30	209	304	51	355	913	186	1099	
VFD370C23A/E	179	30	209	304	51	355	1091	220	1311	
VFD450C23A/E	228	73	301	387	124	511	1251	267	1518	
VFD550C23A/E	228	73	301	387	124	511	1401	308	1709	
VFD750C23A/E	246	73	319	418	124	542	1770	369	2139	
VFD900C23A/E	224	112	336	381	190	571	2304	484	2788	
VFD007C43A/E							33	25	50	
VFD007C43A/E VFD015C43A/E	-	-	-	-	-	-		25	59	
	-	-	-	-	-	-	45	29	74	
VFD022C43A/E	14	-	14	24	-	24	71	33	104	
VFD037C43A/E	10	-	10	17	-	17	103	38	141	
VFD040C43A/E	10	-	10	17	-	17	116	42	158	
VFD055C43A/E	10	-	10	17	-	17	134	46	180	
VFD075C43A/E	40	14	54	68	24	92	216	76	292	
VFD110C43A/E	66	14	80	112	24	136	287	93	380	
VFD150C43A/E	58	14	73	99	24	124	396	122	518	
VFD185C43A/E	99	21	120	168	36	204	369	138	507	
VFD220C43A/E	99	21	120	168	36	204	476	158	635	
VFD300C43A/E	126	21	147	214	36	250	655	211	866	
VFD370C43A/E	179	30	209	304	51	355	809	184	993	
VFD450C43A/E	179	30	209	304	51	355	929	218	1147	
VFD550C43A/E	179	30	209	304	51	355	1156	257	1413	
VFD750C43A/E	186	30	216	316	51	367	1408	334	1742	
VFD900C43A/E	257	73	330	437	124	561	1693	399	2092	
VFD1100C43A/E	223	73	296	379	124	503	2107	491	2599	
VFD1320C43A/E	224	112	336	381	190	571	2502	579	3081	
VFD1600C43A/E	289	112	401	491	190	681	3096	687	3783	
VFD1850C43A/E			454			771			4589	
VFD2200C43A/E			454			771			5772	
VFD2800C43A/E			769			1307			6381	
VFD3150C43A/E			769			1307			7156	
VFD3550C43A/E			769	-		1307	-		8007	
VFD4500C43A/E			769			1307			11894	
<ul> <li>The required airflow shown in chart is for installing single drive in a confined space.</li> <li>When installing the multiple drives, the required air volume should be the required air volume for single drive X the number of the drives.</li> <li>When installing the multiple drives X the number of the drives, volume of heat dissipation should be the heat dissipated for single drive X the number of the drives.</li> <li>Heat dissipation for each model is calculated by rated voltage, current and default carrier.</li> </ul>										

### 

Normal control Ambient temperature derating curve



Advanced control Ambient temperature derating curve

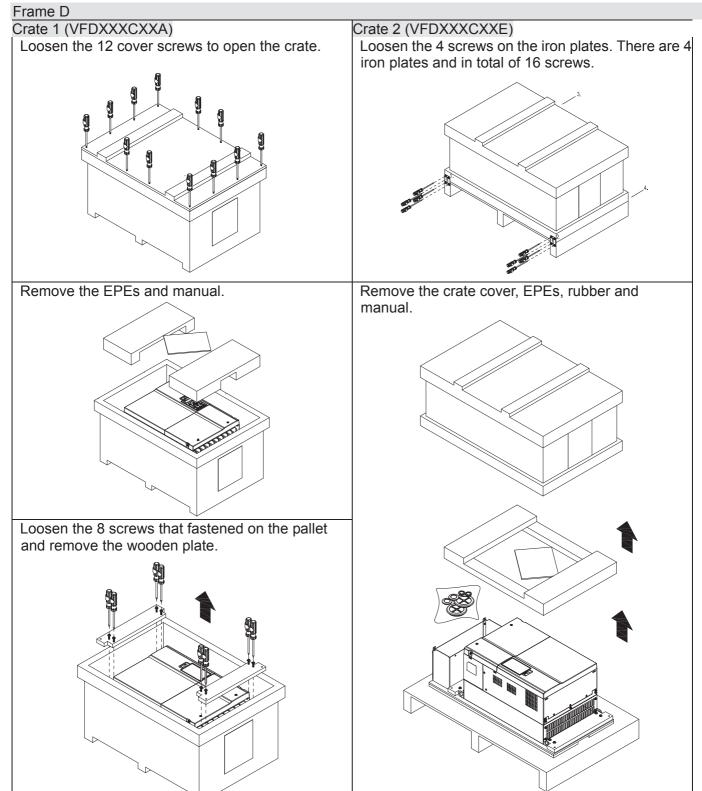


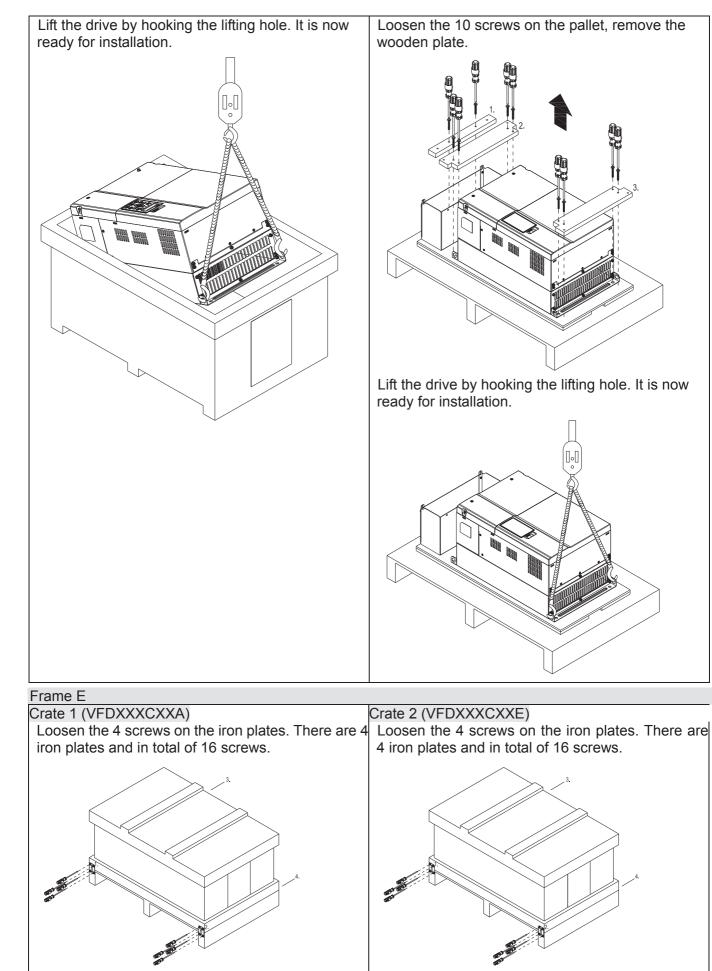
# **Chapter 3 Unpacking**

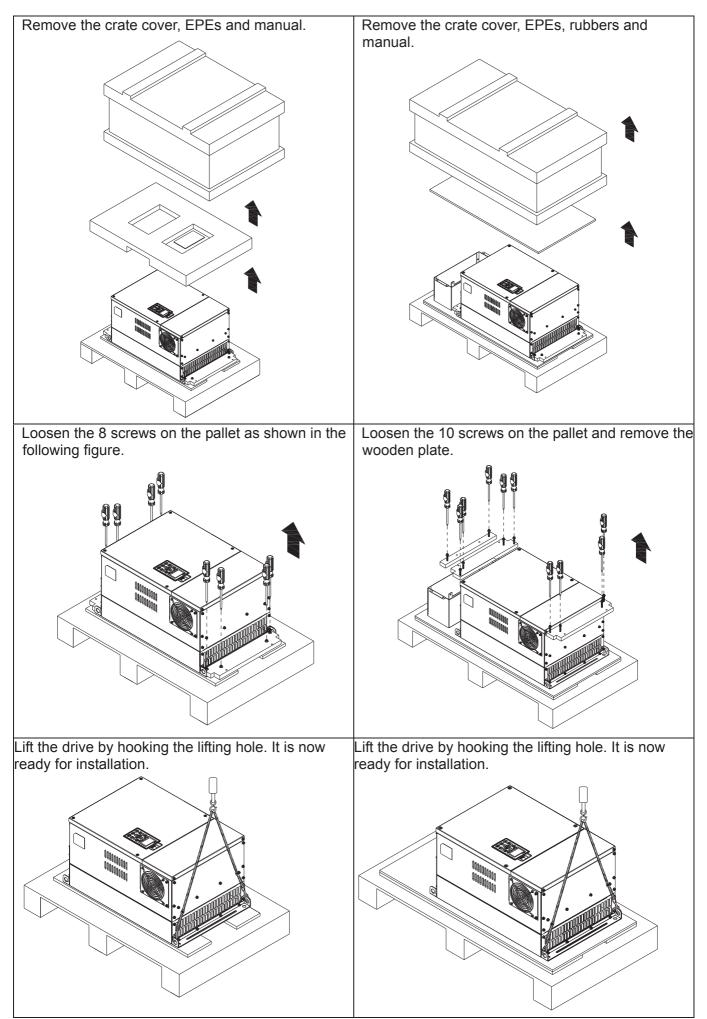
The AC motor drive should be kept in the shipping carton or crate before installation. In order to retain the warranty coverage, the AC motor drive should be stored properly when it is not to be used for an extended period of time.

# 3-1 Unpacking

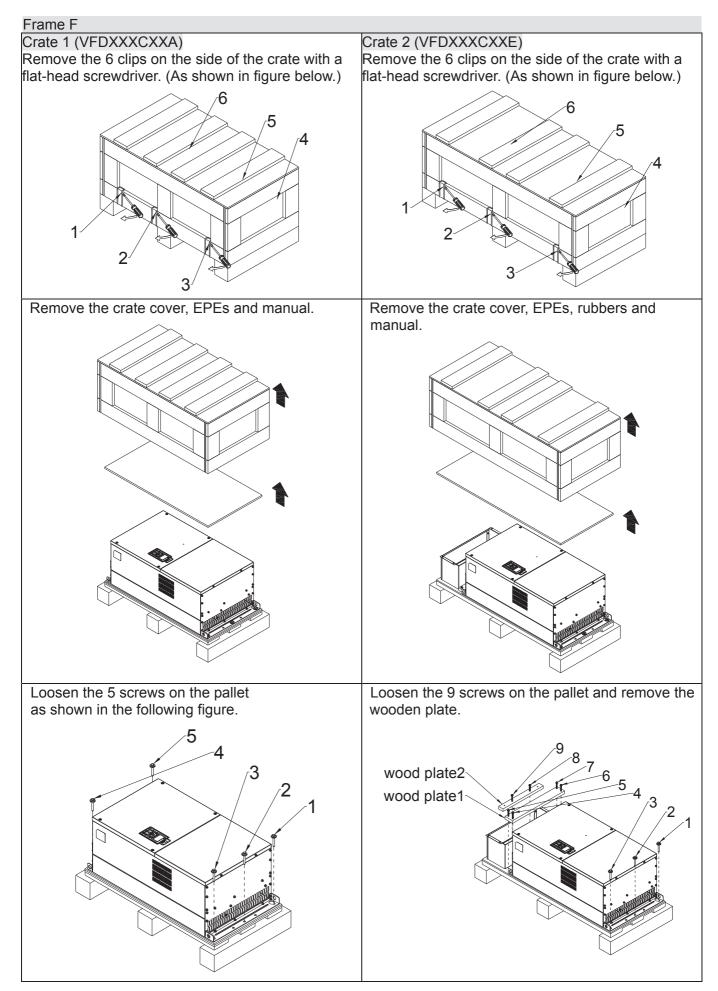
The AC motor drive is packed in the crate. Follows the following step for unpack:

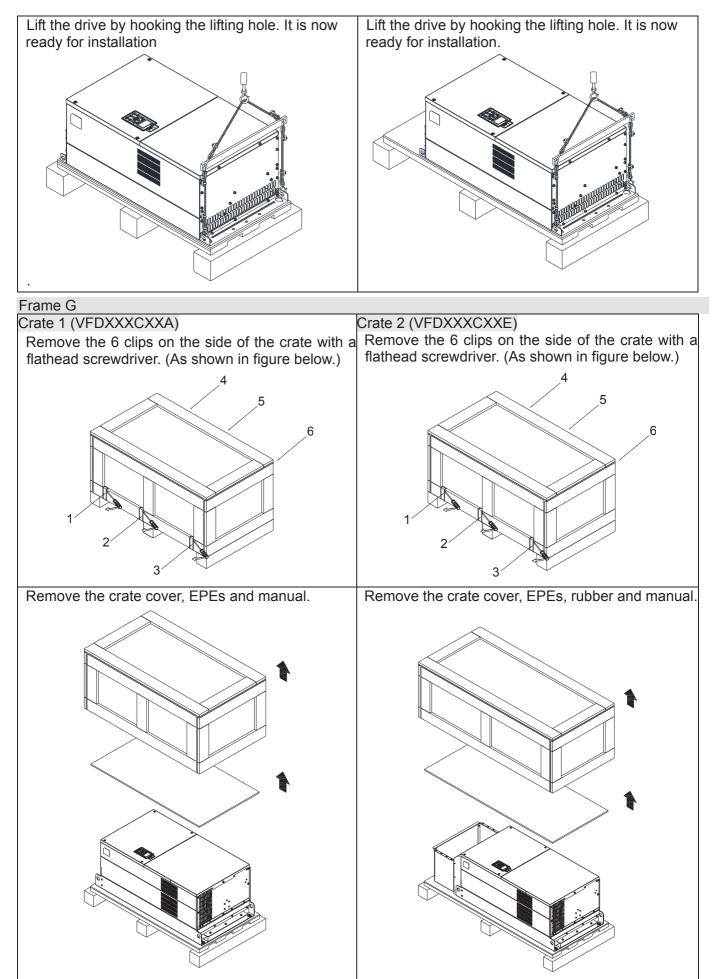




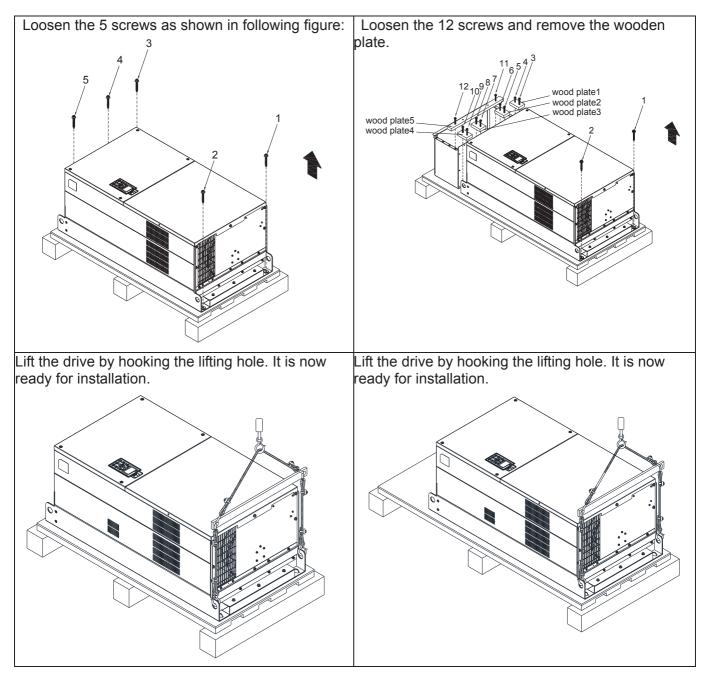


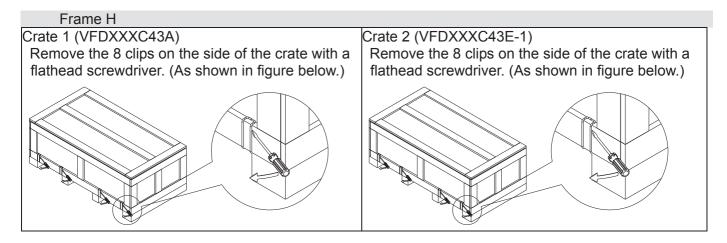
#### Chapter 3 Unpacking | C2000 Series

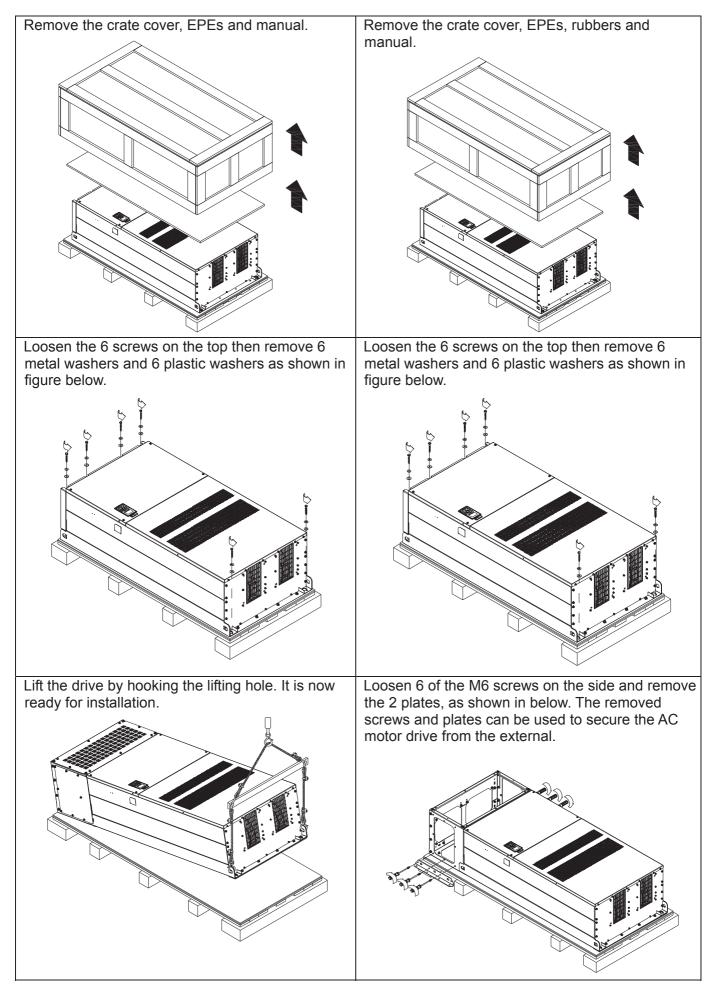




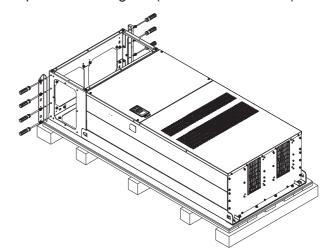
#### Chapter 3 Unpacking | C2000 Series



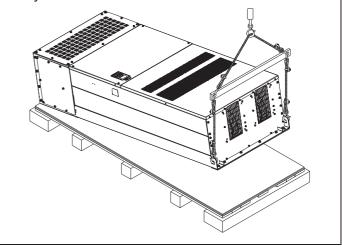


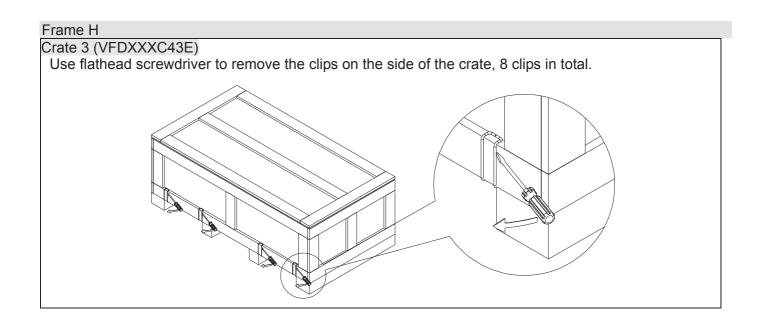


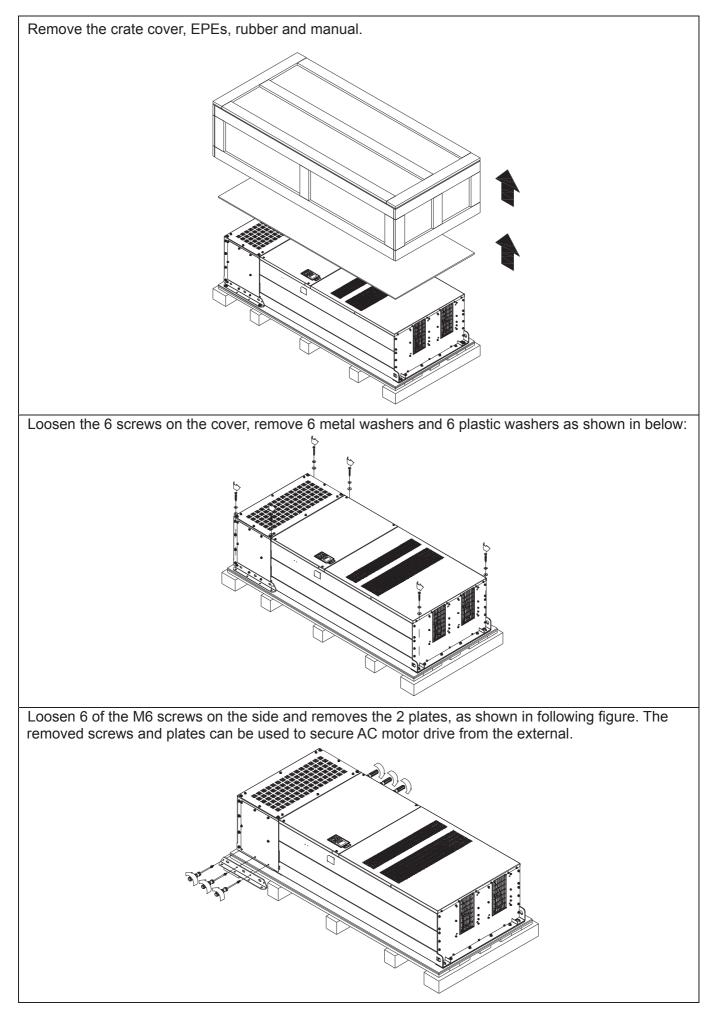
Secure the drive from the external. (Skip to the next step if this situation does not apply to you.) Loosen 8 of M8 screws on the both sides and place the 2 plates that were removed from the last step. Fix the plates to AC motor drive by fasten 8 of the M8 screws. (As shown in below) Torque: 150~180kg-cm (130.20~156.24lb-in.)

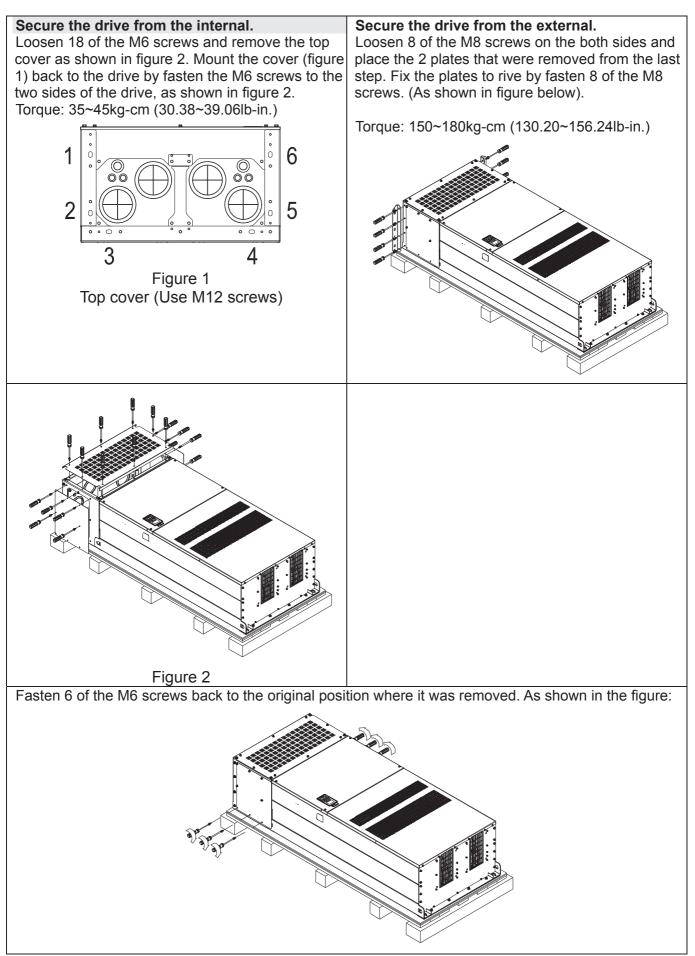


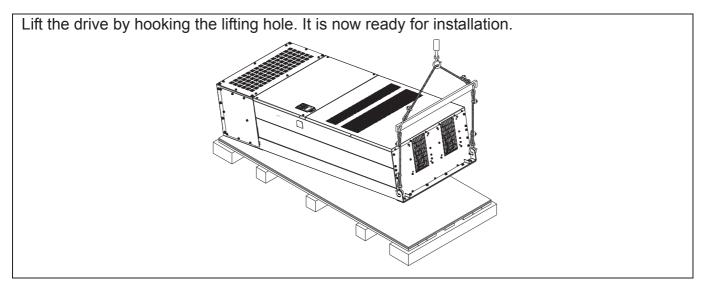
Lift the drive by hooking the lifting hole. It is now ready for installation.









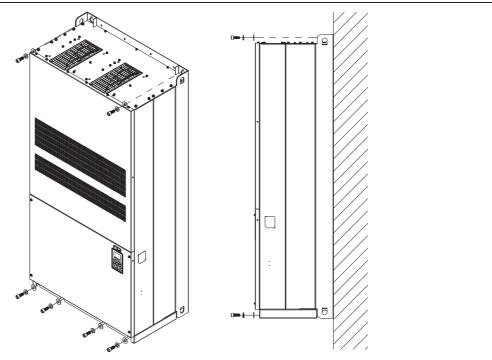


#### Frame H Secure the drive

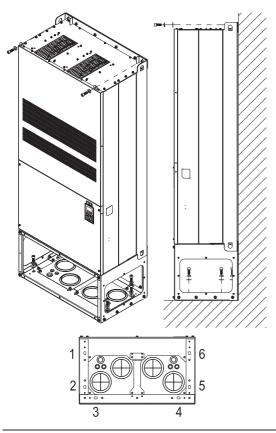
(VFDXXXC43A)

Screw: M12\*6

Torque: 340-420kg-cm [295.1-364.6lb-in.]

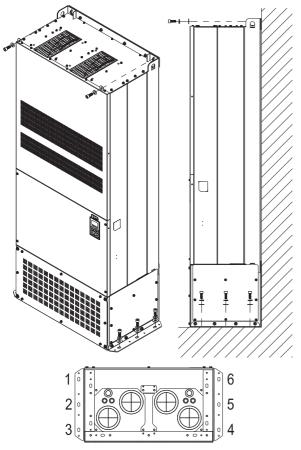


## (VFDXXXC43E) & (VFDXXXC43E-1)



Secure the drive from the internal.

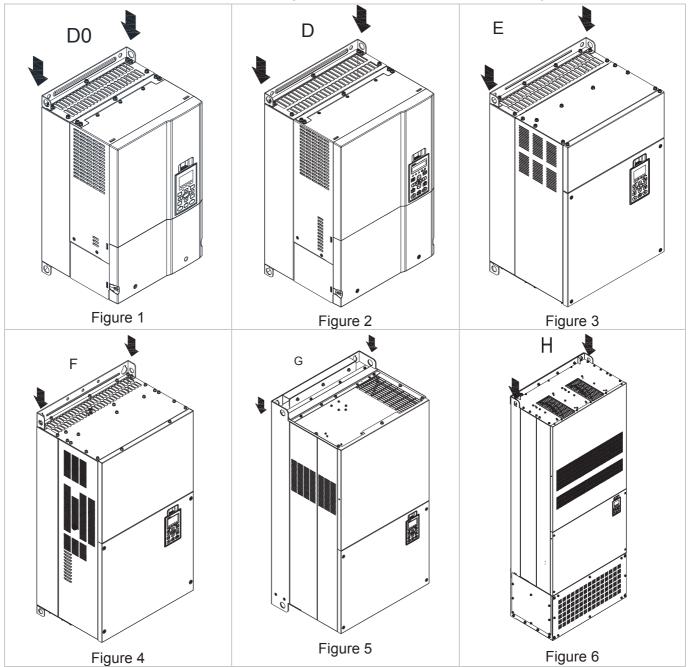
Screw: M12\*8 Torque: 340-420kg-cm [295.1-364.6lb-in.]

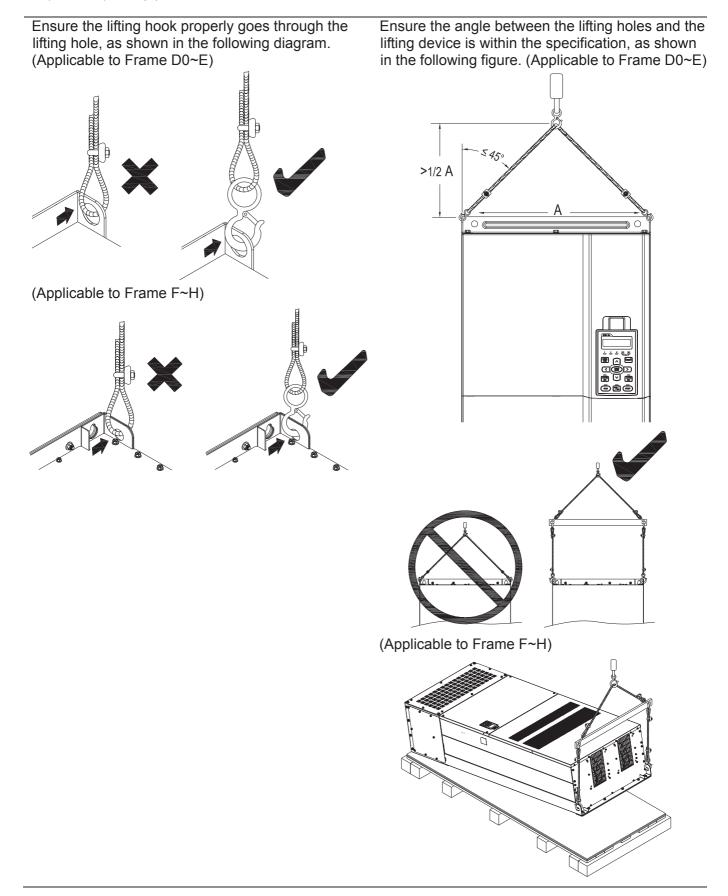


Secure the drive from the external. Screw: M12\*8 Torque: 340-420kg-cm [295.1-364.6lb-in.]

# 3-2 The Lifting Hook

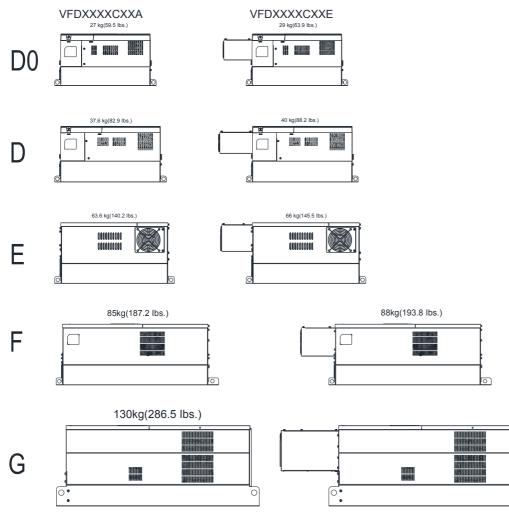
The arrows indicate the location of the lifting holes of frame D to H, as shown in figure below:



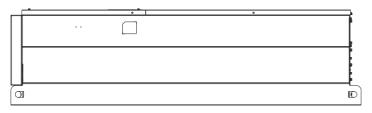


0

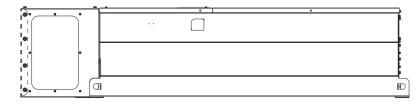
## Weight



H1: VFD2800C43A; VFD3150C43A; VFD3550C43A; VFD4500C43A 235kg (518.1lbs)



H2: VFD2800C43E-1; VFD3150C43E-1; VFD3550C43E-1; VFD4500C43E-1 257kg (566.6lbs)



H3: VFD2800C43E; VFD3150C43E; VFD3550C43E; VFD4500C43E 263kg (579.8lbs)

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 D	Ę

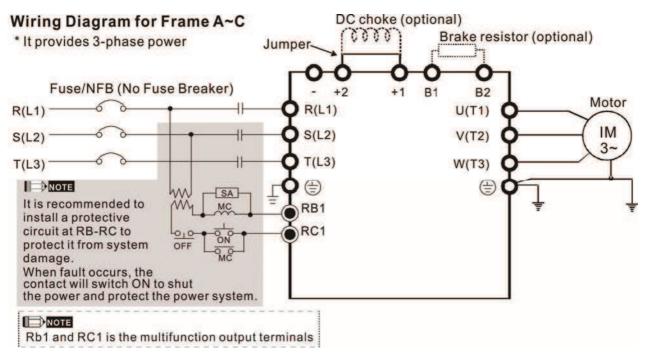
# **Chapter 4 Wiring**

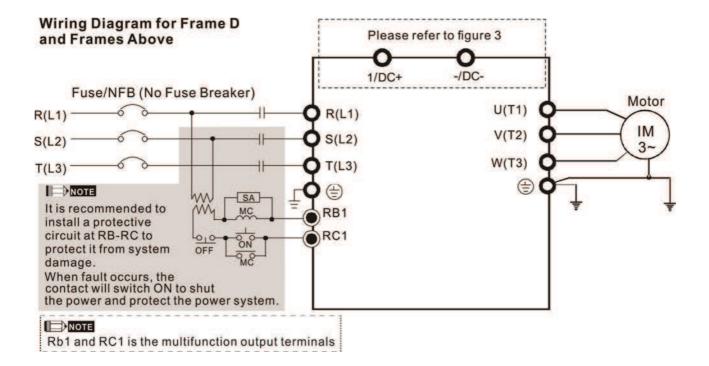
After removing the front cover, examine if the power and control terminals are clearly noted. Please read following precautions before wiring.

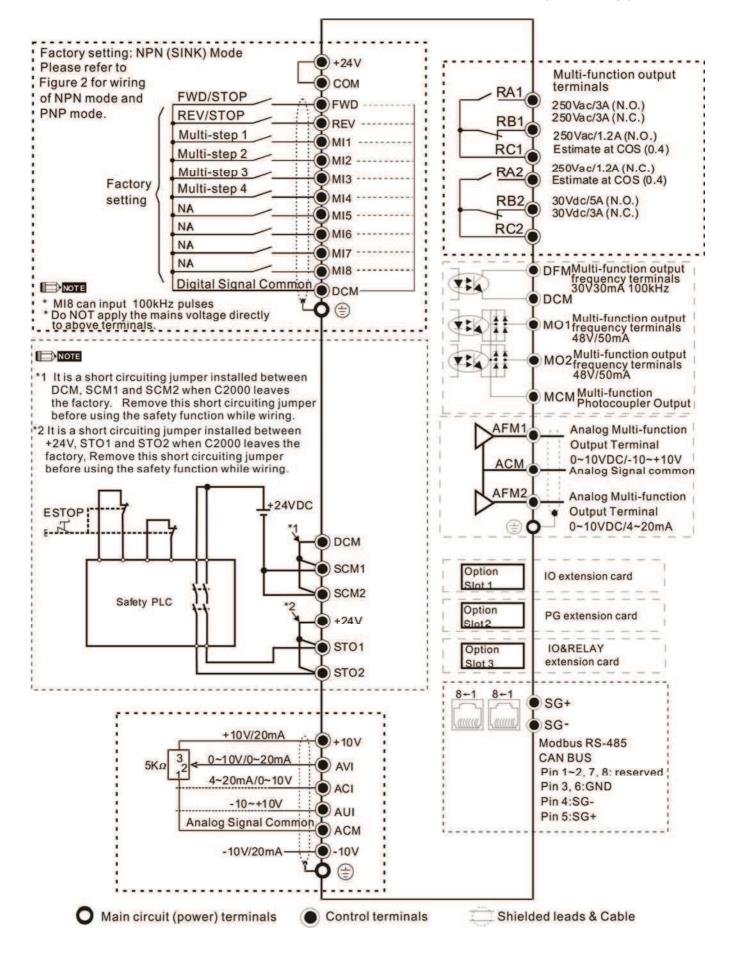
- ☑ Make sure that power is only applied to the R/L1, S/L2, T/L3 terminals. Failure to comply may result in damage to the equipments. The voltage and current should lie within the range as indicated on the nameplate (Chapter 1-1).
- ☑ All the units must be grounded directly to a common ground terminal to prevent lightning strike or electric shock.
- ☑ Please make sure to fasten the screw of the main circuit terminals to prevent sparks which is made by the loose screws due to vibration

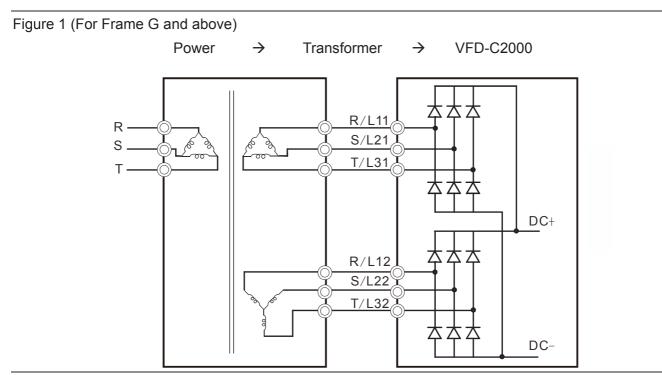
DANGER	R	It is crucial to turn off the AC motor drive power before any wiring installation are made. A charge may still remain in the DC bus capacitors with hazardous voltages even if the power has been turned off therefore it is suggested for users to measure the remaining voltage before wiring. For your personnel saftery, please do not perform any wiring before the voltage drops to a safe level < 25 Vdc. Wiring installation with remaninig voltage condition may caus sparks and short circuit. Only qualified personnel familiar with AC motor drives is allowed to perform installation, wiring and commissioning. Make sure the power is turned off before wiring to prevent electric shock.
CAUTION	N	<ul> <li>When wiring, please choose the wires with specification that complys with local regulation for your personnel safety.</li> <li>Check following items after finishing the wiring: <ol> <li>Are all connections correct?</li> <li>Any loosen wires?</li> <li>Any short-circuits between the terminals or to ground?</li> </ol> </li> </ul>

# 4-1 Wiring



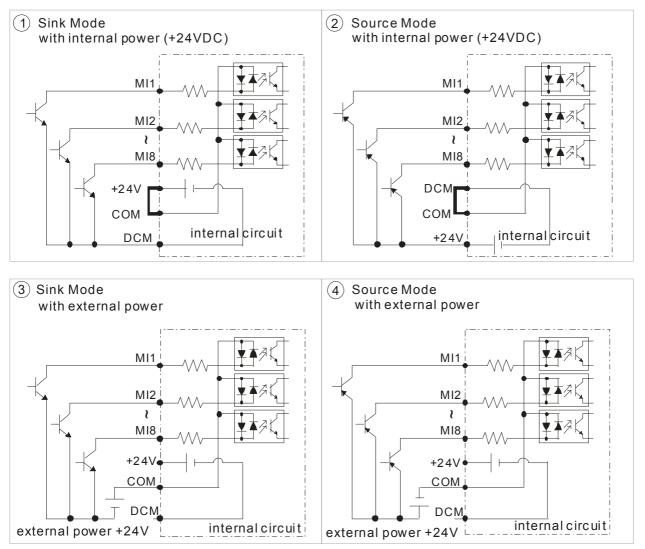






### Figure 2

 $\mathsf{SINK}\;(\mathsf{NPN})\;/\!\mathsf{SOURCE}\;(\mathsf{PNP})\;\mathsf{Mode}$ 



### Figure 3

Function of DC Link

- ☑ Applicable to Frame E~H
- Operation Instruction
  - 1. When RST power is off, please disconnect terminal r and terminal s. (As circled in dotted line, uninstall the gray section and properly store cable r and cable s. Cable r and cable s are not available in optional accessories, do not dispose them.)

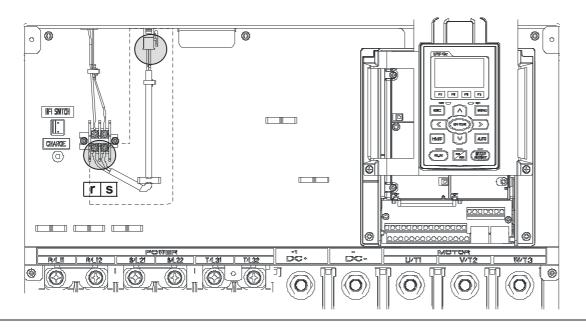
After terminal r and terminal s are cleared, user may now connect new power source to terminal r and terminal s. Please connect 220Vac for 220V model and 440 Vac for 440V model.

When the drive power is on, if terminal r and terminal s are not connected to new power source (220 Vac for 220V model and 440Vac for 440 V model), the digital keypad will display an error message "ryF".

2. When DC Link is used as a DC Bus connection (RST power is applied), it is not required to remove terminal r and terminal s.

## 

Common DC Bus can only be applied to the drives with same power range. If in your case the drives are in different power range, please contact with us (Delta Industrial Automation Business Unit).



# 4-2 System Wiring Diagram

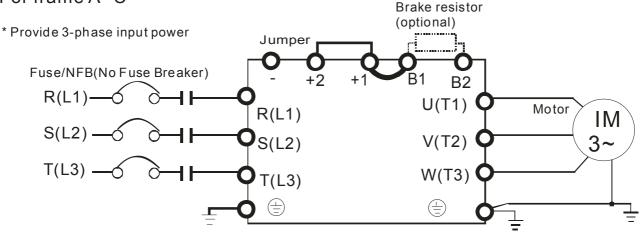
# Power input terminal

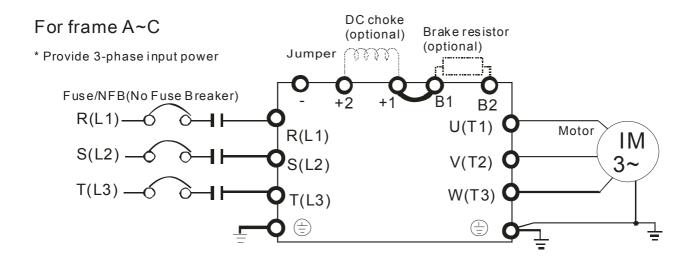
Power input terminal		
	Power input terminal	Please supply power according to the rated power specifications indicated in the manual (refer to 9 Specifications Table).
NFB or fuse	NFB or fuse	There may be a large inrush current during power on. Refer to 7-2 NFB to select a suitable NFB or fuse.
AC reactor (input terminal)	Electromagnetic contactor	Switching ON/OFF the primary side of the electromagnetic contactor can turn the integrated elevator device ON/OFF, but frequent switching is a cause of machine failure. Do not switch ON/OFF more than once an hour. Do not use the electromagnetic contactor as the power switch for the integrated elevator drive; doing so will shorten the life of the integrated elevator drive.
EMI filter EMI filter R/L1 S/L2 T/L3 E + B1 M B20	AC reactor (input terminal) 연	When the main power supply capacity is greater than 500kVA, or when it switches into the phase capacitor, the instantaneous peak voltage and current generated will destroy the internal circuit of the integrated elevator drive. It is recommended to install an input side AC reactor in the integrated elevator drive. This will also improve the power factor and reduce power harmonics. The wiring distance should be within 10m. Please refer to 7-4.
U/T1 V/T2 W/T3 $\textcircled{E}$ E	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 10MHz. Please refer to Appendix 7-5.
AC reactor	EMI filter	Can be used to reduce electromagnetic interference.
(output terminal)	Brake resistor	Used to shorten deceleration time of the motor. Please refer to 7-1.
Motor	AC reactor (output terminal)	The wiring length of the motor will affect the size of the reflected wave on the motor end. It is recommended to install an AC reactor when the motor wiring length is greater than 20 meters. Refer to 7-4.

# **Chapter 5 Main Circuit Terminals**

# 5-1 Main Circuit Diagram

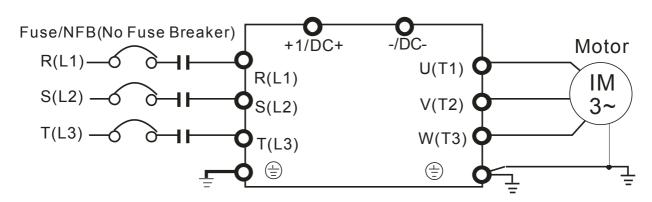
# For frame A~C



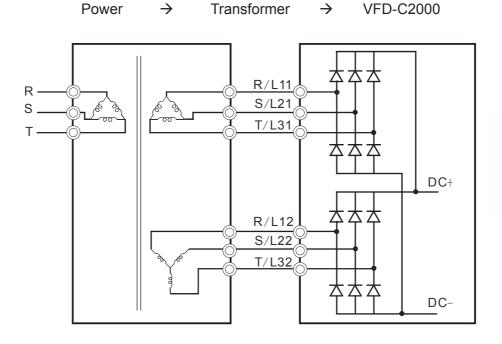


# For frame D0 and above D0

\* Provide 3-phase input power

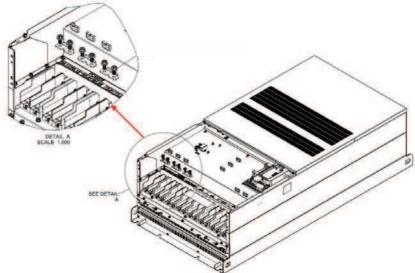


## For Frame G and above





Please remove short circuit plate of FRAME G and H if 12 pulse is implemented



Before implementing 12 pulse, consult Delta for more detail

Terminals	Descriptions
R/L1, S/L2, T/L3	AC line input terminals 3-phase
U/T1, V/T2, W/T3	AC drive output terminals for connecting 3-phase induction motor
	Applicable to frame A~C
+1, +2	Connections for DC reactor to improve the power factor. It needs to remove the
	jumper for installation.
	Connections for brake unit (VFDB series)
	(for 230V models: $\leq$ 22kW, built-in brake unit)
+1/DC+, -/DC-	(for 460V models: $\leq$ 30kW, built-in brake unit)
	Common DC Bus
B1, B2	Connections for brake resistor (optional)
	Earth connection, please comply with local regulations.

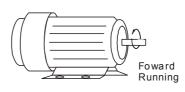


Main power terminals

- ☑ Do not connect 3-phase model to one-phase power. R/L1, S/L2 and T/L3 has no phase-sequence requirement, it can be used upon random selection.
- ☑ It is recommend to add a magnetic contactor (MC) to the power input wiring to cut off power quickly and reduce malfunction when activating the protection function of the AC motor drive. Both ends of the MC should have an R-C surge absorber.
- ☑ Fasten the screws in the main circuit terminal to prevent sparks condition made by the loose screws due to vibration.
- Please use voltage and current within the specification.
- When using a general GFCI (Ground Fault Circuit Interrupter), select a current sensor with sensitivity of 200mA or above and not less than 0.1-second operation time to avoid nuisance tripping.
- ☑ Please use the shield wire or tube for the power wiring and ground the two ends of the shield wire or tube.
- ☑ Do NOT run/stop AC motor drives by turning the power ON/OFF. Run/stop AC motor drives by RUN/STOP command via control terminals or keypad. If you still need to run/stop AC motor drives by turning power ON/OFF, it is recommended to do so only ONCE per hour.

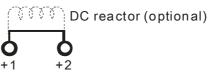
Output terminals for main circuit

- When it needs to install the filter at the output side of terminals U/T1, V/T2, W/T3 on the AC motor drive. Please use inductance filter. 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.
- $\ensuremath{\boxtimes}$  Use well-insulated motor, suitable for inverter operation.
- ☑ Note down the rated data and the torque force of the wiring when the output terminal is below 75°C. This information provides the right wiring method to wire terminals (It corresponds to the terminals of the motor wire and non-motor wire).
- ☑ 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 motor will rotate counterclockwise (as viewed on the shaft end of the motor) when a forward operation command is received. To permanently reverse the direction of motor rotation, switch over any of the two motor leads

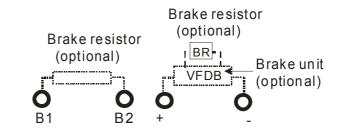


Terminals for connecting DC reactor, external brake resistor, external brake resistor and DC circuit

☑ This is the terminals used to connect the DC reactor to improve the power factor. For the factory setting, it connects the short-circuit object. Please remove this short-circuit object before connecting to the DC reactor.



Connect a brake resistor or brake unit in applications with frequent deceleration ramps, short deceleration time, too low brake torque or requiring increased brake torque.



- ☑ The external brake resistor of Frame A, B and C should connect to the terminals (B1, B2) of AC motor drives.
- ☑ For those models without built-in brake resistor, please connect external brake unit and brake resistor (both of them are optional) to increase brake torque.
- ☑ When the terminals +1, +2 and are not used, please leave the terminals open.
- ☑ DO NOT connect [+1, -], [+2, -], [+1/DC+, -/DC-] or brake resistor directly to prevent drive damage.
- DC+ and DC- are connected by common DC bus, please refer to Chapter
   5-1(Main Circuit Terminal) for the wiring terminal specification and the wire gauge information.
- ☑ Please refer to the VFDB manual for more information on wire gauge when installing the brake unit.

# 5-2 Main Circuit Terminals

## Frame A

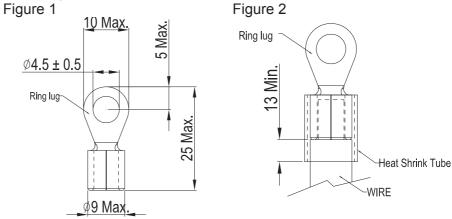
Main circuit terminals: R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, ⊕, B1, B2, +1, +2, -

	R/
	-
©	
	UL
	UL

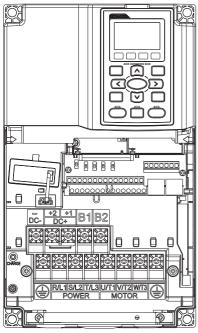
Models	Max. Wire Gauge	Min. Wire Gauge	Torque (±10%)	
VFD007C23A		14 AWG (2.1mm <sup>2</sup> )		
VFD015C23A		12 AWG (3.3mm <sup>2</sup> )		
VFD022C23A		10 AWG (5.3mm <sup>2</sup> )		
VFD037C23A		8 AWG (8.4mm <sup>2</sup> )		
VFD007C43A		14 AWG (2.1mm <sup>2</sup> )		
VFD007C43E		14 AWG (2.1mm <sup>2</sup> )		
VFD015C43A		14 AWG (2.1mm <sup>2</sup> )	M4	
VFD015C43E	8 AWG	14 AWG (2.1mm <sup>2</sup> )	20kg-cm	
VFD022C43A	(8.4mm <sup>2</sup> )	14 AWG (2.1mm <sup>2</sup> )	(17.4 lb-in.)	
VFD022C43E		14 AWG (2.1mm <sup>2</sup> )	(1.962Nm)	
VFD037C43A		10 AWG (5.3mm <sup>2</sup> )		
VFD037C43E		10 AWG (5.3mm <sup>2</sup> )		
VFD040C43A		10 AWG (5.3mm <sup>2</sup> )		
VFD040C43E		10 AWG (5.3mm <sup>2</sup> )		
VFD055C43A		10 AWG (5.3mm <sup>2</sup> )		
VFD055C43E		10 AWG (5.3mm <sup>2</sup> )		
UL installations must use 600V, $75^{\circ}$ C or $90^{\circ}$ C wire. Use copper wire only.				

1. Figure 1 shows the terminal specification.

2. Figure 2 shows the specification of insulated heat shrink tubing that comply with UL (600V, YDPU2).



### Frame B



R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, 🕀, B1, B2, +1, +2, -

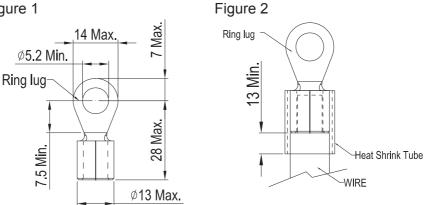
Models	Max. Wire Gauge	Min. Wire Gauge	Torque (±10%)	
VFD055C23A		8 AWG (8.4mm <sup>2</sup> )		
VFD075C23A		6 AWG (13.3mm <sup>2</sup> )		
VFD110C23A		4 AWG (21.2mm <sup>2</sup> )	M5	
VFD075C43A	4 4 4 4 4 6	8 AWG (8.4mm <sup>2</sup> )	35kg-cm	
VFD075C43E	4 AWG (21.2mm <sup>2</sup> )	8AWG (8.4mm <sup>2</sup> )	(30.4 lb-in.)	
VFD110C43A	(21.2mm)	8 AWG (8.4mm <sup>2</sup> )	(3.434Nm)	
VFD110C43E		8 AWG (8.4mm <sup>2</sup> )		
VFD150C43A		6 AWG (13.3mm <sup>2</sup> )		
VFD150C43E	-	6 AWG (13.3mm <sup>2</sup> )		
UL installations must use 600V, $75^{\circ}$ C or $90^{\circ}$ C wire. Use copper wire				
only.				

# 

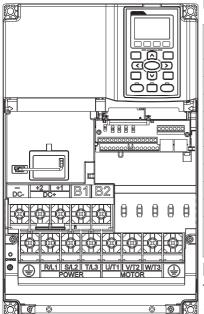
Terminal D+ [+2 & +1]: Torque: 45 kg-cm [39.0lb-in.] (4.415Nm) (±10%)

- 1. VFD110C23A must use 600V, 90°C wire when surrounding temperature exceeds  $45^{\circ}$ C.
- 2. Figure 1 shows the terminal specification.
- 3. Figure 2 shows the specification of insulated heat shrink tubing that comply with UL (600V, YDPU2).

Figure 1



#### Frame C



Main circuit terminals:

R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, 🕀, B1, B2, +1, +2, -

Models	Max. Wire Gauge	Min. Wire Gauge	Torque (±10%)
VFD150C23A		1 AWG (42.4mm <sup>2</sup> )	
VFD185C23A		1/0 AWG (53.5mm <sup>2</sup> )	
VFD220C23A		1/0 AWG (53.5mm <sup>2</sup> )	M8 80kg-cm (69.4 lb-in.) (7.85Nm)
VFD185C43A	1/0 AWG (53.5mm <sup>2</sup> )	4 AWG (21.2mm <sup>2</sup> )	
VFD185C43E		4 AWG (21.2mm <sup>2</sup> )	
VFD220C43A		4 AWG (21.2mm <sup>2</sup> )	
VFD220C43E		4 AWG (21.2mm <sup>2</sup> )	
VFD300C43A		2 AWG (33.6mm <sup>2</sup> )	
VFD300C43E		2 AWG (33.6mm <sup>2</sup> )	
UL installations must use 600V, 75 $^\circ C$ or 90 $^\circ C$ wire. Use copper wire			

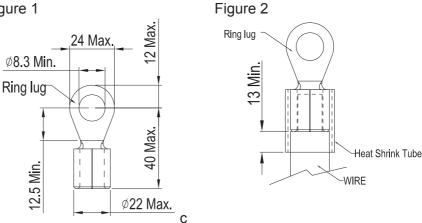
PΗ only.

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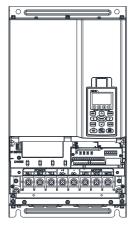
Terminal D+ [+2 & +1]: Torque: 90 kg-cm [78.2lb-in.] (8.83Nm) (±10%)

- 1. VFD220C23A must use 600V, 90°C wire when surrounding temperature exceeds  $40^{\circ}$ C.
- 2. Figure 1 shows the terminal specification.
- 3. Figure 2 shows the specification of insulated heat shrink tubing that comply with UL (600V, YDPU2).

Figure 1



### Frame D0



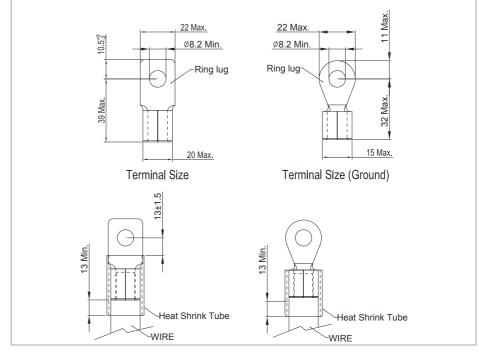
Main circuit terminals:

R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, , +1/DC+, -/DC-

, , , ,	, ,	, , , ,	
Models	Max. Wire Gauge	Min. Wire Gauge	Torque (±10%)
VFD370C43S		1/0 AWG (53.5mm <sup>2</sup> )	M8
VFD450C43S	2/0 AWG	2/0 AWG (67.4mm <sup>2</sup> )	80kg-cm
VFD370C43U	(67.4mm <sup>2</sup> )	1/0 AWG (53.5mm <sup>2</sup> )	(70 lb-in.)
VFD450C43U		1/0 AWG (53.5mm <sup>2</sup> )	(7.85Nm)

UL installations must use 600V, 75°C or 90°C wire. Use copper wire only.

Specification of grounding wire: 2AWG\*2(33.6mm<sup>2</sup>\*2) Figure on the right shows the specification of insulated heat shrink tubing that comply with UL (600V, YDPU2).



# Frame D

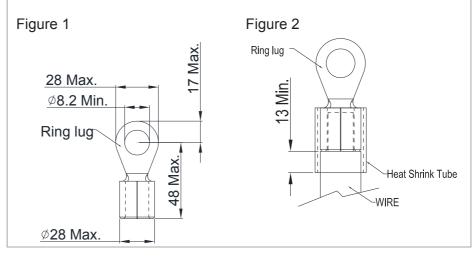
Main circuit terminals:

R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, , +1/DC+, -/DC-

1					
	Models	Max. Wire Gauge	Min. Wire Gauge	Torque (±10%)	
	VFD300C23A		4/0 AWG (107mm <sup>2</sup> )		
	VFD370C23A	300MCM	250MCM (127mm <sup>2</sup> )		
	VFD550C43A	(152mm <sup>2</sup> )	3/0 AWG (85mm <sup>2</sup> )		
	VFD750C43A		300MCM (152mm <sup>2</sup> )	M8	
	VFD300C23E		3/0 AWG (85mm <sup>2</sup> )	200kg-cm	
	VFD370C23E		4/0 AWG (107mm <sup>2</sup> )	(173 lb-in.)	
	VFD370C43E	4/0 AWG.	1/0 AWG (53.5mm <sup>2</sup> )	(19.62Nm)	
	VFD450C43E	(107mm <sup>2</sup> )	1/0 AWG (53.5mm <sup>2</sup> )		
	VFD550C43E		2/0 AWG (67.4mm <sup>2</sup> )		
	VFD750C43E		4/0 AWG (107mm <sup>2</sup> )		
1	<b>A FILL C I C</b>	1 000			

1. UL installations must use 600V, 75°C or 90 °C wires. Use copper wire only.

- 2. Figure 1 shows the terminal specification.
- 3. Figure 2 shows the specification of insulated heat shrink tubing that comply with UL (600V, YDPU2).



#### Frame E

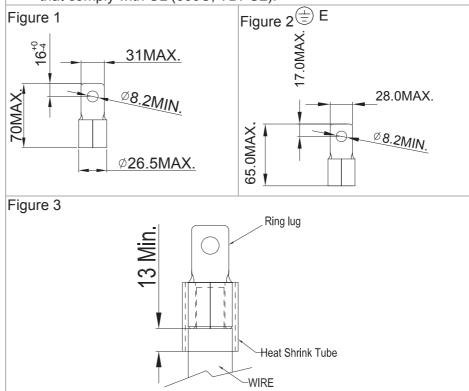
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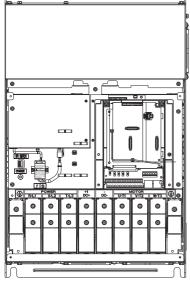
Main circuit terminals:

R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, ⊕, +1/DC+, -/DC-

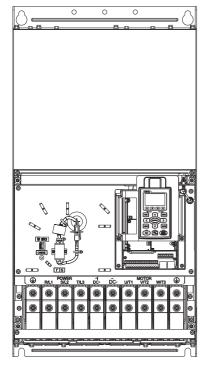
			<b>T</b>
Models	Max. Wire Gauge	Min. Wire Gauge	Torque (±10%)
VFD450C23A		1/0AWG*2 (53.5mm <sup>2</sup> *2)	
VFD550C23A		3/0AWG*2 (85mm <sup>2</sup> *2)	
VFD750C23A	300MCM*2 (152mm <sup>2</sup> *2)	4/0 AWG*2 (107mm <sup>2</sup> *2)	
VFD900C43A		1/0AWG*2 (53.5mm <sup>2</sup> *2)	MO
VFD1100C43A	-	3/0AWG*2 (85mm <sup>2</sup> *2)	M8 200kg-cm
VFD450C23E		1/0AWG*2 (53.5mm <sup>2</sup> *2)	(173 lb-in.)
VFD550C23E		2/0AWG*2 (67.4mm <sup>2</sup> *2)	(19.62Nm)
VFD750C23E	4/0 AWG*2 (107mm <sup>2</sup> *2)	3/0AWG*2 (85mm <sup>2</sup> *2)	
VFD900C43E		1/0AWG*2 (53.5mm <sup>2</sup> *2)	
VFD1100C43E		2/0AWG*2 (67.4mm <sup>2</sup> *2)	

- 1. UL installations must use 600V, 75°C or 90 °C wires. Use copper wire only.
- Specification of grounding wire<sup>(±)</sup>: 300MCM [152 mm<sup>2</sup>] Torque: M8 180kg-cm (156 lb-in.) (17.64Nm) (±10%), as shown in Figure 2.
- 3. Figure 1 shows the specification for ring lug.
- 4. Figure 3 shows the specification of insulated heat shrink tubing that comply with UL (600C, YDPU2).





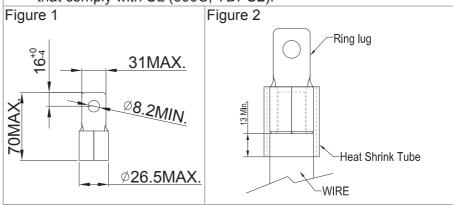
Frame F



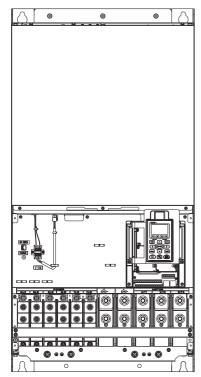
Main circuit terminals: R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, +1/DC+, -/DC-

Models	Max. Wire Gauge	Min. Wire Gauge	Torque (±10%)
VFD900C23A	300MCM*2 (152mm <sup>2</sup> *2)	300MCM*2 (152mm <sup>2</sup> *2)	
VFD1320C43A		4/0 AWG*2 (107mm <sup>2</sup> *2)	MO
VFD1600C43A		300MCM*2 (152mm <sup>2</sup> )	M8 200kg-cm
VFD900C23E	4/0 AWG*2 (107mm <sup>2</sup> *2)	4/0 AWG*2 (107mm <sup>2</sup> *2)	(173 lb-in.) (19.62Nm)
VFD1320C43E		3/0AWG*2 (85mm <sup>2</sup> *2)	(19.021111)
VFD1600C43E		4/0 AWG*2 (107mm <sup>2</sup> *2)	

- 1. VFD900C23A/E installations must use  $90^{\circ}$ C wire.
- For other model, UL installations must use 600V, 75°C or 90°C wire. Use copper wire only.
- 3. Specification of grounding wire <sup>(</sup> = ) : 300MCM\*2 [152 mm<sup>2</sup>\*2] Torque: M8 200kg-cm (173 lb-in.) (19.62Nm) (±10%)
- 5. Figure 1 shows the specification for ring lug.
- 4. Figure 2 shows the specification of insulated heat shrink tubing that comply with UL (600C, YDPU2).



#### Frame G



Main circuit terminals: R/L11, R/L12, S/L21, S/L22, T/L31, T/L32

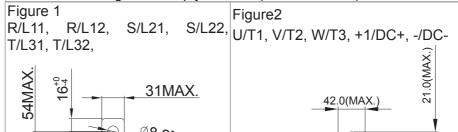
Models	Max. Wire Gauge	Min. Wire Gauge	Torque (±10%)
VFD1850C43A	300MCM*4 (152mm <sup>2</sup> *4)	2/0AWG*4 (67.4mm <sup>2</sup> *4)	N40
VFD2200C43A		3/0AWG*4 (85mm <sup>2</sup> *4)	M8 200kg-cm
VFD1850C43E		1/0AWG*4 (53.5mm <sup>2</sup> *4)	(173 lb-in.) (19.62Nm)
VFD2200C43E		2/0AWG*4 (67.4mm <sup>2</sup> *4)	(19.021111)

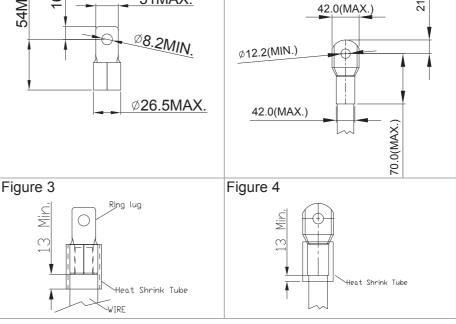
Main circuit terminals:

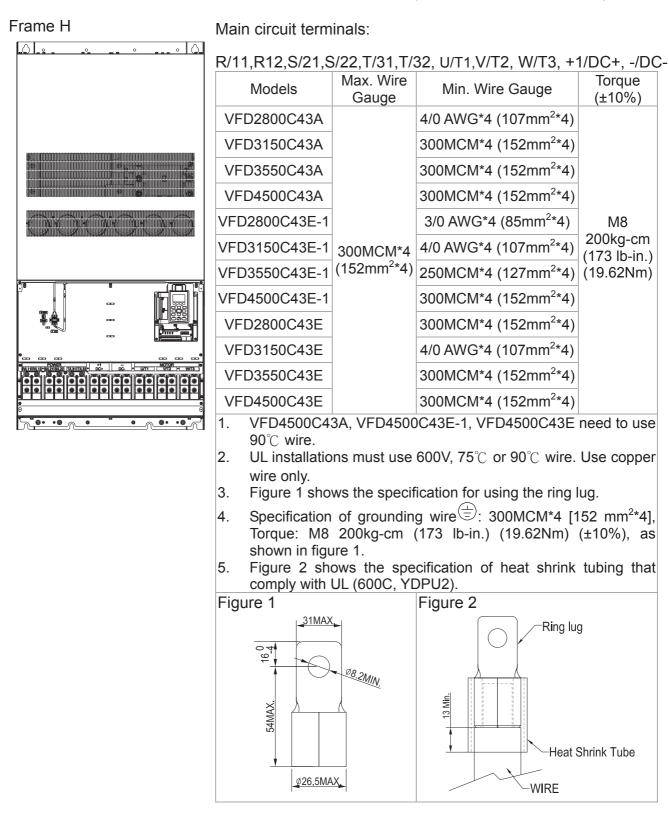
U/T1, V/T2, W/T3, +1/DC+, -/DC-

0/11, 0/12, 0/13, 1/001, -/00-				
	Models	Max. Wire Gauge	Min. Wire Gauge	Torque (±10%)
	VFD1850C43A	500MCM*2 (253mm <sup>2</sup> *2)	400MCM*2 (203mm <sup>2</sup> *2)	M12
	VFD2200C43A		500MCM*2 (253mm <sup>2</sup> *2)	408kg-cm
	VFD1850C43E		300MCM*2 (152mm <sup>2</sup> *2)	(354lb-in.) ( 40Nm)
	VFD2200C43E		400MCM*2 (203mm <sup>2</sup> *2)	( 401111)

- UL installations must use 600V, 75°C or 90°C wire. Use copper wire only.
- Use 600V, 90°C wire for VFD2200C43A when the surrounding temperature is over 45°C.
- 3. Figure 1 and Figure 2 show the specification for using ring lug.
- Specification for grounding wire<sup>(±)</sup>: 300MCM\*4 [152 mm<sup>2</sup>\*2] Torque: M8 200kg-cm (173 lb-in.) (19.62Nm) (±10%), as shown in Figure 1
- 5. Figure 3 and Figure 4 shows the specification of insulated heat shrink tubing that comply with UL (600C, YDPU2).



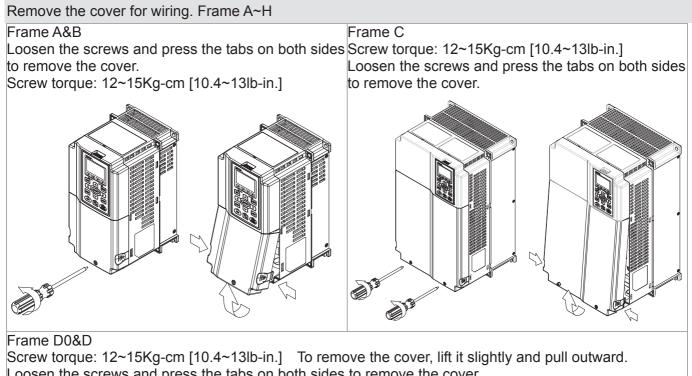




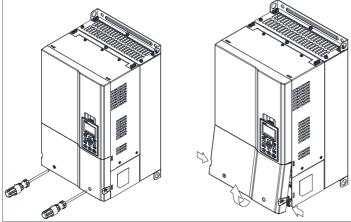
# **Chapter 6 Control Terminals**

Please remove the top cover before wiring the multi-function input and output terminals,

The drive appearances shown in the figures are for reference only, a real drive may look different.

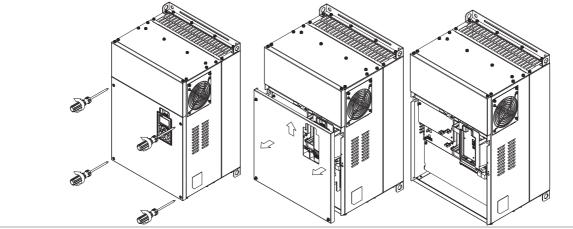


Loosen the screws and press the tabs on both sides to remove the cover.



#### Frame E

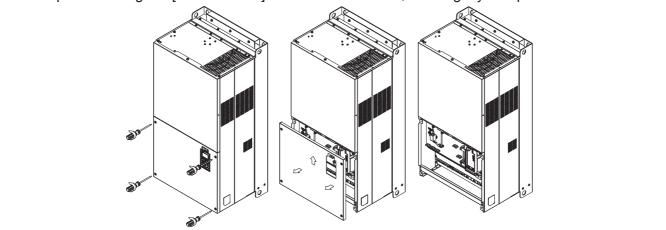
Screw torque: 12~15Kg-cm [10.4~13lb-in.] To remove the cover, lift it slightly and pull outward.



#### Chapter 6 Control Terminals | C2000 Series

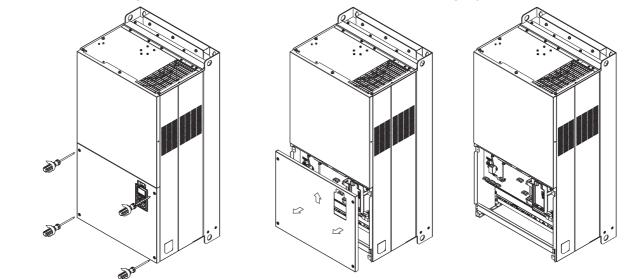
#### Frame F

Screw torque: 12~15Kg-cm [10.4~13lb-in.] To remove the cover, lift it slightly and pull outward



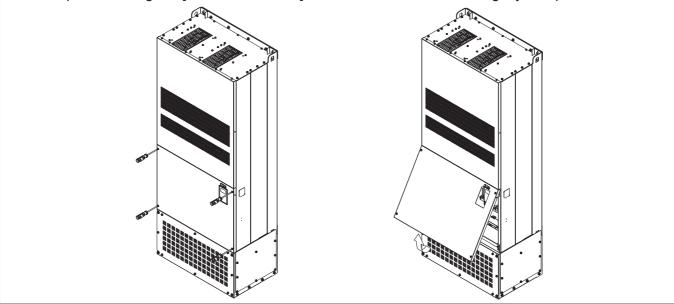
#### Frame G

Screw torque: 12~15Kg-cm [10.4~13lb-in.] To remove the cover, lift it slightly and pull outward



### Frame H

Screw torque: 14~16Kg-cm [12.15~13.89lb-in.] To remove the cover, lift it slightly and pull outward



# 6-1 Specifications of Control Terminal

0-10V AFM1 AFM2 -10-10V 0-10V 0-10V 0-10V 0-10V 0-10V 0-20mA 0-20mA 0-10V 0-20mA 0-10V 120 0-10V 0-10V 0-10V 0-10V 0-20mA	MI3 MI5 MI7 SGND (C)
AFM2 -10V AUI ACM MCM DFM SCM1SCM2 DCM DCM REV MIZ MIX	4 MI6 MI8 SG+ SG-

Removable Terminal Block

Wire Gauge: 26~16AWG  $(\,0.1281\text{-}1.318\text{mm}^2)$  ,

Torque: (A) 5kg-cm [4.31lb-in.] (0.49Nm) (As shown in figure above)

(B) 8kg-cm [6.94lb-in.] (0.78Nm) (As shown in figure above)

Wiring precautions:

- Reserves 5mm and properly install the wire into the terminal; fasten the installation by a slotted screwdriver. If the wire is stripped, sort the wire before install into the terminal.
- Flathead screwdriver: blade width 3.5mm, tip thickness 0.6mm
- In the figure above, the factory setting for S1-SCM is short circuit. The factory setting for +24V-COM is short circuit and SINK mode (NPN); please refer to Chapter 4 Wiring for more detail.

Terminals	Terminal Function	Factory Setting (NPN mode)
+24V	Digital control signal common	+24V±5% 200mA
	(Source)	
COM	Digital control signal common (Sink)	Common for multi-function input terminals
FWD	Forward-Stop command	FWD-DCM: ON➔ forward running OFF➔ deceleration to stop
REV	Reverse-Stop command	REV-DCM: ON→ reverse running OFF→ deceleration to stop
MI1 ~ MI8	Multi-function input 1~8	Refer to parameters 02-01~02-08 to program the multi-function inputs MI1~MI8. Source mode ON: the activation current is $3.3mA \ge 11Vdc$ OFF: cut-off voltage $\le 5Vdc$ Sink Mode ON: the activation current is $3.3mA \le 13Vdc$ OFF: cut-off voltage $\ge 19Vdc$
DFM	Digital frequency meter DFM DCM	Regard the pulse voltage as the output monitor signal Duty-cycle: 50% Min. load impedance: 1kΩ/100pf Max. current: 30mA Max. voltage: 30Vdc
DCM	Digital frequency signal common	, , , , , , , , , , , , , , , , , , ,
MO1	Multi-function Output 1 (photocoupler)	The AC motor drive releases various monitor signals, such as drive in operation, frequency attained and overload indication, via transistor (open collector).

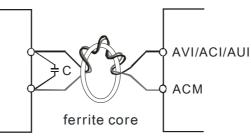
Terminals	Terminal Function	Factory Setting (NPN mode)	
MO2	Multi-function Output 2 (photocoupler)	MO1 MO2 MCM	
МСМ	Multi-function Output Common	Max 48Vdc 50mA	
RA1	Multi-function relay output 1 (N.O.) a	Resistive Load: 3A(N.O.)/3A(N.C.) 250VAC	
RB1	Multi-function relay output 1 (N.C.) b	5A(N.O.)/3A(N.C.) 30VDC	
RC1	Multi-function relay common	Inductive Load (COS 0.4): 1.2A(N.O.)/1.2A(N.C.) 250VAC 2.0A(N.O.)/1.2A(N.C.) 30VDC	
RA2	Multi-function relay output 2 (N.O.) a		
RB2	Multi-function relay output 2 (N.C.) b	It is used to output each monitor signal, such as drive is in operation, frequency attained or overload indication.	
RC2	Multi-function relay common		
+10V	Potentiometer power supply	Analog frequency setting: +10Vdc 20mA	
-10V	Potentiometer power supply	Analog frequency setting: -10Vdc 20mA	
AVI	Analog voltage input	Impedance: 20kΩ Range: 0~20mA/4~20mA/0~10V =0~Max. Output Frequency (Pr.01-00) AVI switch, factory setting is 0~10V	
ACI	Analog current input ACI ACI circuit ACI ACI circuit ACI ACI circuit ACI ACI circuit	Impedance: 250Ω Range: 0~20mA/4~20mA/0~10V = 0 ~ Max. Output Frequency (Pr.01-00) ACI Switch, factory setting is 4~20mA	
AUI	Auxiliary analog voltage input +10V AUI(-10V~+10V) ACM	Impedance: 20kΩ Range: -10~+10VDC=0 ~ Max. Output Frequency(Pr.01-00)	

Terminals	Terminal Function	Factory Setting (NPN mode)
AFM1		0~10V Max. output current 2mA, Max. load 5kΩ -10~10V maximum output current 2mA, maximum load 5kΩ Output current: 2mA max Resolution: 0~10V corresponds to Max. operation frequency Range: 0~10V → -10~+10V AFM 1 Switch, factory setting is 0~10V
AFM2		0~10V Max. output current 2mA, Max. load 5kΩ 0~20mA Max. load 500Ω Output current: 20mA max Resolution: 0~10V corresponds to Max. operation frequency Range: 0~10V → 4~20mA AFM 2 Switch, factory setting is 0~10V
ACM	Analog Signal Common	Common for analog terminals
STO1		
SCM1	Default setting is shorted	
STO2	Power removal safety function for EN	
SCM2	when 3101~30W1,3102~30W	2 is activated, the activation current is $3.3mA \ge 11Vdc$
SG+		
SG-	Modbus RS-485	
SGND	-	
RJ-45	PIN 1,2,7,8 : ReservedPINPIN 4: SG-PIN 5: S	3, 6: SGND G+

NOTE: Wire size of analog control signals: 18 AWG (0.75 mm<sup>2</sup>) with shielded wire

## 6-2 Analog input terminals (AVI, ACI, AUI, ACM)

- Analog input signals are easily affected by external noise. Use shielded wiring and keep it as short as possible (<20m) with proper grounding. If the noise is inductive, connecting the shield to terminal ACM can bring improvement.
- ☑ If the analog input signals are affected by noise from the AC motor drive, please connect a capacitor and ferrite core as indicated in the following diagram.



Wind each wires 3 times or more around the core

### Digital inputs (FWD, REV, MI1~MI8, COM)

- ☑ When using contacts or switches to control the digital inputs, please use high quality components to avoid contact bounce.
- ☑ The "COM" terminal is the common side of the photo-coupler. Any of wiring method, the "common point" of all photo-coupler must be the "COM".

### Chapter 6 Control Terminals | C2000 Series

- When the photo-coupler is using internal power supply, the switch connection for Sink and Source as below:
   MI-DCM: Sink mode
   MI-+24V: Source mode
- ☑ When the photo-coupler is using external power supply, please remove the short circuit cable between the +24V and COM terminals. The connection mode is Sink mode or Source mode is according to the below:

The "+" of 24V connecting to "COM: Sink mode

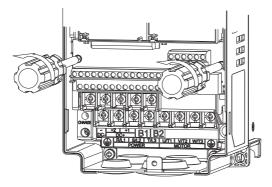
The "-" of 24V connecting to COM: Source mode

### Transistor outputs (MO1, MO2, MCM)

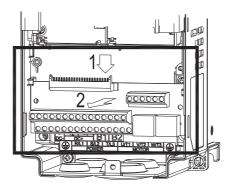
- $\square$  Make sure to connect the digital outputs to the right polarity.
- ☑ When connecting a relay to the digital outputs connect a surge absorber across the coil and check the polarity.

### 6-3 Remove the Terminal Block

1. Loosen the screws by screwdriver. (As shown in figure below).



2. Remove the control board by pulling it out for a distance 6~8 cm (as 1 in the figure) then lift the control board upward(as 2 in the figure).



# **Chapter 7 Optional Accessories**

- 7-1 All Brake Resistors and Brake Units Used in AC Motor Drives
- 7-2 Non-fuse Circuit Breaker
- 7-3 Fuse Specification Chart
- 7-4 AC/DC Reactor
- 7-5 Zero Phase Reactor
- 7-6 EMI Filter
- 7-7 Digital Keypad
- 7-8 Panel Mounting
- 7-9 Conduit Box Kit
- 7-10 Fan Kit
- 7-11 Flange Mounting Kit
- 7-12 USB/RS-485 Communication Interface IF6530

The optional accessories listed in this chapter are available upon request. Installing additional accessories to your drive would substantially improve the drive's performance. Please select an applicable accessory according to your need or contact the local distributor for suggestion.

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

22	<b>^\ /</b>	
<b>∠</b> 3	UV	

Appli Mo				* <sup>1</sup> 125%Brakin		* <sup>2</sup> Max. Brake Torque				
HP	kW	Braking Torque (kg-m)	Brake Unit * <sup>4</sup> VFDB	* <sup>3</sup> Braking Resisto each Brake	r series for Unit	Resistor value spec. for each AC motor Drive	Total Braking Current (A)	Min. Resistor Value (Ω)	Max. Total Braking Current (A)	Peak Power (kW)
1	0.7	0.5	-	BR080W20	00*1	80W200Ω	1.9	63.3	6	2.3
2	1.5	1.0	-	BR200W09	91*1	200W91Ω	4.2	47.5	8	3.0
3	2.2	1.5	-	BR300W07	70*1	300W70Ω	5.4	38.0	10	3.8
5	3.7	2.5	-	BR400W04	40*1	400W40Ω	9.5	19.0	20	7.6
7.5	5.5	3.7	-	BR1K0W02	20*1	1000W20Ω	19	14.6	26	9.9
10	7.5	5.1	-	BR1K0W02	20*1	1000W20Ω	19	14.6	26	9.9
15	11	7.5	-	BR1K5W0	13*1	1500W13Ω	29	13.6	28	10.6
20	15	10.2	-	BR1K0W4P3*2	2 series	2000W8.6Ω	44	8.3	46	17.5
25	18	12.2	-	BR1K0W4P3*2	2 series	2000W8.6Ω	44	8.3	46	17.5
30	22	14.9	-	BR1K5W3P3*2	2 series	3000W6.6Ω	58	5.8	66	25.1
40	30	20.3	2015*2	BR1K0W5P1*2	2 series	4000W5.1Ω	75	4.8	80	30.4
50	37	25.1	2022*2	BR1K2W3P9*2	2 series	4800W3.9Ω	97	3.2	120	45.6
60	45	30.5	2022*2	BR1K5W3P3*2	2 series	6000W3.3Ω	118	3.2	120	45.6
75	55	37.2	2022*3	BR1K2W3P9*2	2 series	7200W2.6Ω	145	2.1	180	68.4
100	75	50.8	2022*4	BR1K2W3P9*2	2 series	9600W2Ω	190	1.6	240	91.2
125	90	60.9	2022*4	BR1K5W3P3*2	2 series	12000W1.65Ω	230	1.6	240	91.2

#### 460V

Appli Mo	cable otor			* <sup>1</sup> 125%Brakin	g Torque 10	9%ED		* <sup>2</sup> Ma	ax. Brake Toro	que
HP	kW	Braking Torque (kg-m)	Brake Unit * <sup>4</sup> VFDB	* <sup>3</sup> Braking Resisto each Brake		Resistor value spec. for each AC motor Drive	Total Braking Current (A)	Min. Resistor Value (Ω)	Max. Total Braking Current (A)	Peak Power (kW)
1	0.7	0.5	-	BR080W7	50*1	80W750Ω	1	190.0	4	3.0
2	1.5	1.0	-	BR200W3	60*1	200W360Ω	2.1	126.7	6	4.6
3	2.2	1.5	-	BR300W2	50*1	300W250Ω	3	108.6	7	5.3
5	3.7	2.5	-	BR400W1	50*1	400W150Ω	5.1	84.4	9	6.8
5.5 7.5	4.0 5.5	2.7 3.7	-	BR1K0W0	075*1	1000W75Ω	10.2	54.3	14	10.6
10	7.5	5.1	-	BR1K0W0	75*1	1000W75Ω	10.2	47.5	16	12.2
15	11	7.5	-	BR1K5W0	43*1	1500W43Ω	17.6	42.2	18	13.7
20	15	10.2	-	BR1K0W016*2	2 series	2000W32Ω	24	26.2	29	22.0
25	18	12.2	-	BR1K0W016*2	2 series	2000W32Ω	24	23.0	33	25.1
30	22	14.9	-	BR1K5W013*2	2 series	3000W26Ω	29	23.0	33	25.1
40	30	20.3	-	BR1K0W016*4	2 parallel, 2 series	4000W16Ω	47.5	14.1	54	41.0
50	37	25.1	4045*1	BR1K2W015*4	2 parallel, 2 series	4800W15Ω	50	12.7	60	45.6
60	45	30.5	4045*1	BR1K5W013*4	2 parallel, 2 series	6000W13Ω	59	12.7	60	45.6
75	55	37.2	4030*2	BR1K0W5P1*4	4 parallel	8000W10.2Ω	76	9.5	80	60.8
100	75	50.8	4045*2	BR1K2W015*4	2 parallel, 2 series	9600W7.5Ω	100	6.3	120	91.2
125	90	60.9	4045*2	BR1K5W013*4	2 parallel, 2 series	12000W6.5Ω	117	6.3	120	91.2
150	110	74.5	4110*1	BR1K2W015*10	5 parallel, 2 series	12000W6Ω	126	6.0	126	95.8

	cable otor			* <sup>1</sup> 125%Braking		* <sup>2</sup> Max. Brake Torque				
ΗP	kW	Braking Torque (kg-m)	Brake Unit	* <sup>3</sup> Braking Resisto each Brake		Resistor value spec. for each AC motor Drive	Total Braking Current (A)	Min. Resistor Value (Ω)	Max. Total Braking Current (A)	Peak Power (kW)
175	132	89.4	4160*1	BR1K5W012*12	6 parallel, 2 series	18000W4Ω	190	4.0	190	144.4
215	160	108.3	4160*1	BR1K5W012*12	6 parallel, 2 series	18000W4Ω	190	4.0	190	144.4
250	185	125.3	4185*1	BR1K5W012*14	7 parallel, 2 series	21000W3.4Ω	225	3.4	225	172.1
300	220	148.9	4110*2	BR1K2W015*10	5 parallel, 2 series	24000W3Ω	252	3.0	252	190.5
375	280	189.6	4160*2	BR1K5W012*12	6 parallel, 2 series	36000W2Ω	380	2.0	380	288.8
425	315	213.3	4160*2	BR1K5W012*12	6 parallel, 2 series	36000W2Ω	380	2.0	380	288.8
475	355	240.3	4185*2	BR1K5W012*14	7 parallel, 2 series	42000W1.7Ω	450	1.7	450	344.2

<sup>\*1</sup> Calculation for 125% brake toque: (kw)\*125%\*0.8; where 0.8 is motor efficiency.

Because there is a resistor limit of power consumption, the longest operation time for 10%ED is 10sec (on: 10sec/ off: 90sec).
 \*<sup>2</sup> Please refer to the Brake Performance Curve for "Operation Duration & ED" vs. "Braking Current".

\*<sup>3</sup> For heat dissipation, a resistor of 400W or lower should be fixed to the frame and maintain the surface temperature below 50°C; a resistor of 1000W and above should maintain the surface temperature below 350°C.

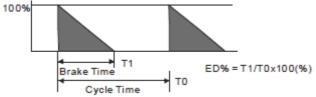
\*<sup>4</sup> Please refer to VFDB series Braking Module Instruction for more detail on braking resistor.

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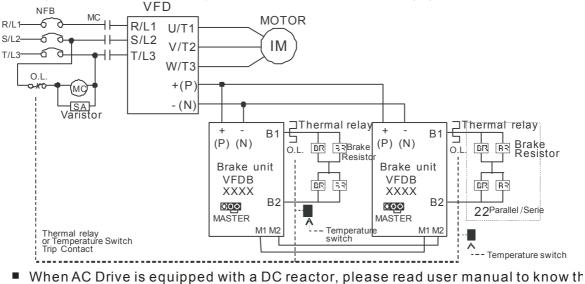
460V

1. Definition for Brake Usage ED%

Explanation: The definition of the brake usage ED (%) is for assurance of enough time for the brake unit and brake resistor to dissipate away heat generated by braking. When the brake resistor heats up, the resistance would increase with temperature, and brake torque would decrease accordingly. Recommended cycle time is one minute.



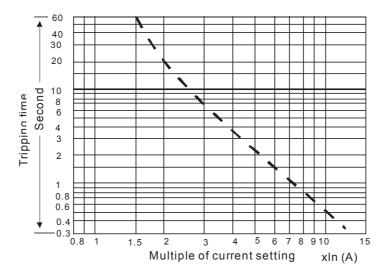
For safety concern, install an overload relay (O.L) between the brake unit and the brake resistor in conjunction with the magnetic contactor (MC) prior to the drive for abnormal protection. The purpose of installing the thermal overload relay is to protect the brake resistor from damage due to frequent brake, or due to brake unit keeping operating resulted from unusual high input voltage. Under such circumstance, just turn off the power to prevent damaging the brake resistor.



- when AC Drive is equipped with a DC reactor, please read user manual to know i wiring method of input circuit of brake unit +(P).
- Do Not connect input circuit -(N) to the neutral point of the power system.
- 2. If damage to the drive or other equipment is due to the fact that the brake resistors and brake modules in use are not provided by Delta, the warranty will be void.

- 3. Take into consideration the safety of the environment when installing the brake resistors. If the minimum resistance value is to be utilized, consult local dealers for the calculation of Watt figures.
- 4. When using more than 2 brake units, equivalent resistor value of parallel brake unit can't be less than the value in the column "Minimum Equivalent Resistor Value for Each AC Drive" (the right-most column in the table). Please read the wiring information in the user manual of brake unit thoroughly prior to operation
- This chart is for normal usage; if the AC motor drive is applied for frequent braking, it is suggested to enlarge 2~3 times of the Watts.
- 6. Thermal Relay:

Thermal relay selection is basing on its overload capability. A standard braking capacity for C2000 is 10%ED (Tripping time=10s). The figure below is an example of 406V, 110kw AC motor drive. It requires the thermal relay to take 260% overload capacity in 10s (Host starting) and the braking current is 126A. In this case, user should select a rated 50A thermal relay. The property of each thermal relay may vary among different manufacturer, please carefully read specification.



### 7-2 Non-fuse Circuit Breaker

Comply with UL standard: Per UL 508, paragraph 45.8.4, part a.

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

3-phase 230V								
Model	Recommended non-fuse breaker (A)							
VFD007C23A	15							
VFD015C23A	20							
VFD022C23A	30							
VFD037C23A	40							
VFD055C23A	50							
VFD075C23A	60							
VFD110C23A	100							
VFD150C23A	125							
VFD185C23A	150							
VFD220C23A	200							
VFD300C23A/E	225							
VFD370C23A/E	250							
VFD450C23A/E	300							
VFD550C23A/E	400							
VFD750C23A/E	450							
VFD900C23A/E	600							

3-phase 460V								
Model	Recommended non-fuse breaker(A)							
VFD007C43A/E	5							
VFD015C43A/E	10							
VFD022C43A/E	15							
VFD040C43A/E	20							
VFD037C43A/E	20							
VFD055C43A/E	30							
VFD075C43A/E	40							
VFD110C43A/E	50							
VFD150C43A/E	60							
VFD185C43A/E	75							
VFD220C43A/E	100							
VFD300C43A/E	125							
VFD370C43A/E/S/U	150							
VFD450C43A/E/S/U	175							
VFD550C43A/E	250							
VFD750C43A/E	300							
VFD900C43A/E	300							
VFD1100C43A/E	400							
VFD1320C43A/E	500							
VFD1600C43A/E	600							
VFD1850C43A/E	600							
VFD2200C43A/E	800							
VFD2800C43A/E	1000							
VFD3150C43A/E	1200							
VFD3550C43A/E	1350							

## 7-3 Fuse Specification Chart

- Use only the fuses comply with UL certificated.
- Use only the fuses comply with local regulations.

230V Model	Input Cur	rent I(A)	Line	Fuse	
	Heavy Duty	Normal Duty	I (A)	Bussmann P/N	
VFD007C23A	6.1	6.4	20	JJS-20	
VFD015C23A	11	12	35	JJS-35	
VFD022C23A	15	16	50	JJS-50	
VFD037C23A	18.5	20	80	JJS-80	
VFD055C23A	26	28	100	JJS-100	
VFD075C23A	34	36	130	JJS-130	
VFD110C23A	50	52	175	JJS-175	
VFD150C23A	68	72	250	JJS-250	
VFD185C23A	78	83	300	JJS-300	
VFD220C23A	95	99	350	JJS-350	
VFD300C23A/E	118	124	400	DLS-R-400	
VFD370C23A/E	136	143	500	DLS-R-500	
VFD450C23A/E	162	171	700	JJN-700	
VFD550C23A/E	196	206	800	JJN-800	
VFD750C23A/E	233	245	1000	JJN-1000	
VFD900C23A/E	315	331	1000	KTU-1000	
	Input Cur	rent I(A)	Line Fuse		
460VModel	Heavy Duty	Normal Duty	I (A)	Bussmann P/N	
VFD007C43A/E	4.1	4.3	10	JJS-10	
VFD015C43A/E	5.6	5.9	15	JJS-15	
VFD022C43A/E	8.3	8.7	20	JJS-20	
VFD037C43A/E	13	14	30	JJS-30	
VFD040C43A/E	14.5	15.5	35	JJS-35	
VFD055C43A/E	16	17	45	JJS-45	
VFD075C43A/E	19	20	70	JJS-70	
VFD110C43A/E	25	26	90	JJS-90	
VFD150C43A/E	33	35	125	JJS-125	
VFD185C43A/E	38	40	125	JJS-125	
VFD220C43A/E	45	47	150	JJS-150	
VFD300C43A/E	60	63	200	JJS-200	
VFD370C43/S/U	70	74	300	DLS-R-300	
VFD450C43/S/U	96	101	350	DLS-R-350	
VFD550C43A/E	108	114	400	DLS-R-400	
VFD750C43A/E	149	157	600	DLS-R-600	
VFD900C43A/E	159	167	600	JJN-600	
VFD1100C43A/E	197	207	800	JJS-800	
VFD1320C43A/E	228	240	800	KTU-800	
VFD1600C43A/E	285	300	800	KTU-800	
VFD1850C43A/E	361	380	800	KTU-800	
VFD2200C43A/E	380	400	1000	KTU-1000	
VFD2800C43A/E	469	494	1200	KTU-1200	
VFD3150C43A/E	527	555	1200	KTU-1200	
VFD3550C43A/E	594	625	1600	KTU-1600	

\* Contact Delta Electronics or an authorized distributor for corresponding fuse of VFD4500C43A/E

### 7-4 AC/DC Reactor

When the AC Motor Drive is connected directly to a large-capacity power transformer (600kVA or above) or when a phase lead capacitor is switched, excess peak currents may occur in the power input circuit due to the load changes and the converter section may be damaged. To avoid this, it is recommend to use a serial connected AC input reactor (3%) at the AC Motor Drive mains input side to reduce the current and improve the input power efficiency.

### AC Input/output Reactor

200V~230V/ 50~60Hz

Туре	KW	ΗP	Rated Amps of AC Reactor (Arms)	Max. continuous Amps (Arms)	3% impedance (mH)	5% impedance (mH)	Built-in DC reactor	3% Input AC reactor Delta part #
007	0.75	1	5	8.64	2.536	4.227	Х	N/A
015	1.5	2	8	12.78	1.585	2.642	Х	N/A
022	2.2	3	11	18	1.152	1.922	Х	N/A
037	3.7	5	17	28.8	0.746	1.243	Х	N/A
055	5.5	7.5	25	43.2	0.507	0.845	Х	N/A
075	7.5	10	33	55.8	0.32	0.534	Х	DR033AP320
110	11	15	49	84.6	0.216	0.359	Х	DR049AP215
150	15	20	65	111.6	0.163	0.271	Х	DR065AP162
185	18.5	25	75	127.8	0.169	0.282	Х	N/A
220	22	30	90	154.8	0.141	0.235	Х	N/A
300	30	40	120	205.2	0.106	0.176	0	N/A
370	37	50	146	250.2	0.087	0.145	0	N/A
450	45	60	180	307.8	0.070	0.117	0	N/A
550	55	75	215	367.2	0.059	0.098	0	N/A
750	75	100	255	435.6	0.049	0.083	0	N/A
900	90	125	346	592.2	0.037	0.061	0	N/A

380V~460V/ 50~60Hz

Туре	KW	HP	Rated Amps of AC Reactor (Arms)	Max. continuous Amps (Arms)	3% impedance (mH)	5% impedance (mH)	Built-in DC reactor	3% Input AC reactor Delta part #
007	0.75	1	3	5.22	8.102	13.502	Х	N/A
015	1.5	2	4	6.84	6.077	10.127	Х	N/A
022	2.2	3	6	10.26	4.050	6.752	Х	N/A
037	3.7	5	9	14.58	2.700	4.501	Х	N/A
040	4	5	10.5	17.1	2.315	3.858	Х	N/A
055	5.5	7.5	12	19.8	2.025	3.375	Х	N/A
075	7.5	10	18	30.6	1.174	1.957	Х	DR018A0117
110	11	15	24	41.4	0.881	1.468	Х	DR024AP880
150	15	20	32	54	0.66	1.101	Х	DR032AP660

Туре	KW	HP	Rated Amps of AC Reactor (Arms)	Max. continuous Amps (Arms)	3% impedance (mH)	5% impedance (mH)	Built-in DC reactor	3% Input AC reactor Delta part #
185	18.5	25	38	64.8	0.639	1.066	Х	N/A
220	22	30	45	77.4	0.541	0.900	Х	N/A
300	30	40	60	102.6	0.405	0.675	0	N/A
370	37	50	73	124.2	0.334	0.555	0	N/A
450	45	60	91	154.8	0.267	0.445	0	N/A
550	55	75	110	189	0.221	0.368	0	N/A
750	75	100	150	257.4	0.162	0.270	0	N/A
900	90	125	180	307.8	0.135	0.225	0	N/A
1100	110	150	220	376.2	0.110	0.184	0	N/A
1320	132	175	260	444.6	0.098	0.162	0	N/A
1600	160	215	310	531	0.078	0.131	0	N/A
1850	185	250	370	633.6	0.066	0.109	0	N/A
2200	220	300	460	786.6	0.054	0.090	0	N/A
2800	280	375	550	941.4	0.044	0.074	0	N/A
3150	315	420	616	1053	0.039	0.066	0	N/A
3550	355	475	683	1168.2	0.036	0.060	0	N/A
4500	450	600	866	1468.8	0.028	0.047	0	N/A

### **DC Reactor**

200V~230V/ 50~60Hz

Туре	kW	HP	Rated Amps of AC Reactor	Max. continuous Amps	Inductance (mh)
007	0.75	1	5	8.64	5.857
015	1.5	2	8	12.78	3.660
022	2.2	3	11	18	2.662
037	3.7	5	17	28.8	1.722
055	5.5	7.5	25	43.2	1.172
075	7.5	10	33	55.8	0.851
110	11	15	49	84.6	0.574
150	15	20	65	111.6	0.432
185	18.5	25	75	127.8	0.391
220	22	30	90	154.8	0.325

### 380V~460V/ 50~60Hz

Туре	kW	HP	Rated Amps of AC Reactor	Max. continuous Amps	Inductance (mh)
007	0.75	1	3	5.22	18.709
015	1.5	2	4	6.84	14.031
022	2.2	3	6	10.26	9.355
037	3.7	5	9	14.58	6.236
040	4	5	10.5	17.1	5.345

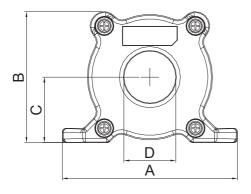
Туре	kW	HP	Rated Amps of AC Reactor	Max. continuous Amps	Inductance (mh)
055	5.5	7.5	12	19.8	4.677
075	7.5	10	18	30.6	3.119
110	11	15	24	41.4	2.338
150	15	20	32	54	1.754
185	18.5	25	38	64.8	1.477
220	22	30	45	77.4	1.247

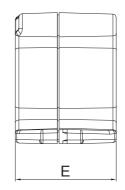
THD

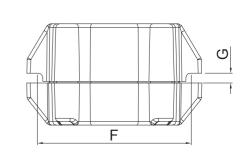
Motor Drive Spec	With	With Built in	DC Reactor			
Deceter Spee	3% Input	5% Input	4%	3% Input	5% Input	
Reactor Spec.	AC Reactor	AC Reactor	DC Reactor	AC Reactor	AC Reactor	
5th	38.5%	30.8%	25.5%	27.01%	25.5%	
7th	15.3%	9.4%	18.6%	9.54%	8.75%	
11th	7.1%	6.13%	7.14%	4.5%	4.2%	
13th	3.75%	3.15%	0.48%	0.22%	0.17%	
THDi	43.6%	34.33%	38.2%	30.5%	28.4%	
Note:	THDi may have some difference due to different installation conditions and environment					

According to IEC61000-3-12, DC Reactor is designed with 4% system impedance, and AC Reactor is designed with 3% system impedance.

## 7-5 Zero Phase Reactors

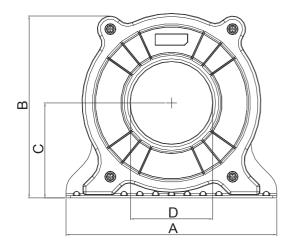






UNIT: mm(inch)

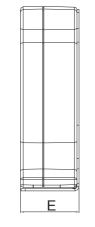
model	Α	В	С	D	E	F	G(Ø)	Torque
RF008X00A	98 (3.858)	73 (2.874)	36.5 (1.437)	29 (1.142)	56.5 (2.224)	86 (3.386)	5.5 (0.217)	< 10kgf/cm <sup>2</sup>
RF004X00A	110 (4.331)	87.5 (3.445)	43.5 (1.713)	36 (1.417)	53 (2.087)	96 (3.780)	5.5 (0.217)	< 10kgf/cm <sup>2</sup>

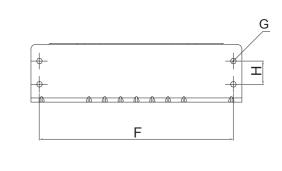


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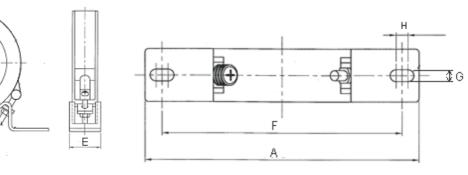
C





UNIT: mm(inch)

model	Α	В	С	D	E	F	G(Ø)	н	Torque
RF002X00A	200	172.5	90	78	55.5	184	5.5	22	<4Ekaf/am <sup>2</sup>
RFUUZAUUA	(7.874)	(6.791)	(3.543)	(3.071)	(2.185)	(7.244)	(0.217)	(0.866)	<45kgf/cm <sup>2</sup>



UNIT: mm(inch)

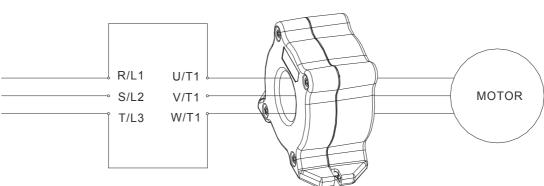
model	Α	В	С	D	Е	F	G(Ø)	Н	I
RF300X00A	241(9.488)	217(8.543)	114(4.488)	155(6.102)	42(1.654)	220(8.661)	6.5(0.256)	7.0(0.276)	20(0.787)

Reactor model (Note)	Recommended Wire Size		Wiring Method	Qty	Corresponding motor drives
RF008X00A	≦8 AWG	$\leq$ 8.37 mm <sup>2</sup>	Diagram A	1	VFD007C23A; VFD015C23A; VFD022C23A; VFD037C23A; VFD007C43A; VFD015C43A; VFD022C43A; VFD037C43A; VFD040C43A VFD055C43A
RF004X00A	$\leq$ 4 AWG	$\leq$ 21.15 mm <sup>2</sup>	Diagram A	1	VFD055C23A; VFD075C23A; VFD110C23A; VFD110C43A; VFD150C43A; VFD075C43A; VFD110C43A; VFD150C43A
RF002X00A	$\leq$ 2 AWG	$\leq$ 33.62 mm <sup>2</sup>	Diagram A	1	VFD150C23A; VFD185C23A; VFD220C23A; VFD300C23A; VFD370C23A; VFD185C43A; VFD220C43A; VFD300C43A; VFD370C43A; VFD450C43A; VFD550C43A; VFD750C43A
RF300X00A	≦300 MCM	$\leq$ 152 mm <sup>2</sup>	Diagram A	1	VFD450C23A; VFD550C23A; VFD750C23A; VFD900C23A; VFD900C43A; VFD1100C43A; VFD1320C43A; VFD1600C43A; VFD1850C43A; VFD2200C43A; VFD2800C43A; VFD3150C43A; VFD3550C43A; VFD4500C43A

Note: 600V insulated cable wire

#### Diagram A

Please put all wires through at least one core without winding.



Zero Phase Reactor

- Note 1: The table above gives approximate wire size for the zero phase reactors but the selection is ultimately governed by the type and diameter of cable fitted i.e. the cable must fit through the center hole of zero phase reactors.
- Note 2: Only the phase conductors should pass through, not the earth core or screen.
- **Note3:** When long motor output cables are used an output zero phase reactor may be required to reduce radiated emissions from the cable.

### 7-6 EMI Filter

					e Length	Radiation Emission default carrier
Model	input Current	Applicable EMI Filter	Zero Phase Reactor	default carri	frequency	
				EN61800-3 C1	EN61800-3 C2	EN61800-3 C2
VFD007C23A	6.4A			50m	100m	Pass
VFD015C23A	12A	EMF021A23A	RF008X00A	50m	100m	Pass
VFD022C23A	16A	EIVIFUZIAZSA	KF000A00A	50m	100m	Pass
VFD037C23A	20A			50m	100m	Pass
VFD055C23A	28A			50m	100m	Pass
VFD075C23A	36A	EMF056A23A	RF004X00A	50m	100m	Pass
VFD110C23A	52A			50m	100m	Pass
VFD150C23A	76A			50m	100m	Pass
VFD185C23A	83A	KMF3100A		50m	100m	Pass
VFD220C23A	99A		RF002X00A	50m	100m	Pass
VFD300C23A	124A			50m	100m	Pass
VFD370C23A	143A	B84143D0150R127		50m	100m	Pass
VFD450C23A	171A			50m	100m	Pass
VFD550C23A	206A	B84143B0250S020	RF300X00A	50m	100m	Pass
VFD750C23A	245A			50m	100m	Pass
VFD900C23A	331A	B84143B0400S020		50m	100m	Pass
VFD007C43A	4.3A			50m	100m	Pass
VFD015C43A	5.9A	EMF014A43A		50m	100m	Pass
VFD022C43A	8.7A			50m	100m	Pass
VFD037C43A	14A		RF008X00A	50m	100m	Pass
VFD040C43A	15.5A	EMF018A43A		50m	100m	Pass
VFD055C43A	17A			50m	100m	Pass
VFD075C43A	20A			50m	100m	Pass
VFD110C43A	26A	EMF039A43A	RF004X00A	50m	100m	Pass
VFD150C43A	35A	]		50m	100m	Pass
VFD185C43A	40A			50m	100m	Pass
VFD220C43A	47A	KMF370A		50m	100m	Pass
VFD300C43A	63A	]		50m	100m	Pass
VFD370C43A	74A		RF002X00A	50m	100m	Pass
VFD450C43A	101A			50m	100m	Pass
VFD550C43A	114A	-B84143D0150R127		50m	100m	Pass
VFD750C43A	157A	]		50m	100m	Pass

				CE Cabl	e Length	Radiation Emission	
Model	input Current	Applicable EMI Filter	Zero Phase Reactor	default carri	er frequency	default carrier frequency	
	ourion			EN61800-3 C1			
VFD900C43A	167A	B84143D0200R127		50m	100m	Pass	
VFD1100C43A	207A	D04143D0200R127		50m	100m	Pass	
VFD1320C43A	240A			50m	100m	Pass	
VFD1600C43A	300A	MIF3400B		50m	100m	Pass	
VFD1850C43A	380A	WIIF 3400B	RF300X00A	50m	100m	Pass	
VFD2200C43A	400A		KF300A00A	50m	100m	Pass	
VFD2800C43A	494A			50m	100m	Pass	
VFD3150C43A	555A	MIF3800		50m	100m	Pass	
VFD3550C43A	625A			50m	100m	Pass	
VFD4500C43A	866A	B84143B1000S020		50m	100m	Pass	

### **EMI Filter Installation**

All electrical equipment, including AC motor drives, will generate high-frequency/low-frequency noise and will interfere with peripheral equipment by radiation or conduction when in operation. By using an EMI filter with correct installation, much interference can be eliminated. It is recommended to use DELTA EMI filter to have the best interference elimination performance.

We assure that it can comply with following rules when AC motor drive and EMI filter are installed and wired according to user manual:

- EN61000-6-4
- EN61800-3: 1996

### EN55011 (1991) Class A Group 1 (1<sup>st</sup> Environment, restricted distribution)

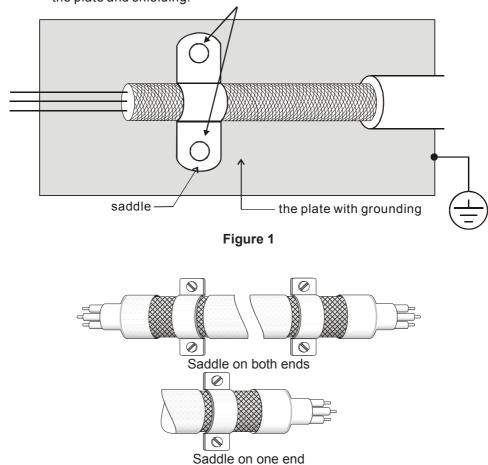
#### **General precaution**

- 1. EMI filter and AC motor drive should be installed on the same metal plate.
- 2. Please install AC motor drive on footprint EMI filter or install EMI filter as close as possible to the AC motor drive.
- 3. Please wire as short as possible.
- 4. Metal plate should be grounded.
- 5. The cover of EMI filter and AC motor drive or grounding should be fixed on the metal plate and the contact area should be as large as possible.

### Choose suitable motor cable and precautions

Improper installation and choice of motor cable will affect the performance of EMI filter. Be sure to observe the following precautions when selecting motor cable.

- 1. Use the cable with shielding (double shielding is the best).
- 2. The shielding on both ends of the motor cable should be grounded with the minimum length and maximum contact area.
- 3. Remove any paint on metal saddle for good ground contact with the plate and shielding.



Remove any paint on metal saddle for good ground contact with the plate and shielding.

Figure 2

#### The length of motor cable

When motor is driven by an AC motor drive of PWM type, the motor terminals will experience surge voltages easily due to components conversion of AC motor drive and cable capacitance. When the motor cable is very long (especially for the 460V series), surge voltages may reduce insulation quality. To prevent this situation, please follow the rules below:

- Use a motor with enhanced insulation.
- Connect an output reactor (optional) to the output terminals of the AC motor drive

The length of the cable between AC motor drive and motor should be as short as possible (10 to 20 m or less)

For models 7.5hp and above:

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

■ For models 5hp and less:

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

#### 

Never connect phase lead capacitors or surge absorbers to the output terminals of the AC motor drive.

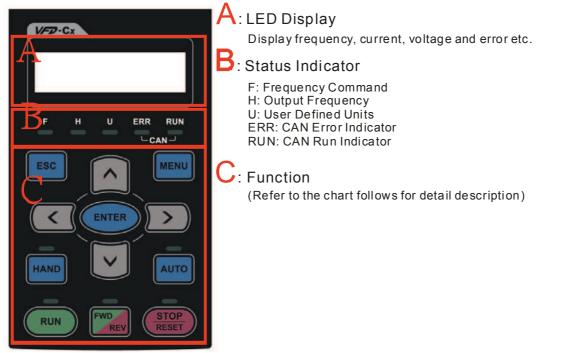
- If the length is too long, the stray capacitance between cables will increase and may cause leakage current. It will activate the protection of over current, increase leakage current or not insure the correction of current display. The worst case is that AC motor drive may damage.
- If more than one motor is connected to the AC motor drive, the total wiring length is the sum of the wiring length from AC motor drive to each motor.
- For the 460V series AC motor drive, when an overload relay is installed between the drive and the motor to protect motor over heating, the connecting cable must be shorter than 50m. However, an overload relay malfunction may still occur. To prevent the malfunction, install an output reactor (optional) to the drive or lower the carrier frequency setting (Pr.00-17).

### 

When a thermal O/L relay protected by motor is used between AC motor drive and motor, it may malfunction (especially for 460V series), even if the length of motor cable is only 165 ft (50m) or less. To prevent it, please use AC reactor and/or lower the carrier frequency (Pr. 00-17 PWM carrier frequency).

## 7-7 Digital Keypad

### 7-7-1 KPC-CE01



Key	Description
ESC	ESC Key
200	Press ESC key to return to the previous page. It also functions as a return to last category key in the sub-menu.
MENU	Menu Key
	Press MENU key under any condition will return to the main MENU.
	Menu content:
	1. Parameter Detail 3. Keypad locked
	2. Copy Parameter 4. PLC Function
ENTER	ENTER Key
	Press ENTER and go to the next level. If it is the last level then press ENTER to execute the command.
HAND	HAND ON Key
	1. HAND key will operates according to the parameter settings when the source of HAND master frequency
	command and the source of HAND operation command is properly set,. The factory setting of the source
	command for frequency and operation are from the digital keypad .
	2. Press HAND key in stop status, the drive setting switches to the parameter setting of HAND. Press HAND
	key in during operation, the drive will come to stop then switches to the parameter setting of HAND. 3. When process complete: H/A LED ON.
AUTO	Auto Operation Key
AUIO	1. AUTO function executes according to the parameter settings of the source of AUTO frequency and AUTO
	operation. The factory setting is the external terminal (source of operation is 4-20mA).
	2. Press the ATUO key in stop status, the drivel switches to auto-setting. Press the auto key during operation
	status, the drivel will come to stop and switch to auto-setting.
	3. When process complete: H/A LED is OFF
FWD/REV	Operation Direction Key
	1. FWD/REV key controls the operation direction but will NOT activate the drive. FWD: forward, REV: reverse.
	2. The drive operates in the direction as shown by the LED light.
RUN	Start Key
	1. This button is functional only when the keypad is the source of the command.
	2. This button allows the motor drive to run by following its settings. See Description of LED functions for LED
	status 2. Droce repetedly the "DUN" bytten is allow while the materiality is stamping
STOP	3. Press repeatedly the "RUN" button is allow while the motor drive is stopping. Stop Key.
SIUF	1. STOP key has the highest priority in command.
	2. Press STOP key, the drive will come to stop under any condition.
	3. The RESET key can be used to reset the drive when faults occur. If the RESET key is not responding, check
	MENU → Fault Records and check the most recent fault.
L	

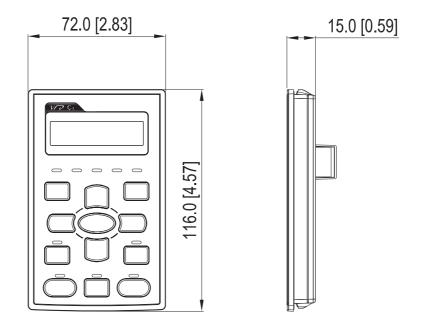
#### LED **Descriptions** Steady ON: operation indicator of the AC motor drive, including DC brake, zero speed, standby, restart after fault and speed search. RUN Blinking: drive is decelerating to stop or in the status of base block. Steady OFF: drive doesn't execute the operation command Steady ON: stop indicator of the AC motor drive. STOP Blinking: drive is in the standby status. Steady OFF: drive doesn't execute "STOP" command. Green light= Forward ; Red light= Reversely Operation Direction LED Steady ON: the drive is running forward. WD Blinking: the drive is changing direction. RE Steady Off: the drive is running reversely. RUN (Green light): Condition/State LED status OFF CANopen at initial No LED CANopen at pre-operation Blinking ON 200 | 200 CANopen ~"RUN" ms ms OFF Single CANopen at stopped flash ON 200 200 100 ms ms ms OFF ON CANopen at operation status No LED ERR (Red light): LED Condition/ State status OFF No Error Single One message fail flash ON 200 200 100 ms ms ms OFF Double Guarding fail or heartbeat fail CANopen ~"ERR" flash ON 200 200 100 200 ms ms ms ms OFF Triple SYNC fail flash ON 200 200 200 200 200 100 ms ms ms ms ms ms OFF

### Descriptions of LED Functions

ON

Bus off

### 7-7-2 Dimension



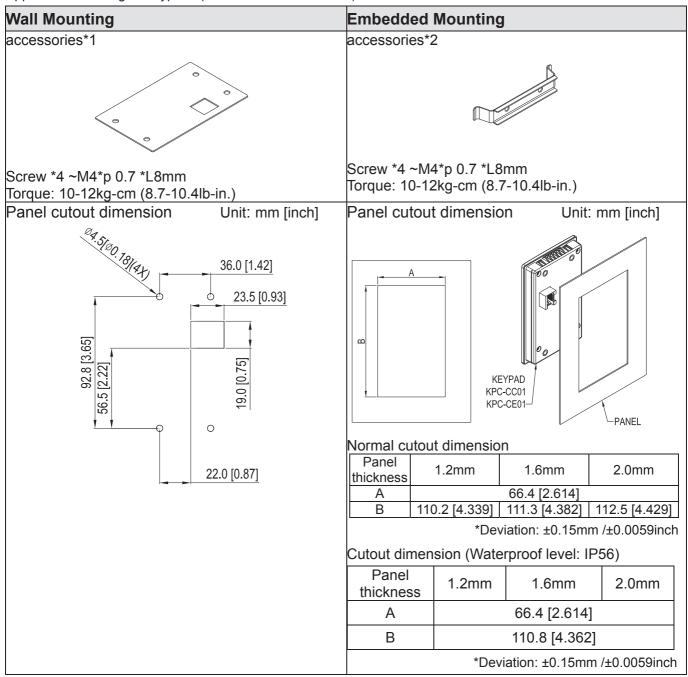
### 7-7-3 RJ45 Extension Lead for Digital Keypad

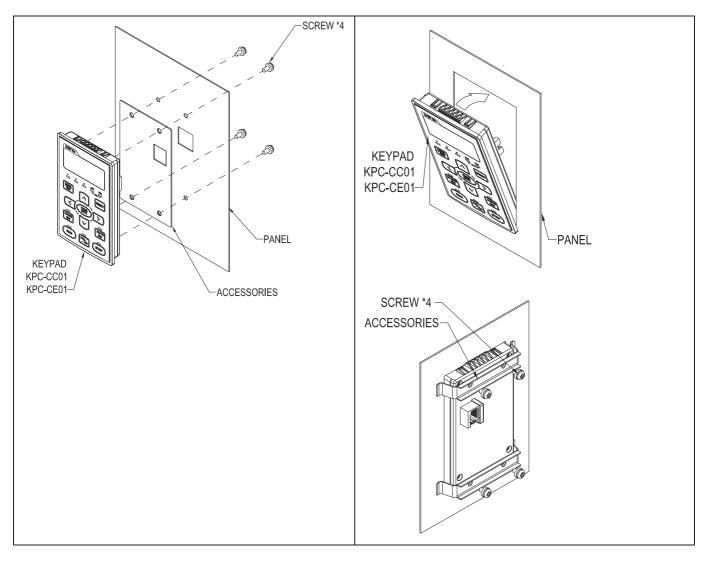
Part #	Description
CBC-K3FT	3 feet RJ45 extension lead (approximately 0.9m)
CBC-K5FT	5 feet RJ45 extension lead (approximately 1.5 m)
CBC-K7FT	7 feet RJ45 extension lead (approximately 2.1 m)
CBC-K10FT	10 feet RJ45 extension lead (approximately 3 m)
CBC-K16FT	16 feet RJ45 extension lead (approximately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

## 7-8 Panel Mounting (MKC-KPPK)

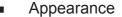
For MKC-KPPK model, user can choose wall mounting or embedded mounting, protection level is IP56.

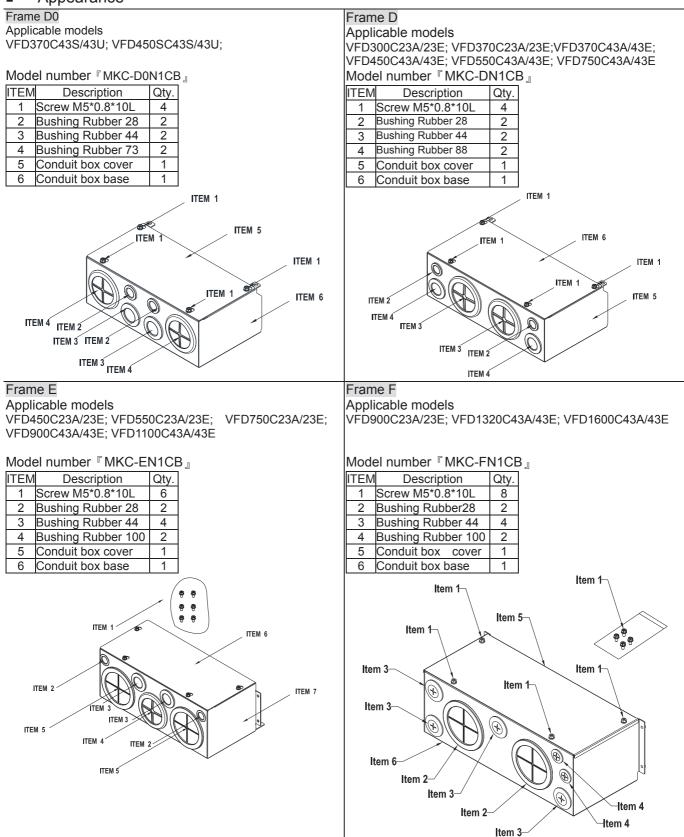
Applicable to the digital keypads (KPC-CC01 & KPC-CE01).

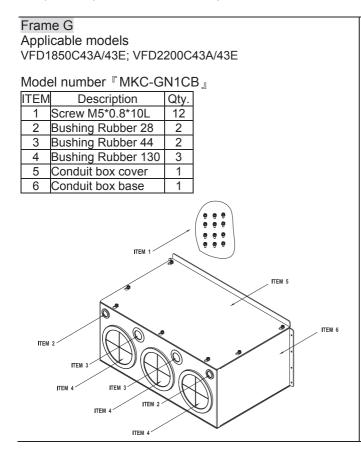




### 7-9 Conduit Box Kit



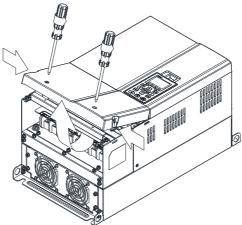




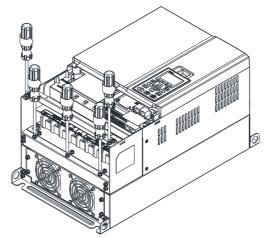
### Conduit Box Installation

#### Frame D0

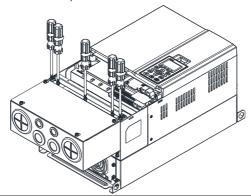
1. Loosen the cover screws and press the tabs on each side of the cover to remove the cover, as shown in the following figure. Screw torque: 12~15kg-cm (10.4~13 lb-in)



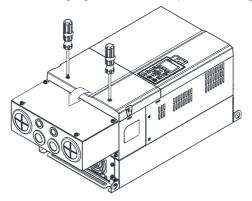
2. Remove the 5 screws shown in the following figure. Screw torque:24~26kg-cm (20.8~22.6lb-in)



3. Install the conduit box by fasten the 5 screws shown in the following figure. Screw torque:24~26kg-cm (20.8~22.6lb-in)

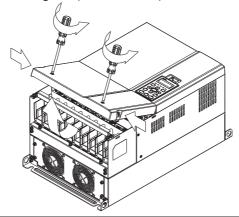


4. Fasten the 2 screws shown in the following figure. Screw torque: 12~15kg-cm (10.4~13 lb-in)

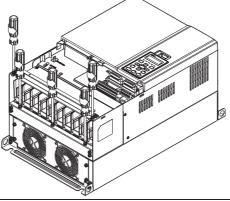


#### Frame D

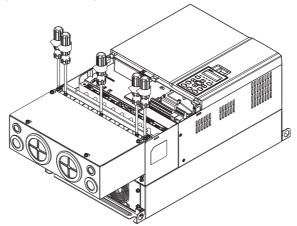
1. Loosen the cover screws and press the tabs on each side of the cover to remove the cover, as shown in the following figure. Screw torque: 12~15kg-cm (10.4~13 lb-in)



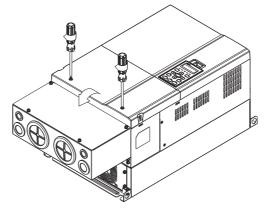
2. Remove the 5 screws shown in the following figure. Screw torque:24~26kg-cm (20.8~22.6lb-in)



3. Install the conduit box by fasten the 5 screws shown in the following figure. Screw torque:24~26kg-cm (20.8~22.6lb-in)

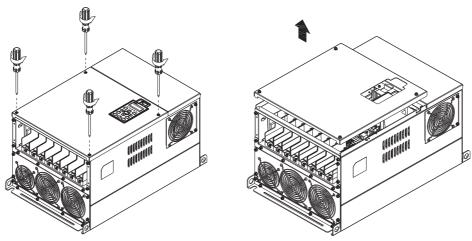


4. Fasten the 2 screws shown in the following figure. Screw torque: 12~15kg-cm (10.4~13 lb-in)

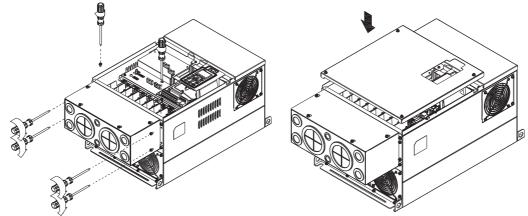


#### Frame E

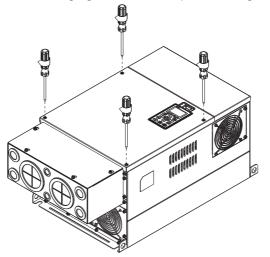
1. Loosen the 4 cover screws and lift the cover; Screw torque: 12~ 15 kg-cm (10.4~13lb-in).



2. Fasten the 6 screws shown in the following figure and place the cover back to the original position. Screw torque: 24~26kg-cm (20.8~22.6lb-in).

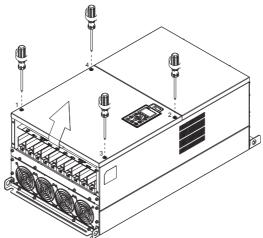


3. Fasten the 4 screws shown in the following figure. Screw torque:12~15kg-cm (10.4~13lb-in) \_\_\_\_

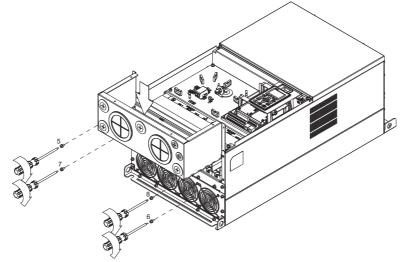


### Frame F

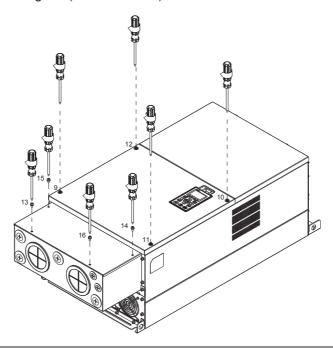
1. Loosen the cover screws and press the tabs on each side of the cover to remove the cover, as shown in the following figure. Screw torque: 12~15kg-cm (10.4~13 lb-in).



2. Install the conduit box by fastens the 4 screws, as shown in the following figure. Screw torque: 24~26kg-cm (20.8~22.6lb-in).

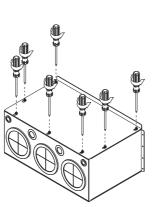


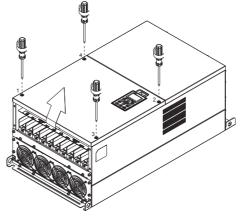
 Install the conduit box by fasten all the screws shown in the following figure Screw 9~12 torque: 12~15kg-cm (10.4~13.6lb-in) Screw 13~16 torque: 24~26kg-cm (20.8~22.6lb-in)



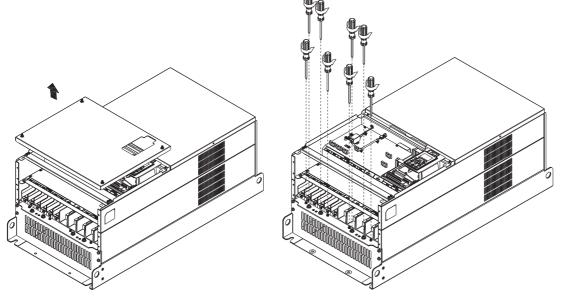
#### Frame G

 On the conduit box, loosen 7 of the cover screws and remove the cover <sup>¬</sup> Screw torque: 24~26kg-cm (20.8~22.6lb-in) . On the drive, loosen 4 of the cover screws and press the tabs on each side of the cover to remove the cover, as shown in the following figure. Screw torque: 12~15kg-cm (10.4~13lb-in).

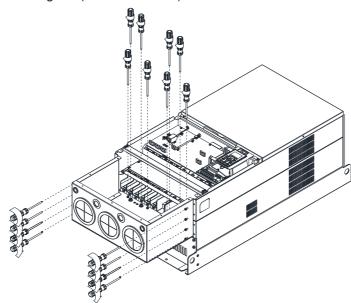




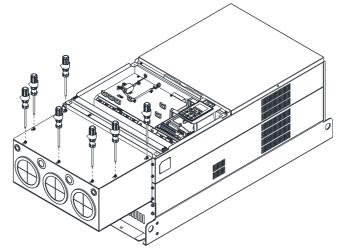
Remove the top cover and loosen the screws. M5 Screw torque: 24~26kg-cm (20.8~22.6lb-in) M8 Screw torque: 100~120kg-cm (86.7~104.1lb-in)



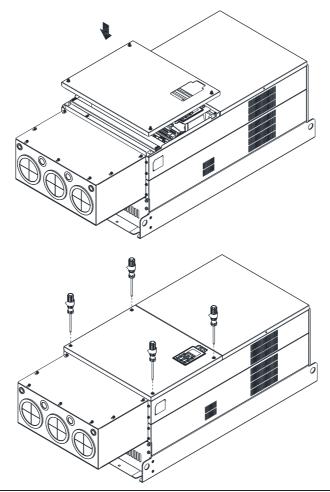
 Install the conduit box by fastening all the screws shown in the following figure. M5 Screw torque: 24~26kg-cm (20.8~22.6lb-in) M8 Screw torque: 100~120kg-cm (86.7~104.1lb-in)



Fasten all the screws. Screw torque: 24~26kg-cm (20.8~22.6lb-in).

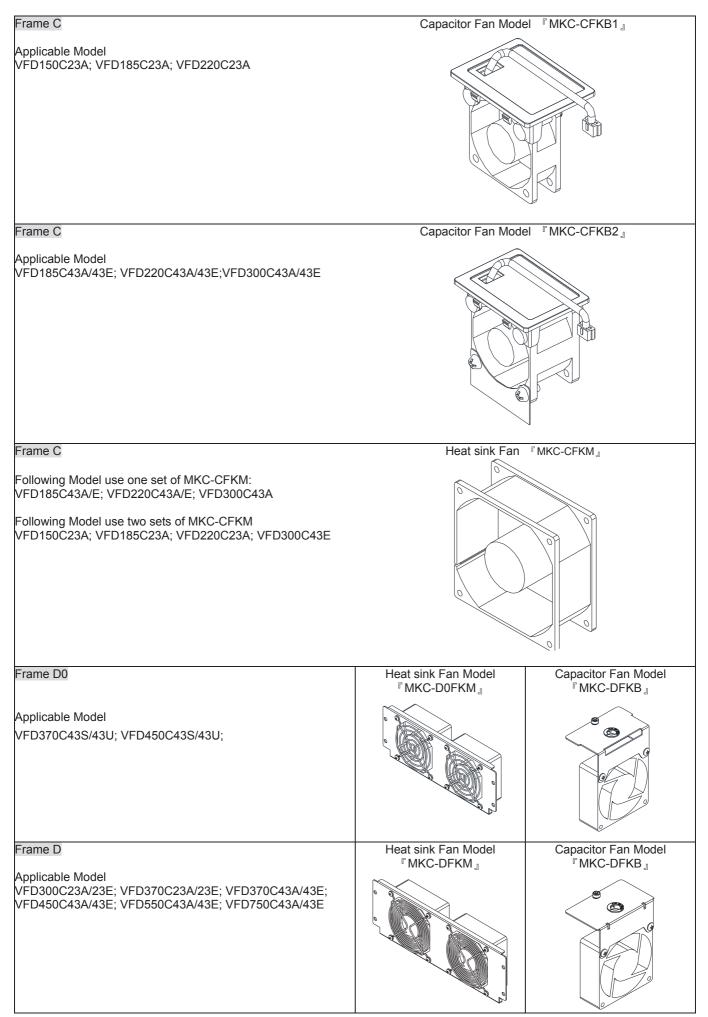


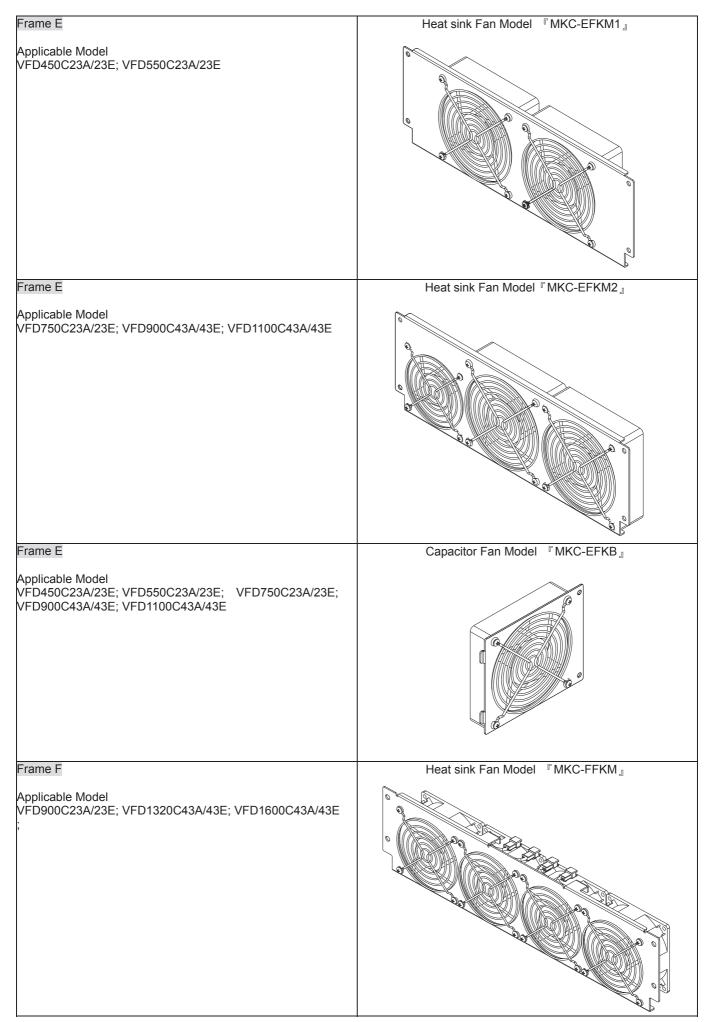
Place the cover back to the top and fasten the screws (as shown in the figure). Screw torque:  $12 \sim 15$ kg-cm ( $10.4 \sim 13$ lb-in).

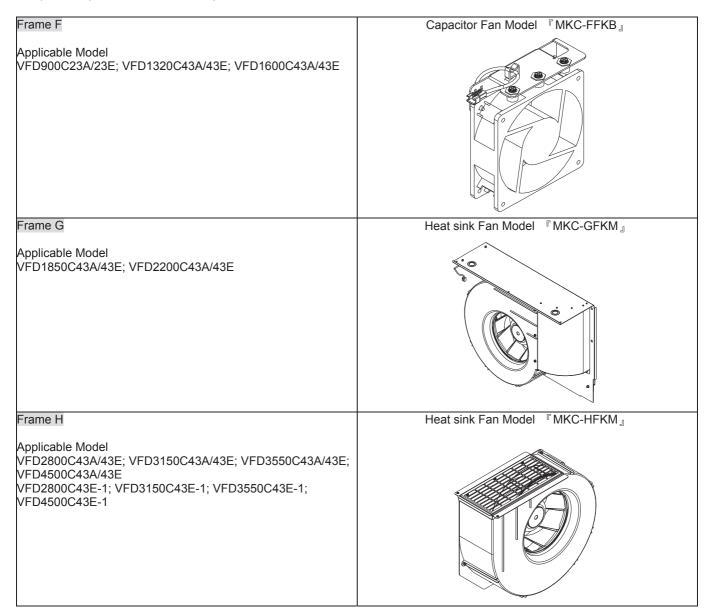


### 7-10 Fan Kit

# Frames of the fan kit Frame A Heat sink Fan Model <sup>®</sup> MKC-AFKM <sub>』</sub> Applicable Model VFD015C23A; VFD022C23A; VFD037C23A;VFD022C43A/43E; VFD037C43A/43E;VFD040C43A/43E; VFD055C43A/43E Heat sink Fan Model 『MKC-BFKM1』 Frame B Applicable Model VFD055C23A; VFD075C43A/43E Frame B Heat sink Fan Model 『MKC-BFKM2』 Applicable Model VFD075C23A; VFD110C23A; VFD110C43A/43E; VFD150C43A/43E Frame B Capacitor Fan Model 『MKC-BFKB』 Applicable Model VFD055C23A; VFD075C23A; VFD110C23A;VFD075C43A/43E; VFD110C43A/43E;VFD150C43A/43E







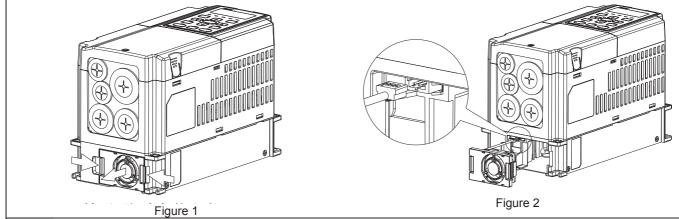
#### Fan Removal

### Frame A

Model 『MKC-AFKM』: Heat Sink Fan

#### Applicable model

VFD015C23A; VFD022C23A; VFD022C43A/43E; VFD037C23A; VFD037C43A/43E; VFD040C43A/43E; VFD055C43A/43E Refer to Figure 1, press the tabs on both side of the fan to 2. Disconnect the power terminal before removing the fan. 1. successfully remove the fan. (As shown below.)



(As shown below.)

Figure 2

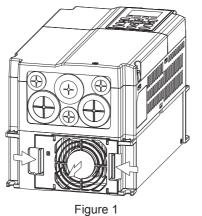
#### Frame B

#### Model 『MKC-BFKM1』 Heat Sink Fan

#### Applicable model

VFD055C23A; VFD075C43A/43E;VFD075C23A;

1. Refer to Figure 1, press the tab on both side of the fan to 2. Disconnect the power terminal before removing the fan. successfully remove the fan.

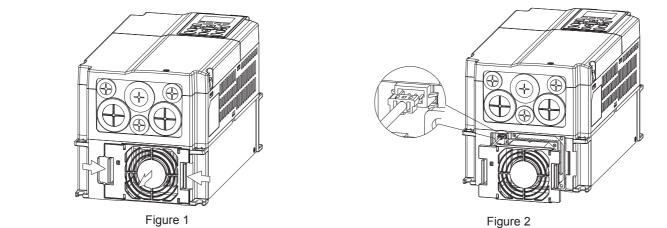


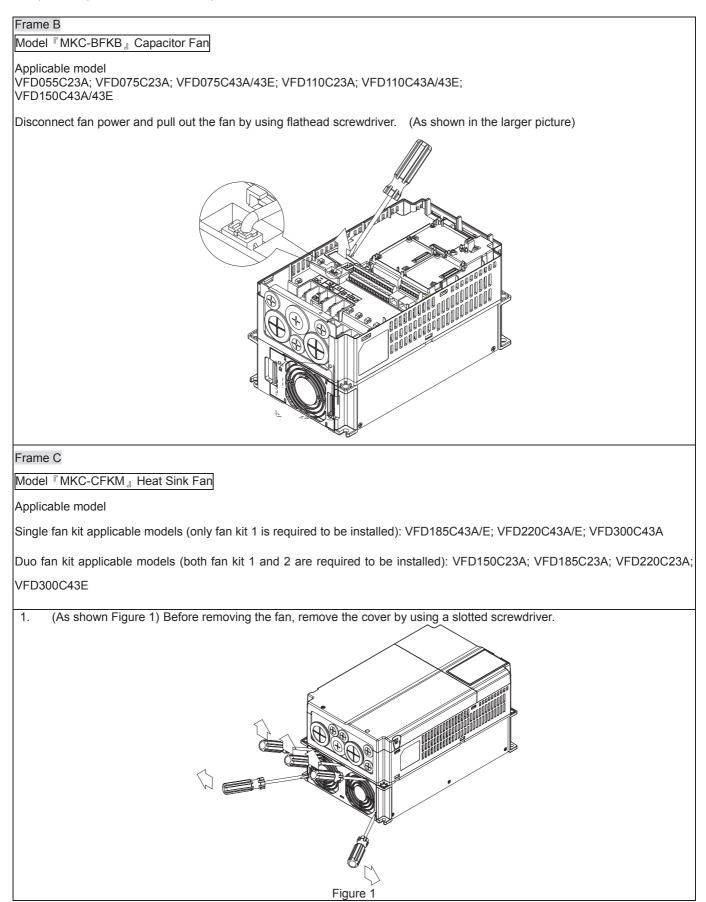
Frame B

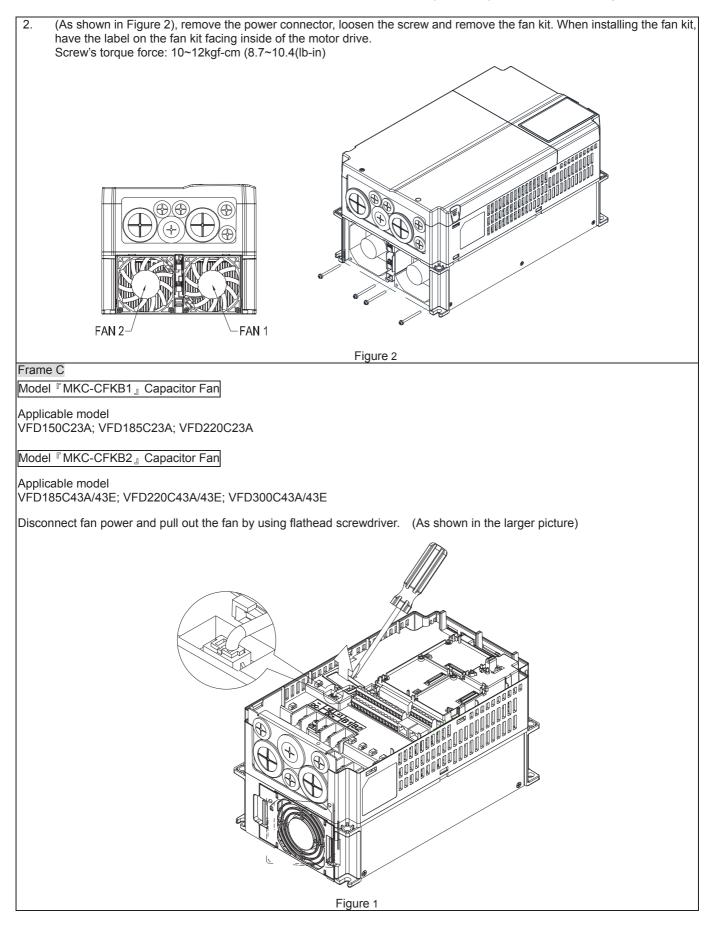
### Model MKC-BFKM2 Heat Sink Fan

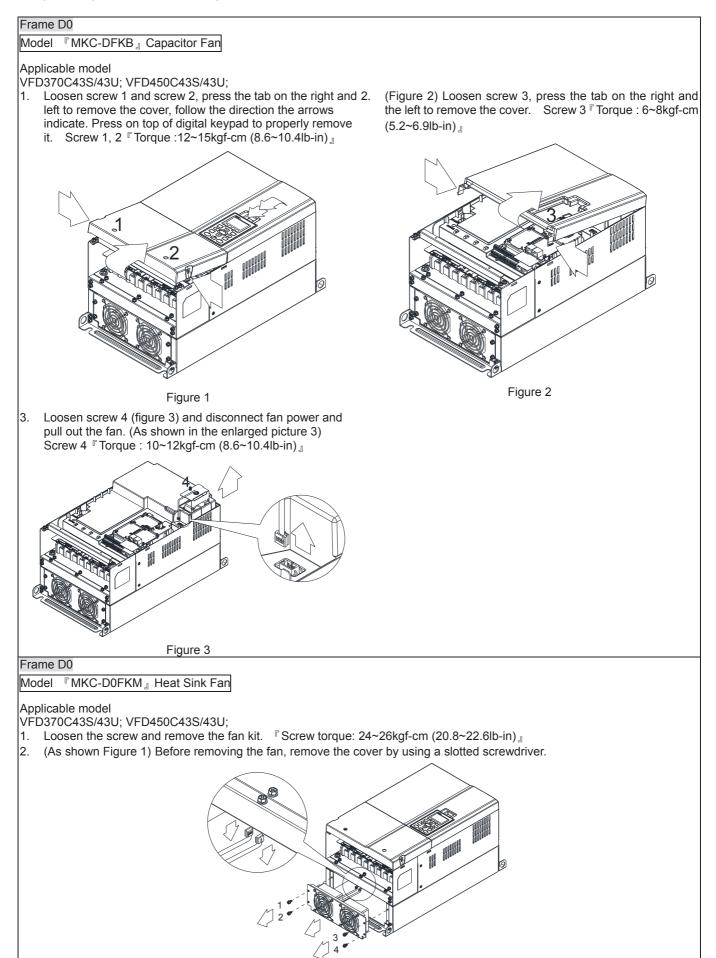
#### Applicable model

- VFD075C23A; VFD110C23A; VFD110C43A/43E; VFD150C43A/43E
- 1. Refer to Figure 1, press the tab on both side of the fan to 2. Disconnect the power terminal before removing the fan. successfully remove the fan. (As shown below.)

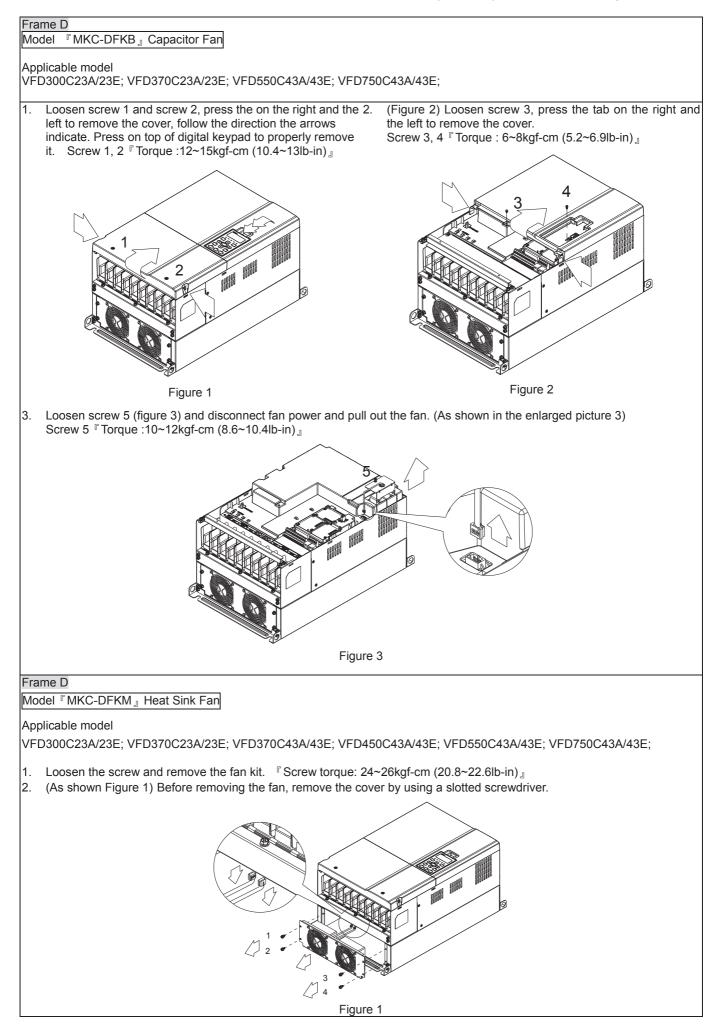












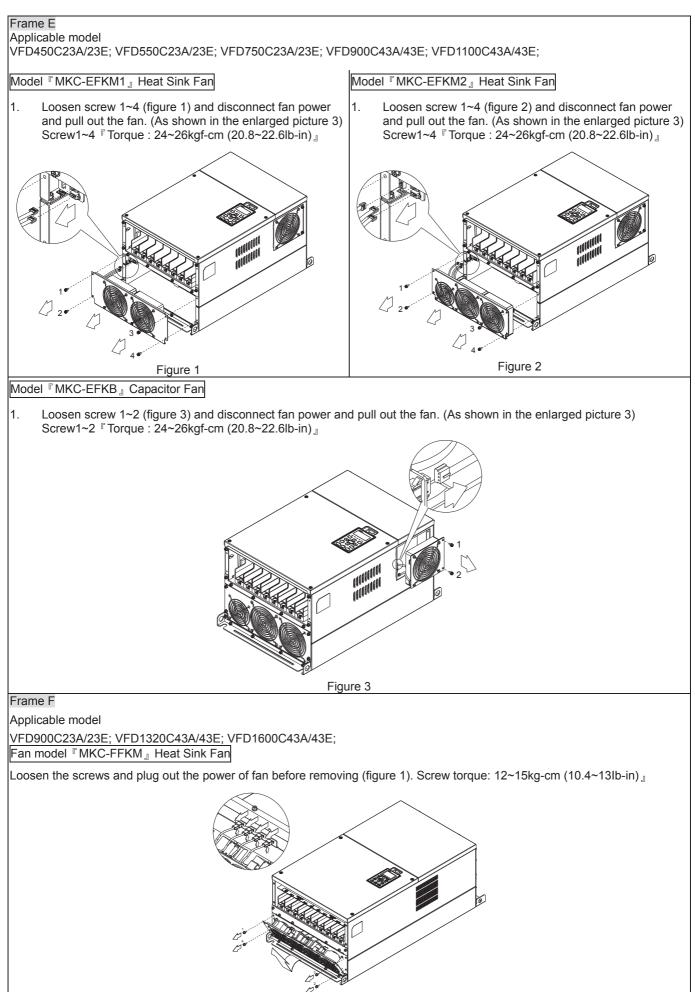
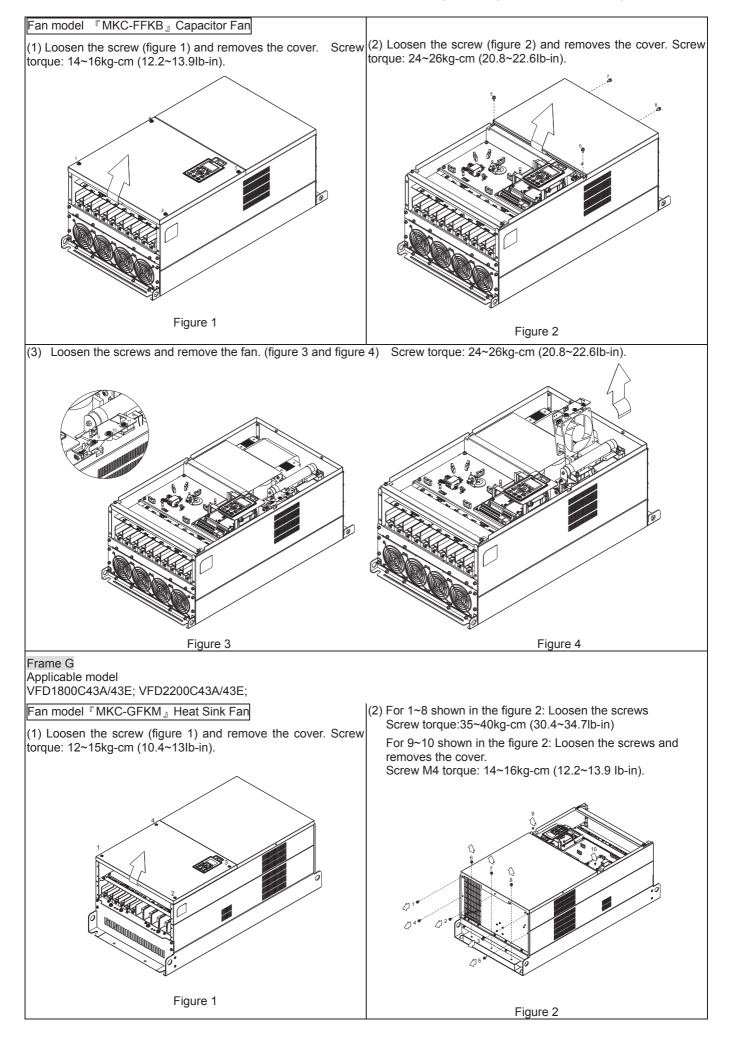
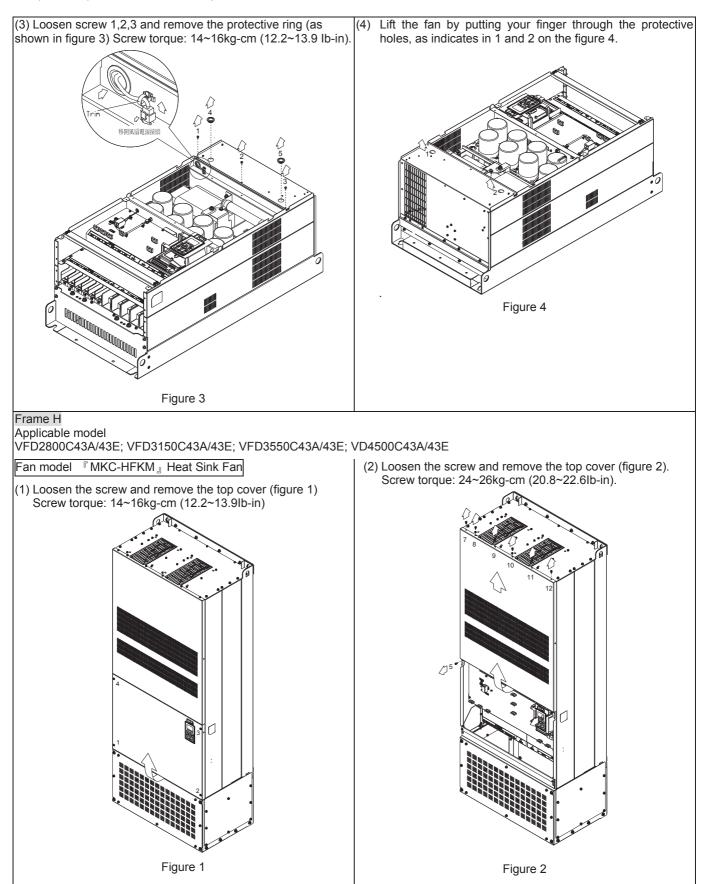
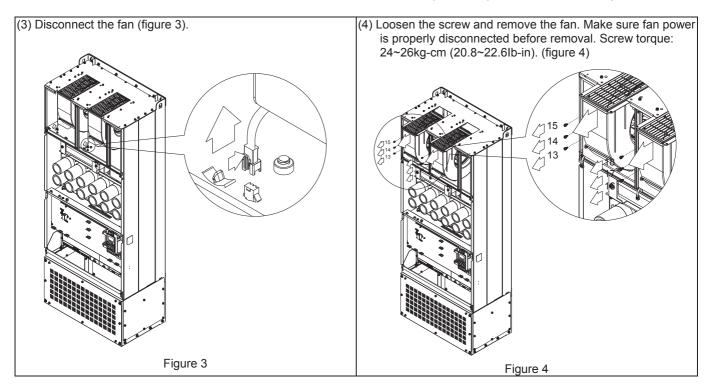


Figure 1



### Chapter 7 Optional Accessories | C2000 Series





### 7-11 Flange Mounting Kit

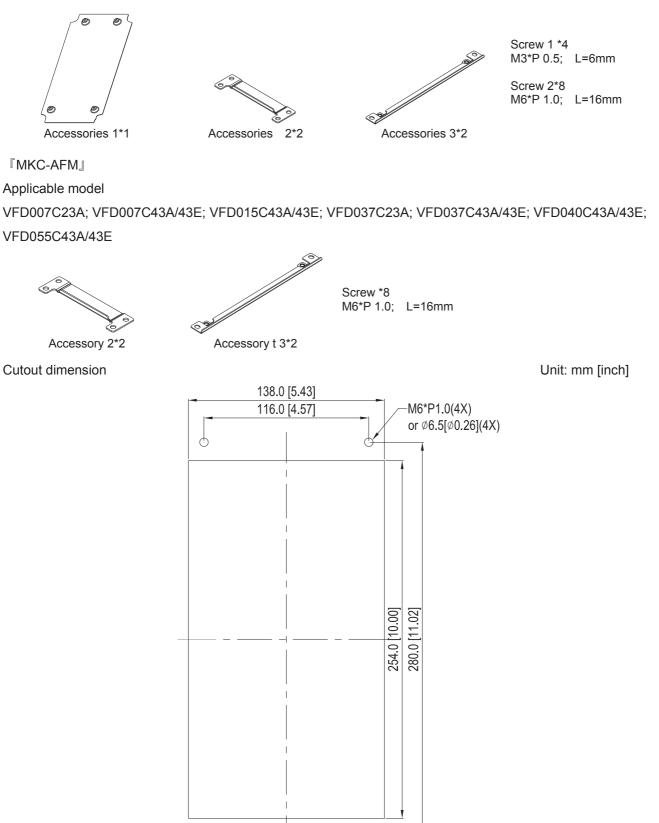
Applicable Models, Frame A~F

Frame A

『MKC-AFM1』

### Applicable model

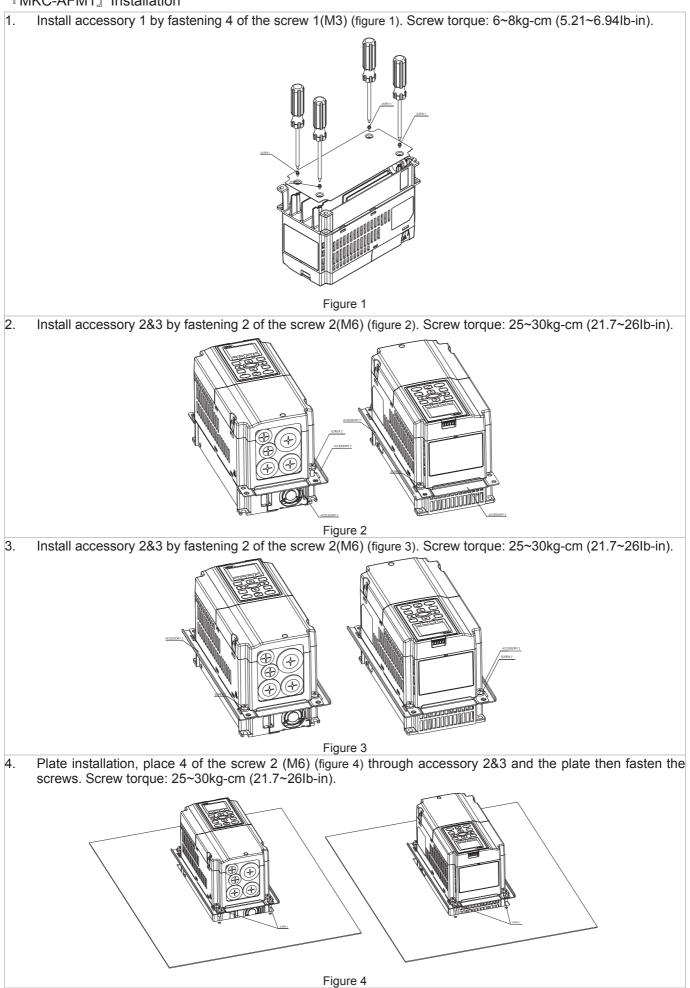
VFD015C23A; VFD022C23A; VFD022C43A/43E



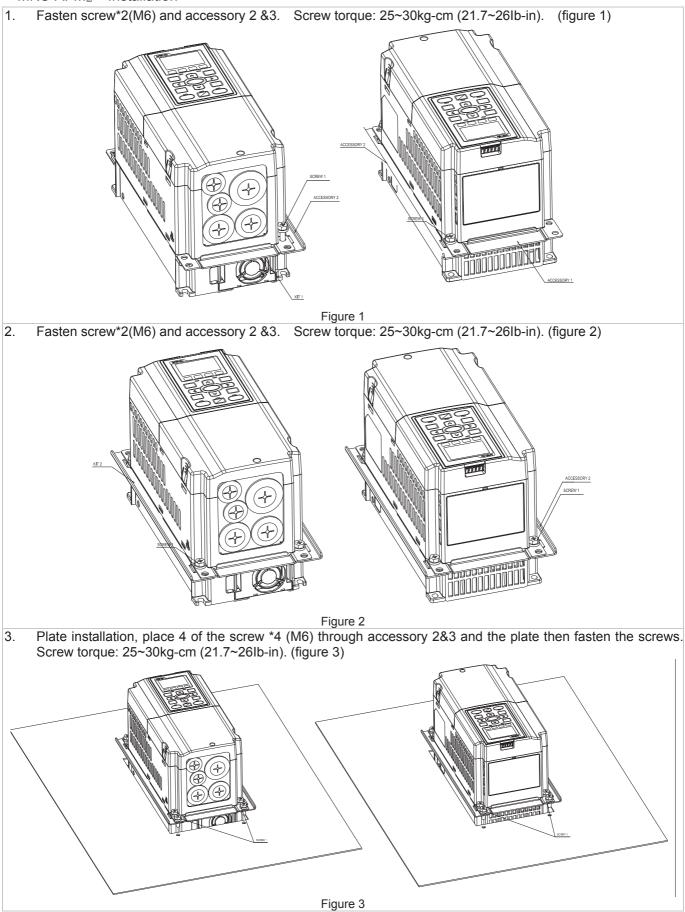
 $\bigcirc$ 

 $\bigcirc$ 

### 『MKC-AFM1』 Installation



### 『MKC-AFM』 Installation



### Frame B

『MKC-BFM』

### Applicable model

VFD055C23A; VFD075C23A; VFD110C23A; VFD075C43A/43E; VFD110C43A/43E; VFD150C43A/43E

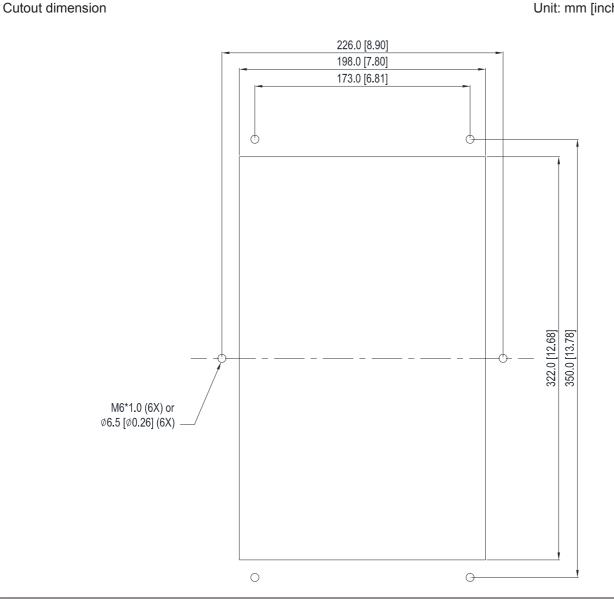
2\*2



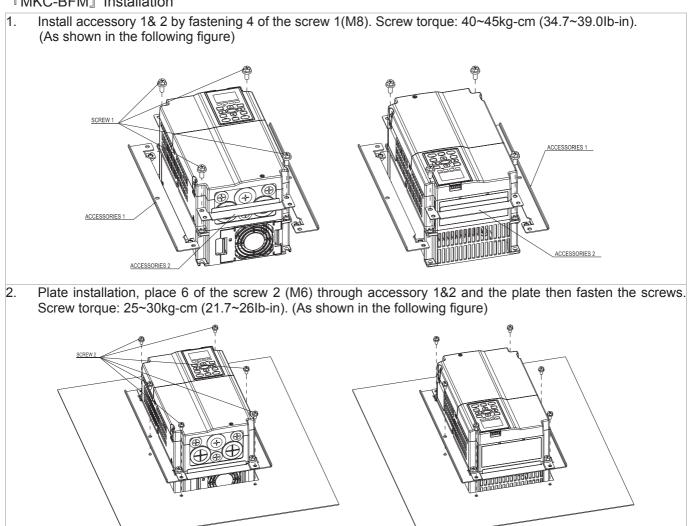
Accessory 1\*2



Screw 1 \*4 ~ M8\*P 1.25; Screw 2\*6 ~ M6\*P 1.0;



### 『MKC-BFM』 Installation



### Frame C

### 『MKC-CFM』

### Applicable model

VFD150C23A; VFD185C23A; VFD220C23A; VFD185C43A/43E; VFD220C43A/43E; VFD300C43A/43E

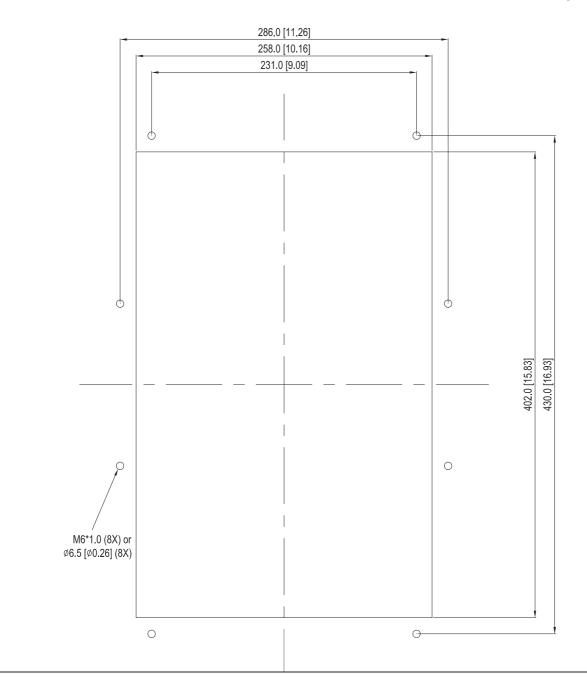




Screw 1\*4 ~ M8\*P 1.25; Screw 2\*8 ~ M6\*P 1.0;

Accessory 1\*2

Cutout dimension



### 『MKC-CFM』 Installation

 Install accessory 1& 2 by fastening 4 of the screw 1(M8). Screw torque: 50~55kg-cm (43.4~47.7lb-in). (As shown in the following figure)

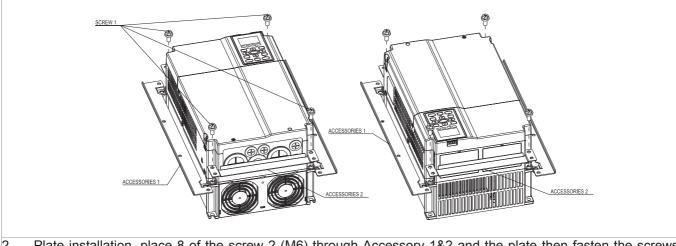
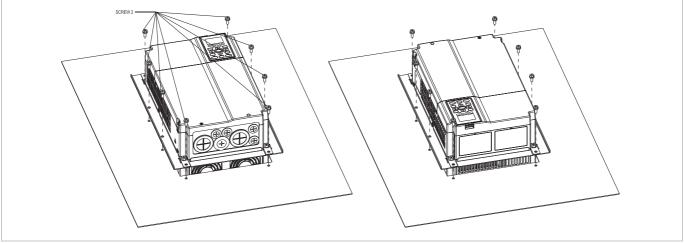


 Plate installation, place 8 of the screw 2 (M6) through Accessory 1&2 and the plate then fasten the screws. Screw torque: 25~30kg-cm (21.7~26lb-in). (As shown in the following figure)

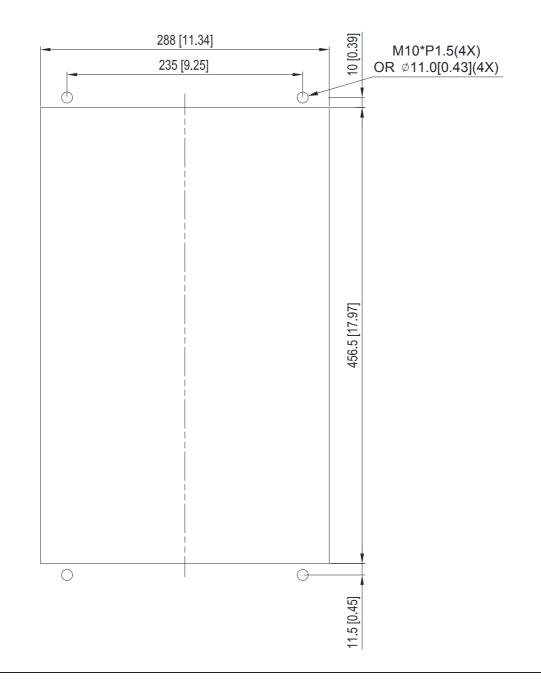


### Frame D0

### Applicable model

VFD370C43S/U; VFD450C43S/U

### Cutout dimension



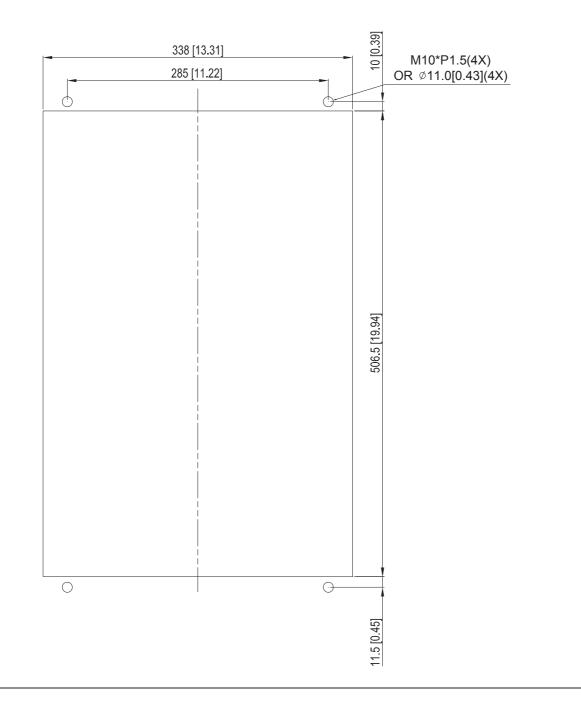
Chapter 7 Optional Accessories | C2000 Series

### Frame D

### Applicable model

VFD300C23A/23E; VFD370C23A/23E; VFD550C43A/43E; VFD750C43A/43E

### Cutout dimension

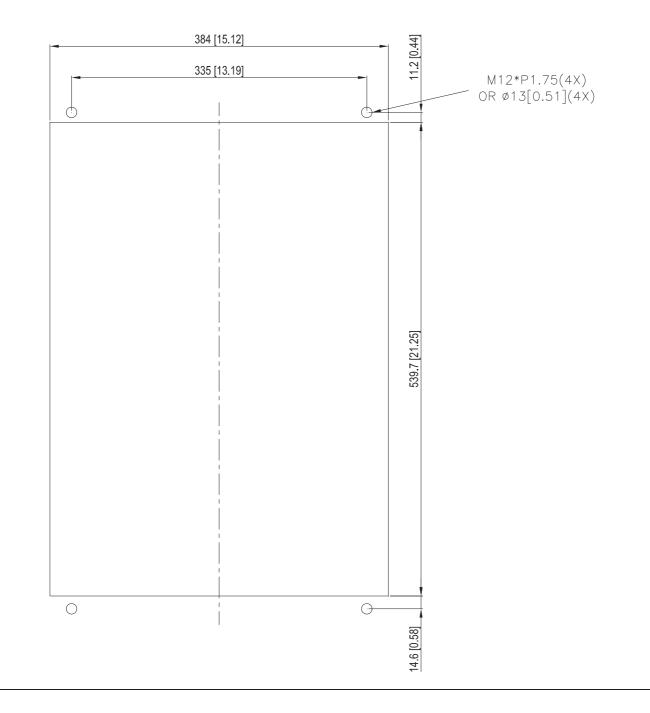


### Frame E

### Applicable model

VFD450C23A/23E; VFD550C23A/23E; VFD750C23A/23E; VFD900C43A/43E; VFD1100C43A/43E;

### Cutout dimension



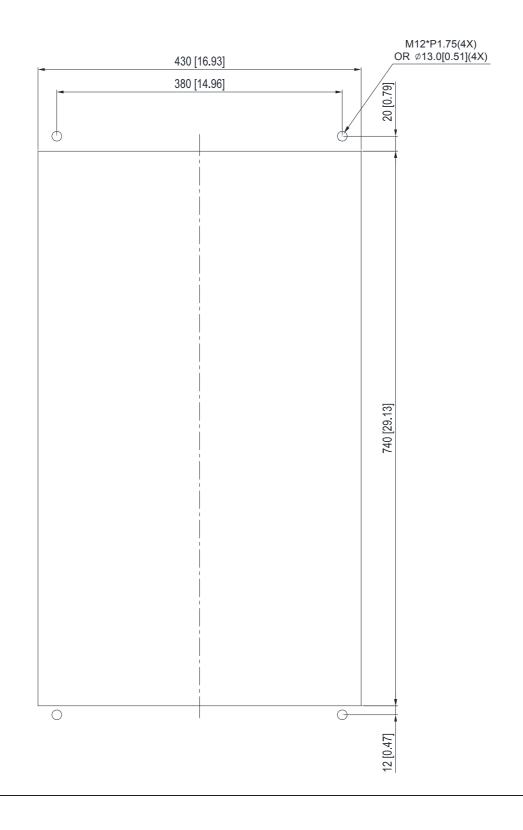
Frame D0&D&E 1. Loosen 8 screws and remove Fixture 2 (as shown in 2. Loosen 10 screws and remove Fixture 1 (as shown the following figure). in the following figure). 3. Fasten 4 screws (as shown in the following figure). Fasten 5 screws (as shown in the following figure). 4. Screw torque: 30~32kg-cm (26.0~27.8lb-in). Screw torgue: 30~32kg-cm (26.0~27.8lb-in). Fasten 5 screws (as shown in the following figure). 5. Fasten 4 screws (as shown in the following figure). 6. Screw torque: 24~26kg-cm (20.8~22.6lb-in). Screw torque: 24~26kg-cm (20.8~22.6lb-in). Place 4 screws (M10) through Fixture 1&2 and the 7. plate then fasten the screws. (as shown in the following figure) Frame D0/D M10\*4 Screw torque: 200~240kg-cm (173.6~208.3lb-in). Frame E M12\*4 Screw torque: 300~400kg-cm (260~347lb-in). FIXTURE 1

### Frame F

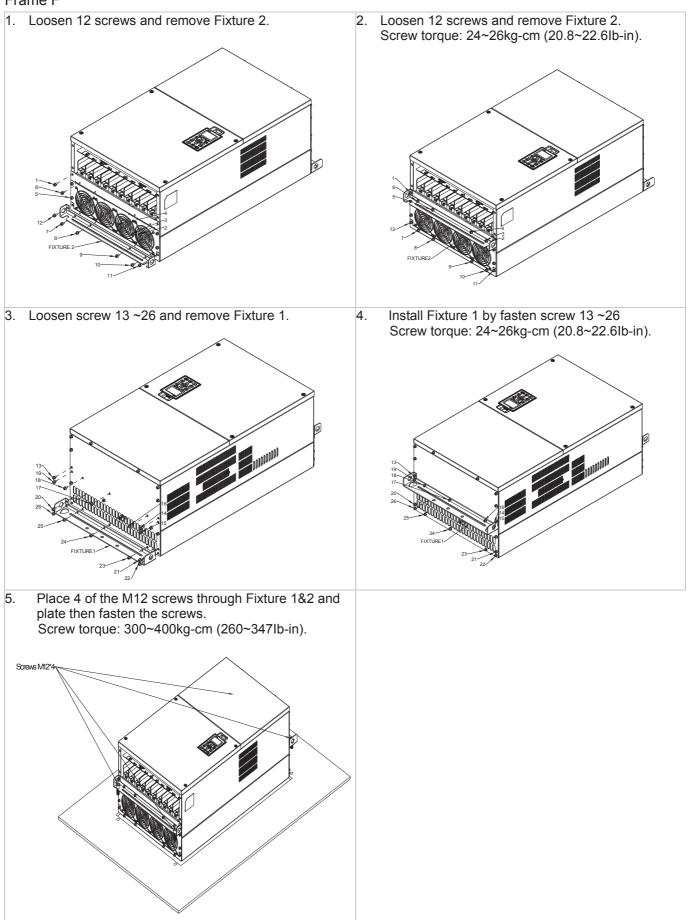
### Applicable model

VFD900C23A/23E; VFD1320C43A/43E; VFD1600C43A/43E

### Cutout dimension



### Frame F



### 7-12 USB/RS-485 Communication Interface IFD6530

## Marning

✓ Please thoroughly read this instruction sheet before installation and putting it into use.

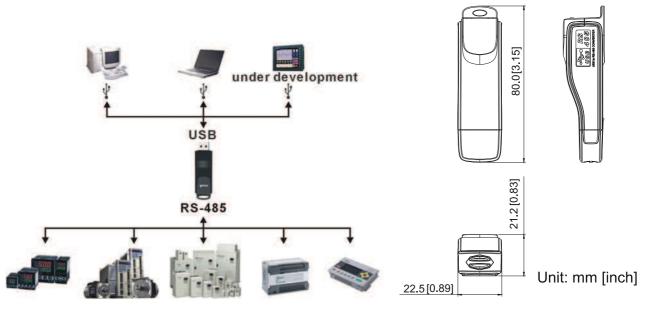
✓ The content of this instruction sheet and the driver file may be revised without prior notice. Please consult our distributors or download the most updated instruction/driver version at http://www.delta.com.tw/product/em/control/cm/control\_cm\_main.asp

### 1. Introduction

IFD6530 is a convenient RS-485-to-USB converter, which does not require external power-supply and complex setting process. It supports baud rate from 75 to 115.2kbps and auto switching direction of data transmission. In addition, it adopts RJ-45 in RS-485 connector for users to wire conveniently. And its tiny dimension, handy use of plug-and-play and hot-swap provide more conveniences for connecting all DELTA IABU products to your PC.

Applicable Models: All DELTA IABU products.

(Application & Dimension)



### 2. Specifications

Power supply	No external power is needed	
Power consumption	1.5W	
Isolated voltage	2,500VDC	
Baud rate	75, 150, 300, 600, 1,200, 2,400, 4,800, 9,600, 19,200, 38,400, 57,600, 115,200 bps	
RS-485 connector	RJ-45	
USB connector	A type (plug)	
Compatibility	patibility Full compliance with USB V2.0 specification	
Max. cable length	Max. cable length RS-485 Communication Port: 100 m	
Support RS-485 half-duplex transmission		

### Chapter 7 Optional Accessories | C2000 Series

■ RJ-45



PIN	Description
1	Reserved
2	Reserved
3	GND
4	SG-

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

### 3. Preparations before Driver Installation

Please extract the driver file (IFD6530\_Drivers.exe) by following steps. You could find driver file (IFD6530\_Drivers.exe) in the CD supplied with IFD6530.

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

STEP 1	STEP 2
InstallShield Wizard	InstallShield Wizard
Welcome to the InstallShield Wizard for Silicon Laboratories CP210x Evaluation Kit Tools	License Agreement Please read the following license agreement carefully.
The InstallShieldR Wizard will install Silicon Laboratories CP210x Evaluation Kit Tool: Release 3.31 on your computer. To continue, click Next.	Press the PAGE DDWN key to see the rest of the agreement.
Cancel	

### **STEP 3**

STEP 4

Choose Destination Location Select folder where Setup will install files.	InstallShield Wizard Complete
Setup will install Silicon Laboratories CP210x Evaluation Kit Tools Release 3.31 in the following folder.	Setup has finished installing Silicon Laboratories CP210x Evaluation Kit Tools Release 3.31 on your computer.
To install to this folder, click Next. To install to a different folder, click Browse and select another folder.	
Destination Folder	
C:\SiLabs\MCU\CP210x Bjowse	
talShield	
< Back Next> Cancel	Cancel

### **STEP 5**

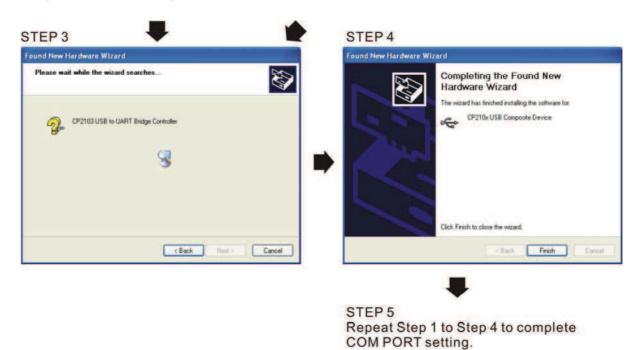
You should have a folder marked SiLabs under drive C. c:\ SiLabs

### 4. Driver Installation

After connecting IFD6530 to PC, please install driver by following steps.



### Chapter 7 Optional Accessories | C2000 Series



### 5. LED Display

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

# **Chapter 8 Option Cards**

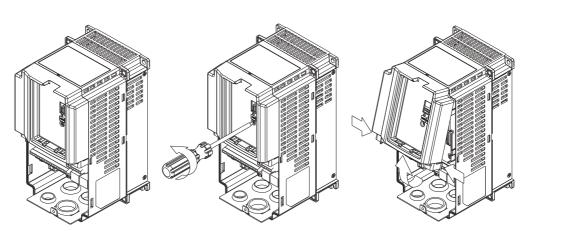
- 8-1 Removed Key Cover
- 8-2 Srews Specification for Option Card Terminals
- 8-3 EMC-D42A
- 8-4 EMC-D611A
- 8-5 EMC-R6AA
- 8-6 EMC-BPS01
- 8-7 EMC-PG01/02L
- 8-8 EMC-PG01/02O
- 8-9 EMC-PG01/02U
- 8-10 EMC-PG01R
- 8-11 CMC-MOD01
- 8-12 CMC-PD01
- 8-13 CMC-DN01
- 8-14 CMC-EIP01
- 8-15 EMC-COP01

### Chapter 8 Optional Cards | C2000 Series

Please select applicable option cards for your drive or contact local distributor for suggestion. To prevent drive damage during installation, please removes the digital keypad and the cover before wiring. Refer to the following instruction.

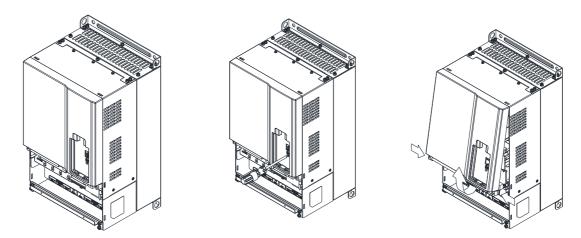
### 8-1 Removed key cover

Frame A&B&C Screw Torque: 8~10Kg-cm [6.9~8.7lb-in.]



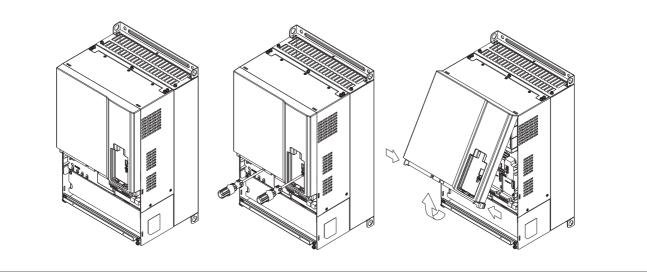
### Frame D0

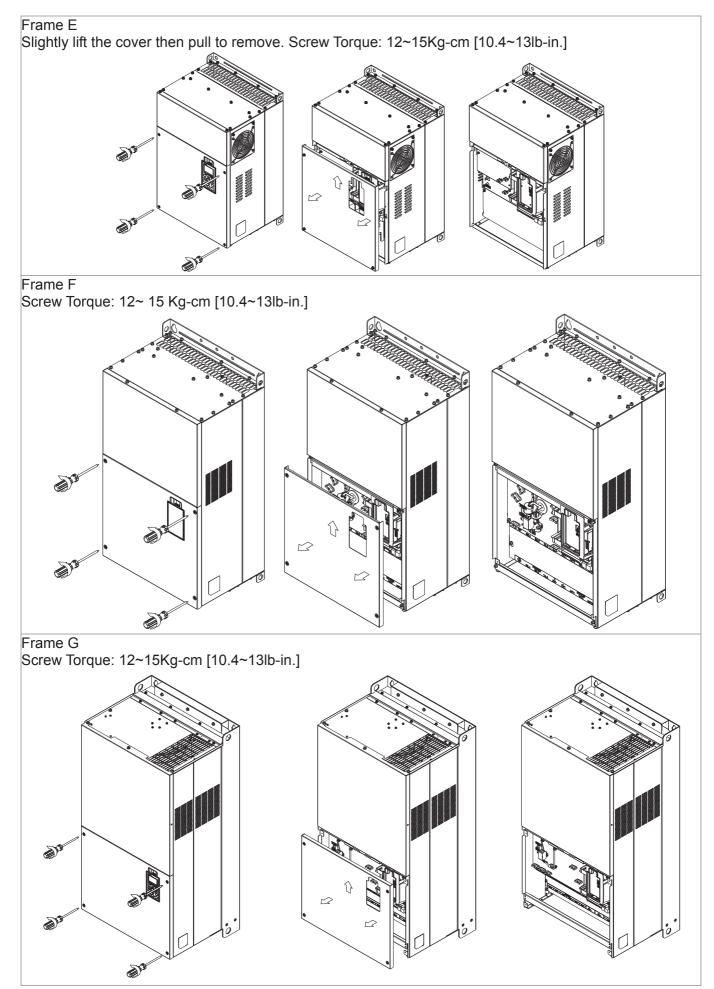
Screw Torque: 8~10Kg-cm [6.9~8.7lb-in.]



### Frame D

Screw Torque: 8~10Kg-cm [6.9~8.7lb-in.]





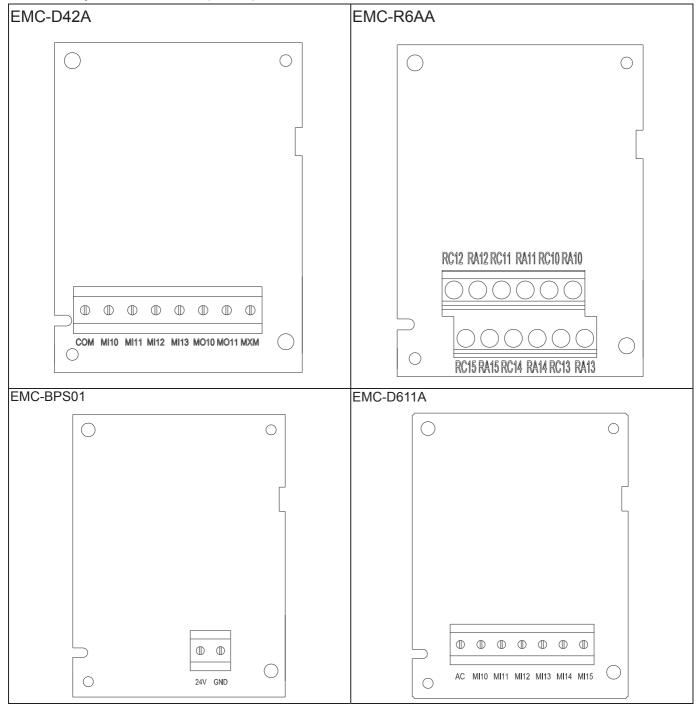
# Frame H Screw Torque: 14~16Kg-cm [12.15~13.89lb-in.]

	1	RJ45 (Socket) for digital keypad
		KPC-CC01; KPC-CE01
		Please refer to CH10 Digital Keypad for more details on
		KPC-CE01.
3 Slot 3		Please refer to CH10 Digital Keypad for more details on
		optional accessory RJ45 extension cable.
	2	Communication extension card (Slot 1)
(4) Slot 2 Slot 1		CMC-MOD01; CMC-PD01;
		CMC-DN01; CMC-EIP01;
		EMC-COP01;
	3	I/O & Relay extension card (Slot 3)
	•	EMC-D42A; EMC-D611A;
		EMC-R6AA; EMC-BPS01;
	4	
	4	PG Card (Slot 2)
		EMC-PG01L; EMC-PG02L;
		EMC-PG010; EMC-PG020;
		EMC-PG01U; EMC-PG02U;
		EMC-PG01R;

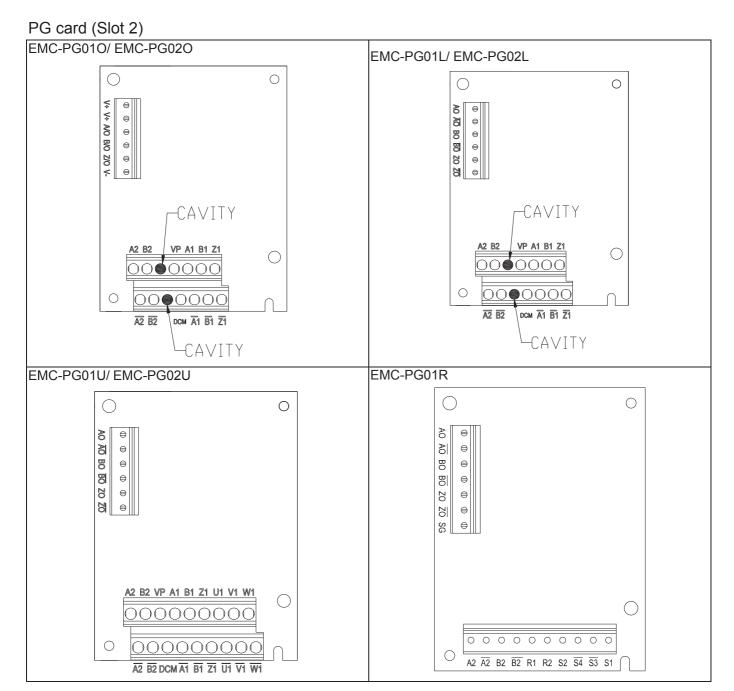
### 8-2 Screws Specification for option card terminals:

EMC-D42A	Wire gauge	24~12AWG (0.205~3.31mm <sup>2</sup> )
EMC-D611A		
EMC-BPS01	Torque	5Kg-cm [4.34Ib-in]
Wire Wire	Wire gauge	26~16AWG (0.128~1.31mm <sup>2</sup> )
EMC-R6AA	Torque	8Kg-cm [6.94Ib-in]
EMC-PG01L		
EMC-PG01O	Wire gauge	30~16AWG (0.0509~1.31mm <sup>2</sup> )
EMC-PG01R	Torque	2Kg-cm [1.74Ib-in]
EMC-PG01U		

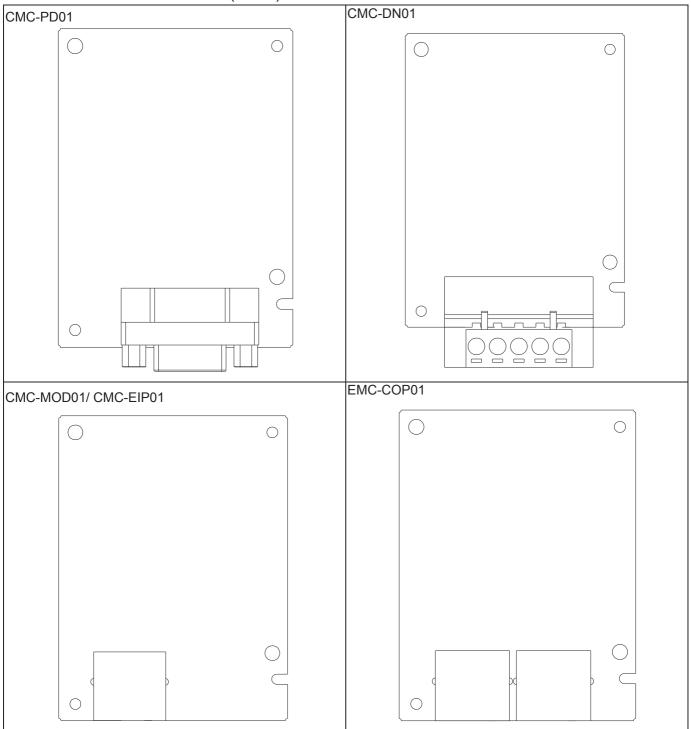
### I/O & Relay extension card (Slot 3)



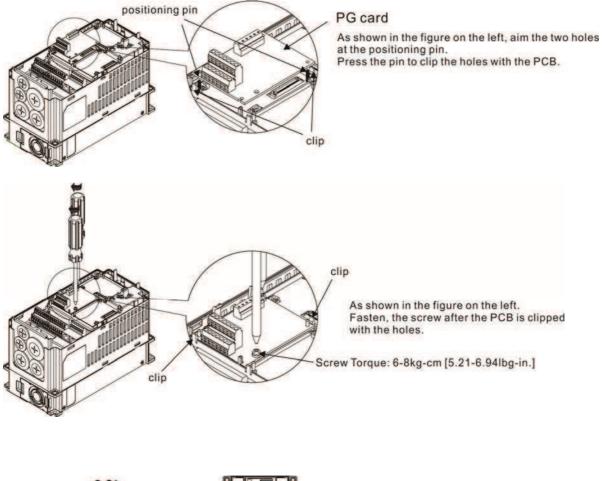
### Chapter 8 Optional Cards | C2000 Series

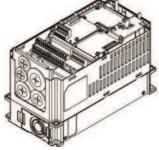


Communication extension card (Slot 1)



### PG Card intallation

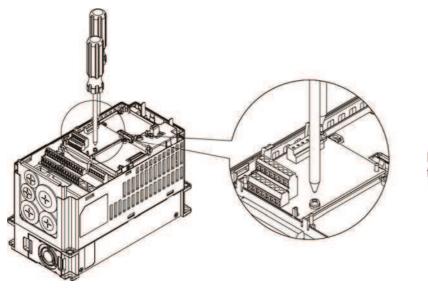




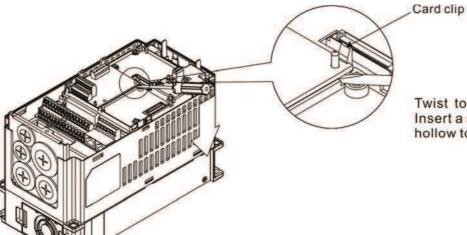


As shown in the figure on the left, installation is completed.

### Disconneting the extension card



Remove the two screws as shown in the figure on the left.



iiiiiii

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

Twist to open the other card clip to remove the PCB.

Card clip

### 8-3 EMC-D42A

	Terminals	Descriptions
I/O Extension Card	СОМ	Common for Multi-function input terminals Select SINK(NPN)/SOURCE(PNP) in J1 jumper / external power supply
	MI10~ MI13	Refer to parameters 02-26~02-29 to program the multi-function inputs MI10~MI13. Internal power is applied from terminal E24: +24Vdc±5% 200mA, 5W External power +24VDC: max. voltage 30VDC, min. voltage 19VDC, 30W ON: the activation current is 6.5mA OFF: leakage current tolerance is 10µA
	MO10~MO11	Multi-function output terminals (photocoupler) The AC motor drive releases various monitor signals, such as drive in operation, frequency attained and overload indication, via transistor (open collector).
	МХМ	Common for multi-function output terminals MO10, MO11(photocoupler) Max 48VDC 50mA

### 8-4 EMC-D611A

	Terminals	Descriptions
	AC	AC power Common for multi-function input terminal (Neutral)
I/O Extension Card	MI10~ MI15	Refer to Pr. 02.26~ Pr. 02.31 for multi-function input selection Input voltage: 100~130VAC Input frequency: 47~63Hz Input impedance: 27Kohm Terminal response time: ON: 10ms OFF: 20ms

### 8-5 EMC-R6AA

	Terminals	Descriptions
	n R10A~R15A R10C~R15C	Refer to Pr. 02.36~ Pr. 02.41 for multi-function input selection
		Resistive load:
		5A(N.O.) 250VAC
Relay Extension		5A(N.O.) 30VDC
Card		Inductive load (COS 0.4)
		2.0A(N.O.) 250VAC
		2.0A(N.O.) 30VDC
		It is used to output each monitor signal, such as drive is in
		operation, frequency attained or overload indication.

### 8-6 EMC-BPS01

Terminals	Descriptions	
		Input power: 24V±5%
	ver 24V GND	Maximum input current:0.5A
External Power		Note:
Supply		1) Do not connect control terminal +24V (Digital control signal common:
		SOURCE) directly to the EMC-BPS01input terminal 24V.
		2) Do not connect control terminal GND directly to the EMC-BPS01 input
		termina GND.

Note: Refer to I/O & Rlay extension card installation/ disconnecting method for PG Card installation/ disconnecting.

# 8-7 EMC-PG01L/EMC-PG02L

#### Terminal description

Set by Pr.10-00~10-02, 10-16~10-18

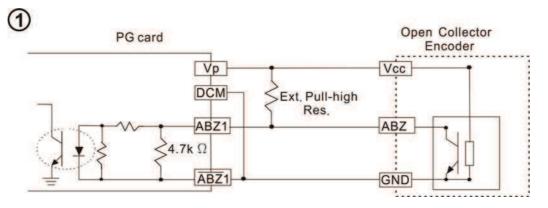
Terminals		Descriptions
	VP	Output voltage for power: +5V/+12V±5% (use FSW3 to switch +5V/+12V) Max. output current: 200mA
504	DCM	Common for power and signal
PG1	A1, /A1, B1, /B1, Z1, /Z1	Encoder input signal (Line Driver or Open Collector) Open Collector input voltage: +5~+24V (Note 1) It can be 1-phase or 2-phase input. EMC-PG01L: Max. input frequency: 300kHz EMC-PG02L: Max. input frequency: 30kHz(Note 2)
PG2         A2, /A2, B2, /B2           PG OUT         AO, /AO, BO, /BO, ZO, /ZO, SG,		Pulse Input signal (Line Driver or Open Collector) Open Collector input voltage: +5~+24V (Note1) It can be 1-phase or 2-phase input. EMC-PG01L: Max. input frequency: 300kHz EMC-PG02L: Max. input frequency: 30kHz(Note 2)
		PG Card Output signals. It has division frequency function: 1~255 times Max. output voltage for Line driver: 5VDC Max. output current: 50mA EMC-PG01L Max. output frequency: 300kHz EMC-PG02L Max. output frequency: 30kHz SG is the GND of PG card. It is also the GND of position machine or PLC to make the ouput signal to be the common pivot point.

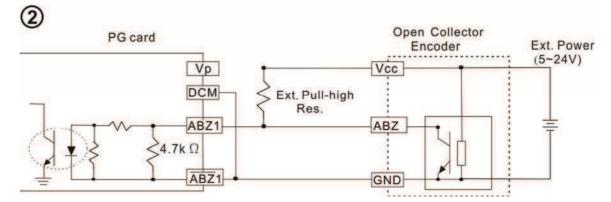
Note 1: Open Collector application, input current 5~15mA to each set then each set needs one pull-up resistor. If input voltage of open collector is 24V, the power of encoder needs to be connected externally. Please refer diagram 2 of PG1.

5V	Recommended pull-up resistor: above100~220Ω, 1/2W
12V	Recommended pull-up resistor: above 510~1.35kΩ, 1/2W
24V	Recommended pull-up resistor, above1.8k~3.3kΩ, 1/2W

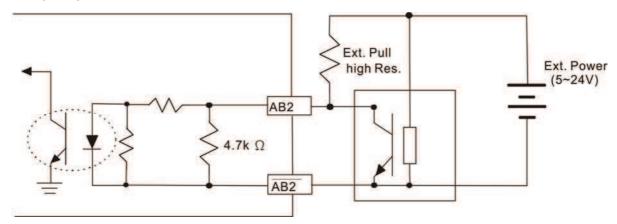
Note 2: If the required bandwidth is not over 30kHz at the application, it is recommended to use EMC-PG02O/L (bandwidth 30kHz) to avoid interference.

PG1 card wiring diagram (the image 1 and 2 below are wiring diagrams of Open Collector encoder)



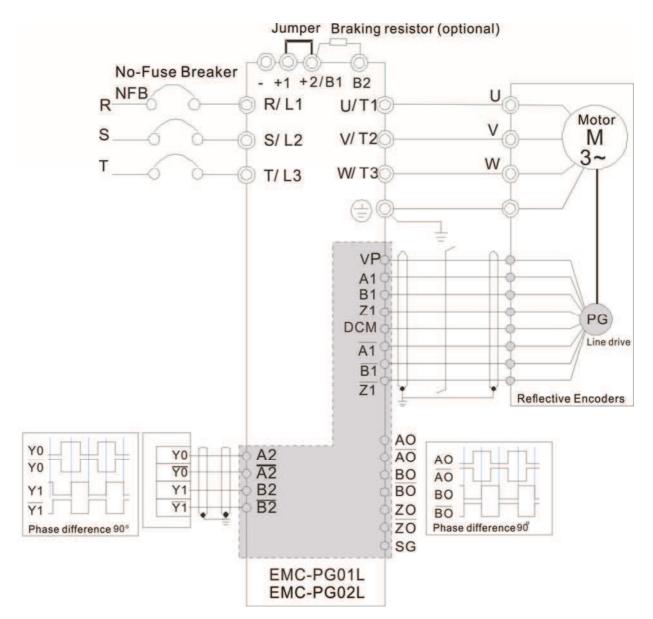


PG2 Wiring Diagram



#### ■ EMC-PG01L/EMC-PG02L Wiring Diagram

- Please use a shielded cable to prevent interference. Do not run control wires parallel to any high voltage AC power line (200 V and above).
- $\square$  Recommended wire size 0.21 to 0.81mm<sup>2</sup> (AWG24 to AWG18).
- ☑ Cable length: Less than 100m



## 8-8 EMC-PG010/EMC-PG020

#### Terminal descriptions

Set by Pr.10-00~10-02, 10-16~10-18

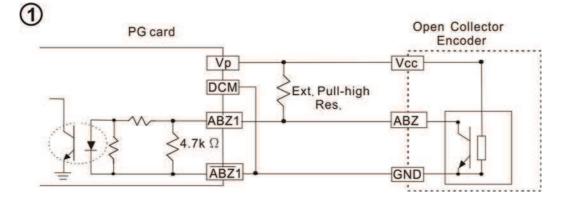
Terminals		Descriptions		
	VP	Output voltage for power: +5V/+12V±5% (use FSW3 to switch +5V/+12V) Max. output current: 200mA		
	DCM	Common for power and signal		
PG1		Encoder Input signal (Line Driver or Open Collector)		
		Open Collector Input Voltage: +5V~+24V (Note 1)		
	A1, /A1, B1, /B1, Z1, /Z1	It can be 1-phase or 2-phase input.		
	, ,	EMC-PG010 Max. input frequency: 300kHz		
		EMC-PG02O Max. input frequency: 30kHz(Note 2)		
	A2, /A2, B2, /B2	Pulse Input Signal (Line Driver or Open Collector)		
PG2		Open Collector Input Voltage: +5~+24V (Note 1)		
FGZ		EMC-PG010 Max. input frequency: 300kHz		
		EMC-PG02O Max. input frequency: 30kHz(Note 2)		
	V+, V+	Needs external power source for PG OUT circuit.		
	V', V'	Input voltage of power:+12V ~ +24V		
	V-	Input voltage for the negative side		
		PG Card Output signals has division frequency function: 1~255 times.		
PG OUT		On the open collector's output signal, add a high-pull resistor on the external		
10001	A/O, B/O, Z/O	power V+ $\sim$ V- (e.g. power of PLC) to prevent the interference of the receiving		
		signal. Max. • [Three pull-up resistor are included in the package (1.8kW/1W)]		
		(Note 1)		
		EMC-PG01O Max. input frequency: 300kHz		
		EMC-PG020 Max. input frequency: 30kHz		

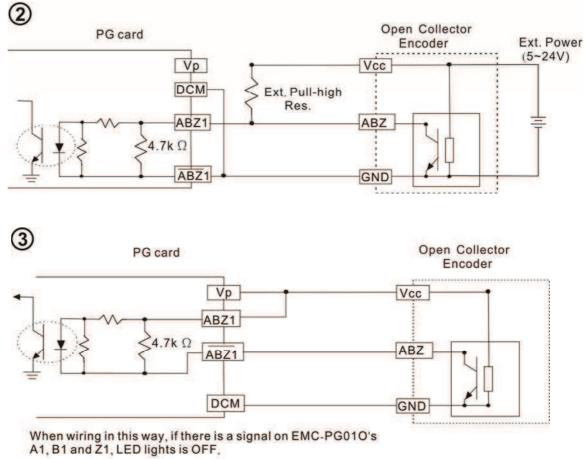
Note 1: Open Collector application, input current 5~15mA to each set then each set needs one pull-up resistor. If input voltage of open collector is 24V, the power of encoder needs to be connected externally. Please refer diagram 2 of PG1.

	5V	Recommended pull-up resistor: above100~220Ω, 1/2W
	12V	Recommended pull-up resistor: above 510~1.35k $\Omega$ , 1/2W
	24V	Recommended pull-up resistor, above1.8k~3.3kΩ, 1/2W
. 1	fthe required b	and width is not over 20kl In at the application, it is recomm

Note 2: If the required bandwidth is not over 30kHz at the application, it is recommended to use EMC-PG02O/L (bandwidth 30kHz) to avoid interference.

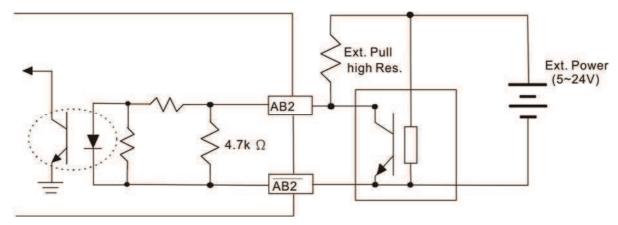
PG1 card wiring diagram (the image 1 and 2 below are wiring diagrams of Open Collector encoder)





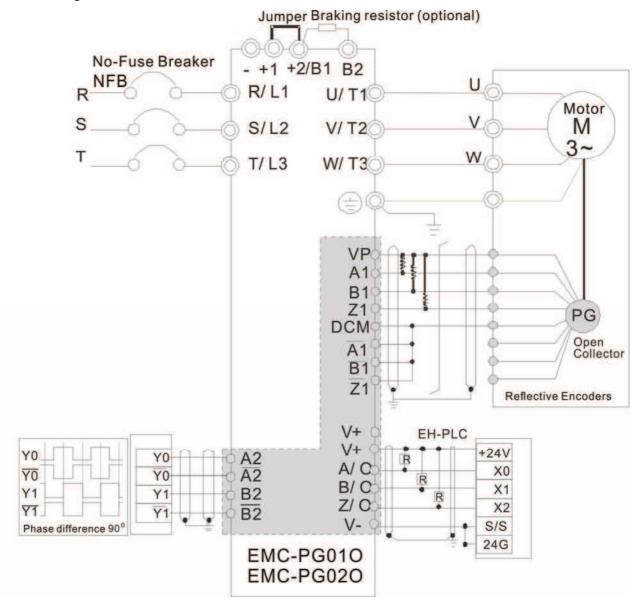
If A1, B1 and Z1 have no signals, LED lights is ON.

PG2 Wiring Diagram



#### EMC-PG010/EMC-PG020 Wiring Diagram

- Please use a shielded cable to prevent interference. Do not run control wires parallel to any high voltage AC power line (200 V and above).
- $\square$  Recommended wire size 0.21 to 0.81mm<sup>2</sup> (AWG24 to AWG18).
- ☑ Cable length: Less than 30m



# 8-9 EMC-PG01U/ EMC-PG02U

- FSW1 S: Standard UVW Output Encoder; D: Delta Encoder
- When using the Delta Encoder, wait for at least 250ms after powering up to receive signals from UVW. If a running command is received before UVW signals finish, a PGF5 error message will be given. So wait for 250ms before sending a running command.
- EMC-PG02U has encoder disconnection detection function.
- Set by Pr.10-00~10-02, 10-16~10-18

Terminals		Descriptions	
	VP	Output voltage for power: +5V/+12V±5% (use FSW3 to switch +5V/+12V) Max. output current: 200mA	
004	DCM	Common for power and signal	
PG1	A1, /A1, B1, /B1, Z1, /Z1	Encoder input signal (Line Driver) It can be 1-phase or 2-phase input. Max. output frequency: 300kP/sec	
	U1, /U1, V1, /V1, W1, /W1	Encoder input signal	
PG2	A2, /A2, B2, /B2	Pulse Input signal (Line Driver or Open Collector) Open Collector Input Voltage: +5~+24V (Note1) It can be 1-phase or 2-phase input. Max. output frequency: 300kP/sec.	
PG OUT AO, /AO, BO, /BO, ZO, /ZO, SG		PG Card Output signals. It has division frequency function: 1~255 times Max. output voltage for Line driver: 5Vdc Max. output current: 50mA Max. output frequency: 300kP/sec SG is the GND of PG card. It is also the GND of position machine or PLC to make the ouput signal to be the common pivot point.	

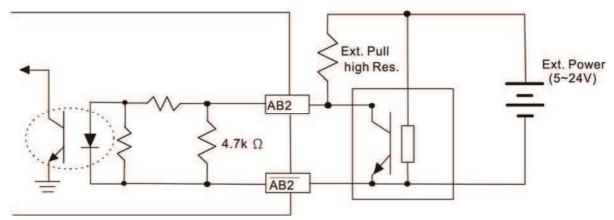
 Solution
 Note 1: Open Collector application, input current 5~15mA to each set then each set needs one pull-up resistor.

 5V
 Recommended pull-up resistor: above100~220Ω, 1/2W

 12V
 Recommended pull-up resistor: above 510~1.35kΩ, 1/2W

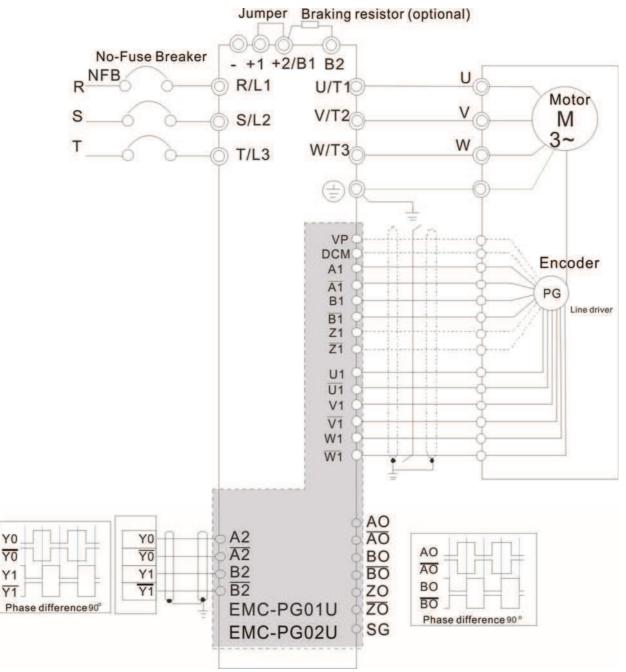
 24V
 Recommended pull-up resistor, above1.8k~3.3kΩ, 1/2W

PG2 Wiring Diagram



#### EMC-PG01U Wiring Diagram

- Please use a shielded cable to prevent interference. Do not run control wires parallel to any high voltage AC power line (200 V and above).
- $\square$  Recommended wire size 0.21 to 0.81mm<sup>2</sup> (AWG24 to AWG18).
- ☑ Cable length: Less than 30m



## 8-10 EMC-PG01R

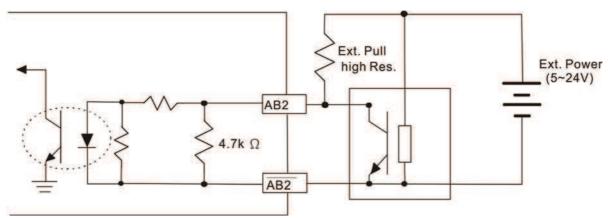
#### Terminal Descriptions

Set by Pr.10-00~10-02

Terminals		Descriptions	
	R1- R2	Resolver Output Power 7Vrms, 10kHz	
PG1	S1, /S3, S2, /S4,	Resolver Input Signal (S2, /S4=Sin; S1, /S3=Cos) 3.5±0.175Vrms, 10kHz	
PG2	A2, /A2, B2, /B2	Pulse Input signal (Line Driver or Open Collector) Open Collector Input Voltage: +5~+24V (Note1) It can be 1-phase or 2-phase input. Max. output frequency: 300kP/sec.	
PG OUT	AO, /AO, BO /BO		
Note 1: Open Collector application, input current 5~15mA to each set then each set needs one pull-up resistor			

5V	Recommended pull-up resistor: above100~220Ω, 1/2W
12V	Recommended pull-up resistor: above 510~1.35k $\Omega$ , 1/2W
24V	Recommended pull-up resistor, above1.8k~3.3kΩ, 1/2W

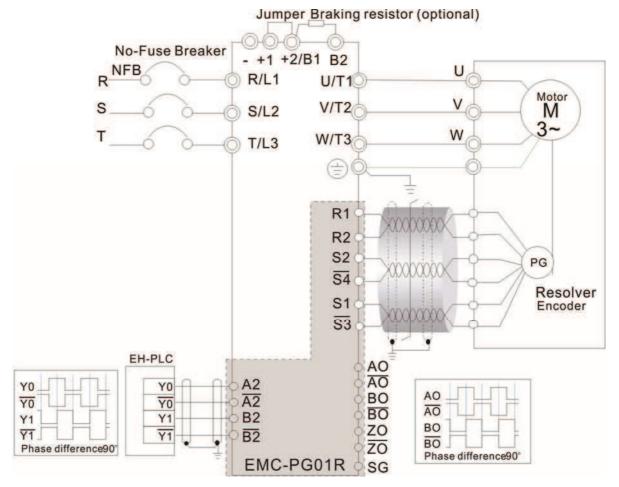
#### PG2 Wiring Diagram



- DOS(Degradation of Signal) : If the amplitude of the sine wave input of the S1-/S3/S2-/S4 is lower than or higher than the encoder IC's specification, a red light will be on. The possible reasons which cause this problem are the following.
  - 1. The turns ratio of the resolver encoder is not 1:0.5 which makes the sine wave input of the S1-/S3/S2-/S4 not equal to 3.5±0.175Vrms.
  - 2. While motor is running, motor creates common mode noise which makes accumulated voltage to be more than 3.5±0.175Vrms
- LOT(Loss of Tracking): Compare the angle of S1-/S3/S2-/S4 sine wave input to the R1-R2 cosine wave. If their difference is more than 5 degree, a red light will be on. Here are the possible reasons why that happens:
  - 1. The output frequency of the PG card is incorrect.
  - 2. The specification of Resolver's encoder is not 10KHz
  - 3. The motor creates common mode noise while it is running. That causes a big difference, while the motor is rotating, between main winding's cosine wave angle and the sine wave angle of second and third windings.

#### EMC-PG01R Wiring Diagram

- Please use a shielded cable to prevent interference. Do not run control wires parallel to any high voltage AC power line (200 V and above).
- $\square$  Recommended wire size 0.21 to 0.81mm<sup>2</sup> (AWG24 to AWG18).
- ☑ Cable length: Less than 100m

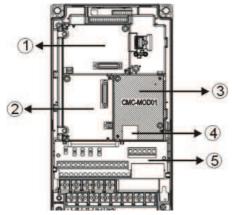


# 8-11 CMC-MOD01

#### Features

- 1. Supports Modbus TCP protocol
- 2. MDI/MDI-X auto-detect
- 3. Baud rate: 10/100Mbps auto-detect
- 4. E-mail alarm
- 5. AC motor drive keypad/Ethernet configuration
- 6. Virtual serial port.

#### Product File



1	I/O CARD &	Relay Card
---	------------	------------

<sup>②</sup> PG Card

<sup>③</sup> Comm. Card

<sup>④</sup> RJ-45 connection port

S Removable control circuit terminal

Specifications

#### Network Interface

Interface	RJ-45 with Auto MDI/MDIX	
Number of ports	1 Port	
Transmission method	IEEE 802.3, IEEE 802.3u	
Transmission cable	Category 5e shielding 100M	
Transmission speed	10/100 Mbps Auto-Detect	
Notwork protocol	ICMP, IP, TCP, UDP, DHCP, HTTP, SMTP, MODBUS OVER TCP/IP,	
Network protocol	Delta Configuration	

#### **Electrical Specification**

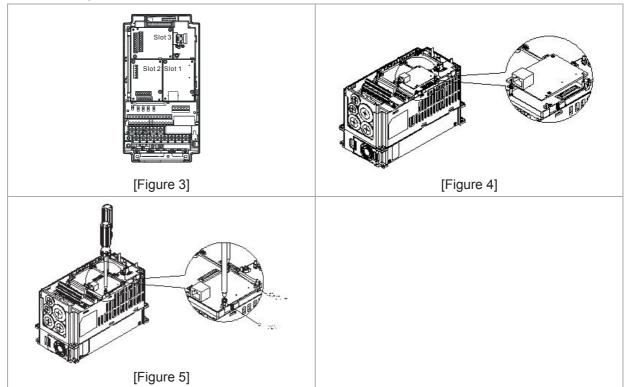
Power supply voltage	5VDC (supply by the AC motor drive)
Insulation voltage	2KV
Power consumption	0.8W
Weight	25g

#### Environment

Noise immunity	ESD (IEC 61800-5-1, IEC 61000-4-2) EFT (IEC 61800-5-1, IEC 61000-4-4) Surge Test (IEC 61800-5-1, IEC 61000-4-5) Conducted Susceptibility Test (IEC 61800-5-1, IEC 61000-4-6)	
Operation/storage	Operation: -10°C ~ 50°C (temperature), 90% (humidity) Storage: -25°C ~ 70°C (temperature), 95% (humidity)	
Vibration/shock immunity	International standard: IEC 61800-5-1, IEC 60068-2-6/IEC 61800-5-1, IEC 60068-2-27	

#### Install CMC-MOD01 to VFD-C2000

- 1. Switch off the power supply of VFD-C2000.
- 2. Open the front cover of VFD-C2000.
- 3. Place the insulation spacer into the positioning pin at Slot 1 (shown in Figure 3), and aim the two holes on the PCB at the positioning pin. Press the pin to clip the holes with the PCB (shown in Figure 4).
- 4. Screw up at torque 6 ~ 8 kg-cm (5.21 ~ 6.94 in-lbs) after the PCB is clipped with the holes (shown in Figure 5).



#### Communication Parameters for VFD-C2000 Connected to Ethernet

When VFD-C2000 is link to Ethernet, please set up the communication parameters base on the table below. Ethernet master will be able to read/write the frequency word and control word of VFD-C2000 after communication parameters setup.

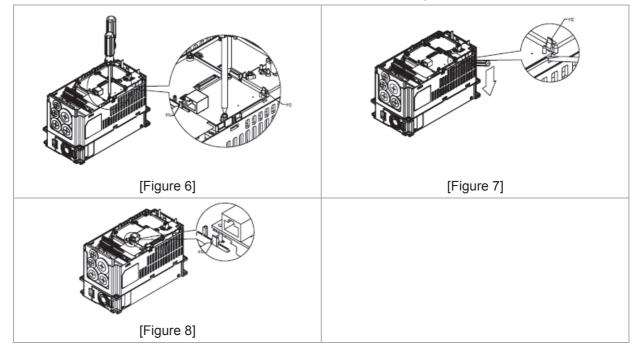
Parameter	Function	Set value (Dec)	Explanation
P00-20	Source of frequency command setting	8	The frequency command is controlled by communication card.
P00-21	Source of operation command setting	5	The operation command is controlled by communication card.

#### Chapter 8 Optional Cards | C2000 Series

P09-30	Decoding method for communication	0	Decoding method for Delta AC motor drive
P09-75	IP setting	0	Static IP(0) / Dynamic distribution IP(1)
P09-76	IP address -1	192	IP address 192.168.1.5
P09-77	IP address -2	168	IP address 192.168.1.5
P09-78	IP address -3	1	IP address 192.168.1.5
P09-79	IP address -4	5	IP address 192.168.1.5
P09-80	Netmask -1	255	Netmask 255.255.255.0
P09-81	Netmask -2	255	Netmask 255.255.255.0
P09-82	Netmask -3	255	Netmask 255.255.255.0
P09-83	Netmask -4	0	Netmask 255.255.255.0
P09-84	Default gateway -1	192	Default gateway 192.168.1.1
P09-85	Default gateway -2	168	Default gateway 192.168.1.1
P09-86	Default gateway -3	1	Default gateway 192.168.1.1
P09-87	Default gateway -4	1	Default gateway 192.168.1.1

#### Disconnecting CMC- MOD01 from VFD-C2000

- 1. Switch off the power supply of VFD-C2000.
- 2. Remove the two screws (shown in Figure 6).
- 3. Twist opens the card clip and inserts the slot type screwdriver to the hollow to prize the PCB off the card clip (shown in Figure 7).
- 4. Twist opens the other card clip to remove the PCB (shown in Figure 8).



#### Basic Registers

BR#	R/W	Content	Explanation
#0	R	Model name	Set up by the system; read only. The model code of CMC-MOD01=H'0203
#1	R	Firmware version	Displaying the current firmware version in hex, e.g. H'0100 indicates the firmware version V1.00.
#2	R	Release date of the version	Displaying the data in decimal form. 10,000s digit and 1,000s digit are for "month"; 100s digit and 10s digit are for "day". For 1 digit: 0 = morning; 1 = afternoon.
#11	R/W	Modbus Timeout	Pre-defined setting: 500 (ms)
#13	R/W	Keep Alive Time	Pre-defined setting: 30 (s)

#### ■ LED Indicator & Troubleshooting

#### LED Indicators

LED	Status		Indication	How to correct it?
POWER			Power supply in normal status	
FOWER	Green	Off	No power supply	Check the power supply
	On	Network connection in normal status		
LINK	LINK Green	Flashes	Network in operation	
		Off	Network not connected	Check if the network cable is connected

#### Troubleshooting

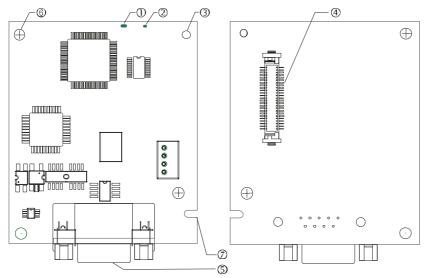
Abnormality	Cause	How to correct it?
POWER LED off	AC motor drive not powered	Check if AC motor drive is powered, and if the power supply is normal.
POWER LED OII	CMC-MOD01 not connected to AC motor drive	Make sure CMC-MOD01 is connected to AC motor drive.
	CMC-MOD01 not connected to network	Make sure the network cable is correctly connected to network.
LINK LED off	Poor contact to RJ-45 connector	Make sure RJ-45 connector is connected to Ethernet port.
	CMC-MOD01 not connected to network	Make sure CMC-MOD01 is connected to network.
No module found	PC and CMC-MOD01 in different networks and blocked by network firewall.	Search by IP or set up relevant settings by AC motor drive keypad.
	CMC-MOD01 not connected to network	Make sure CMC-MOD01 is connected to the network.
Fail to open CMC-MOD01 setup	Incorrect communication setting in DCISoft	Make sure the communication setting in DCISoft is set to Ethernet.
page	PC and CMC-MOD01 in different networks and blocked by network firewall.	Conduct the setup by AC motor drive keypad.
Able to open CMC-MOD01 setup page but fail to utilize webpage monitoring	Incorrect network setting in CMC-MOD01	Check if the network setting for CMC-MOD01 is correct. For the Intranet setting in your company, please consult your IT staff. For the Internet setting in your home, please refer to the network setting instruction provided by your ISP.
Fail to send e-mail	Incorrect network setting in CMC-MOD01	Check if the network setting for CMC-MOD01 is correct.
Fail to send e-mail	Incorrect mail server setting	Please confirm the IP address for SMTP-Server.

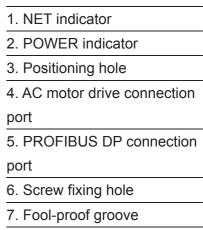
# 8-12 CMC-PD01

#### Features

- 1. Supports PZD control data exchange.
- 2. Supports PKW polling AC motor drive parameters.
- 3. Supports user diagnosis function.
- 4. Auto-detects baud rates; supports Max. 12Mbps.

#### Product Profile





#### Specifications

#### PROFIBUS DP Connector

Interface	DB9 connector
Transmission method	High-speed RS-485
Transmission cable	Shielded twisted pair cable
Electrical isolation	500VDC

#### Communication

Message type	Cyclic data exchange
Module name	CMC-PD01
GSD document	DELA08DB.GSD
Company ID	08DB (HEX)
Serial transmission speed supported (auto-detection)	9.6kbps; 19.2kbps; 93.75kbps; 187.5kbps; 125kbps; 250kbps; 500kbps; 1.5Mbps; 3Mbps; 6Mbps; 12Mbps (bit per second)

#### **Electrical Specification**

Power supply	5VDC (supplied by AC motor drive)
Insulation voltage	500VDC
Power consumption	1W
Weight	28g

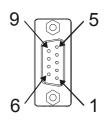
#### Environment

Noise immunity	ESD(IEC 61800-5-1,IEC 6100-4-2) EFT(IEC 61800-5-1,IEC 6100-4-4) Surge Teat(IEC 61800-5-1,IEC 6100-4-5) Conducted Susceptibility Test(IEC 61800-5-1,IEC 6100-4-6)
Operation /storage	Operation: -10°C ~ 50°C (temperature), 90% (humidity) Storage: -25°C ~ 70°C (temperature), 95% (humidity)
Shock / vibration resistance	International standards: IEC61131-2, IEC68-2-6 (TEST Fc)/IEC61131-2 & IEC 68-2-27 (TEST Ea)

#### Installation

#### PROFIBUS DP Connector

PIN	PIN name	Definition
1	-	Not defined
2	-	Not defined
3	Rxd/Txd-P	Sending/receiving data P(B)
4	-	Not defined
5	DGND	Data reference ground
6	VP	Power voltage – positive
7	-	Not defined
8	Rxd/Txd-N	Sending/receiving data N(A)
9	-	Not defined



#### LED Indicator & Troubleshooting

There are 2 LED indicators on CMC-PD01. POWER LED displays the status of the working power. NET LED displays the connection status of the communication.

#### POWER LED

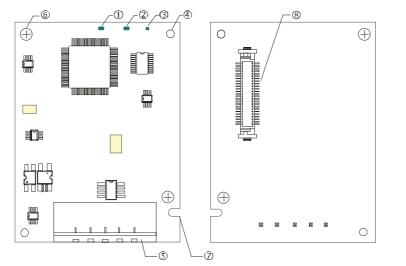
LED status	Indication	How to correct it?
Green light on	Power supply in normal status.	
Off	No power	Check if the connection between CMC-PD01 and AC motor drive is normal.

#### NET LED

LED status	Indication	How to correct it?
Green light on	Normal status	
Red light on	CMC-PD01 is not connected to PROFIBUS DP bus.	Connect CMC-PD01 to PROFIBUS DP bus.
Red light flashes	Invalid PROFIBUS communication address	Set the PROFIBUS address of CMC-PD01 between 1 ~ 125 (decimal)
Orange light flashes	CMC-PD01 fails to communication with AC motor drive.	Switch off the power and check whether CMC-PD01 is correctly and normally connected to AC motor drive.

# 8-13 CMC-DN01

- Functions
  - 1. Based on the high-speed communication interface of Delta HSSP protocol, able to conduct immediate control to AC motor drive.
  - 2. Supports Group 2 only connection and polling I/O data exchange.
  - 3. For I/O mapping, supports Max. 32 words of input and 32 words of output.
  - 4. Supports EDS file configuration in DeviceNet configuration software.
  - 5. Supports all baud rates on DeviceNet bus: 125kbps, 250kbps, 500kbps and extendable serial transmission speed mode.
  - 6. Node address and serial transmission speed can be set up on AC motor drive.
  - 7. Power supplied from AC motor drive.
- Product Profile



1. NS indicator
2. MS indicator
3. POWER indicator
4. Positioning hole
5. DeviceNet connection port
6. Screw fixing hole
7. Fool-proof groove
8. AC motor drive connection
port

#### Specifications

#### **DeviceNet Connector**

Interface	5-PIN open removable connector. Of 5.08mm PIN interval				
Transmission	CAN				
Transmission cable	Shielded twisted pair cable (with 2 power cables)				
Transmission speed	125kbps, 250kbps, 500kbps and extendable serial transmission speed				
Network protocol	DeviceNet protocol				

#### AC Motor Drive Connection Port

Interface 50 PIN communication terminal	
Transmission method SPI communication	
Terminal function	<ol> <li>Communicating with AC motor drive</li> <li>Transmitting power supply from AC motor drive</li> </ol>
Communication	Delta HSSP protocol

#### **Electrical Specification**

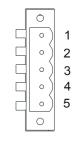
Power supply voltage	5VDC (supplied by AC motor drive)
Insulation voltage	500VDC
Communication wire power consumption	0.85W
Power consumption	1W
Weight	23g

#### Environment

Noise immunity	ESD (IEC 61800-5-1,IEC 6100-4-2) EFT (IEC 61800-5-1,IEC 6100-4-4) Surge Teat(IEC 61800-5-1,IEC 6100-4-5) Conducted Susceptibility Test (IEC 61800-5-1,IEC 6100-4-6)
Operation /storage	Operation: -10°C ~ 50°C (temperature), 90% (humidity) Storage: -25°C ~ 70°C (temperature), 95% (humidity)
Shock / vibration resistance	International standards: IEC61131-2, IEC68-2-6 (TEST Fc)/IEC61131-2 & IEC 68-2-27 (TEST Ea)

#### **DeviceNet Connector**

PIN	Signal	Color	Definition	
1	V+	Red	DC24V	
2	Н	White	Signal+	
3	S	-	Earth	
4	L	Blue	Signal-	
5	V-	Black	0V	



#### LED Indicator & Troubleshooting

There are 3 LED indicators on CMC-DN01. POWER LED displays the status of power supply. MS LED and NS LED are dual-color LED, displaying the connection status of the communication and error messages.

#### POWER LED

LED status Indication		How to correct it?	
On	Power supply in abnormal status.	Check the power supply of CMC-DN01.	
Off	Power supply in normal status		

#### NS LED

LED status	Indication	How to correct it?		
Off	No power supply or CMC-DN01 has not completed MAC ID test yet.	<ol> <li>Check the power of CMC-DN01 and see if the connection is normal.</li> <li>Make sure at least one or more nodes are on the bus.</li> <li>Check if the serial transmission speed of CMC-DN01 is the same as that of other nodes.</li> </ol>		
Green light CMC-DN01 is on-line but has not flashes established connection to the master.		<ol> <li>Configure CMC-DN01 to the scan list of the master.</li> <li>Re-download the configured data to the master.</li> </ol>		
Green light on	CMC-DN01 is on-line and is normally connected to the master			
Red light flashes	CMC-DN01 is on-line, but I/O connection is timed-out.	<ol> <li>Check if the network connection is normal.</li> <li>Check if the master operates normally.</li> </ol>		
Red light on	Red light on1. The communication is down.1. The communication is down.1. Make sure all the MAC IDs on the not repeated.2. MAC ID test failure.3. No network power supply.3. Check if the network installation3. No network power supply.4. CMC-DN01 is off-line.3. Check if the node address of CMC-ID illegal.5. Check if the network power supply.			

#### MS LED

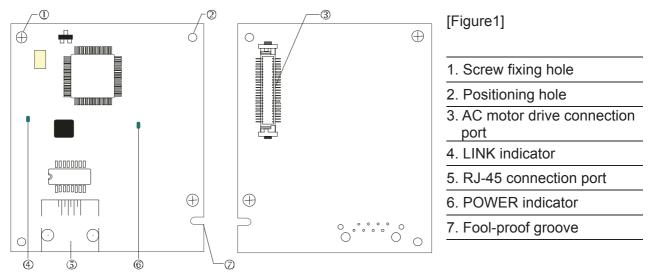
LED status	Indication	How to correct it?
Off	No power supply or being off-line	Check the power supply of CMC-DN01 and see of the connection is normal.
Green light flashes	Switch the master PLL, to RUIN status	
Green light on	I/O data are normal	
Red light flashes	Mapping error	<ol> <li>Reconfigure CMC-DN01</li> <li>Re-power AC motor drive</li> </ol>
Red light on	Hardware error	<ol> <li>See the error code displayed on AC motor drive.</li> <li>Send back to the factory for repair if necessary.</li> </ol>
Orange light flashes	CMC-DN01 is establishing connection with AC motor drive.	If the flashing lasts for a long time, check if CMC-DN01 and AC motor drive are correctly installed and normally connected to each other.

# 8-14 CMC-EIP01

#### Features

- 1. Supports Modbus TCP and Ethernet/IP protocol
- 2. MDI/MDI-X auto-detect
- 3. Baud rate: 10/100Mbps auto-detect
- 4. AC motor drive keypad/Ethernet configuration
- 5. Virtual serial port

#### Product Profile



#### Specifications

#### Network Interface

Interface	RJ-45 with Auto MDI/MDIX
Number of ports	1 Port
Transmission method	IEEE 802.3, IEEE 802.3u
Transmission cable	Category 5e shielding 100M
Transmission speed	10/100 Mbps Auto-Detect
Network protocol	ICMP, IP, TCP, UDP, DHCP, HTTP, SMTP, MODBUS OVER TCP/IP, EtherNet/IP, Delta Configuration

#### **Electrical Specification**

Weight	25g
Insulation voltage	500VDC
Power consumption	0.8W
Power supply voltage	5VDC

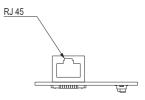
#### Environment

	ESD (IEC 61800-5-1,IEC 61000-4-2)
Noise immunity	EFT (IEC 61800-5-1,IEC 61000-4-4)
	Surge Test (IEC 61800-5-1,IEC 61000-4-5)
	Conducted Susceptibility Test (IEC 61800-5-1,IEC 61000-4-6)
Operation/storage	Operation: -10°C ~ 50°C (temperature), 90% (humidity)
Operation/storage	Storage: -25°C ~ 70°C (temperature), 95% (humidity)
Vibration/shock immunity	International standard: IEC 61800-5-1, IEC 60068-2-6/IEC 61800-5-1, IEC 60068-2-27

#### Installation

Connecting CMC-EIP01 to Network

- 1. Turn off the power of AC motor drive.
- 2. Open the cover of AC motor drive.
- Connect CAT-5e network cable to RJ-45 port on CMC-EIP01 (See Figure 2).



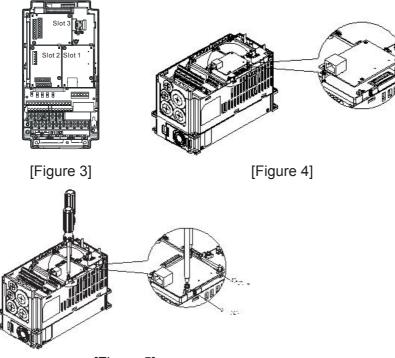


#### RJ-45 PIN Definition

PIN	Signal	Definition	PIN	Signal	Definition	
1	Tx+	Positive pole for data transmission	5		N/C	
2	Tx-	Negative pole for data transmission	6	Rx-	Negative pole for data receiving	
3	Rx+	Positive pole for data receiving	7		N/C	8 1
4		N/C	8		N/C	

#### Connecting CMC-EIP01 to VFD-C2000

- 1. Switch off the power of AC motor drive.
- 2. Open the front cover of AC motor drive.
- 3. Place the insulation spacer into the positioning pin at Slot 1 (shown in Figure 3), and aim the two holes on the PCB at the positioning pin. Press the pin to clip the holes with the PCB (see Figure 4).
- 4. Screw up at torque 6 ~ 8 kg-cm (5.21 ~ 6.94 in-lbs) after the PCB is clipped with the holes (see Figure 5).



[Figure 5]

#### Communication Parameters for VFD-C2000 Connected to Ethernet

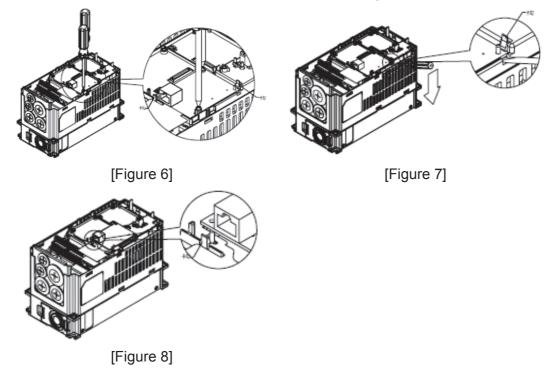
When VFD-C2000 is connected to Ethernet network, please set up the communication parameters for it according to the table below. The Ethernet master is only able to read/write the frequency word and control word of VFD-C2000 after the communication parameters are set.

Parameter (Dec)	Function	Set value (Dec)	Explanation
P00-20	Source of frequency command setting	8	The frequency command is controlled by communication card.
P00-21	Source of operation command setting	5	The operation command is controlled by communication card.
P09-30	Decoding method for communication	0	The decoding method for Delta AC motor drive
P09-75	IP setting	0	Static IP(0) / Dynamic distribution IP(1)
P09-76	IP address -1	192	IP address 192.168.1.5
P09-77	IP address -2	168	IP address 192.168.1.5
P09-78	IP address -3	1	IP address 192.168.1.5
P09-79	IP address -4	5	IP address 192.168.1.5
P09-80	Netmask -1	255	Netmask 255.255.255.0
P09-81	Netmask -2	255	Netmask 255.255.255.0
P09-82	Netmask -3	255	Netmask 255.255.255.0
P09-83	Netmask -4	0	Netmask 255.255.255.0
P09-84	Default gateway -1	192	Default gateway 192.168.1.1
P09-85	Default gateway -2	168	Default gateway 192.168.1.1
P09-86	Default gateway -3	1	Default gateway 192.168.1.1
P09-87	Default gateway -4	1	Default gateway 192.168.1.1

#### Chapter 8 Optional Cards | C2000 Series

#### Disconnecting CMC- EIP01 from VFD-C2000

- 1. Switch off the power supply of VFD-C2000.
- 2. Remove the two screws (see Figure 6).
- 3. Twist opens the card clip and inserts the slot type screwdriver to the hollow to prize the PCB off the card clip (see Figure 7).
- 4. Twist opens the other card clip to remove the PCB (see Figure 8).



#### LED Indicator & Troubleshooting

There are 2 LED indicators on CMC-EIP01. The POWER LED displays the status of power supply, and the LINK LED displays the connection status of the communication.

#### LED Indicators

LED	SI	tatus	Indication	How to correct it?			
POWER Green On Off		On	Power supply in normal status				
		Off	No power supply	Check the power supply.			
		On	Network connection in normal status				
LINK Green Flashes		Flashes	Network in operation				
		Off	Network not connected	Check if the network cable is connected.			

Troubleshooting

Abnormality	Cause	How to correct it?		
	AC motor drive not powered	Check if AC motor drive is powered, and if the power supply is normal.		
POWER LED off	CMC-EIP01 not connected to AC motor drive	Make sure CMC-EIP01 is connected to AC motor drive.		
	CMC-EIP01 not connected to network	Make sure the network cable is correctly connected to network.		
LINK LED off	Poor contact to RJ-45 connector	Make sure RJ-45 connector is connected to Ethernet port.		

Abnormality	Cause	How to correct it?		
	CMC-EIP01 not connected to network	Make sure CMC-EIP01 is connected to network.		
No communication card found	PC and CMC-EIP01 in different networks and blocked by network firewall.	Search by IP or set up relevant settings by AC motor drive keypad.		
	CMC-EIP01 not connected to network	Make sure CMC-EIP01 is connected to the network.		
Fail to open CMC-EIP01 setup	Incorrect communication setting in DCISoft	Make sure the communication setting in DCISoft is set to Ethernet.		
page	PC and CMC-EIP01 in different networks and blocked by network firewall.	Conduct the setup by AC motor drive keypad.		
Able to open CMC-EIP01 setup page but fail to utilize webpage monitoring	Incorrect network setting in CMC-EIP01	Check if the network setting for CMC-EIP01 is correct. For the Intranet setting in your company, please consult your IT staff. For the Internet setting in your home, please refer to the network setting instruction provided by your ISP.		
	Incorrect network setting in CMC-EIP01	Check if the network setting for CMC-EIP01 is correct.		
Fail to send e-mail	Incorrect mail server setting	Please confirm the IP address for SMTP-Server.		

# 8-15 EMC-COP01

Built-in EMC-COP01 card are available in VFDXXXC23E/VFDXXXC43E series.

#### **RJ-45** Pin definition



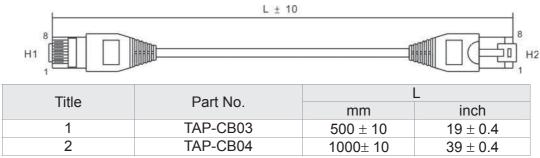
RS485 socket

Pin	Pin name	Definition
1	CAN_H	CAN_H bus line (dominant
	_	high)
2	CAN_L	CAN_L bus line (dominant low)
3	CAN_GND	Ground/0V/V-
7	CAN_GND	Ground/0V/V-

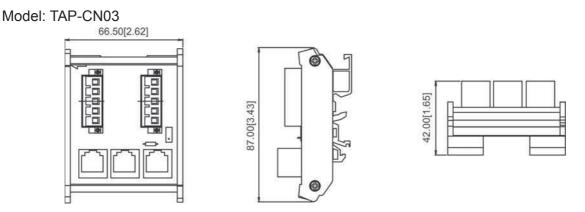
#### Specifications

Interface	RJ-45
Number of ports	1 Port
Transmission method	CAN
Transmission cable	CAN standard cable
Transmission speed	1M 500k 250k 125k 100k 50k
Communication protocol	CANopen

 CANopen Communication Cable Model: TAP-CB03, TAP-CB04



#### CANopen Dimension



#### 

For more information on CANopen, please refer to Chapter 15 CANopen Overview or CANopen user manual can also be downloaded on Delta website: <u>http://www.delta.com.tw/industrialautomation/</u>.

# **Chapter 9 Specification**

# 9-1 230V Series

<u> </u>					•	r						
		Frame Size	0.07	045	A	007	055	B	440	450	C	
		lodel VFDC	007	015	022	037	055	075	110	150	185	220
		able Motor Output(kW)	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5
	Applic	cable Motor Output(HP)	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22
D	Heavy duty	Rated Output Capacity (kVA)	1.9	2.8	4.0	6.4	9.6	12	19	25	28	34
atin	du	Rated Output Current (A)	4.8	7.1	10	16	24	31	47	62	71	86
Ř		Carrier Frequency (kHz)					2	2~6kHz				
Output Rating	Normal duty	Rate Output Capacity (kVA)	2.0	3.2	4.4	6.8	10	13	20	26	30	36
0	dL	Rated Output Current (A)	5	8	11	17	25	33	49	65	75	90
	2	Carrier Frequency (kHz)				2~15k⊢	z				2~10kHz	
_	Inp	out Current (A) Heavy Duty	6.1	11	15	18.5	26	34	50	68	78	95
Input Rating		Input Current (A) Normal Duty	6.4	12	16	20	28	36	52	72	83	99
μF	F	Rated Voltage/Frequency			3	-phase AC	200V~24	0V (-15% ~	+10%), 50	)/60Hz		
npi		Dperating Voltage Range						)~265Vac				
_		Frequency Tolerance					4	7~63Hz				
		AC Drive Weight		2.6± 0.3k	٢g			± 1Kg			9.8± 1.5Kg	
		Cooling method	N	latural cod					Fan coolir	ng		
		Braking Chopper			Fra	ame A to C	(built-in);	Frame D ar	nd above (o	optional)		
		DC reactor						; Frame D a				
		EMC Filter		Frame A to C (optional); Frame D and above (optional)								
		EMC-COP01						al); VFDXX				
		· · · · · · · · · · · · · · · · · · ·							_			
		Frame Size		D		E		F				
		lodel VFDC	300	370	450	550	750	900				
		able Motor Output(kW)	22	30	37	45	55	75				
	Applic	able Motor Output(HP)	30	37	45	55	75	90				
βĹ	Heavy duty	Rated Output Capacity (kVA)	45	55	68	81	96	131				
atin	dr	Rated Output Current (A)	114	139	171	204	242	329				
ЦЦ		Carrier Frequency (kHz)	<u> </u>		2	~6kHz						
Output Rating	Normal duty	Rate Output Capacity (kVA)	48	58	72	86	102	138				
-	dr	Rated Output Current (A)	120	146	180	215	255	346				
		Carrier Frequency (kHz)		0kHz		2~	9 kHz					
_	Inp	ut Current (A) Heavy Duty	118	136	162	196	233	315				
Input Rating	Input Current (A) Normal Duty		124	143	171	206	245	331				
Rated Voltage/Frequency			3-phase AC 200V~240V (-15% ~ +10%), 50/60Hz									
C Operating Voltage Range			170~265Vac									
		Frequency Tolerance			47	′~63Hz						
		AC Drive Weight	38.5	± 1.5Kg		64.8± 1.5Kg 86.5±1 .5Kg						
		Cooling method			Fan	Cooling						
		Braking Chopper	Fran	ne A to C	(built-in); F	rame D ar	d above (	optional)				
		DC reactor	Fran	ne A to C	(optional);	Frame D a	ind above	(built-in)				
		EMI Filter	Fram	e A to C (	optional); I	Frame D a	nd above (	optional)				
		EMC-COP01	V	FDXXC23	A (optiona	I); VFDXX	XC23E (bu	uilt-in)				

### 9-2 460V Series

		Frame Size			/	4				В			С		C	0
	Мо	del VFDC	007	015	022	037	040	055	075	110	150	185	220	300	370	450
А	pplica	able Motor Output(kW)	0.75	1.5	2.2	3.7	4.0	5.5	7.5	11	15	18.5	22	30	37	45
A	pplica	able Motor Output(HP)	1	2	3	5	5	7.5	10	15	20	25	30	40	50	60
	luty	Rated Output Capacity (kVA)	2.3	3.0	4.5	6.5	7.6	9.6	14	18	24	29	34	45	55	69
b	Heavy duty	Rated Output Current (A)	2.9	3.8	5.7	8.1	9.5	11	17	23	30	36	43	57	69	86
Output Rating	Ψ	Carrier Frequency (kHz)		1			1		2~6kHz	z (2kHz)				1		
Dutpul	duty	Rate Output Capacity (kVA)	2.4	3.2	4.8	7.2	8.4	10	14	19	25	30	36	48	58	73
	Normal duty	Rated Output Current (A)	3.0	4.0	6.0	9.0	10.5	12	18	24	32	38	45	60	73	91
		Carrier Frequency (kHz)			1	2~1	5kHz (8	kHz)	1	1			2~1	0kHz (6l	kHz)	
ng	In	put Current (A) Heavy Duty	4.1	5.6	8.3	13	14.5	16	19	25	33	38	45	60	70	96
Input Rating		Input Current (A) Normal Duty	4.3	5.9	8.7	14	15.5	17	20	26	35	40	47	63	74	101
ndu		ted Voltage/Frequency				3	3-phase	AC 380			~+10%),	50/60H	Z			
-		erating Voltage Range								28Vac						
		Frequency Tolerance AC Drive Weight			2.6+	0.3Kg				63Hz 5.4± 1Kg		0	.8± 1.5k	(a	27+	1 Kg
		Cooling method	Natura			0.5Ky			•			9	.01 1.5P	.y	211	TRY
		Braking Chopper	Natara	Natural cooling Fan cooling Frame A to C (built-in); Frame D and above (optional)												
		DC reactor		Frame A to C (optional); Frame D and above (built-in)												
		EMI Filter		VFDXXXC43A Frame A to C: No EMI Filter; VFDXXXC43E: Built-in EMI Filter VFDXXXC43A/43E Frame D and above: EMI Filter is optional												
		EMC-COP01		VFDXXC43A (optional); VFDXXXC43E (built-in)												
		Frame Size	D		E			F		C	3		Н			
	Mod	lel VFDC	550	750	900	1100	1320	1600	1850	2200	2800	3150	3550	4500		
		ble Motor Output(kW)	55	75	90	110	132	160	185	220	280	315	355	450		
Ap	oplica	ble Motor Output(HP)	75	100	125	150	175	215	250	300	375	420	475	600		
	duty	Rated Output Capacity (kVA)	84	114	136	167	197	235	280	348	417	466	517	677		
ng	Heavy duty	Rated Output Current (A) Carrier Frequency	105	143	171	209	247	295	352	437	523	585	649	816		
ut Rating	Т	(kHz)						2~6kHz	(2kHz)							
Outpu	duty	Rate Output Capacity (kVA)	88	120	143	175	207	247	295	367	438	491	544	720		
	Normal	Rated Output Current (A)	110	150	180	220	260	310	370	460	550	616	683	866		
	(kHz)					)kHz (6ł	,					)kHz (4k	,			
<u>b</u>	Input	Current (A) Heavy Duty	108	149	159	197	228	285	361	380	469	527	594	816		
nput Rating		Input Current (A) Normal Duty	114	157	167	207	240	300	380	400	494	555	625	866		
out		ed Voltage/Frequency			3	-phase	AC 380\			+10%),	50/60H	Z				
Ĕ		erating Voltage Range						323~5								
		requency Tolerance AC Drive Weight	38.5± ′	1.5Ka	64.8± 1	5Ka	20	47~6 .5± 1.5k		134±	1Kc		228Kg			
		Cooling method	JU.JI	.ory	04.0I	.orvy	00	Fan c		134±	+r\y		ZZONY			
		Braking Chopper			Fra	ame A te	o C (buil			nd abov	e (ontio	nal)				
		DC reactor			Fra	ame A te	o C (opti	onal); F	rame D	and abo	ve (buil	t-in)				
		EMI Filter		VFDXX	XC43A	Frame A	A to C: N 43E Fra	Io EMI F	Filter; VF	DXXXC	43E: Bu	uilt-in EN	/II Filter			

#### 

EMC-COP01

- The value of the carrier frequency is a factory setting. To increase the carrier frequency, the current needs to be decreased. See derating curve diagram of Pr06-55 for more information.
- When the control mode is FOC senrorless, TQC+PG, TQC sensorless, PM+PG and PM sensorless, the current needs to be decreased. For more information see Pr06-55.

VFDXXC43A (optional); VFDXXXC43E (built-in)

- When a load is a shock or impact load, use a higher level model.
- For FRAME A, B and C, Model VFDXXXC43A the enclosure type is IP20/NEMA1/UL TYPE1.
- For FRAME D and above, if the last character of the model is A then the enclosure type is IP20 but the wiring terminal is IP00; if the last character of the model is E, the enclosure type is IP20/NEMA1/UL TYPE1.

### **General Specifications**

	Control Method					
	Control Method	1: V/F, 2: SVC, 3: VF+PG, 4: FOC+PG, 5: TQC+PG, Reach up to 150% or above at 0.5Hz.				
	Starting Torque	Under FOC+PG mode, starting torque can reach 150% at 0Hz.				
	V/F Curve					
		4 point adjustable V/F curve and square curve 5Hz (vector control can reach up to 40Hz)				
	Speed Response Ability					
	Torque Limit	Max. 200% torque current				
	Torque Accuracy	±5%				
S	Max. Output Frequency(Hz)	normal duty: 0.01~600.00Hz; Heavy duty: 0.00 ~ 300.00 Hz				
stic	Frequency Output Accuracy	Digital command:±0.01%, -10 $^\circ$ C ~+40 $^\circ$ C, Analog command: ±0.1%, 25±10 $^\circ$ C				
Control Characteristics	Output Frequency Resolution	Digital command:0.01Hz, Analog command: 0.03 X max. output frequency/60 Hz ( $\pm$ 11 bit)				
ara	Overload Tolerance	Normal duty: rated output current is 120% for 60 seconds				
ъ		Heavy duty: rated output current is 150% for 60 seconds				
ō	Frequency Setting Signal	+10V~-10, 0~+10V, 4~20mA, 0~20mA, Pulse input				
Duti	Accel./decel. Time	0.00~600.00/0.0~6000.0 seconds				
Ŏ	Main control function	ntrol function Torque control, Droop control, Speed/torque control switching, Feed forward control, Zero-servo control Momentary power loss ride thru, Speed search, Over-torque detection, Torque limit, 17-step speed (max Accel/decel time switch, S-curve accel/decel, 3-wire sequence, Auto-Tuning (rotational, stationary), Dwe Cooling fan on/off switch, Slip compensation, Torque compensation, JOG frequency, Frequence upper/lower limit settings, DC injection braking at start/stop, High slip braking, PID control (with slee function),Energy saving control, MODOBUS communication (RS-485 RJ45, max. 115.2 kbps), Fau restart, Parameter copy				
	Fan Control	Frame A,B is on/off control Frame C and above is PWM control				
	Motor Protection	Electronic thermal relay protection				
Protection Characteristics	Over-current Protection	For drive model 230V and 440V Over-current protection for 220% rated current current clamp 『Normal duty: 170~175%』; 『Heavy duty: 180~185%』				
aracte	Over-voltage Protection	230: drive will stop when DC-BUS voltage exceeds 410V 460: drive will stop when DC-BUS voltage exceeds 820V				
n Cha	Over-temperature Protection	Built-in temperature sensor				
ctic	Stall Prevention	Stall prevention during acceleration, deceleration and running independently				
Protect	Restart After Instantaneous Power Failure	Parameter setting up to 20 seconds				
	Grounding Leakage Current Protection	Leakage current is higher than 50% of rated current of the AC motor drive				
	Certifications	CE, CUUS, GB/T12668-2, Certification in progress)				

# 9-3 Environment for Operation, Storage and Transportation

DO NOT expose the AC motor drive in the bad environment, such as dust, direct sunlight, corrosive/inflammable gasses, humidity, liquid and vibration environment. The salt in the air must be less than 0.01mg/cm<sup>2</sup> every year.

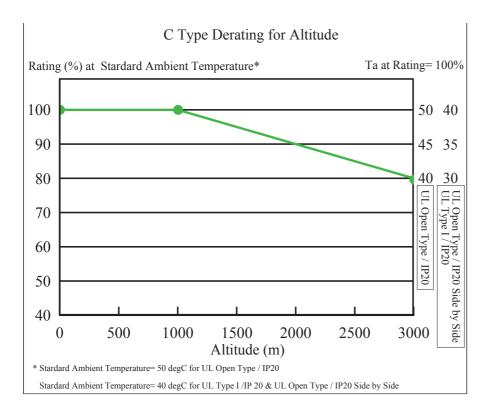
	Installation location	IEC60364-1/IEC606	64-1 Pollution degree 2, Indoor use only			
	Surrounding	Storage	-25 °C ~ +70 °C			
	Temperature	Transportation	-25 °C ~ +70 °C			
	Temperature	Non-condensation				
		Operation	Max. 95%			
	Rated Humidity	Storage/	Max. 95%			
		Transportation	-			
		No condense wate Operation/				
En line and		Storage	86 to 106 kPa			
Environment	Air Pressure	Transportation	70 to 106 kPa			
		IEC721-3-3	70 10 100 KFa			
		Operation	Class 3C2: Class 3S2			
	Pollution Level	Storage	Class 2C2; Class 2S2			
		Transportation	Class 1C2: Class 1S2			
		No concentrate				
	Altitude	Operation	If AC motor drive is installed at altitude 0~1000m, follow normal operation restriction. If it is install at altitude 1000~2000m, decrease 2% of rated current or lower 0.5°C of temeperature for every 100m increase in altitude. Maximum altitude for Corner Grounded is 2000m.			
Package Drop	Storage Transportation	ISTA procedure 1A	A(according to weight) IEC60068-2-31			
1.0mm, peak to peak value range from 2Hz to 13.2 Hz; 0.7G~1.0G range from 13.2Hz to 55Hz; 1.0G range Vibration						
	512 Hz. Comply with IEC 60068-2-6					
Impact	IEC/EN 60068-2-2	EC/EN 60068-2-27				
Operation Position	Max. allowed offset angle $\pm 10^{\circ}$ (under normal installation position)					

Model	Frame	Top cover Conduit Box		Protection Level	Operation Temperature
	Frame A~C 230V: 0.75~22kW	Top cover Removed	Standard conduit	IP20/UL Open Type	<b>-10~50</b> ℃
	460V: 0.75~30kW	Standard with top cover	plate	IP20/UL Type1/NEMA1	<b>-10~40</b> ℃
VFDxxxCxxA	Frame D~H 230V: >22kW 460V: >30kW	N/A	No conduit box	IP00/IP20/UL Open Type Only the circled area is IP00, other are IP20	- <b>10~50°</b> ℃
	Frame A~C	Top cover Removed	Standard conduit	IP20/UL Open Type	<b>-10~50</b> ℃
VFDxxxCxxE	460V: 0.75~30kW	Standard with top cover	plate	IP20/UL Type1/NEMA1	<b>-10~40</b> ℃
	Frame D~H 230V: >22kW 460V: >30kW	N/A	Standard conduit box	IP20/UL Type1/NEMA1	<b>-10~40</b> ℃

# 9-4 Specification for Operation Temperature and Protection Level

#### Chapter 9 Specifications | C2000 Series

# 9-5 Derating of ambient temperature and altitude



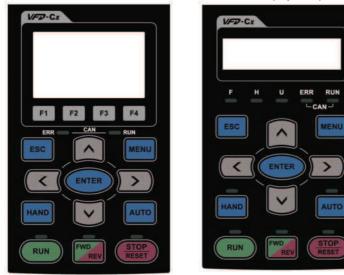
Protection Level	Operating Environment
UL Type I / IP20	When the AC motor drive is operating at the rated current and the ambient temperature has to be between $10^{\circ}$ C ~ +40 $^{\circ}$ C. When the temperature is over $40^{\circ}$ C, for every increase by $1^{\circ}$ C, decrease 2% of the rated current. The maximum allowable temperature is $60^{\circ}$ C.
UL Open Type / IP20	When the AC motor drive is operating at the rated current and the ambient temperature has to be between $-10^{\circ}$ C ~ $+50^{\circ}$ C. When the temperature is over $50^{\circ}$ C, for every increase by $1^{\circ}$ C, decrease 2% of the rated current. The maximum allowable temperature is $60^{\circ}$ C.
High Altitude	If AC motor drive is installed at altitude 0~1000m, follow normal operation restriction. If it is install at altitude 1000~2000m, decrease 2% of rated current or lower $0.5^{\circ}$ C of temperature for every 100m increase in altitude. Maximum altitude for Corner Grounded is 2000m. Contact Delta for more information, if you need to use this motor drive at an altitude of 2000m or higher.

# **Chapter 10 Digital Keypad**

- 10-1 Descriptions of Digital Keypad
- 10-2 Function of Digital Keypad KPC-CC01
- 10-3 TPEditor Installation Instruction
- 10-4 Fault Code Description of Digital Keypad KPC-CC01

#### Chapter 10 Digital Keypad | C2000 Series

### 10-1 Descriptions of Digital Keypad KPC-CC01 KPC-CE01(Option)



Communication Interface RJ-45 (socket) \ RS-485 interface;

Installation Method

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

# **Descriptions of Keypad Functions**

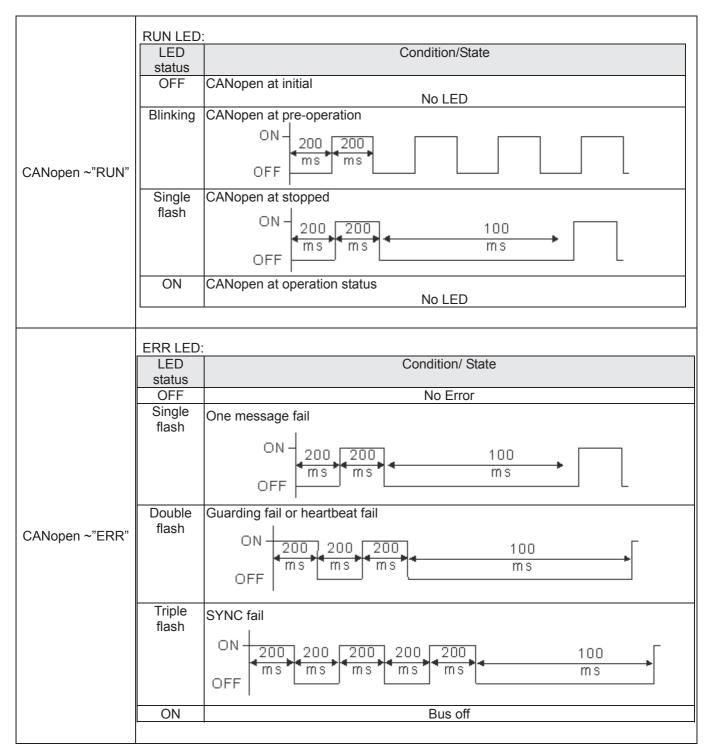
Key	Descriptions
RUN	<ol> <li>Start Operation Key</li> <li>It is only valid when the source of operation command is from the keypad.</li> <li>It can operate the AC motor drive by the function setting and the RUN LED will be ON.</li> <li>It can be pressed again and again at stop process.</li> <li>When enabling "HAND" mode, it is only valid when the source of operation command is from the keypad.</li> </ol>
<b>STOP</b> <b>RESET</b>	<ol> <li>Stop Command Key. This key has the highest processing priority in any situation.</li> <li>When it receives STOP command, no matter the AC motor drive is in operation or stop status, the AC motor drive needs to execute "STOP" command.</li> <li>The RESET key can be used to reset the drive after the fault occurs. For those faults that can't be reset by the RESET key, see the fault records after pressing MENU key for details.</li> </ol>
FWD	<ul> <li>Operation Direction Key</li> <li>1. This key is only control the operation direction NOT for activate the drive. FWD: forward, REV: reverse.</li> <li>2. Refer to the LED descriptions for more details.</li> </ul>
ENTER	ENTER Key Press ENTER and go to the next level. If it is the last level then press ENTER to execute the command.
ESC	ESC Key ESC key function is to leave current menu and return to the last menu. It is also functioned as a return key in the sub-menu.
MENU	Press menu to return to main menu.         Menu content:         KPC-CE01 does not support function 5 ~13.         1. Parameter setup       7. Quick start       13. PC Link         2. Copy Parameter       8. Display Setup         3. Keypad Locked       9. Time Setup         4. PLC Function       10. Language Setup         5. Copy PLC       11. Startup Menu         6. Fault Record       12. Main Page
	<ul> <li>Direction: Left/Right/Up/Down</li> <li>In the numeric value setting mode, it is used to move the cursor and change the numeric value.</li> <li>In the menu/text selection mode, it is used for item selection.</li> </ul>

F1 F2 F3 F4	<ol> <li>Function Key</li> <li>The functions keys have factory settings and can be defined by users. The factory settings of F1 and F4 work with the function list below. For example, F1 is JOG function, F4 is a speed setting key for adding/deleting user defined parameters.</li> <li>Other functions must be defined by TPEditor first. TPEditor software V1.30.6 is available for download at:</li> </ol>
	<ul> <li><u>http://www.delta.com.tw/ch/product/em/download/download_main.asp?act=3&amp;pid=1&amp;cid=</u></li> <li><u>1&amp;tpid=3</u></li> <li>Installation Instruction for TPEditor is on page 10-15 of this chapter.</li> </ul>
HAND	HAND ON Key
	1. This key is executed by the parameter settings of the source of Hand frequency and hand operation. The factory settings of both source of Hand frequency and hand operation are the digital keypad.
	2. Press HAND ON key at stop status, the setting will switch to hand frequency source and hand operation source. Press HAND ON key at operation status, it stops the AC motor drive first (display AHSP warning), and switch to hand frequency source and hand operation source.
	3. Successful mode switching for KPC-CE01, "H/A" LED will be on; for KPC-CC01, it will display HAND mode/ AUTO mode on the screen.
Αυτο	<ol> <li>This key is executed by the parameter settings of the source of AUTO frequency and AUTO operation. The factory setting is the external terminal (source of operation is 4-20mA).</li> </ol>
	<ol> <li>Press Auto key at stop status, the setting will switch to hand frequency source and hand operation source. Press Auto key at operation status, it stops the AC motor drive first (display AHSP warning), and switch to auto frequency source and auto operation source.</li> <li>Successful mode switching for KPC-CE01, "H/A" LED will be off; for KPC-CC01, it will</li> </ol>
	display HAND mode/ AUTO mode on the screen

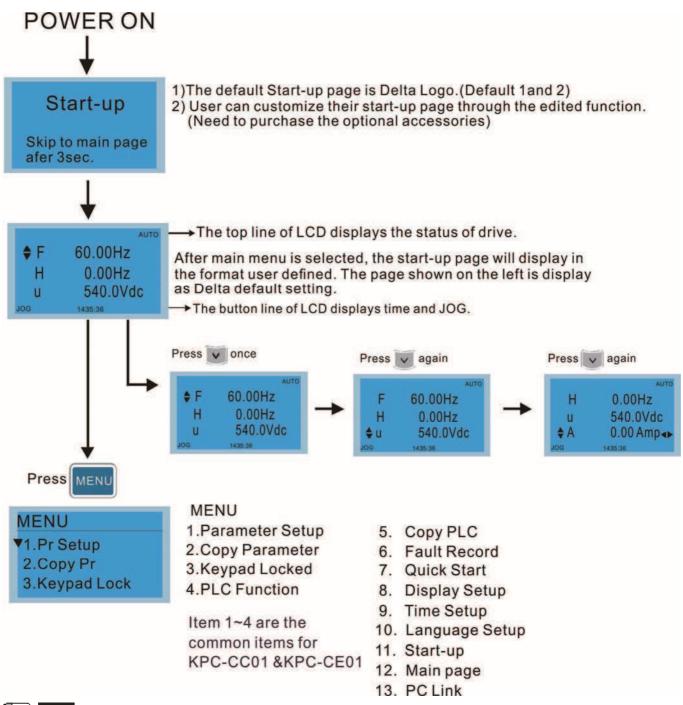
# Descriptions of LED Functions

LED	Descriptions
RUN	Steady ON: operation indicator of the AC motor drive, including DC brake, zero speed, standby, restart after fault and speed search.
	Blinking: drive is decelerating to stop or in the status of base block. Steady OFF: drive doesn't execute the operation command
STOP RESET	Steady ON: stop indicator of the AC motor drive.
	Blinking: drive is in the standby status.
	Steady OFF: drive doesn't execute "STOP" command.
FWD	Operation Direction LED 1. Green light is on, the drive is running forward.
	2. Red light is on, the drive is running backward.
	3. Twinkling light: the drive is changing direction.
HAND	(Only KPC-CE01 support this function)
	Setting can be done during operation.
	HAND LED: When HAND LED is on (HAND mode); when HAND LED is off (AUTO mode).
AUTO	(Only KPC-CE01Support this function )
	Setting can be done during operation.
	AUTO LED: when AUTO LED is on (AUTO mode); when AUTO LED is off (HAND mode).

#### Chapter 10 Digital Keypad | C2000 Series

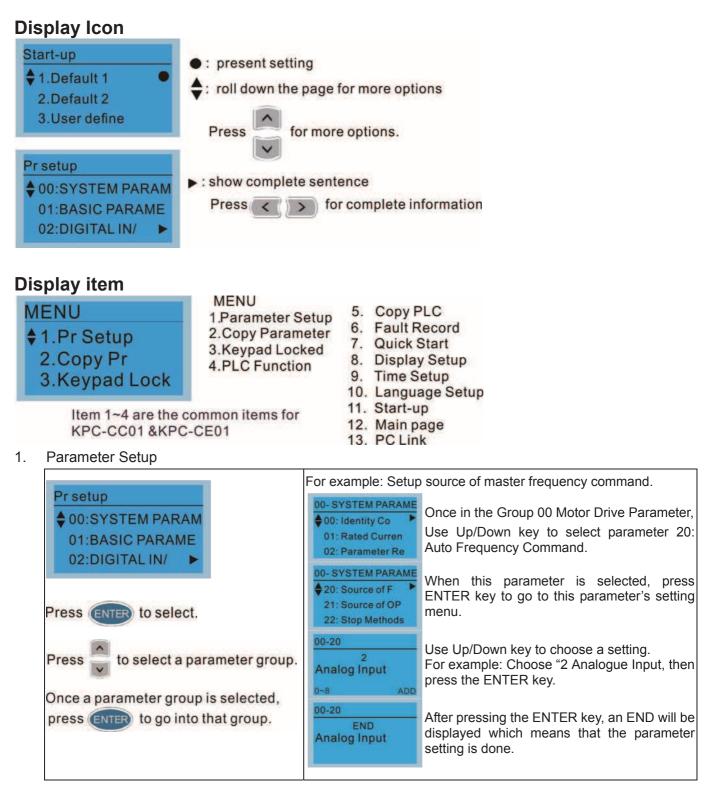


# 10-2 Function of Digital Keypad KPC-CC01



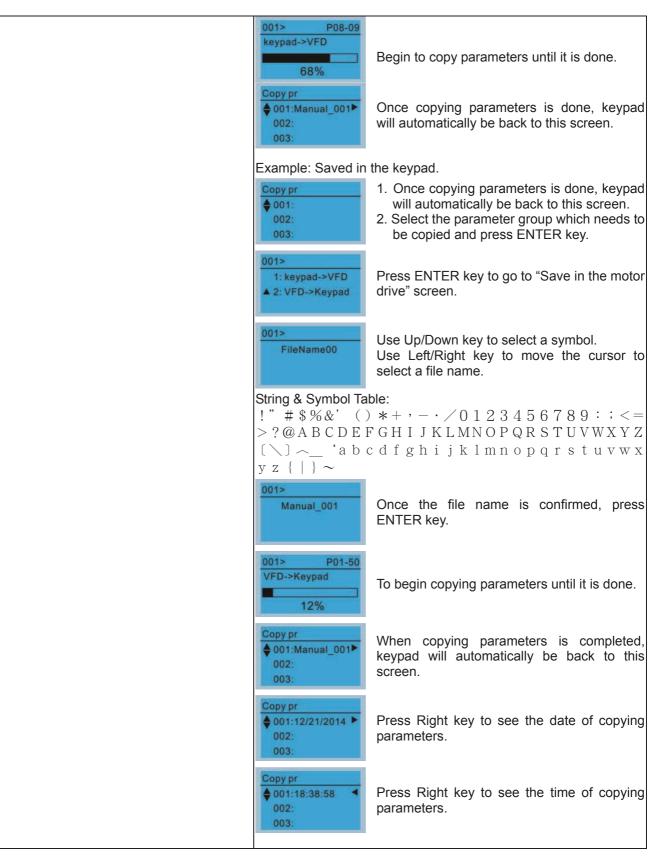
#### 

- 1. Startup page can only display pictures, no flash.
- 2. When Power ON, it will display startup page then the main page. The main page displays Delta's default setting F/H/A/U, the display order can be set by Pr.00.03 (Startup display). When the selected item is U page, use left key and right key to switch between the items, the display order of U page is set by Pr.00.04 (User display).



## 2. Copy Parameter

Copy Pr		4 duplicates are pr	ovided
♦ 001:Manual_001 ►		The steps are show	wn in the example below.
002:FileName01		Example: Saved in	the motor drive.
003:FileName02		Copy pr	1 Go to Copy Parameter
The state of the s	♦ 001:Manual_001►	2 Select the parameter group which needs to	
Press ENTER key to go to 001~004:		002: 003:	be copied and press ENTER key.
content storage		001> ▼ 1: keypad->VFD 2: VFD->Keypad	<ol> <li>Select 1: Save in the motor drive.</li> <li>Press ENTER key to go to "Save in the motor drive" screen.</li> </ol>



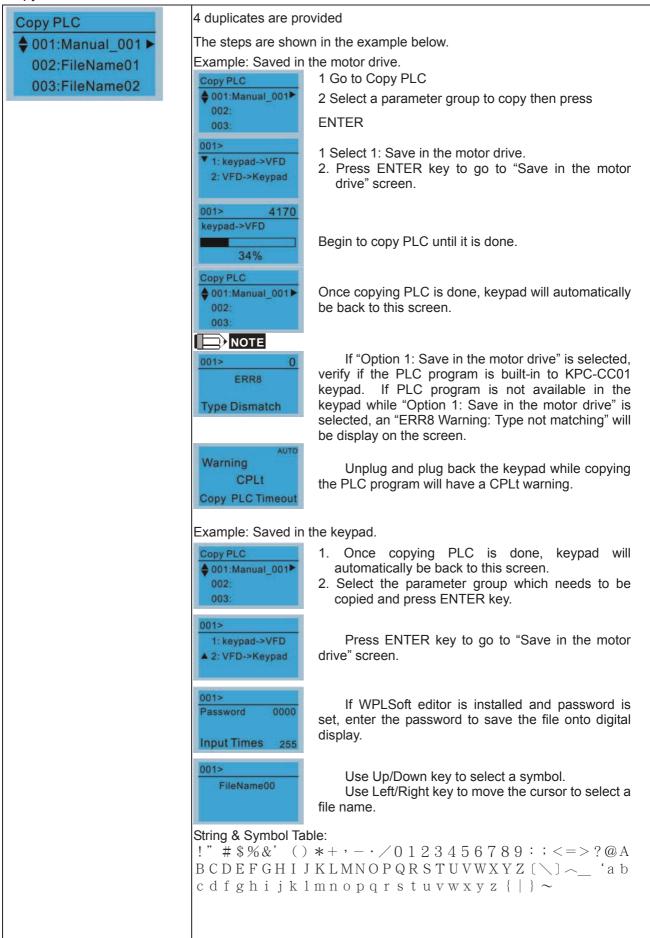
3. Keypad locked

Keypad Lock	Keypad Locked		
Press ENTER to Lock Key	"keypad locked" wh	This function is used to lock the keypad. The main page would not display "keypad locked" when the keypad is locked, however it will display the message"please press ESC and then ENTER to unlock the keypad" when any key is pressed.	
Press ENTER to lock	Ашто <b>♦</b> F 60.00Hz H 0.00Hz u 540.0Vdc JOG 14:35:58	When the keypad is locked, the main screen doesn't display any status to show that.	
	Keypad Lock Press ESC 3 sec to UnLock Key	Press any key on the keypad; a screen as shown in image on the left will be displayed.	
	4000 ↓F 60.00Hz H 0.00Hz u 540.0Vdc JOG 14:35:58	If ESC key is not pressed, the keypad will automatically be back to this screen.	
	Keypad Lock Press ESC 3 sec to UnLock Key	The keypad is still locked at this moment. By pressing any key, a screen as shown in the image on the left will still be displayed.	
	4000 ♦F 60.00Hz H 0.00Hz u 540.0Vdc JOG 14:35:58	Press ESC for 3 seconds to unlock the keypad and the keypad will be back to this screen. Then each key on the keypad is functional.	
	Turn off the power	and turn on the power again will not lock keypad.	

## 4. PLC Function

PLC	When activate and stop PLC function, the PLC status will be displayed on main page of Delta default setting.		
<ul> <li>▼1.Disable</li> <li>2.PLC Run</li> <li>3.PLC Stop</li> </ul>	PLC 1.Disable \$2.PLC Run 3.PLC Stop	Optipn 2: Enable PLC function	
Press Up/Down key to select a PLC's function. Then press ENTER.	A PLC/RUN AUTO ♦F 60.00Hz H 0.00Hz U 540.0Vdc JOG 14:35:58	Factory setting on the main screen displays PLC/RUN status bar.	
	PLC 1.Disable 2.PLC Run *3.PLC Stop	Option 3: Disable PLC function	
	PLC/STOP AUTO ♦F 60.00Hz H 0.00Hz u 540.0Vdc JOG 14:35:58	Factory setting on the main screen displays PLC/STOP status bar	
	PLC/STOP AUTO Warning PLFF Function defect	If the PLC program is not available in the control board, PLFF warning will be displayed when choosing option 2 or 3. In this case, select option 1 : No Function to clear PLFF warning.	
	The PLC function of KPC-CE01 can only displays:		
	1. PLC0 2. PLC1 3. PLC2		

5. Copy PLC



001> Manual_001	Once the file name is confirmed, press ENTER key.
001> 2010 VFD->Keypad 12%	To begin copying parameters until it is done.
Copy PLC ♦ 001:Manual_001► 002: 003:	When copying parameters is completed, keypad will automatically be back to this screen.
Copy PLC ♦ 001:12/21/2014 ► 002: 003:	Press Right key to see the date of copying parameters.
Copy PLC ♦ 001:18:38:58 ◀ 002: 003:	Press Right key to see the time of copying parameters.

## 6. Fault record

Tault record		
Fault record ▼1:oL 2:ovd 3:GFF	Able to store 6 error code (Keypad V1.02 and previous versions) Able to store 20 error code(Keypad V1.0e3 and previous version) The most recent error record is shown as the first record. Select an error record to see its detail such as date, tme, frequency, current, voltage, DCBUs voltage)	
Press ENTER to select. KPC-CE01 does not support	Fault record ▼1:oL 2:ovd 3:GFF	Press Up/Down key to select an error record. After selecting an error code, press ENTER to see that error record's detail
this function.	1: oL ♦ Current: 79.57 Voltage: 189.2 BUS Voltage:409.5 1: oL ♦ Date: 01/20/2014 Time: 21:02:24 Outfreq: 32.61	Press Up/Down key to see an error record's detail such as date, time, frequency, current, voltage, DCBus voltage.
	Fault record 1:oL \$ 2:ovd 3:GFF	Press Up/Down key to select an error record. After selecting an error code, press ENTER to see that error record's detail
	2: ovd ♦ Current: 79.57 Voltage: 189.2 BUS Voltage:409.5 2: ovd ♦ Date: 01/20/2014 Time: 21:02:24 Outfreq: 32.61	Press Up/Down key to see an error record's detail such as date, time, frequency, current, voltage, DCBus voltage.
	KPC-CC01 is re fault records will	AC motor drive are record and save to KPC-CC01. When moved and apply to another AC motor drive, the previous not be deleted. The new fault records of the present AC accumulate to KPC-CC01.

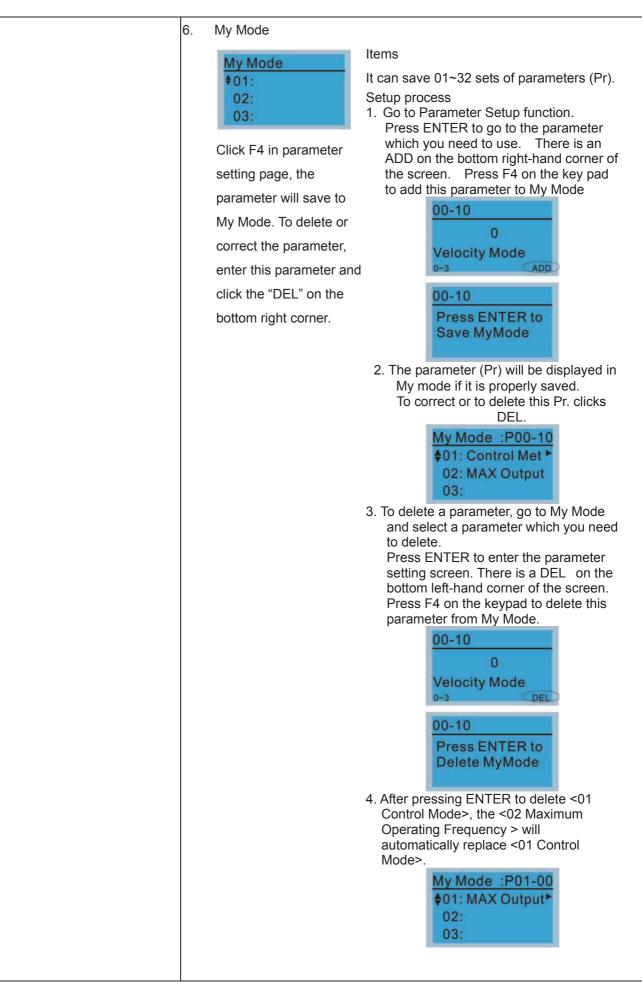
7. Quick Start

Quick Start	
Quick Start	Description:
▼ 1: V/F Mode         2: VFPG Mode         3: SVC Mode         Press ENTER to select.         Quick Start:         1. V/F Mode         2. VFPG Mode         3. SVC Mode         4. FOCPG Mode         5. TQCPG Mode         6. My Mode	<ul> <li>1. VF Mode</li> <li>1. VF Mode :P00-07 <ul> <li>101:Password De</li> <li>02:Password Input</li> <li>01:Password Decoder</li> </ul> </li> <li>00-07 <ul> <li>0</li> <li>Password Decoder</li> <li>0.65535</li> </ul> </li> <li>1. Parameter Protection Password Setting (P00-08) <ul> <li>2. Parameter Protection Password Setting (P00-08)</li> <li>3. Control Mode (P00-10)</li> <li>4. Control Mode (P00-10)</li> <li>4. Control of Speed Mode (P00-11)</li> <li>5. Load Selection (P00-20)</li> <li>7. Source of the Master Frequency command (AUTO) (P00-22)</li> <li>9. Digital Keypad STOP function (P00-32)</li> <li>10. Max. Operation Frequency (P01-00)</li> <li>11. Base Frequency of Motor 1 (P01-01)</li> <li>12. Max. Output Voltage Setting of Motor 1 (P01-02)</li> <li>13. Min. Output Frequency of Motor 1 (P01-08)</li> <li>15. Output Frequency Lower Limit (P01-10)</li> <li>16. Output Frequency Lower Limit (P01-11)</li> <li>17. Accel. Time 1 (P01-12)</li> <li>18. Decel Time 1 (P01-13)</li> <li>19. Over-voltage Stall Prevention (P06-01)</li> <li>20. Software Brake Level (P07-00)</li> <li>21. Filter Time of Slip Compensation (P07-24)</li> </ul> </li> </ul></li></ul></li></ul></li></ul></li></ul>
	<ul> <li>23. Slip Compensation Gain (P07-27)</li> <li>2. VFPG Mode</li> <li>23. Slip Compensation Gain (P07-27)</li> <li>2. VFPG Mode :P00-07 <ul> <li>\$01: Password Det</li> <li>01: Password Decoder</li> <li>00-07 <ul> <li>0</li> <li>Password Decoder</li> <li>0</li> <li>00-07 </li> <li>0</li> <li>Password Decoder</li> <li>0</li> <li>00-07 <ul> <li>0</li> <li>Password Decoder</li> <li>0</li> <li< td=""></li<></ul></li></ul></li></ul></li></ul></li></ul></li></ul></li></ul></li></ul>

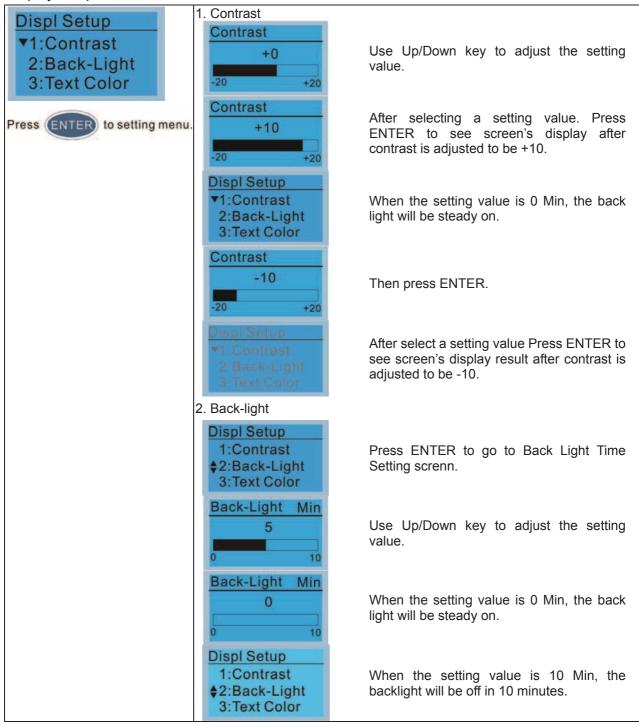
	18. 19.	Decel Time 1 (P01-13) Over-voltage Stall Prevention
	19.	(P06-01)
	20.	Software Brake Level (P07-00)
	21.	Filter Time of Torque Command
		(P07-24)
	22.	Filter Time of Slip Compensation
		(P07-25)
	23.	Slip Compensation Gain (P07-27)
	24.	
	25.	Encoder Pulse (P10-01)
	26.	Encoder Input Type Setting (P10-02)
	27.	ASR Control ( P) 1 (P11-06)
	28. 29.	ASR Control (I) 1 (P11-07)
	29. 30.	ASR Control ( P) 2 (P11-08) ASR Control (I) 2 (P11-09)
	31.	P Gain of Zero Speed (P11-10)
	32.	I Gain of Zero Speed (P11-11)
3. SVC Mode	02.	
	Item	IS
SVC Mode :P00-07	1.	Parameter Protection Password Input
\$01:Password De►		(P00-07)
02:Password Inp	2.	Parameter Protection Password
03:Control Meth		Setting (P00-08)
	3.	Control Mode (P00-10)
01: Password Decoder	4.	Control of Speed Mode (P00-11)
	5. 6.	Load Selection (P00-16)
00-07	0. 7.	Carrier Frequency (P00-17) Source of the Master Frequency
0	7.	Command (AUTO) (P00-20)
Password Decoder	8.	Source of the Operation Command
	•	(AUTO) (P00-21)
0~65535	9.	Stop Method (P00-22)
	10.	Digital Keypad STOP function
		(P00-32)
	11.	Max. Operation Frequency (P01-00)
	12.	Base Frequency of Motor 1 (P01-01)
	13.	Max. Output Voltage Setting of Motor 1 (P01-02)
	14.	Min. Output Frequency of Motor 1
		(P01-07)
	15.	Min. Output Voltage of Motor 1
		(P01-08)
	16.	Output Frequency Upper Limit
	47	(P01-10)
	17.	Output Frequency Lower Limit
	18.	(P01-11) Accel. Time 1 (P01-12)
	10.	
	20.	
	20.	(P05-01)
	21.	Rated Power of Induction Motor 1
		(P05-02)
	22.	Rated Speed of Induction Motor 1
	23.	(P05-03) Pole Number of Induction Motor 1
	23.	(P05-04)
	24.	No-load Current of Induction Motor 1
		(P05-05)
	25.	Over-voltage Stall Prevention
	00	(P06-01)
	26.	Over-current Stall Prevention during Acceleration (P06-03)
	27.	Derating Protection (P06-55)
	27. 28	Software Brake Level (P07-00)

	29. Emergency Stop (EF) & Force to Stop Selection (P07-20)
	30. Filter Time of Torque Command
	(P07-24) 31. Filter Time of Slip Compensation
	(P07-25)
	32. Slip Compensation Gain (P07-27)
4. FOCPG Mode	
and the second se	Items
FOCPG Mode :P00-07 \$01:Password De	<ol> <li>Parameter Protection Password Input (P00-07)</li> </ol>
02:Password Inp	2. Parameter Protection Password Setting
03:Control Meth	(P00-08) 3. Control Mode (P00-10)
01: Password Decoder	4. Control of Speed Mode (P00-11)
01. Password Decoder	5. Source of the Master Frequency Command (AUTO) (P00-20)
00-07	6. Source of the Operation Command
0	(AUTO) (P00-21)
Password Decoder	<ol> <li>Stop Method (P00-22)</li> <li>Max. Operation Frequency (P01-00)</li> </ol>
0~65535	9. Base Frequency of Motor 1 (P01-01)
	10. Max. Output Voltage Setting of Motor 1 (P01-02)
	11. Output Frequency Upper Limit (P01-10)
	<ol> <li>Output Frequency Lower Limit (P01-11)</li> <li>Accel. Time 1 (P01-12)</li> </ol>
	14. Decel Time 1 (P01-13)
	<ol> <li>Full-load Current of Induction Motor 1 (P05-01)</li> </ol>
	16. Rated Power of Induction Motor 1
	(P05-02) 17. Rated Speed of Induction Motor 1
	(P05-03)
	<ol> <li>Pole Number of Induction Motor 1 (P05-04)</li> </ol>
	19. No-load Current of Induction Motor 1
	(P05-05) 20. Over-voltage Stall Prevention (P06-01)
	21. Over-current Stall Prevention during
	Acceleration (P06-03) 22. Derating Protection (P06-55)
	23. Software Brake Level (P07-00)
	24. Emergency Stop (EF) & Force to Stop Selection (P07-20)
	25. Encoder Type Selection (P10-00)
	<ul><li>26. Encoder Pulse (P10-01)</li><li>27. Encoder Input Type Setting (P10-02)</li></ul>
	28. System Control (P11-00)
	29. Per Unit of System Inertia (P11-01)
	<ol> <li>ASR1 Low-speed Bandwidth (P11-03)</li> <li>ASR2 High-speed Bandwidth (P11-04)</li> </ol>
	32. Zero-speed Bandwidth (P11-05)

5.	TQCPG Mode		
5.	TQCPG Mode :P00-07	11.	Password Input (Decode) (P00-07) Password Setting (P00-08) Control Mode (P00-10) Control of Speed Mode (P00-11) Source of the Master Frequency Command (P00-20) Source of the Operation Command (P00-21) Max. Operation Frequency (P01-00) Base Frequency of Motor 1 (P01-01) Max. Output Voltage Setting of Motor 1 (P01-02) Full-load Current of Induction Motor 1 (P05-01) Rated Power of Induction Motor 1 (P05-02) Rated Speed of Induction Motor 1
			(P05-03) Pole Number of Induction Motor 1 (P05-04)
		<ol> <li>15.</li> <li>16.</li> <li>17.</li> <li>18.</li> <li>20.</li> <li>21.</li> <li>22.</li> <li>23.</li> <li>24.</li> <li>25.</li> <li>26.</li> <li>27.</li> <li>28.</li> <li>29.</li> <li>30.</li> <li>31.</li> </ol>	No-load Current of Induction Motor 1 (P05-05) Over-voltage Stall Prevention (P06-01) Software Brake Level (P07-00) Encoder Type Selection (P10-00) Encoder Pulse (P10-01) Encoder Input Type Setting (P10-02) System Control (P11-00) Per Unit of System Inertia (P11-01) ASR1 Low-speed Bandwidth (P11-03) ASR2 High-speed Bandwidth (P11-04) Zero-speed Bandwidth (P11-05) Max. Torque Command (P11-27) Source of Torque Offset (P11-28) Torque Offset Setting (P11-29) Source of Torque Command (P11-33) Torque Command (P11-34) Speed Limit Selection (P11-36) Forward Speed Limit (torque mode) (P11-37) Reverse Speed Limit (torque mode) (P11-38)



8. Display setup



#### 9. Time setting

-		
Time setup           2009/01/01          :::	Time Setup 2014/01/01 00 : 00 : 00	Use Up/Down key to set up Year
Use Left/Right key to select Year, Month, Day, Hour, Minute or Second to set up	Time Setup 2014/01/01 00 : 00 : 00	Use Up/Down key to set up Month

Time Setup 2014/01/01 00 : 00 : 00	Use Up/Down key to set up day			
Time Setup 2014/01/01 21 : 00 : 00	Use Up/Down key to set up hour			
Time Setup 2014/01/01 21 : 12 : 00	Use Up/Down key to set up Minute			
Time Setup 2014/01/01 21 : 12 : 14	Use Up/Down key to set up Second			
Time Setup END	After setting up, press ENTER to confirm the setup.			
When the digital keypad	When the digital keypad is removed, the time setting will be in standby status			
for 7 days. After this per	for 7 days. After this period, the time needs to be reset.			

# 10. Language setup

Language ▼1:English ♥	Language setting option Language setting option	is displayed in the language of the user's choice. is:
2:繁體中文	1. English	5.
3:简体中文	2. 繁體中文	6. Espanol
Use Up/Down key to select	3. 简体中文	7. Portugues
language, than press ENTER.	4. Turkce	

# 11. Startup-up



3. User Defined: optional accessory is require (TPEditor & USB/RS-485
Communication Interface-IFD6530)
Install an editing accessory would allow users to design their own start-up
page.If editor accessory is not installed, "user defined" option will dispay a
blank page.
DELTA VFD C2000 X-Y-Z 3-axis station X-axis
USB/RS-485 Communication Interface-IFD6530 Please refer to Chapter 07 Optional Acessories for more detail.
<u>TPEditor</u> Go to Delta's website to download TPEditor V1.30.6 or later versions. <u>http://www.delta.com.tw/ch/product/em/download/download_main.asp?act</u>
=3&pid=1&cid=1&tpid=3

## 12. Main page

Main Page	1. Default page
<ul> <li>▼ 1.Default</li> <li>2.User Define</li> </ul>	▲ F 60.00Hz H 0.00Hz u 540.0Vdc
Default picture and editable picture are available upon	F 600.00Hz >>> H >>> A >>> U (circulate)
selection. Press ENTER to select.	<ul> <li>User Defined: optional accessory is require (TPEditor &amp; USB/RS-485 Communication Interface-IFD6530) Install an editing accessory would allow users to design their own start-up page.If editor accessory is not installed, "user defined" option will dispay a blank page.</li> <li>Freq. 60.00Hz Current 123.45A DC BUS 543.21Vdc</li> <li>PID target 50.00% PID feedback 47.45% Output freq. 53.21Hz</li> </ul>
	USB/RS-485 Communication Interface-IFD6530 Please refer to Chapter 07 Optional Acessories for more detail.
	TPEditor         Go to Delta's website to download TPEditor V1.30.6 or later versions. <u>http://www.delta.com.tw/ch/product/em/download/download_main.asp?act</u> =3&pid=1&cid=1&tpid=3

# 13. PC Link

PC Link T. TPEditor		allows users to connect the keypad to a bad and edit user defined pages.
2. VFDSoft	PC Link Waiting 0%	Click ENTER to go to <waiting connect="" pc="" to=""></waiting>

Ir	n TPEditor, choose <co< th=""><th>mmunication&gt;, then choose "Write to</th><th>o HMI"</th></co<>	mmunication>, then choose "Write to	o HMI"
	d'i Ealet) (Wen() Company) Olgentio) Lond Fage Lemman L D 2 2 2 2 2 0 0 0 0 1 2 2 2 2 2 2 2 2 2 2	end faithings (Conversion and Conversion and Conver	- in the second
	X-axis Output cument ###.# PID tanget 0 YYYY/MM/DD HH:MM:SS [		B The O Borne
	A B C B L B C C		Process
C	Choose <yes> in the <c< th=""><th>confirm to Write&gt; dialogue box.</th><th>0 9 0</th></c<></yes>	confirm to Write> dialogue box.	0 9 0
	01 Matrix Matrix Campbell Construct Last Approximate 0 ■ ● ■ ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ●		dr.
	X-axis Outputcument ####.# PID tanget 0	F41	in The frame 0 1 BootRage
		Down Type F.B. TA VET-C Lance Mackae Type VET-C Fordiel Sank Control	8 1 4 8 1 1 (2005) 2010 - 1 (2005)
	PC Link Receiving 28% PC Link	Start downloading pages to edit	KPC-CC01.
	Completed 100%	Download completed	
2.	VFDSoft: this function	allows user to link to the VFDSoft C	perating
	software then to uploa	d data	
	Copy parameter 1~4 in	ו KPC-CC01	
	Connect KPC-CCO1 t	o a computer	
	PC Link 1TPEditor ▲2. VFDSoft	Start downloading pages to KPC-CC01	edit to
	PC Link \$001: C2000_Fan1► 002: C2000_Fan2 003: C2000_Pum1	Use Up/Down key to select a g group to upload to VFDSoft. Press ENTER	parameter

PC Link 1:       0         Waiting       Waiting to connect to PC         0%       Waiting to connect to PC
Open VFDSoft, choose <parameter function="" manager=""></parameter>
na Day Molar Carlos Map
Dist Verse
Read Content
Refer Neurope
Contraction (Contraction)
In Parameter Manager, choose <load from="" kpc-cc01="" parameter="" table=""></load>
The transmitter Management  The Transmitter  The Transmi
(07.400 2007/02.24.2004)
Choose the right communication port and click OK

PC Link 1: 2170 Receiving 58%	Start to upload parameters to VFDSoft
PC Link 1: 3640 Completed 100%	Uploading parameter is completed
Before using the user de	fined starting screen and user defined main
screen, the starting scree	en setup and the main screen setup have to be
preset as user defined.	
If the user defined page a	are not downloaded to KPC-CC01, the starting
screen and the main scre	een will be blank.

# Other display

When fault occur, the menu will display:



- 1. Press ENTER and start RESET. If still no response, please contact local distributor or return to the factory. To view the fault DC BUS voltage, output current and output voltage, press "MENU"→"Fault Record".
- 2. Press ENTER again, if the screen returns to main page, the fault is clear.
- 3. When fault or warning message appears, backlight LED will blinks until the fault or the warning is cleared.

# Optional accessory: RJ45 Extension Lead for Digital Keypad

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

Note: When you need to buy communication cables, buy non-shielded , 24 AWG, 4 twisted pair, 100 ohms communication cables.

# **10-3 TPEditor Installation Instruction**

TPEditor can edit up to 256 HMI (Human-Machine Interface) pages with a total storage capacity of 256kb.

Each page can edit 50 normal objects and 10 communication objects.

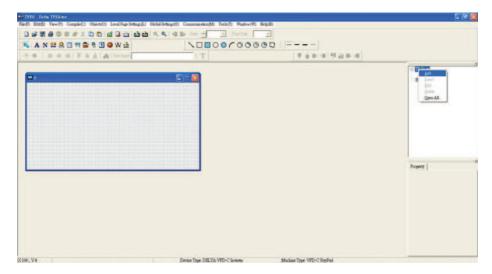
- 1) TPEditor: Setup & Basic Functions
  - 1. Run TPEditor version 1.30



2. Go to File(F)→Click on New. The Window below will pop up. At the device type, click on the drop down menu and choose DELTA VFD-C Inverter. At the TP type, click on the drop down menu and choose VFD-C KeyPad. As for File Name, enter TPE0. Now click on OK.

New Project		
HMI >> PLC		
Set Device Type		
DELTA VFD-C Inverter		•
TP Type		
VFD-C KeyPad		•
File Name		
TPBO		
OK	Cancel	

3. You are now at the designing page. Go to Edit (E)→Click on Add a New Page (A) or go to the TP page on the upper right side, right click once on TP page and choose Add to increase one more page for editing. The current firmware of Keypad is version1.00 and can support up to 4 pages.



4. Edit Startup Page

5. Static Text A. Open a blank page, click once on this button A, and then double click on that blank page. The following windows will pop up.

a an		= 17 Fige 0 Boo Fige
	State Text Setting Free Ontes Star Dantes Mapping Free Dantes Free	elige e e e e
	OK Qued	Chara Salo Pinar Salo Ten Liners Ten Liners Hand Agenerati Agenerati Hand Agenerati Hand Agenerati Hand Agenerati Hand Salo Ten Salo Ten Salo

6. Static Bitmap  $\rightarrow$  Open a blank page, then click once on this button  $\square$  and then double click on that blank page. The following window will pop up.

l	890 290	S dago+		- + B		Poter	S TP Page
- - - - - - - -	RADDOTH	Asarwelli Asarwelli Asarwelli Asarwelli Asarwelli Asarwelli Asarwelli Asarwelli Asarwelli Asarwelli Asarwelli Asarwelli Asarwelli	Atenvel15 Atenvel15 Atenvel16 Atenvel17 Atenvel18 Atenvel18 Atenvel21 Atenve	Annual An	A tensol(i) dearroll(i) dearr	Novel	Boo Puge
		860) 8995(D)	( Dimege (* long)		• 榮恕()) • 秋语		(gBos: bdo (Lrtt, Top, Wath Dimup Feed (Dimup)

Please note that Static Bitmap setting support only images in BMP format. Now choose a image that you need and click open, then that image will appear in the Static Bitmap window.

7. Geometric Bitmap  $\rightarrow$  As shown in the picture on the left side, there are 11 kinds of geometric bitmap to choose. Open a new blank page then click once on a geometric bitmap icon that you need. Then drag that icon and enlarge it to the size that you need on that blank page.

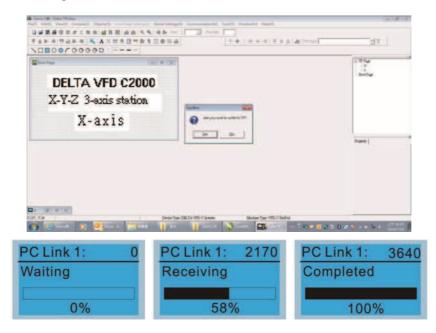
8. Finish editing the keypad starting screen and select **Communication>Input User Defined Keypad Starting Screen.** 

Dage		(a) TP Fuge Boor Fuge
DELTA VFD C20		
X-Y-Z 3-exis statio	<b>N</b>	
X-axis		
		Property

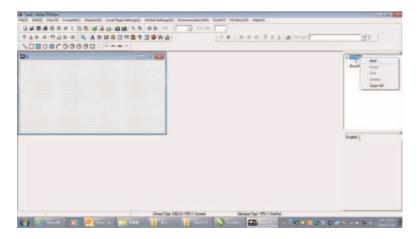
- 9. Downloading setting: Go to Tool > Communication. Set up communication port and speed of IFD6530.
- 10. Only three speed selections are available: 9600 bps, 19200 bps and 38400 bps.

TP Station Address	I ÷
PC COM Port	00M3 -
Baud Rate	9600 .

11. When a dialogue box displayed on the screen asking to confirm writing or not, press buttons on the keypad to go to MENU, select PC LINK and then press ENTER and wait for few seconds. Then select YES on the screen to start downloading.



- 2) Edit Main Page & Example of Download
  - 1. Go to editing page, select EditàAdd one page or press the button ADD on the right hand side of the HMI page to increase number of pages to edit. This keypad currently support up to 256 pages.



2. On the bottom right-hand corner of the HMI, click on a page number to edit or go to VIEW >HMI page to start editing main page. As shown in the image, the following objects are available. From left to right: Static Text, ASCII Display, Static Bitmap, Scale, Bar Graph, Button, Clock Display, Multi-state bit map, Units, Numeric Input and 11 geometric bitmaps and lines of different width. The application of Static Text, Static Bitmap, and geometric bitmap is the same as the editing startup page.



3. Numric/ASCII Display : To add a Numeric/ASCII Display object to a screen, double click on the object to set up Related Devices, Frame Setting, Fonts and Alignment.

Refer Device	]		Frame Setting Font Setting	No Frame	•
Value Type	Unsigned	*	Alignment	Align Left •	
Value Length	16 Bits	*	🗖 Leading Zeros		
Integer Number	5	*	T Azithmetic		
Decimal Number	Ø	+	OK	Cancel	

Related Device: Choose the VFD Communication Port that you need, if you want to read output frequency (H), set the VFD Communication Port to \$2202. For other values, please refer to ACMD ModBus Comm Address List.

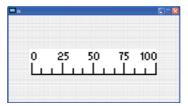
C PLC	Refer Device	
☞ VFD	Alsolue Addr. 2100	
Septon I	012345	OK
(0~255) II =	6789AB	Clear
TP Post COM1 +	CDEF./	Close

4. Scale Setting "" : On the Tool Bar, click on this "" for Scale Setting. You can also edit Scale Setting in the Property Window on the right hand side of your computer screen.

Scale Position	Тор	•	Font Setting
Scale Side	Normal Direction	-	5x8 •
Value Length	16 Bits 🔹	Main Scale	5
Max Value	100	Sub Scale	2
Min Value	0	UK	Cancel

- a. Scale Position: Click on the drop down list to choose which position that you need to place a scale.
- b. Scale Side: Click on the drop down list to choose if you want to number your scale from smaller number to bigger number or from big to small. Click OK to accept this setting or click Cancel to abort.
- c. Font Setting: Click on the drop down list to choose the Font setting that you need then click OK to accept the setting or click Cancel to abort.
- d. Value Length: Click on the drop down to choose 16bits or 32 bits. Then click OK to accept the setting or click Cancel to abort.
- e. Main Scale & Sub Scale: In order to divide the whole scale into equal parts, key in the numbers of your choices for main scale and sub scale.
- f. Maximum value & Minimum Value are the numbers on the two ends of a scale. They can be negative numbers. But the values allowed to be input are limited by the length of value. For example, when the length of value is set to **be hexadecimal**, the maximum and the minimum value cannot be input as -4000.

Follow the Scale setting mentioned above; you will have a scale as shown below.



5. Bar Graph setting

Refer Device		Direction Setting	
<u>\$2100</u>		From Bottom to Top	•
Value Type	Unsign	ed 🕑	
Value Length	16 Bits		
Max Value	65535		OK
Min Value	0		Cancel

- a. Related Device: Choose the VFD Communication Port that you need.
- b. Direction Setting: Click on the drop down menu to choose one of the following directions: From Bottom to Top, From Top to Bottom, From Left to Right or From Right to Left.
- c. Maximum Value & Minimum Value: They define the range covered by the maximum value and minimum value. If a value is smaller than or equal to the minimum value, then the bar graph will be blank. If a value is bigger or equal to the maximum value, then the bar graph will be full. If a value is between minimum and maximum value, then the bar graph will be filled proportionally.

6. Button <sup>1</sup> : Currently this function only allows the Keypad to switch pages, other functions are not yet available. Text input function and Image inserted functions are not yet supported.

Double click on <sup>1</sup>8 to open set up window.

Page Jump Setting Page No	Frame Setting	Single Frame
	Font Setting Text Alignment Middle 💽 Middle 💌	5x8  Bitmap Alignment Middle Middle
	Graph Input:	
Before Writing     G Reset     After Writing     C Set	[None]	Bitmap Read
User Level 0 🔹		Bitmap Clear
	Page No 0 Call C Before Writing C After Writing C Set	Page No Page No Page No Prame Setting Fort Setting Text Alignment Middle Middle Graph Input Call

<Button Type> allows users set up buttons' functions. <Page Jump> and <Constant Setting> are the only two currently supported functions.

A [Page Jump] function setting

- Page Jump setting: After you choose the Page Jump function in the drop down list, you will see this Page Jump Setting Menu
- <Function Key> allows you to assign functions to the following keys on the KPC-CC01 keypad: F1, F2, F3, F4, Up, Down, Left and Right. Please note that the Up and Down keys are locked by TPEditor. These two keys cannot be programmed. If you want to program Up and Down keys, go to Tool→Function Key Settings (F)→Re-Define Up/Down Key(R).

Communication Settings(C) AutoSave Setup(A)		
Function Key Setting(F)	Re-Define Up/Down Key(R)	
	三 三 単 一 単 直 単 一 単	
anguage Setting(L)	•	- TP Page
		- 0. Boot Page
		Doorrage

 Button Text: This function allows user to name buttons. For example, key in <Next Page> in the empty space, a button will have the wording <Next Page> displayed on it.

B [ Constant setting ] function

This function is to set up the memory address' value of the VFD or PLC. When pressing the <function button> set up in before, a value will be written to the memory address of the <Constant Setting>. This function can be used as initializing a variable.

Button Type	martant Setting	•	Coustant Setting	-	France Setting	Single France 🔺
Wore-in F Read	\$211A	-			Fost Setting Test Allgranest Mukile	5a8 • Bitnip Algnoent Makile •
Function Rey	FD	•			Mukile •	Middle -
Value Length	16 Bis	•	r al		Graph Input	
Value Type	Unsigned	•	@ Before Writing	Ø Report		
Ocontrol State	0	•	C Alter Waters	C 20	(None)	Bitmap Read
Total States	F	H	User Level	0 •		Bitmap Citar
Button Text	-	_			OK	Caurt

7. Clock Display Setting 1: The setup window of the Clock Display is shown as the image below. Time, Day or Date can be displayed on the keypad.

Open a new file and click once in that window, you will see the following

In the clock display setting, you can choose to display Time, Day or Date on the Keypad. To adjust time, go to #9 on the Keypad's menu. You can also adjust Frame Setting, Font Setting and Alignment.

Clock Display Setting				
	Frame Setting	No Fran	ne	-
	Font Setting	Align L	eft	•
Time Association	Alignment	5x8		-
🕼 TP Time	• Time	C Day	⊂ Date	
C PLC Time	OK	Ca	ncel	

8. Multi-state bitmap S: The setup window of the multi-state is shown as the image below. This object reads the bit's property value of the PLC. It defines what image or wording is when this bit is 0 or when this bit is 1. Set the initial status to be 0 or 1 to define the displayed image or wording.

Mo	Graph Input	
	U (None)	Bitmap Read Bitmap Clear
Total States 2 Cunent State 0 Device Value >= Ran 0	Text Input	Font Setting
1	OK	Cancel

9. Unit Measurement Research Click once on this Button: Open a new file and double click on that window, you will see the following

Units Setting	
Metrology Type	Time
Unit Name	ms
OK	Canoel

Choose from the drop down list the Metrology and the Unity Name that you need. As for Metrology, you have the following choices Length, Square Measure, Volume/Solid Measure, Weight, Speed, Time and Temperature. The unit name changes automatically when you change metrology type.

10. Numeric Input Setting

This menu allows you to provide parameters or communication ports and to input numbers.

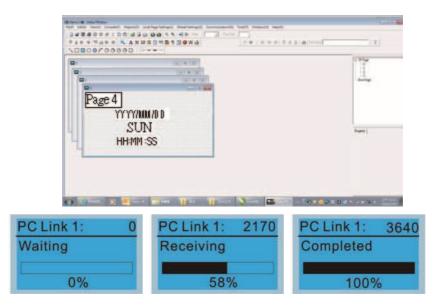
Click once on this button

Open a new file and double click on that window, you will see the following:

OutLine Setting Frame Setting Font Setting	No Frame 💌
Hori. Alignment Vert. Alignment	
Call Setting	
C Before Write	
User Level	0 -
	Frame Setting     Font Setting     Hori. Alignment     Call Setting     Call     Gall     Gall     Ader Went     Ader Went

- a. Related Device: There are two blank spaces to fill in, one is <Write> and another one is <Read>. Input the numbers that you want to display and the corresponding numbers of a parameter and that of a communication port. For example, input 012C to Read and Write Parameter P01-44.
- b. OutLine Setting: The Frame setting, Font setting, Vertical Alignment and Horizontal Alignment are the same as mentioned before. Click on the drop down menu and choose the setting that you need.
- c. Function key: The setting here allows you to program keys on the keypad. Press the key on the menu then the corresponding key on the keypad will start to blink, then press Enter to confirm the setting.
- d. Value Type & Value Length: These two factors influence the range of the Minimum and Maximum Value of the Limit Setting. Please note that the corresponding supporting values for C2000 have to be 16bits. The 32bits values are not supported.
- e. Value Setting: This part is set automatically by the keypad itself.
- f. Limit Setting: Input the range the security setting here.
- g. For example, if you set Function Key as F1, Minimum Value as 0 and Maximum Value ias 4, then press F1 on Keypad Then you can press Up and Down key on the keypad to increase or decrease the value. Press Enter Key on the keypad to confirm your setting. You can also go to parameter table 01-44 to verify if your input correctly the value.
- 11. Download TP Page : Press Up or Down key on the keypad until you reach #13 PC Link. Then press Enter on the keypad and you will see the word "Waiting" on keypad's screen. Now choose a page that you have created then go to Communication (M)→Write to TP(W) to start downloading the page to the keypad

When you see the word Completed on the keypad's screen, that means the download is done. Then you can press ESC on the keypad to go back to the menu of the keypad.



#### 3) Edit Main Page

 On the bottom right-hand corner of the HMI, click on a page number to edit or go to VIEW >HMI page to start editing main page. As shown in the image, the following objects are available. From left to right: Static Text, ASCII Display, Static Bitmap, Scale, Bar Graph, Button, Clock Display, Multi-state bit map, Units, Numeric Input and 11 geometric bitmaps and lines of different width. The application of Static Text, Static Bitmap, and geometric bitmap is the same as the editing startup page.

Carol B Mar	in The Desiries
147.9 (8)	
	Examp (

2. Numric/ASCII Display : To add a Numeric/ASCII Display object to a screen, double click on the object to set up Related Devices, Frame Setting , Fonts and Alignment.

Numeric/ASCII Di	splay Setting					
Refer Device		-	P. A.v.			
\$2100			Frame Setting	No Frame		-
	112.000		Font Setting	5x8 💌		
Value Type	Unsigned	*	Alignment	Align Left	•	
Value Length	16 Bits	*				
Integer Number	5	+				
Decimal Number	Ó	*	OK	Cancel		

Related Device: Choose the VFD Communication Port that you need, if you want to read output frequency (H), set the VFD Communication Port to \$2202. For other values, please refer to ACMD ModBus Comm Address List.

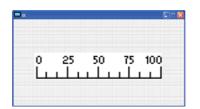
	Refer Device	
C PLC	🗂 Device Nime 🚺 👻	
@ VFD	Absolute Addr. 2100	
	012345	OK
Set PLC ID (0~255)	6789AB	Clear
TP Post COM1 +	CDEF. /	Close

3. Scale Setting <sup>111</sup>: On the Tool Bar, click on this <sup>111</sup> for Scale Setting. You can also edit Scale Setting in the Property Window on the right hand side of your computer screen.

Scale Setting			
Scale Position	Тор	•	Font Setting
Scale Side	Normal Direction	-	5x8 🔹
Value Length	16 Bits 🔹	Main Scale	5
Max Value	100	Sub Scale	2
Min Value	0	<u>UK</u>	Cancel

- i. Scale Position: Click on the drop down list to choose which position that you need to place a scale.
- ii. Scale Side: Click on the drop down list to choose if you want to number your scale from smaller number to bigger number or from big to small. Click OK to accept this setting or click Cancel to abort.
- iii. Font Setting: Click on the drop down list to choose the Font setting that you need then click OK to accept the setting or click Cancel to abort.
- iv. Value Length: Click on the drop down to choose 16bits or 32 bits. Then click OK to accept the setting or click Cancel to abort.
- v. Main Scale & Sub Scale: In order to divide the whole scale into equal parts, key in the numbers of your choices for main scale and sub scale.
- vi. Maximum value & Minimum Value are the numbers on the two ends of a scale. They can be negative numbers. But the values allowed to be input are limited by the length of value. For example, when the length of value is set to **be hexadecimal**, the maximum and the minimum value cannot be input as -4000.

Follow the Scale setting mentioned above; you will have a scale as shown below.



4. Bar Graph setting

Refer Device	_	Direction Setting	
82100		From Bottom to Top	-
Value Type	Unsign	ed 👱	
Value Length	16 Bits	•	
Max Value	65535		OK
Min Value	0		Cancel

- i. Related Device: Choose the VFD Communication Port that you need.
- ii. Direction Setting: Click on the drop down menu to choose one of the following directions: From Bottom to Top, From Top to Bottom, From Left to Right or From Right to Left.
- iii. Maximum Value & Minimum Value: They define the range covered by the maximum value and minimum value. If a value is smaller than or equal to the minimum value, then the bar graph will be blank. If a value is bigger or equal to the maximum value, then the bar graph will be full. If a value is between minimum and maximum value, then the bar graph will be filled proportionally.
- 5. Button <sup>1</sup> : Currently this function only allows the Keypad to switch pages, other functions are not yet available. Text input function and Image inserted functions are not yet supported.

Double click on <sup>1</sup> to open set up window.

Button Type Page Jump	Page Jump Setting Page No	Frame Setting	Single Frame
Write-in		Font Setting Text Alignment Middle	5x8 • Bitmap Alignment Middle •
Function Key	*	Middle • Middle •	Middle
Value Length	E Call	Graph Input:	4
Value Type Current State 0	After Writing		
Total States	User Level 0		Bitmap Read Bitmap Clear
Button Text		ок	Cancel

<Button Type> allows users set up buttons' functions. <Page Jump> and <Constant Setting> are the only two currently supported functions.

A [ Page Jump ] function setting

- Page Jump setting: After you choose the Page Jump function in the drop down list, you will see this Page Jump Setting Menu
- <Function Key> allows you to assign functions to the following keys on the KPC-CC01 keypad: F1, F2, F3, F4, Up, Down, Left and Right. Please note that the Up and Down keys are locked by TPEditor. These two keys cannot be programmed. If you want to program Up and Down keys, go to Tool→Function Key Settings (F)→Re-Define Up/Down Key(R).

Communication Settings(C) LutoSave Setup(A)		
function Key Setting(F)	Re-Define Up/Down Key(R)	
age Size(S) Frid Setting(G)	王 金 新 (中) 野 金 新 (明)	
anguage Setting(L)	•	😑 TP Page
		-0. Boot Page

 Button Text: This function allows user to name buttons. For example, key in <Next Page> in the empty space, a button will have the wording <Next Page> displayed on it.

#### B [ Constant setting ] function

This function is to set up the memory address' value of the VFD or PLC. When pressing the <function button> set up in before, a value will be written to the memory address of the <Constant Setting>. This function can be used as initializing a variable.

Button Setting						
Button Type	Constant Setting	•	Constant Setting		Frame Setting Single Frame	
Wors-in (** Josef					Post Sening Text Abgravent Muklie •	528 • Bitnap Algnoons Mukile • Mukile •
Value Length	16 Bits	•	r ol		Graph Input	
Value Type Occurrent State	Uusgani	•	C Better Water C After Water	P 100 C 20	(Nose)	il Netrosta
Totil States	100	-	Uses Level	0 •	1	Bitmap Read Bitmap Cites
Button Text	-				OK	Onot

6. Clock Display Setting : The setup window of the Clock Display is shown as the image below. Time, Day or Date can be displayed on the keypad.

Open a new file and click once in that window, you will see the following In the clock display setting, you can choose to display Time, Day or Date on the Keypad. To adjust time, go to #9 on the Keypad's menu. You can also adjust Frame Setting, Font Setting and Alignment.

Clock Display Setting			
	Frame Setting	No Frame	-
	Font Setting	Align Left	•
Time Association	Alignment	5x8	•
🕫 TP Time	• Time	C Day C Date	
C PLC Time	OK	Cancel	

7. Multi-state bitmap Y: The setup window of the multi-state is shown as the image below. This object reads the bit's property value of the PLC. It defines what image or wording is when this bit is 0 or when this bit is 1. Set the initial status to be 0 or 1 to define the displayed image or wording.

Graph Input Graph Input Value Type Value Length Total States 2 	Refer Device		
Valee Type (None) Ditmap Read Ditmap Read Bitmap Clear	diam and the	Graph Input	
Total States	Value Type	[None]	
	Cunent State 0	Text Input	Font Setting

8. Unit Measurement Click once on this Button: Open a new file and double click on that window, you will see the following

Units Setting	
Metrology Type	Time
Unit Name	ms
OK	Cancel

Choose from the drop down list the Metrology and the Unity Name that you need. As for Metrology, you have the following choices Length, Square Measure, Volume/Solid Measure, Weight, Speed, Time and Temperature. The unit name changes automatically when you change metrology type.

# 9. Numeric Input Setting

This menu allows you to provide parameters or communication ports and to input numbers.

# Click once on this button

Open a new file and double click on that window, you will see the following:

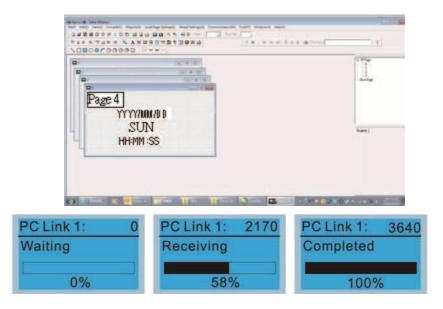
Numeric Input Se	tting			
Refer Device Write Read		OutLine Setting Frame Setting Font Setting	No Frame	•
F Function Key		Hori. Alignment Vert. Alignment Call Setting	Middle Middle	•
Value Type Value Length	Unsignéd 💌 16 Bits 💌			
Value Setting Integer Number Decimal Number	5 •	G Before Writer     C After Writing		
Limit Setting Min Value	0	User Level	0 🔹	
Max Value	65535	OK	Cancel	

- h. Related Device: There are two blank spaces to fill in, one is <Write> and another one is <Read>. Input the numbers that you want to display and the corresponding numbers of a parameter and that of a communication port. For example, input 012C to Read and Write Parameter P01-44.
- i. OutLine Setting: The Frame setting, Font setting, Vertical Alignment and Horizontal Alignment are the same as mentioned before. Click on the drop down menu and choose the setting that you need.
- j. Function key: The setting here allows you to program keys on the keypad. Press the key on the menu then the corresponding key on the keypad will start to blink, then press Enter to confirm the setting.
- k. Value Type & Value Length: These two factors influence the range of the Minimum and Maximum Value of the Limit Setting. Please note that the corresponding supporting values for C2000 have to be 16bits. The 32bits values are not supported.
- I. Value Setting: This part is set automatically by the keypad itself.
- m. Limit Setting: Input the range the security setting here.

- n. For example, if you set Function Key as F1, Minimum Value as 0 and Maximum Value ias 4, then press F1 on Keypad Then you can press Up and Down key on the keypad to increase or decrease the value. Press Enter Key on the keypad to confirm your setting. You can also go to parameter table 01-44 to verify if your input correctly the value.
- 10. Download TP Page : Press Up or Down key on the keypad until you reach #13 PC Link.

Then press Enter on the keypad and you will see the word "Waiting" on keypad's screen. Now choose a page that you have created then go to Communication (M) $\rightarrow$ Write to TP(W) to start downloading the page to the keypad

When you see the word Completed on the keypad's screen, that means the download is done. Then you can press ESC on the keypad to go back to the menu of the keypad.



# **10-4 Digital Keypad KPC-CC01 Fault Codes and Descriptions**

Following fault codes and description are for digital keypad KPC-CC01 with version V1.01 and version higher.

LCM Display *	Description	Corrective Actions
Fault FrEr kpdFlash Read Er	Keypad flash memory read error	<ul> <li>An error has occurred on keypad's flash memory.</li> <li>1. Press RESET on the keypad to clear errors.</li> <li>2. Verify what kind of error has occurred on keypad's flash memory.</li> <li>3. Shut down the system, wait for ten minutes, and then power on again the system.</li> <li>If none of the solution above works, contact your authorized local dealer.</li> </ul>
Fault FSEr kpdFlash Save Er	Keypad flash memory save error	<ul> <li>An error has occurred on keypad's flash memory.</li> <li>1. Press RESET on the keypad to clear errors.</li> <li>2. Press RESET on the keypad to clear errors.</li> <li>3. Shut down the system, wait for ten minutes, and then power on again the system.</li> <li>If none of the solution above works, contact your authorized local dealer.</li> </ul>
Fault FPEr kpdFlash Pr Er	Keypad flash memory parameter error	<ul> <li>Errors occurred on parameters of factory setting.</li> <li>It might be caused by firmware update.</li> <li>1. Press RESET on the keypad to clear errors.</li> <li>2. Verify if there's any problem on Flash IC.</li> <li>3. Shut down the system, wait for ten minutes, and then power on again the system.</li> <li>If none of the solution above works, contact your local authorized dealer.</li> </ul>
Fault VFDr Read VFD Info Er	Keypad flash memory when read AC drive data error	<ul> <li>Keypad can't read any data sent from VFD.</li> <li>Verify if the keypad is properly connect to the motor drive by a communication cable such as RJ-45.</li> <li>Press RESET on the keypad to clear errors.</li> <li>Shut down the system, wait for ten minutes, and then power on again the system.</li> <li>If none of the solution above works, contact your local authorized dealer.</li> </ul>
Fault CPUEr CPU Error	and then power on again the system.	<ul> <li>A Serious error has occurred on keypad's CPU.</li> <li>1. Verify if there's any problems on CPU clock?</li> <li>2. Verify if there's any problem on Flash IC?</li> <li>3. Verify if there's any problem on RTC IC?</li> <li>4. Verify if the communication quality of the RS485 is good?</li> <li>5. Shut down the system, wait for ten minutes, and then power on again the system. If none of the solution above works, contact your local authorized dealer.</li> </ul>

Warning Code

LCM Display *	Description	Corrective Actions
Low Display	Description	Motor drive doesn't accept the communication
HAND Warning CE01	Modbus function code error	<ul><li>command sent from keypad.</li><li>1. Verify if the keypad is properly connected to the motor drive on the communication contact by a communication cable such as RJ-45.</li></ul>
Comm Command Er		2. Press RESET on the keypad to clear errors. If none of the solution above works, contact your local authorized dealer.
HAND Warning CE02 Comm Address Er	Modbus data address error	<ul> <li>Motor rive doesn't accept keypad's communication address.</li> <li>1. Verify if the keypad is properly connected to the motor drive on the communication contact by a communication cable such as RJ-45.</li> <li>2. Press RESET on the keypad to clear errors.</li> <li>If none of the solution above works, contact your local authorized dealer.</li> </ul>
HAND Warning CE03 Comm Data Error	Modbus data value error	<ul> <li>Motor drive doesn't accept the communication data sent from keypad.</li> <li>1. Verify if the keypad is properly connected to the motor drive on the communication contact by a communication cable such as RJ-45.</li> <li>2. Press RESET on the keypad to clear errors.</li> <li>If none of the solution above works, contact your local authorized dealer.</li> </ul>
HAND Warning CE04 Comm Slave Error	Modbus slave drive error	<ul> <li>Motor drive cannot process the communication command sent from keypad.</li> <li>1. Verify if the keypad is properly connected to the motor drive on the communication contact by a communication cable such as RJ-45.</li> <li>2. Press RESET on the keypad to clear errors.</li> <li>3. Shut down the system, wait for ten minutes, and then power on again the system.</li> <li>If none of the solution above works, contact your local authorized dealer.</li> </ul>
HAND Warning CE10 KpdComm Time Out	Modbus transmission time-Out	<ul> <li>Motor drive doesn't respond to the communication command sent from keypad.</li> <li>1. Verify if the keypad is properly connected to the motor drive on the communication contact by a communication cable such as RJ-45.</li> <li>2. Press RESET on the keypad to clear errors.</li> <li>3. Shut down the system, wait for ten minutes, and then power on again the system.</li> <li>If none of the solution above works, contact your local authorized dealer.</li> </ul>
HAND Warning TPNO TP No Object	Object not supported by TP Editor	Keypad's TP Editor uses unsupported object. 1. Verify how the TP editor should use that object. Delete unsupported object and unsupported

File	Copy	Setting	Fault	Descri	otion
1 110	COPY	ocuing	i uuit	DCOUN	

LCM Display *	Description	Corrective Actions
	Description	
File 1 Err 1	Parameter and rile are read only	The property of the parameter/file is read-only and cannot be written to. 1. Verify the specification on the user manual.
Read Only		If the solution above doesn't work, contact your local authorized dealer.
File 1 Err Write Fail	Fail to write parameter and file	An error occurred while write to a parameter/file. 1. Verify if there's any problem on the Flash IC. 2. Shut down the system, wait for ten minutes, and then power on again the system. If none of the solution above work, contact your local authorized dealer.
File 1 Err VFD Running	AC drive is in operating status	A setting cannot be made while motor drive is in operation. 1. Verify if the drive is not in operation. If the solution above doesn't work, contact your local authorized dealer.
File 1 Err Pr Lock	AC drive parameter is locked	A setting cannot be made because a parameter is locked. 1. Verify if the parameter is locked or not. If it is locked, unlock it and try to set up the parameter again. If the solution above doesn't work, contact your local authorized dealer.
File 1 Err Pr Changing	AC drive parameter changing	A setting cannot be made because a parameter is being modified. 1. Verify if the parameter is being modified. If it is not being modified, try to set up that parameter again. If the solution above doesn't work, contact your local authorized dealer.
File 1 Err Fault Code	Fault code	A setting cannot be made because an error has occurred on the motor drive. 1. Verify if there's any error occurred on the motor dive. If there isn't any error, try to make the setting again. If the solution above doesn't work, contact your local authorized dealer.
File 1 Err Warning Code	Warning code	A setting cannot be made because of a warning message given to the motor drive. 1. Verify if there's any warning message given to the motor drive. If the solution above doesn't work, contact your local authorized dealer.
File 1 Err Type Dismatch	File type dismatch	Data need to be copied are not same type, so the setting cannot be made. 1. Verify if the products' serial numbers need to be copied fall in the category. If they are in the same category, try to make the setting again. If the solution above doesn't work, contact your authorized dealer.
File 1 Err Password Lock	File is locked with password	<ul> <li>A setting cannot be made, because some data are locked.</li> <li>1. Verify if the data are unlocked or able to be unlocked. If the data are unlocked, try to make the setting again.</li> <li>2. Shut down the system, wait for ten minutes, and then power on again the system.</li> <li>If none of the solution above works, contact your local authorized dealer.</li> </ul>

LCM Display *	Description	Corrective Actions
File 1 Err 10 Password Fail	File version dismatch	A setting cannot be made because the password is incorrect. 1. Verify if the password is correct. If the password is correct, try to make the setting again. 2. Shut down the system, wait for ten minutes, and then power on again the system. If none of the solution above works, contact your local authorized dealer.
File 1 Err Version Fail	AC drive copy function time-out	A setting cannot be made, because the version of the data is incorrect. 1. Verify if the version of the data matches the motor drive. If it matches, try to make the setting again. If none of the solution above works, contact your local authorized dealer.
File 1 Err VFD Time Out	Other keypad error	<ul> <li>A setting cannot be made, because data copying timeout expired.</li> <li>1. Redo data copying.</li> <li>2. Verify if copying data is authorized. If it is authorized, try again to copy data.</li> <li>3. Shut down the system, wait for ten minutes, and then power on again the system.</li> <li>If none of the solution above works, contact your local authorized dealer.</li> </ul>
File 1 Err Keypad Issue	Other AC drive error	This setting cannot be made, due to other keypad issues. (Reserved functions) If such error occurred, contact your local authorized dealer.
File 1 Err VFD Issue	File is locked with password	This setting cannot be made, due to other motor drive issues. (Reserved functions). If such error occurred, conatct your local authorized dealer.

\* The content in this chapter only applies on V1.01 and above of KPC-CC01 keypad.

# **Chapter 11 Summary of Parameter Settings**

This chapter provides summary of parameter settings for user to gather the parameter setting ranges, factory settings and set parameters. The parameters can be set, changed and reset by the digital keypad.

1)  $\cancel{1}$ : the parameter can be set during operation

2) For more detail on parameters, please refer to Ch12 Description of Parameter Settings.

## **00 Drive Parameters**

IM: Induction Motor; PM: Permanent Magnet Motor

Pr.	Explanation	Settings	Factory Setting
00-00	Identity Code of the AC Motor Drive	4: 230V, 1HP 5: 460 V, 1HP 6: 230V,2HP 7: 460 V, 2HP 8: 230V, 3HP 9: 460 V, 3HP 10: 230V, 5HP 11: 460 V, 5HP 12: 230V, 7.5HP 13: 460 V, 7.5HP 14: 230V, 10HP 15: 460V, 10HP 16: 230V, 15HP 17: 460V, 15HP 18: 230V, 20HP 20: 230V, 25HP 21: 460V, 20HP 20: 230V, 25HP 21: 460V, 20HP 23: 460V, 30HP 24: 230V, 40HP 25: 460V, 40HP 26: 230V, 50HP 27: 460V, 50HP 28: 230V, 60HP 30: 230V, 75HP 31: 460V, 75HP 31: 460V, 75HP 31: 460V, 105HP 33: 460V, 100HP 34: 230V, 100HP 35: 460V, 105HP 35: 460V, 125HP 37: 460V, 150HP 39: 460V, 150HP 41: 460V, 250HP 41: 460V, 250HP 45: 460V, 300HP 45: 460V, 300HP 45: 460V, 300HP 45: 460V, 300HP 45: 460V, 375HP 51: 460V, 425HP 51: 460V, 5HP (4KW)	Read
00-01	Display AC Motor Drive Rated Current	Display by models	Read only

	00-02	Parameter Reset	<ul> <li>0: No function</li> <li>1: Read only</li> <li>5: Reset KWH display to 0</li> <li>6: Reset PLC (including CANopen Master Index)</li> <li>7: Reset CANopen Index (Slave)</li> <li>8: No function</li> <li>9: All parameters are reset to factory settings(base frequency is 50Hz)</li> <li>10: All parameters are reset to factory settings (base frequency is 60Hz)</li> </ul>	0
×	00-03	Start-up Display Selection	0: F (frequency command) 1: H (output frequency) 2: U (multi-function display, see Pr.00-04) 3: A (output current)	0
*	00-04	Content of Multi-function Display	<ul> <li>D: Note that the end of the end of</li></ul>	3

		Coefficient Gain in Actual Output	<ul> <li>38: Display drive status (6.)</li> <li>39: Display estimated output torque, positive and negative, using Nt-m as unit (t 0.0: positive torque; -0.0: negative torque (C.)</li> <li>40: Torque Command (L) (Unit: %)</li> <li>41: KWH display (J) (Unit: kWH)</li> <li>42: PID Reference (h.) (Unit: %)</li> <li>43: PID offset (o.) (Unit: %)</li> <li>44: PID Output Fcmd(Hz) (b.) (Unit: Hz)</li> <li>45: Hardware ID</li> </ul>	
00	0-05	Frequency	0~160.00	1.00
00	0-06	Software Version	Read only	#.#
00	0-07	Parameter Protection Password Input	$0 \sim 65535$ $0 \sim 3$ : the times of password attempts	0
00	0-08	Parameter Protection Password Setting	<ul> <li>0 ~ 65535</li> <li>0: No password protection / password is entered correctly (Pr00-07)</li> <li>1: Parameter is locked</li> </ul>	0
00	0-09	Reserved		
00	D-10	Control Mode	0: Speed mode 1: Point-to-Point position control 2: Torque mode 3: Home mode	0
00	0-11	Control of Speed Mode	<ul> <li>0: VF (IM V/f control)</li> <li>1: VFPG (IM V/f control+ Encoder)</li> <li>2: SVC(IM Sensorless vector control)</li> <li>3: FOCPG (IM FOC vector control+ encoder)</li> <li>4: FOCPG (PM FOC vector control + Encoder)</li> <li>5: FOC Sensorless (IM field oriented sensorless vector control)</li> <li>6: PM Sensorless (PM field oriented sensorless vector control)</li> <li>7: IPM Sensorless (IPM field oriented sensorless vector control)</li> </ul>	0
00	0-12	Point-to-Point Position mode	0: Relative position 1: Absolute position	0
00	D-13	Torque Mode Control	0: TQCPG (IM Torque control + Encoder) 1: TQCPG (PM Torque control + Encoder) 2: TQC Sensorless (IM Sensorless torque control)	0
00	0-14	Reserved		
00	0-15	Reserved		
00	D-16	Load Selection	0: Normal load 1: Heavy load	0
00	0-17	Carrier Frequency	Normal load           230V         460V         Carrier Frequency           1-15HP         1-20HP         2~15KHz           20-50HP         25-75HP         2~10KHz           60-125HP         100-600HP         2~9KHz	8 6 4
			230V         460V         Carrier Frequency           1-15HP         1-20HP         2~15KHz           20-50HP         25-75HP         2~10KHz           60-125HP         100-600HP         2~9KHz	2
00	D-18	Reserved		
00	D-19	PLC Command Mask	Bit 0: Control command by PLC force control Bit 1: Frequency command by PLC force control Bit 2: Position command by PLC force control Bit 3: Torque command by PLC force control	Read only

	00-20	Source of Master Frequency Command (AUTO)	<ul> <li>0: Digital keypad</li> <li>1: RS-485 serial communication</li> <li>2: External analog input (Pr.03-00)</li> <li>3: External UP/DOWN terminal</li> <li>4: Pulse input without direction command (Pr.10-16 without direction)</li> <li>5: Pulse input with direction command (Pr.10-16)</li> <li>6: CANopen communication card</li> <li>7: Reserved</li> <li>8: Communication card (no CANopen card)</li> </ul>	0
	00-21	Source of the Operation Command (AUTO)	<ul> <li>0: Digital keypad</li> <li>1: External terminals. Keypad STOP disabled.</li> <li>2: RS-485 serial communication. Keypad STOP disabled.</li> <li>3: CANopen communication card</li> <li>4: Reserved</li> <li>5: Communication card (no CANopen card)</li> </ul>	0
N	00-22	Stop Method	0: Ramp to stop 1: Coast to stop	0
N	00-23	Control of Motor Direction	0: Enable forward/reverse 1: Reverse disable 2: Forward disable	0
	00-24	Memory of Frequency Command	Read only	Read only
~	00-25	User Defined Characteristics	Bit $0~3$ : user defined decimal place 0000b: no decimal place 0010b: two decimal place 0011b: three decimal place Bit $4~15$ : user define on unit 000xh: Hz 001xh: rpm 002xh: % 003xh: kg 004xh: m/s 005xh: kW 006xh: HP 007xh: ppm 008xh: 1/m 008xh: kg/h 00Cxh: $lb/s$ 00Dxh: $lb/m$ 00Exh: $lb/h$ 00Exh: $lb/h$ 00Exh: $lb/h$ 00Exh: $lb/h$ 00Exh: $lb/h$ 01xh: ft/m 012xh: ft 013xh: degC 014xh: degF 015xh: mbar 015xh: mbar 015xh: mbar 015xh: mbar 015xh: mWG 018xh: ftWG 01Bxh: ftWG 01Exh: L/s 01Dxh: L/s 012xh: th 012xh: th 012xh: mWG 01Axh: inWG 01Axh: inWG 01Bxh: ftWG 01Exh: L/s 01Exh: L/s 01Exh: L/m 020xh: L/h 021xh: m3/s	0

00-26	Max. User Defined Value	022xh: m3/h 023xh: GPM 024xh: CFM Xxxxh: Hz 0: Disable 0~65535 (when Pr.00-25 set to no decimal place) 0.0~6553.5 (when Pr.00-25 set to 1 decimal place) 0.0~655.35 (when Pr.00-25 set to 2 decimal place) 0.0~65.535 (when Pr.00-25 set to 3 decimal place)	0
00-27	User Defined Value	Read only	Read Only
00-28	Reserved	11	Only
00-29	LOCAL/REMOTE Selection	<ul> <li>0: Standard HOA function</li> <li>1: Switching Local/Remote, the drive stops</li> <li>2: Switching Local/Remote, the drive runs as the REMOTE setting for frequency and operation status</li> <li>3: Switching Local/Remote, the drive runs as the LOCAL setting for frequency and operation status</li> <li>4: Switching Local/Remote, the drive runs as LOCAL setting when switch to Local and runs as REMOTE setting when switch to Remote for frequency and operation status.</li> </ul>	0
00-30	Source of the Master Frequency Command (HAND)	<ul> <li>0: Digital keypad</li> <li>1: RS-485 serial communication</li> <li>2: External analog input (Pr.03-00)</li> <li>3: External UP/DOWN terminal</li> <li>4: Pulse input without direction command (Pr.10-16 without direction)</li> <li>5: Pulse input with direction command (Pr.10-16)</li> <li>6: CANopen communication card</li> <li>7: Reserved</li> <li>8: Communication card (no CANopen card)</li> </ul>	0
00-31	Source of the Operation Command (HAND)	<ul> <li>0: Digital keypad</li> <li>1: External terminals. Keypad STOP disabled.</li> <li>2: RS-485 serial communication. Keypad STOP disabled.</li> <li>3: CANopen communication card</li> <li>4: Reserved</li> <li>5: Communication card (not include CANopen card)</li> </ul>	0
00-32	Digital Keypad STOP Function	0: STOP key disable 1: STOP key enable	0
00-33 ~ 00-39	Reserved	· · · · · · · · · · · · · · · · · · ·	
00-40	Homing mode	X X X X X X X X X X X X X X X X X X X	0000

				<ul> <li>4: Forward run and search for Z-pulse as check point.</li> <li>5: Forward run and search for Z-pulse as check point.</li> <li>6: Forward run to home. Set ORG: ON→OFF as check point.</li> <li>7: Reverse run to home. Set ORG : ON→OFF as check point.</li> <li>8: Define current position as home.</li> </ul>	
			Y	Set X to 0, 1, 2, 3, 6, 7 first. 0: reverse run to Z pulse 1: continue forward run to Z pulse 2: Ignore Z pulse	
			z	When home limit is reached, set X to 2, 3, 4, 5, 6, 7 first.	
				0: display the error 1: reverse the direction	
N	00-41	Homing by frequency 1	0.0	00~600.00Hz	8.00
N	00-42	Homing by frequency 2	0.0	00~600.00Hz	2.00
	00-43 ~ 00-47	Reserved	I		
N	00-48	Display Filter Time (Current)	0.0	001~65.535 sec	0.100
N	00-49	Display Filter Time (Keypad)	0.0	001~65.535 sec	0.100
	00-50	Software Version (date)	Re	ead only	#####
	00-51 ~	Reserved			
	~ 00-61				

### **01 Basic Parameters**

	Pr.	Explanation	Settings	Factory Setting
	01-00	Max. Operation Frequency	0.00~600.00Hz	60.00/ 50.00
	01-01	Output Frequency of Motor 1	0.00~600.00Hz	60.00/ 50.00
	01-02	Output Voltage of Motor 1	230V: 0.0V~255.0V 460V: 0.0V~510.0V	200.0 400.0
	01-03	Mid-point Frequency 1 of Motor 1	0.00~600.00Hz Motor drive with 250HP and above: 1.50	3.00
×	01-04	Mid-point Voltage 1 of Motor 1	230V: 0.0V~240.0V 460V: 0.0V~480.0V Motor drive with 250HP and above: 10.0	11.0 22.0
	01-05	Mid-point Frequency 2 of Motor 1	0.00~600.00Hz	0.50
×	01-06	Mid-point Voltage 2 of Motor 1	230V: 0.0V~240.0V 460V: 0.0V~480.0V	2.0 4.0
	01-07	Min. Output Frequency of Motor 1	0.00~600.00Hz	0.00
×	01-08	Min. Output Voltage of Motor 1	230V: 0.0V~240.0V 460V: 0.0V~480.0V	0.0 0.0
	01-09	Start-Up Frequency	0.00~600.00Hz	0.50
N	01-10	Output Frequency Upper Limit	0.00~600.00Hz	600.00
N	01-11	Output Frequency Lower Limit	0.00~600.00Hz	0
×	01-12	Accel. Time 1	Pr.01-45=0: 0.00~600.00 second Pr.01-45=1: 0.00~6000.0 second Motor drive with 30HP and above: 60.00/60.0	10.00 10.0
×	01-13	Decel Time 1	Pr.01-45=0: 0.00~600.00 second Pr.01-45=1: 0.00~6000.0 second Motor drive with 30HP and above: 60.00/60.0	10.00 10.0
×	01-14	Accel Time 2	Pr.01-45=0: 0.00~600.00 second Pr.01-45=1: 0.00~6000.0 second Motor drive with 30HP and above: 60.00/60.0	10.00 10.0
×	01-15	Decel Time 2	Pr.01-45=0: 0.00~600.00 second Pr.01-45=1: 0.00~6000.0 second Motor drive with 30HP and above: 60.00/60.0	10.00 10.0
×	01-16	Accel Time 3	Pr.01-45=0: 0.00~600.00 second Pr.01-45=1: 0.00~6000.0 second Motor drive with 30HP and above: 60.00/60.0	10.00 10.0
×	01-17	Decel Time 3	Pr.01-45=0: 0.00~600.00 second Pr.01-45=1: 0.00~6000.0 second Motor drive with 30HP and above: 60.00/60.0	10.00 10.0
×	01-18	Accel Time 4	Pr.01-45=0: 0.00~600.00 second Pr.01-45=1: 0.00~6000.0 second Motor drive with 30HP and above: 60.00/60.0	10.00 10.0
×	01-19	Decel Time 4	Pr.01-45=0: 0.00~600.00 second Pr.01-45=1: 0.00~6000.0 second Motor drive with 30HP and above: 60.00/60.0	10.00 10.0
×	01-20	JOG Acceleration Time	Pr.01-45=0: 0.00~600.00 second Pr.01-45=1: 0.00~6000.0 second Motor drive with 30HP and above: 60.00/60.0	10.00 10.0

	Pr.	Explanation	Settings	Factory Setting
N	01-21	JOG Deceleration Time	Pr.01-45=0: 0.00~600.00 second Pr.01-45=1: 0.00~6000.0 second Motor drive with 30HP and above: 60.00/60.0	10.00 10.0
×	01-22	JOG Frequency	0.00~600.00Hz	6.00
×	01-23	1st/4th Accel/decel Frequency	0.00~600.00Hz	0.00
×	01-24	S-curve Acceleration Begin Time 1	Pr.01-45=0: 0.00~25.00 second Pr.01-45=1: 0.0~250.0 second	0.20 0.2
N	01-25	S-curve Acceleration Arrival Time 2	Pr.01-45=0: 0.00~25.00 second Pr.01-45=1: 0.0~250.0 second	0.20 0.2
N	01-26	S-curve Deceleration Begin Time 1	Pr.01-45=0: 0.00~25.00 second Pr.01-45=1: 0.0~250.0 second	0.20 0.2
N	01-27	S-curve Deceleration Arrival Time 2	Pr.01-45=0: 0.00~25.00 second Pr.01-45=1: 0.0~250.0 second	0.20 0.2
	01-28	Skip Frequency 1 (upper limit)	0.00~600.00Hz	0.00
	01-29	Skip Frequency 1 (lower limit)	0.00~600.00Hz	0.00
	01-30	Skip Frequency 2 (upper limit)	0.00~600.00Hz	0.00
	01-31	Skip Frequency 2 (lower limit)	0.00~600.00Hz	0.00
	01-32	Skip Frequency 3 (upper limit)	0.00~600.00Hz	0.00
	01-33	Skip Frequency 3 (lower limit)	0.00~600.00Hz	0.00
	01-34	Zero-speed Mode	0: Output waiting 1: Zero-speed operation 2: Fmin (Refer to Pr.01-07, 01-41)	0
	01-35	Output Frequency of Motor 2	0.00~600.00Hz	60.00/ 50.00
	01-36	Output Voltage of Motor 2	230V: 0.0V~255.0V 460V: 0.0V~510.0V	200.0 400.0
	01-37	Mid-point Frequency 1 of Motor 2	0.00~600.00Hz AC drive with power greater than 250HP: 1.50	3.00
×	01-38	Mid-point Voltage 1 of Motor 2	230V: 0.0V~240.0V 460V: 0.0V~480.0V AC drive with power greater than 250HP: 10.0	11.0 22.0
	01-39	Mid-point Frequency 2 of Motor 2	0.00~600.00Hz	0.50
×	01-40	Mid-point Voltage 2 of Motor 2	230V: 0.0V~240.0V 460V: 0.0V~480.0V	2.0 4.0
	01-41	Min. Output Frequency of Motor 2	0.00~600.00Hz	0.00
N	01-42	Min. Output Voltage of Motor 2	230V: 0.0V~240.0V 460V: 0.0V~480.0V	0.0 0.0
	01-43	V/f Curve Selection	0: V/f curve determined by Pr.01-00~01-08 1: Curve to the power of 1.5 2: Curve to the power of 2	0
M	01-44	Optimal Acceleration/Deceleration Setting	<ul> <li>0: Linear accel. /decel.</li> <li>1: Auto accel.; linear decel.</li> <li>2: Linear accel.; auto decel.</li> <li>3: Auto accel./decel.</li> <li>4: Linear, stall prevention by auto accel./decel. (limit by Pr.01-12~01-21)</li> </ul>	0
	01-45	Time Unit for Accel. /Decel. and S Curve	0: Unit: 0.01 sec 1: Unit: 0.1 sec	0
		1	1	1

	Pr.	Explanation	Settings	Factory Setting
×	01-46	CANopen Quick Stop Time	Pr. 01-45=0: 0.00~600.00 sec Pr. 01-45=1: 0.0~6000.0 sec	1.00

# 02 Digital Input/Output Parameters

Pr.	Explanation	Settings	Factory Setting
02-00	2-wire/3-wire Operation Control	0: 2-wire mode 1, power on for operation control 1: 2-wire mode 2, power on for operation control 2: 3-wire, power on for operation control	0
02-01	Multi-function Input Command 1 (MI1)	0: No function	1
02-02	Multi-function Input Command 2 (MI2)	1: Multi-step speed command 1/multi-step position command 1	2
02-03	Multi-function Input Command 3 (MI3)	2: Multi-step speed command 2/multi-step position command 2	3
02-04	Multi-function Input Command 4 (MI4)	3: Multi-step speed command 3/multi-step position command 3	4
02-05	Multi-function Input Command 5 (MI5)	4: Multi-step speed command 4/multi-step position command 4	0
02-06	Multi-function Input Command 6 (MI6)	5: Reset	0
02-07	Multi-function Input Command 7 (MI7)	6: JOG command (By KPC-CC01 or external control)	0
02-08	Multi-function Input Command 8 (MI8)	7: Acceleration/deceleration speed inhibit	0
02-26	Input terminal of I/O extension card (MI10)	8: The 1 <sup>st</sup> , 2 <sup>nd</sup> acceleration/deceleration time selection	0
02-27	Input terminal of I/O extension card (MI11)	9: The 3 <sup>rd</sup> , 4 <sup>th</sup> acceleration/deceleration time selection	0
02-28	Input terminal of I/O extension card (MI12)	10: EF Input (Pr.07-20)	0
02-29	Input terminal of I/O extension card (MI13)	11: B.B input from external (Base Block)	0
02-30	Input terminal of I/O extension card (MI14)	12: Output stop	0
02-31	Input terminal of I/O extension card (MI15)	13: Cancel the setting of optimal accel. /decel. time	0
		14: Switch between motor 1 and motor 2	
		15: Operation speed command from AVI	
		16: Operation speed command from ACI	
		17: Operation speed command from AUI	
		18: Emergency stop (Pr.07-20)	
		19: Digital up command	
		20: Digital down command 21: PID function disabled	
		22: Clear counter	
		23: Input the counter value (MI6)	
		24: FWD JOG command	
		25: REV JOG command	
		26: TQC/FOCmodel selection	
		27: ASR1/ASR2 selection	
		28: Emergency stop (EF1)	
		29: Signal confirmation for Y-connection	
		30: Signal confirmation for ∆-connection	
		31: High torque bias (Pr.11-30)	
		32: Middle torque bias (Pr.11-31) 33: Low torque bias (Pr.11-32)	
		34: Switch between multi-step position and	
		multi-speed control	
		35: Enable single point position control	
		36: Enable multi-step position learning function (valid	
		at stop)	
		37: Full position control pulse command input enable	
		38: Disable EEPROM write function	

	Pr.	Explanation	Settings	Factory Setting
			39: Torque command direction	
			40: Force coast to stop 41: HAND switch	-
			41: HAND SWICH 42: AUTO switch	
			43: Enable resolution selection (Pr.02-48)	
			44: Reversed direction homing	]
			45: Forward direction homing	-
			46: Homing (ORG)	
			<ul><li>47: Homing function enable</li><li>48: Mechanical gear ratio switch</li></ul>	
			49: Drive enable	
			50: Master dEb action input	
			51: Selection for PLC mode bit0	1
			52: Selection for PLC mode bit1	]
			53: Trigger CANopen quick stop	
			54: Reserved	-
			55: Brake release	
			56: Local/Remote Selection 57~70: Reserved	
,	02-09	UP/DOWN key mode	0: up/down by the accel. /decel. time	0
			1: up/down constant speed (Pr.02-10)	
,	02-10	Constant speed. The Accel. /Decel. Speed of the UP/DOWN Key	0.01~1.00Hz/ms	0.01
	02-11	Digital Input Response Time	0.000~30.000 second	0.005
	02-12	Digital Input Mode Selection	0000h~FFFFh (0: N.O.; 1: N.C. )	0000
	02-13	Multi-function Output 1 RY1	0: No function	11
	02-14	Multi-function Output 2 RY2	1: Operation Indication	1
	02-16	Multi-function Output 3 (MO1)	2: Operation speed attained	0
, 	02-17	Multi-function Output 4 (MO2)	3: Desired frequency attained 1 (Pr.02-22)	0
	02-36	Output terminal of the I/O extension card (MO10)	4: Desired frequency attained 2 (Pr.02-24)	0
,	02-37	Output Terminal of I/O Extension Card (MO11)	5: Zero speed (Frequency command)	0
	02-38	Output Terminal of I/O Extension Card (MO12)	6: Zero speed, include STOP(Frequency command)	0
	02-39	Output Terminal of I/O Extension Card (MO13)	7: Over torque 1(Pr.06-06~06-08)	0
	02-40	Output Terminal of I/O Extension Card (MO14)	8: Over torque 2(Pr.06-09~06-11)	0
	02-41	Output Terminal of I/O Extension Card (MO15)	9: Drive is ready	0
	02-42	Output Terminal of I/O Extension Card (MO16)	10: Low voltage warning (LV) (Pr.06-00)	0
	02-43	Output Terminal of I/O Extension Card (MO17)	11: Malfunction indication	0
	02-44	Output Terminal of I/O Extension Card (MO18)	12: Mechanical brake release(Pr.02-32)	0
	02-45	Output Terminal of I/O Extension Card (MO19)	13: Overheat warning (Pr.06-15)	0
	02-46	Output Terminal of I/O Extension Card (MO20)	14: Software brake signal indication(Pr.07-00)	0
			15: PID feedback error (Pr.08-13, Pr.08-14) 16: Slip error (oSL)	]
			17: Terminal count value attained, does not return to 0 (Pr.02-20)	

	Pr.	Explanation	Settings	Factory Setting
			18: Preliminary count value attained, returns to 0 (Pr.02-19)	
			19: Base Block	_
			20: Warning output	
			21: Over voltage warning	
			22: Over-current stall prevention warning	_
			23: Over-voltage stall prevention warning 24: Operation mode indication	
			25: Forward command	-
			26: Reverse command	-
			27: Output when current >= Pr.02-33	-
			28: Output when current < Pr.02-33	1
			29: Output when frequency >= Pr.02-34	
			30: Output when frequency < Pr.02-34	
			31: Y-connection for the motor coil	
			32: △-connection for the motor coil	1
			33: Zero speed (actual output frequency)	]
			34: Zero speed include 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)	
			39: Position attained (Pr.10-19)	
			40: Speed attained (including Stop)	
			41: Multi-position attained	
			42: Crane function	
			43: Actual motor speed slower than Pr.02-47	-
			44: Low current output (use with Pr.06-71~06-73)	-
			45: UVW Output Electromagnetic valve Switch	-
			46: Master dEb warning output	
			47: Closed brake output 48: Reserved	-
			49: Homing action complete	-
			50: Output for CANopen control	-
			51: Output for communication card	-
			52: Output for RS485	-
			53~64: Reserved	_
			65: Output for both Can & 485 control	-
			66: SO logic A	
			67: Analog input level reached	
			68: SO logic B	1
*	02-18	Multi-function output direction	0000h~FFFFh (0: N.O.; 1: N.C. )	0000
*	02-19	Terminal counting value attained (returns to 0)	0~65500	0
~	02-20	Preliminary counting value attained (not return to 0)	0~65500	0
*	02-21	Digital Output Gain (DFM)	1~166	1 60.00/
~	02-22	Desired Frequency Attained 1	0.00~600.00Hz	60.00/ 50.00
*	02-23	The Width of the Desired Frequency Attained 1	0.00~600.00Hz	2.00
*	02-24	Desired Frequency Attained 2	0.00~600.00Hz	60.00/ 50.00
×	02-25	The Width of the Desired Frequency Attained 2	0.00~600.00Hz	2.00
	02-32	Brake Delay Time	0.000~65.000 sec.	0.000
~	02-33	Output Current Level Setting for Multi-function External Terminals	0~100%	0

	Pr.	Explanation	Settings	Factory Setting
×	02-34	Output frequency setting for multi-function output terminal	0.00~600.00Hz (Motor speed when using PG Card)	0.00
×	02-35	External Operation Control Selection after Reset and Activate	0: Disable 1: Drive runs if run command exists after reset	0
×	02-47	Zero-speed Level of Motor	0~65535 rpm	0
×	02-48	Max. Frequency of Resolution Switch	0.01~600.00Hz	60.00
×	02-49	Switch the delay time of Max. output frequency	0.000~65.000 sec.	0.000
	02-50	Status of Multi-function Input Terminal	Monitor the status of multi-function input terminals	Read only
	02-51	Status of Multi-function Output Terminal	Monitor the status of multi-function output terminals	Read only
	02-52	Display External Output terminal occupied by PLC	Monitor the status of PLC input terminals	Read only
	02-53	Display Analog Input Terminal occupied by PLC	Monitor the status of PLC output terminals	Read only
	02-54	Display the Frequency Command Executed by External Terminal	Read only	Read only
	02-55	Reserved		
	02-56	Reserved		
N	02-57	Multi-function output terminal: Function 42: Brake Current Checking Point	0~150%	0
N	02-58	Multi-function output terminal: Function 42: Brake Frequency Checking Point	0.00~655.35Hz	0.00
	02-59 ~ 02-69	Reserved		
	02-70	IO card types	0 : NO IO card 1 : EMC-BPS01 2 : NO IO card 3 : NO IO card 4 : EMC-D611A 5 : EMC-D42A 6 : EMC-R6AA 7 : NO IO card	Read only

# 03 Analog Input/Output Parameters

	Pr.	Explanation	Settings	Factory Setting
N	03-00	Analog Input Selection (AVI)	0: No function	1
N	03-01	Analog Input Selection (ACI)	1: Frequency command (speed limit under torque control mode)	0
×	03-02	Analog Input Selection (AUI)	2: Torque command (torque limit under speed mode)	0
			3: Torque offset command	
			4: PID target value	
			5: PID feedback signal	
			6: PTC thermistor input value	
			7: Positive torque limit	
			8: Negative torque limit	
			9: Regenerative torque limit	
			10: Positive/negative torque limit	
			11: PT100 thermistor input value	
			12: Reserved	
			13: PID Offset (%) (h.)	
			14~20: Reserved	
N	03-03	Analog Input Bias (AVI)	-100.0~100.0%	0
N	03-04	Analog Input Bias (ACI)	-100.0~100.0%	0
×	03-05	Analog Positive Voltage Input Bias (AUI)	-100.0~100.0%	0
	03-06	Reserved		
×	03-07	Positive/negative Bias Mode (AVI)	0: No bias 1: Lower than or equal to bias	
N	03-08	Positive/negative Bias Mode (ACI)	<ul><li>2: Greater than or equal to bias</li><li>3: The absolute value of the bias voltage while serving</li></ul>	0
×	03-09	Positive/negative Bias Mode (AUI)	as the center 4: Serve bias as the center	
	03-10	Analog Frequency Command for Reverse Run	<ul> <li>0: Negative frequency is not valid. Forward and reverse run is controlled by digital keypad or external terminal.</li> <li>1: Neagtive frequency is valid. Positive frequency = forward run; negative frequency = reverse run. Direction can not be switched by digital keypad or external teriminal control.</li> </ul>	0
×	03-11	Analog Input Gain (AVI)	-500.0~500.0%	100.0
×	03-12	Analog Input Gain (ACI)	-500.0~500.0%	100.0
N	03-13	Analog Positive Input Gain (AUI)	-500.0~500.0%	100.0
×	03-14	Analog Negative Input Gain (AUI)	-500.0~500.0%	100.0
N	03-15	Analog Input Filter Time (AVI)	0.00~20.00 sec.	0.01
×	03-16	Analog Input Filter Time (ACI)	0.00~20.00 sec.	0.01
×	03-17	Analog Input Filter Time (AUI)	0.00~20.00 sec.	0.01
×	03-18	Addition Function of the Analog Input	0: Disable (AVI, ACI, AUI) 1: Enable	0

N	03-19	ACI Signal Loss	<ul><li>0: Disable</li><li>1: Continue operation at the last frequency</li><li>2: Decelerate to 0Hz</li><li>3: Stop immediately and display ACE</li></ul>	0
N	03-20	Multi-function Output 1 (AFM1)	0: Output frequency (Hz)	0
N	03-23	Multi-function Output 2 (AFM2)	1: Frequency command (Hz)	0
			2: Motor speed (Hz)	
			3: Output current (rms) 4: Output voltage	
			5: DC Bus voltage	
			6: Power factor	
			7: Power	
			8: Output torque	
			9: AVI 10: ACI	
			11: AUI	
			12: lq current	
			13: Iq feedback value	
			14: Id current	
			15: Id feedback value	
			16: Vq-axis voltage 17: Vd-axis voltage	
			18: Torque command	
			19: PG2 frequency command	
			20: CANopen analog output	
			21: RS485 analog output	
			22: Communication card analog output 23: Constant voltage/current output	
			24: Reserved	
			25: CAN & 485 output	
×	03-21	Gain of Analog Output 1 (AFM1)	0~500.0%	100.0
		Analog Output 1 when in REV	0: Absolute output voltage	
*	03-22	Direction (AFM1)	<ol> <li>Reverse output 0V; Positive output 0-10V</li> <li>Reverse output 5-0V; Positive output 5-10V</li> </ol>	0
×	03-24	Gain of Analog Output 2 (AFM2)	0~500.0%	100.0
×	03-25	Analog Output 2 when in REV Direction (AFM2)	<ul> <li>0: Absolute output voltage</li> <li>1: Output 0V in REV direction; output 0-10V in FWD direction</li> <li>2: Output 5-0V in REV direction; output 5-10V in FWD direction</li> </ul>	0
×	03-26	Reserved		
×	03-27	AFM2 Output Bias	-100.00~100.00%	0.00
	03-28	AVI Selection	0: 0-10V	0
~	03-20	AVI Selection	1: 0-20mA 2: 4-20mA	0
			0: 4-20mA	
×	03-29	ACI Selection	1: 0-10V	0
			2: 0-20mA	
	03-30	Status of PLC Output Terminal	Monitor the status of PLC output terminals	Read only
×	03-31	AFM2 0-20mA Output Selection	0: 0-20mA Output 1: 4-20mA Output	0
*	03-32	AFM1 DC output setting level	0.00~100.00%	0.00
×	03-33	AFM2 DC Output Setting Level	0.00~100.00%	0.00

	03-34	Reserved		
~	03-35	AFM1 filter output time	0.00 ~ 20.00 Seconds	0.01
×	03-36	AFM2 filter output time	0.00 ~ 20.00 Seconds	0.01
	03-37 ~ 03-43	Reserve		
*	03-44	MO by source of AI level	0: AVI 1: ACI 2: AUI	0
~	03-45	Al upper level	-100%~100.00%	50%
~	03-46	Al lower level	-100%~100.00%	10%
	03-47 ~ 03-49	Reserve		
×	03-50	Analog Input Curve Selection	0: Regular Curve 1: 3 point curve of AVI 2: 3 point curve of ACI 3: 3 point curve of AVI & ACI 4: 3 point curve of AUI 5: 3 point curve of AVI & AUI 6: 3 point curve of ACI & AUI 7: 3 point curve of AVI & ACI & AUI	0
×	03-51	AVI Low Point	Pr.03-28=0, 0.00~10.00V Pr.03-28≠0, 0.00~20.00mA	0.00
~	03-52	AVI Proportional Low Point	0.00~100.00%	0.00
×	03-53	AVI Mid Point	Pr.03-28=0, 0.00~10.00∨ Pr.03-28≠0, 0.00~20.00mA	5.00
~	03-54	AVI Proportional Mid Point	0.00~100.00%	50.00
×	03-55	AVI High Point	Pr.03-28=0, 0.00~10.00V Pr.03-28≠0, 0.00~20.00mA	10.00
~	03-56	AVI Proportional High Point	0.00~100.00%	100.00
×	03-57	ACI Low Point	Pr.03-29=1, 0.00~10.00V Pr.03-29≠1, 0.00~20.00mA	4.00
~	03-58	ACI Proportional Low Point	0.00~100.00%	0.00
~	03-59	ACI Mid Point	Pr.03-29=1, 0.00~10.00∨ Pr.03-29≠1, 0.00~20.00mA	12.00
×	03-60	ACI Proportional Mid Point	0.00~100.00%	50.00
~	03-61	ACI High Point	Pr.03-29=1, 0.00~10.00V Pr.03-29≠1, 0.00~20.00mA	20.00
~	03-62	ACI Proportional High Point	0.00~100.00%	100.00
~	03-63	Positive AUI Voltage Low Point	0.00~10.00V	0.00
*	03-64	Positive AUI Voltage Proportional Low Point	-100.00%~100.00%	0.00
*	03-65	Positive AUI Voltage Mid Point	0.00~10.00V	5.00
~	03-66	Positive AUI Voltage Proportional Mid Point	-100.00%~100.00%	50.00
*	03-67	Positive AUI Voltage High Point	0.00~10.00V	10.00
*	03-68	Positive AUI Voltage Proportional High Point	-100.00%~100.00%	100.00
~	03-69	Negative AUI Voltage Low Point	0.00~ -10.00V	0.00

~	03-70	Negative AUI Voltage Proportional Low Point	-100.00%~100.00%	0.00
×	03-71	Negative AUI Voltage Mid Point	0.00~ -10.00V	-5.00
N	03-72	Negative AUI Voltage Proportional Mid Point	-100.00%~100.00%	-50.00
×	03-73	Negative AUI Voltage High Point	0.00~ -10.00V	-10.00
×	03-74	Negative AUI Voltage Proportional High Point	-100.00%~100.00%	-100.00

# 04 Multi-step Speed Parameters

	Pr.	Explanation	Settings	Factory Setting
×	04-00	1st Step Speed Frequency	0.00~600.00Hz	0
×	04-01	2nd Step Speed Frequency	0.00~600.00Hz	0
N	04-02	3rd Step Speed Frequency	0.00~600.00Hz	0
N	04-03	4th Step Speed Frequency	0.00~600.00Hz	0
N	04-04	5th Step Speed Frequency	0.00~600.00Hz	0
N	04-05	6th Step Speed Frequency	0.00~600.00Hz	0
×	04-06	7th Step Speed Frequency	0.00~600.00Hz	0
×	04-07	8th Step Speed Frequency	0.00~600.00Hz	0
N	04-08	9th Step Speed Frequency	0.00~600.00Hz	0
×	04-09	10th Step Speed Frequency	0.00~600.00Hz	0
N	04-10	11th Step Speed Frequency	0.00~600.00Hz	0
N	04-11	12th Step Speed Frequency	0.00~600.00Hz	0
N	04-12	13th Step Speed Frequency	0.00~600.00Hz	0
N	04-13	14th Step Speed Frequency	0.00~600.00Hz	0
N	04-14	15th Step Speed Frequency	0.00~600.00Hz	0
N	04-15	Position command 1 (rotation)	-30000~30000	0
N	04-16	Position command 1 (pulse)	-32767~32767	0
N	04-17	Position command 2 (rotation)	-30000~30000	0
N N	04-18	Position command 2 (pulse)	-32767~32767	0
×	04-19	Position command 3 (rotation)	-30000~30000	0
N	04-20	Position command 3 (pulse)	-32767~32767	0
×	04-21	Position command 4 (rotation)	-30000~30000	0
N	04-22	Position command 4 (pulse)	-32767~32767	0
N	04-23	Position command 5 (rotation)	-30000~30000	0
N	04-24	Position command 5 (pulse)	-32767~32767	0
×	04-25	Position command 6 (rotation)	-30000~30000	0
×	04-26	Position command 6 (pulse)	-32767~32767	0
×	04-27	Position command 7 (rotation)	-30000~30000	0
×	04-28	Position command 7 (pulse)	-32767~32767	0
×	04-29	Position command 8 (rotation)	-30000~30000	0
N	04-30	Position command 8 (pulse)	-32767~32767	0
×	04-31	Position command 9 (rotation)	-30000~30000	0
N	04-32	Position command 9 (pulse)	-32767~32767	0
×	04-33	Position command 10 (rotation)	-30000~30000	0
×	04-34	Position command 10 (pulse)	-32767~32767	0
N	04-35	Position command 11 (rotation)	-30000~30000	0

	Pr.	Explanation	Settings	Factory Setting
×	04-36	Position command 11 (pulse)	-32767~32767	0
N	04-37	Position command 12 (rotation)	-30000~30000	0
N	04-38	Position command 12 (pulse)	-32767~32767	0
N	04-39	Position command 13 (rotation)	-30000~30000	0
N	04-40	Position command 13 (pulse)	-32767~32767	0
×	04-41	Position command 14 (rotation)	-30000~30000	0
×	04-42	Position command 14 (pulse)	-32767~32767	0
×	04-43	Position command 15 (rotation)	-30000~30000	0
×	04-44	Position command 15 (pulse)	-32767~32767	0
	04-45	Reserve		
	04-49	Reserve		
×	04-50	PLC buffer 0	0~65535	0
N	04-51	PLC buffer 1	0~65535	0
N	04-52	PLC buffer 2	0~65535	0
N	04-53	PLC buffer 3	0~65535	0
×	04-54	PLC buffer 4	0~65535	0
×	04-55	PLC buffer 5	0~65535	0
N	04-56	PLC buffer 6	0~65535	0
N	04-57	PLC buffer 7	0~65535	0
N	04-58	PLC buffer 8	0~65535	0
N	04-59	PLC buffer 9	0~65535	0
N	04-60	PLC buffer 10	0~65535	0
N	04-61	PLC buffer 11	0~65535	0
N	04-62	PLC buffer 12	0~65535	0
N	04-63	PLC buffer 13	0~65535	0
N	04-64	PLC buffer 14	0~65535	0
×	04-65	PLC buffer 15	0~65535	0
N	04-66	PLC buffer 16	0~65535	0
×	04-67	PLC buffer 17	0~65535	0
×	04-68	PLC buffer 18	0~65535	0
N	04-69	PLC buffer 19	0~65535	0

### **05 Motor Parameters**

	Pr.	Explanation	Settings	Factory Setting
	05-00	Motor Auto Tuning	<ul> <li>0: No function</li> <li>1: Rolling test for induction motor(IM) (Rs, Rr, Lm, Lx, no-load current)</li> <li>2: Static test for induction motor(IM)</li> <li>3: No function</li> <li>4: Dynamic test for PM motor magnetic pole</li> <li>5: Dynamic test for PM(SPM) motor</li> <li>6: Rolling test for IM motor flux curve</li> <li>12: FOC Sensorless inertia estimation</li> <li>13: Stacic test for PM(IPM) motor</li> </ul>	0
	05-01	Full-load Current of Induction Motor 1(A)	10~120% of drive's rated current	#.##
N	05-02	Rated Power of Induction Motor 1(kW)	0~655.35kW	#.##
N	05-03	Rated Speed of Induction Motor 1 (rpm)	0~65535 1710(60Hz 4poles) ; 1410(50Hz 4 poles)	1710
	05-04	Pole Number of Induction Motor	2~20	4
	05-05	No-load Current of Induction Motor 1 (A)	0~ Pr.05-01 factory setting	#.##
	05-06	Stator Resistance (Rs) of Induction Motor 1	0~65.535Ω	#.###
	05-07	Rotor Resistance (Rr) of Induction Motor 1	0~65.535Ω	#.###
	05-08	Magnetizing Inductance (Lm) of Induction Motor 1	0~6553.5mH	#.#
	05-09	Stator Inductance (Lx) of Induction Motor 1	0~6553.5mH	#.#
	05-10 ~ 05-12	Reserved		
	05-13	Full-load Current of Induction Motor 2 (A)	10~120%	#.##
N	05-14	Rated Power of Induction Motor 2 (kW)	0~655.35kW	#.##
N	05-15	Rated Speed of Induction Motor 2 (rpm)	0~65535 1710(60Hz 4 poles) ; 1410(50Hz 4 poles)	1710
	05-16	Pole Number of Induction Motor 2	2~20	4
	05-17	No-load Current of Induction Motor 2 (A)	0~ Pr.05-01 factory setting	#.##
	05-18	Stator Resistance (Rs) of Induction Motor 2	0~65.535Ω	#.###
	05-19	Rotor Resistance (Rr) of Induction Motor 2	0~65.535Ω	#.###
	05-20	Magnetizing Inductance (Lm) of Induction Motor 2	0~6553.5mH	#.#
	05-21	Stator Inductance (Lx) of Induction Motor 2	0~6553.5mH	#.#
	05-22	Induction Motor 1/ 2 Selection	1: motor 1 2: motor 2	1
N	05-23	Frequency for Y-connection/△-connection Switch of Induction Motor	0.00~600.00Hz	60.00
	05-24	Y-connection/△-connection Switch of Induction Motor	0: Disable 1: Enable	0

		Delay Time for		
N	05-25	Y-connection/	0.000~60.000 sec.	0.200
ŕ	00 20	Switch of Induction Motor		
	05-26	Accumulative Watt-second of	Read only	#.#
	05-20	Motor in Low Word (W-sec)	Read only	#.#
	05-27	Accumulative Watt-second of	Read only	#.#
		Motor in High Word (W-sec)		
	05-28	Accumulative Watt-hour of Motor (W-Hour)	Read only	#.#
		Accumulative Watt-hour of Motor		
	05-29	in Low Word (KW-Hour)	Read only	#.#
	05-30	Accumulative Watt-hour of Motor	Read only	#.#
	05-50	in High Word (KW-Hour)		#.#
	05-31	Accumulative Motor Operation	00~1439	0
		Time (Min)		
	05-32	Accumulative Motor Operation Time (day)	00~65535	0
			0: Induction Motor	
	05-33	Induction Motor and Permanent	1: SPM Permanent Magnet Motor	0
		Magnet Motor Selection	2: IPM Permanent Magnet Motor	
	05-34	Full-load current of Permanent	0.00~655.35Amps	#.##
	00 01	Magnet Motor		
×	05-35	Rated Power of Permanent	0.00~655.35kW	0.00
		Magnet Motor Rated speed of Permanent	0~65535rpm	
~	05-36	Magnet Motor	0-033351pm	2000
	05.07	Pole number of Permanent	0~65535	40
	05-37	Magnet Motor		10
	05-38	Inertia of Permanent Magnet	0.0~6553.5 kg.cm <sup>2</sup>	0.0
		Motor		
	05-39	Stator Resistance of PM Motor	0.000~65.535Ω	0.000
	05-40	Permanent Magnet Motor Ld	0.00~655.35mH	0.000
	05-41	Permanent Magnet Motor Lq	0.00~655.35mH	0.000
*	05-42	PG Offset angle of PM Motor	0.0~360.0°	0.0
~	05-43	Ke parameter of PM Motor	0~65535 (Unit: V/1000rpm)	0

### **06 Protection Parameters**

	Pr.	Explanation	Settings	Factory Setting
×	06-00	Low Voltage Level	230V: Frame A to D: 150.0~220.0Vdc Frame E and frames above E: 190.0~220.0V 460V:	180.0 200.0
			Frame A to D: 300.0~440.0Vdc Frame E and frames above E: 380.0~440.0V	360.0 400.0
N	06-01	Over-voltage Stall Prevention	0: Disabled 230V: 0.0~450.0Vdc 460V: 0.0~900.0Vdc	380.0 760.0
N	06-02	Selection for Over-voltage Stall Prevention	0: Traditional over-voltage stall prevention 1: Smart over-voltage prevention	0
N	06-03	Over-current Stall Prevention during Acceleration	Normal Load: 0~160%(100%: drive's rated current) Heavy Load: 0~180%(100%: drive's rated current)	120 150
×	06-04	Over-current Stall Prevention during Operation	Normal Load: 0~160%(100%: drive's rated current) Heavy Load: 0~180%(100%: drive's rated current)	120 150
N	06-05	Accel. /Decel. Time Selection of Stall Prevention at Constant Speed	0: by current accel/decel time 1: by the 1st accel/decel time 2: by the 2nd accel/decel time 3: by the 3rd accel/decel time 4: by the 4th accel/decel time 5: by auto accel/decel	0
×	06-06	Over-torque Detection Selection (OT1)	<ol> <li>No function</li> <li>Continue operation after Over-torque detection during constant speed operation</li> <li>Stop after Over-torque detection during constant speed operation</li> <li>Continue operation after Over-torque detection during RUN</li> <li>Stop after Over-torque detection during RUN</li> </ol>	0
×	06-07	Over-torque Detection Level (OT1)	10~250% (100%: drive's rated current)	120
N	06-08	Over-torque Detection Time (OT1)	0.0~60.0 sec.	0.1
M	06-09	Over-torque Detection Selection (OT2)	<ol> <li>0: No function</li> <li>1: Continue operation after Over-torque detection during constant speed operation</li> <li>2: Stop after Over-torque detection during constant speed operation</li> <li>3: Continue operation after Over-torque detection during RUN</li> <li>4: Stop after Over-torque detection during RUN</li> </ol>	0
×	06-10	Over-torque Detection Level (OT2)	10~250% (100%: drive's rated current)	120
N	06-11	Over-torque Detection Time (OT2)	0.0~60.0 sec.	0.1
N	06-12	Current Limit	0~250% (100%: drive's rated current )	170
×	06-13	Electronic Thermal Relay Selection (Motor 1)	<ul><li>0: Special motor (with external forced cooling)</li><li>1: Self-cooled motor (so motor with fan on the shaft)</li><li>2: Disable</li></ul>	2
×	06-14	Electronic Thermal Characteristic for Motor 1	30.0~600.0 sec.	60.0
×	06-15	Heat Sink Over-heat (OH) Warning	0.0~110.0°C	105.0
N	06-16	Stall Prevention Limit Level	0~100% (Pr.06-03, Pr.06-04)	50

Pr.	Explanation	Settings	Factory Setting
06-17	Fault Record 1 (Present Fault Record)	0: No fault record	0
06-18	Fault Record 2	1: Over-current during acceleration (ocA)	0
06-19	Fault Record 3	2: Over-current during deceleration (ocd)	0
06-20	Fault Record 4	3: Over-current during constant speed(ocn)	0
06-21	Fault Record 5	4: Ground fault (GFF)	0
06-22	Fault Record 6	5: IGBT short-circuit (occ)	0
		<ul> <li>5: IGBT short-circuit (occ)</li> <li>6: Over-current at stop (ocS)</li> <li>7: Over-voltage during acceleration (ovA)</li> <li>8: Over-voltage during deceleration (ovd)</li> <li>9: Over-voltage during constant speed (ovn)</li> <li>10: Over-voltage during acceleration (LvA)</li> <li>12: Low-voltage during acceleration (LvA)</li> <li>12: Low-voltage during constant speed (Lvn)</li> <li>14: Stop mid-low voltage (LvS)</li> <li>15: Phase loss protection (OrP)</li> <li>16: IGBT over-heat (OH1)</li> <li>17: Capacitance over-heat (OH2)</li> <li>18: ItH1o (TH1 open: IGBT over-heat protection error)</li> <li>19: tH2o (TH2 open: capacitance over-heat protection error)</li> <li>20: Reserved</li> <li>21: Drive over-load (oL)</li> <li>22: Electronics thermal relay 1 (EoL1)</li> <li>23: Electronics thermal relay 2 (EoL2)</li> <li>24: Motor overheat (oH3) (PTC)</li> <li>25: Reserved</li> <li>26: Over-torque 1 (ot1)</li> <li>27: Over-torque 2 (ot2)</li> <li>28: Low current (uC)</li> <li>29: Home limit error (LMIT)</li> <li>30: Memory write-in error (cF1)</li> <li>31: Memory read-out error (cF2)</li> <li>32: Reserved</li> <li>33: U-phase current detection error (cd1)</li> <li>34: V-phase current detection error (cd3)</li> <li>36: Clamp current detection error (Hd0)</li> <li>37: Over-current detection error (Hd1)</li> <li>38: Over-voltage detection error (Hd2)</li> <li>39: Ground current detection error (Hd3)</li> <li>40: Auto tuning error (AUE)</li> <li>41: PID feedback loss (PGF2)</li> <li>44: PG feedback stall (PGF3)</li> <li>45: PG stip error (PGF4)</li> <li>46: PG ref loss (PGr2)</li> <li>48: Analog current input loss (ACE)</li> <li>49: External fault input (EF)</li> <li>50: Emergency stop (EF1)</li> <li>51: External Base Block (bb)</li> <li>52: Password error (PcodE)</li> <li>53: Reserved</li> </ul>	
		54: Communication error (CE1) 55: Communication error (CE2)	

Pr.	Explanation	Settings	Factor Settin
		56: Communication error (CE3)	
		57: Communication error (CE4)	
		58: Communication Time-out (CE10)	_
		59: PU Time-out (CP10)	-
		60: Brake transistor error (bF)	-
		61: Y-connection/△-connection switch error (ydc)	-
		62: Decel. Energy Backup Error (dEb)	-
		63: Slip error (oSL) 64: Electromagnet switch error (ryF)	-
		65: PG Card Error (PGF5)	-
		66-67: Reserved	-
		68: Sensorless estimated speed have wrong direction	-
		69: Sensorless estimated speed have world direction	-
		70: Sensorless estimated speed is over speed	-
		71: Reserved	-
		72: STO Loss 1	-
		73: External safety gate S1	-
		74~75: Reserved	-
		76: STO	1
		77: STO Loss 2	-
		78: STO Loss 3	1
		79: U phase over current (Uocc)	-
		80: V phase over current (Vocc)	-
		81: W phase over current (Wocc)	-
		82: U phase output phase loss (OPHL)	-
		83: V phase output phase loss (OPHL)	-
		84: W phase output phase loss (OPHL)	-
		85: PG-02U ABZ hardware disconnection	-
		86: PG-02U UVW hardware disconnection	
		87~88: Reserved	
		89: Initial rotor position detection error	
		90: Inner PLC function is forced to stop	
		91~100: Reserved	
		101: CANopen software disconnect1 (CGdE)	_
		102: CAN open software disconnect2 (CHbE)	_
		103: CANopen synchronous error (CSYE)	_
		104: CANopen hardware disconnect (CbFE)	-
		105: CANopen index setting error (CldE)	_
		106: CANopen slave station number setting error (CAdE)	
		107: CANopen index setting exceed limit (CFrE)	-
		108~110: Reserved	-
		111: Internal communication overtime error(InrCOM)	-
		112: PM sensorless shaft Lock error	-
		113: Software OC	1
06-23	Fault Output Option 1	0~65535(refer to bit table for fault code)	0
06-24	Fault Output Option 2	0~65535(refer to bit table for fault code)	0
06-25	Fault Output Option 3	0~65535(refer to bit table for fault code)	0
06-26	Fault Output Option 4	0~65535(refer to bit table for fault code)	0
06-27	Selection 2 (Motor 2)	<ul><li>0: Special motor (with external forced cooling)</li><li>1: Self-cooled motor (so motor with fan on the shaft)</li><li>2: Disable</li></ul>	2
06-28	Electronic Thermal Characteristic for Motor 2	30.0~600.0 sec	60.0
06-29	PTC Detection Selection	0: Warn and keep operation 1: Warn and ramp to stop 2: Warn and coast to stop	0

	Pr.	Explanation	Settings	Factory Setting
			3: No warning	0
N	06-30	PTC Level	0.0~100.0%	50.0
	06-31	Frequency Command for Malfunction	0.00~655.35 Hz	Read only
	06-32	Output Frequency at Malfunction	0.00~655.35 Hz	Read only
	06-33	Output Voltage at Malfunction	0.0~6553.5 V	Read only
	06-34	DC Voltage at Malfunction	0.0~6553.5 V	Read only
	06-35	Output Current at Malfunction	0.00~655.35 Amp	Read only
	06-36	IGBT Temperature at Malfunction	-3276.7~3276.7 ℃	Read
	06-37	Capacitance Temperature at	-3276.7~3276.7 ℃	only Read
	06-38	Malfunction Motor Speed in rpm at	-3276.7~3276.7 rpm	only Read
	06-39	Malfunction Torque Command at Malfunction	-3276.7~3276.7	only Read
	06-40	Status of Multi-function Input	0000h~FFFFh	only Read
	06-41	Terminal at Malfunction Status of Multi-function Output Terminal at Malfunction	0000h~FFFFh	only Read only
	06-42	Drive Status at Malfunction	0000h~FFFFh	Read
	06-43	Reserved		Offiy
N	06-44	STO Latch Selection	0:STO Latch 1:STO No Latch	0
N	06-45	Treatment to Output Phase Loss Detection (OPHL)	0: Warn and keep operation 1: Warn and ramp to stop 2: Warn and coast to stop 3: No warning	3
N	06-46	Deceleration Time of Output Phase Loss	0.000~65.535 sec	0.500
N	06-47	Current detection level of output phase loss	0.00~655.35%	1.00
×	06-48	DC Brake Time of Output Phase Loss	0.000~65.535sec	0.000
	06-49	Reserved		
N	06-50	Time for Input Phase Loss Detection	0.00~600.00 sec	0.20
	06-51	Reserved		
×	06-52	Ripple of Input Phase Loss	230V Series: 0.0~160.0 Vdc 460V Series: 0.0~320.0 Vdc	30.0 / 60.0
N	06-53	Treatment for the detected Input Phase Loss (OrP)	0: warn and ramp to stop 1: warn and coast to stop	0
	06-54	Reserved	· · · · ·	
	06-55	Derating Protection	<ul> <li>0: constant rated current and limit carrier wave by load current and temperature</li> <li>1: constant carrier frequency and limit load current by setting carrier wave</li> <li>2: constant rated current(same as setting 0), but close current limit</li> </ul>	0
~	06-56	PT100 Detected Level 1	0.000~10.000V	5.000

	Pr.	Explanation	Settings	Factory Setting
N	06-57	PT100 Detected Level 2	0.000~10.000V	7.000
N	06-58	PT100 Level 1 Frequency Protect	0.00~600.00Hz	0.00
N	06-59	PT100 activation level delay time	0~6000 sec	60
N	06-60	Software Detection GFF Current Level	0.0~6553.5 %	60.0
N	06-61	Software Detection GFF Filter Time	0.00~655.35 sec	0.10
	06-62	Reserved		
	06-63	Fault Record 1 (Day)	0~65535 days	Read only
	06-64	Fault Record 1 (Min)	0~1439 min	Read only
	06-65	Fault Record 2 (Day)	0~65535 days	Read only
	06-66	Fault Record 2 (Min)	0~1439 min	Read only
	06-67	Fault Record 3 (Day)	0~65535 days	Read only
	06-68	Fault Record 3 (Min)	0~1439 min	Read only
	06-69	Fault Record 4 (Day)	0~65535 days	Read only
	06-70	Fault Record 4 (Min)	0~1439 min	Read
×	06-71	Low Current Setting Level	0.0 ~ 6553.5 %	0.0
N	06-72	Low Current Detection Time	0.00 ~ 655.35sec	0.00
N	06-73	Treatment for low current	<ul> <li>0 : No function</li> <li>1 : Warn and coast to stop</li> <li>2 : Warn and ramp to stop by 2nd deceleration time</li> <li>3 : Warn and operation continue</li> </ul>	0

# **07 Special Parameters**

•.	Pr.	Explanation	Settings	Factory	
N	07-00	Software Brake Level	230V: 350.0~450.0Vdc	Setting 380.0	
			460V: 700.0~900.0Vdc	760.0	
N	07-01	DC Brake Current Level	0~100%	0	
N	07-02	DC Brake Time at RUN	0.0~60.0 sec.	0.0	
N	07-03	DC Brake Time at Stop	0.0~60.0 sec.	0.0	
N	07-04	DC Brake frequency at Stop	0.00~600.00Hz	0.00	
×	07-05	Voltage Incrasing Gain	1~200%	100	
N	07-06	Restart after Momentary Power Loss	<ul><li>0: Stop operation</li><li>1: Speed search for last frequency command</li><li>2: Speed search for minimum output frequency</li></ul>	0	
N	07-07	Maximum Power Loss Duration	0.0~20.0 sec.	2.0	
N	07-08	Base Block Time	0.1~5.0 sec.	0.5	
N	07-09	Current Limit for Speed Search	20~200%	100	
N	07-10	Treatment to Restart After Fault	<ul><li>0: Stop operation</li><li>1: Speed search starts with current speed</li><li>2: Speed search starts with minimum output frequency</li></ul>	0	
N	07-11	Number of Times of Auto Restart After Fault	0~10	0	
×	07-12	Speed Search during Start-up	<ul><li>0: Disable</li><li>1: Speed search for maximum output frequency</li><li>2: Speed search for start-up motor frequency</li><li>3: Speed search for minimum output frequency</li></ul>	0	
×	07-13	Decel. Time to Momentary Power Loss	0: Disable 1~6: Auto decel. time	0	
N	07-14	DEB Return Time	0.0~25.0sec	0.0	
N	07-15	Dwell Time at Accel.	0.00 ~ 600.00sec	0.00	
×	07-16	Dwell Frequency at Accel.	0.00 ~ 600.00Hz	0.00	
×	07-17	Dwell Time at Decel.	0.00 ~ 600.00sec	0.00	
N	07-18	Dwell Frequency at Decel.	0.00 ~ 600.00Hz	0.00	
M	07-19	Fan Cooling Control	<ul> <li>0: Fan always ON</li> <li>1: 1 minute after the AC motor drive stops, fan will be OFF</li> <li>2: When the AC motor drive runs, the fan is ON. When the AC motor drive stops, the fan is OFF</li> <li>3: Fan turns ON when preliminary IGBT temperature (around 60°C) is attained.</li> <li>4: Fan always OFF</li> </ul>	0	
×	07-20	Emergency Stop (EF) & Force to Stop Selection	0: Coast stop 1: By deceleration Time 1 2: By deceleration Time 2 3: By deceleration Time 3 4: By deceleration Time 4 5: System Deceleration 6: Automatic Deceleration	0	
N	07-21	Auto Energy-saving Operation	0: Disable 1: Enable	0	
N	07-22	Energy-saving Gain	10~1000%	100	

	Pr.	Explanation	Settings	Factory Setting
N	07-23	Auto Voltage Regulation(AVR) Function	0: Enable AVR 1: Disable AVR 2: Disable AVR during deceleration	0
N	07-24	Filter Time of Torque Compensation (V/F and SVC control mode)	0.001~10.000 sec	0.020
×	07-25	Filter Time of Slip Compensation (V/F and SVC control mode)	0.001~10.000 sec	0.100
×	07-26	Torque Compensation Gain (V/F and SVC control mode)	0~10 (Default: 1 in SVC mode)	0
×	07-27	Slip Compensation Gain (V/F and SVC control mode)	0.00~10.00	0.00
N	07-28	Reserved		
×	07-29	Slip Deviation Level	0.0~100.0%	0
×	07-30	Detection Time of Slip Deviation	0.0~10.0 sec	1.0
*	07-31	Over Slip Treatment	0: Warn and keep operation 1: Warn and ramp to stop 2: Warn and coast to stop 3: No warning	0
×	07-32	Motor Hunting Gain	0~10000	1000
×	07-33	Autorestart internal of Fault	0.0~6000.0 sec	60.0

## **08 High-function PID Parameters**

	Pr.	Explanation	Settings	Factory Setting
×	08-00	Input Terminal for PID Feedback	<ol> <li>No function</li> <li>Negative PID feedback: on analogue input acc. To setting 5 of Pr. 03-00 to Pr.03-02.</li> <li>Negative PID feedback from PG card (Pr.10-02, skip direction)</li> <li>Negative PID feedback from PG card (Pr.10-02)</li> <li>Positive PID feedback from external terminal AVI (Pr.03-00)</li> <li>Positive PID feedback from PG card (Pr.10-02, skip direction)</li> <li>Positive PID feedback from PG card (Pr.10-02, skip direction)</li> <li>Positive PID feedback from PG card (Pr.10-02, skip direction)</li> <li>Positive PID feedback from PG card (Pr.10-02)</li> <li>Negative PID feedback from communication protocol</li> <li>Positive PID feedback from communication protocol</li> </ol>	0
×	08-01	Proportional Gain (P)	0.0~500.0	1.0
×	08-02	Integral Time (I)	0.00~100.00sec	1.00
N	08-03	Derivative Control (D)	0.00~1.00sec	0.00
×	08-04	Upper Limit of Integral Control	0.0~100.0%	100.0
×	08-05	PID Output Frequency Limit	0.0~110.0%	100.0
×	08-06	PID feedback value by communication protocol	-200.00~200.00%	0.00
×	08-07	PID Delay Time	0.0~35.0 sec	0.0
N	08-08	Feedback Signal Detection Time	dback Signal Detection Time 0.0~3600.0 sec	
N	08-09	Feedback Signal Fault Treatment	0: Warn and keep operation 1: Warn and ramp to stop 2: Warn and coast to stop 3: Warn and operate at last frequency	0
×	08-10	Sleep Frequency	0.00 ~ 600.00Hz	0.00
×	08-11	Wake-up Frequency	0.00 ~ 600.00Hz	0.00
N	08-12	Sleep Time	0.0 ~ 6000.0sec	0.0
×	08-13	PID Deviation Level	1.0 ~ 50.0%	10.0
N	08-14	PID Deviation Time	0.1~300.0sec	5.0
×	08-15	Filter Time for PID Feedback	0.1~300.0sec	5.0
N	08-16	PID Compensation Selection	0: Parameter setting 1: Reserved	0
N	08-17	PID Compensation	-100.0~+100.0%	0
	08-18	Setting of Sleep Mode Function	0: Follow PID output command 1: Follow PID feedback signal	0
N	08-19	Wakeup Integral Limit	0.0~200.0%	50.0
	08-20	PID Mode Selection	0: Serial connection 1: Parallel connection	0
	08-21	Enable PID to Change Operation Direction	0: Operation direction can be changed 1: Operation direction can not be changed	0
×	08-22	Wakeup Delay Time	0.00~600.00 Seconds	0.00
N	08-23	PID Control Flag	Bit $0 = 1$ , PID reverse running must follow the setting of Pr00-23. Bit $0 = 0$ , PID reverse running follow PID's calculated value.	0

# **09** Communication Parameters

	Pr.	Explanation	Settings	Factory Setting		
×	09-00	COM1 Communication Address	1~254	1		
N	09-01	COM1 Transmission Speed	4.8~115.2Kbps	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 warning and continue operation	3		
×	09-03	COM1 Time-out Detection	0.0~100.0 sec.	0.0		
M	09-04	04       COM1 Communication Protocol       1: 7N2 (ASCII)         04       COM1 Communication Protocol       3: 701 (ASCII)         05       702 (ASCII)       6: 8N1 (ASCII)         06       8N1 (ASCII)       7: 8N2 (ASCII)         07       882 (ASCII)       10: 8E2 (ASCII)         11: 802 (ASCII)       11: 802 (ASCII)         11: 802 (ASCII)       11: 802 (ASCII)         12: 8N1 (RTU)       13: 8N2 (RTU)         14: 8E1 (RTU)       15: 801 (RTU)         16: 8E2 (RTU)       16: 8E2 (RTU)         17: 802 (RTU)       17: 802 (RTU)				
	09-05 ~ 09-08	Reserved				
×	09-09	Response Delay Time	0.0~200.0ms	2.0		
	09-10	Main Frequency of the Communication	0.00~600.00Hz	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		
N	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		
×	09-22	Block Transfer 12	0~65535	0		
N N		Block Transfer 12 Block Transfer 13	0~65535 0~65535	0		
,	09-22					
×	09-22 09-23	Block Transfer 13	0~65535	0		

Pr.	Explanation	Settings	Factory Setting			
09-27 ~	Reserved		ootang			
09-29						
09-30	Communication Decoding Method	0: Decoding Method 1 1: Decoding Method 2	1			
09-31	Internal Communication Protocol	0: Modbus 485 -1: Internal Communication Slave 1 -2: Internal Communication Slave 2 -3: Internal Communication Slave 3 -4: Internal Communication Slave 4 -5: Internal Communication Slave 5 -6: Internal Communication Slave 6 -7: Internal Communication Slave 7 -8: Internal Communication Slave 8 -9: Reserved -10: Internal Communication Master -11: Reserve -12: Internal PLC Control	0			
09-32	2 Reserved					
09-33	B PLC command force to 0	0~65535	0			
09-34	Reserved					
09-35	5 PLC Address	1~254	2			
09-36	CANopen Slave Address	0: Disable 1~127	0			
09-37	CANopen Speed	0: 1M 1: 500k 2: 250k 3: 125k 4: 100k (Delta only) 5: 50k	0			
09-38	CANopen Frequency Gain	1.00 ~ 2.00	1.00			
09-39	CANopen Warning Record	bit 0: CANopen Guarding Time out bit 1: CANopen Heartbeat Time out bit 2: CANopen SYNC Time out bit 3: CANopen SDO Time out bit 4: CANopen SDO buffer overflow bit 5: Can Bus Off bit 6: Error protocol of CANopen bit 7: Reserved bit 8: The setting values of CANopen indexs are fail bit 9: The setting value of CANopen address is fail bit10: The checksum value of CANopen indexs is fail	Read only			
09-40	CANopen Decoding Method	0: Delta defined decoding method 1: CANopen DS402 Standard	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			
09-42	2 CANopen Control Status	<ul> <li>0: Not ready for use state</li> <li>1: Inhibit start state</li> <li>2: Ready to switch on state</li> <li>3: Switched on state</li> <li>4: Enable operation state</li> <li>7: Quick Stop Active state</li> <li>13: Err Reaction Activation state</li> <li>14: Error state</li> </ul>	Read Only			

	Pr.	Explanation	Settings	Factory Setting
	09-43	Reset CANopen Index	bit0: reset address 20XX to 0. bit1: reset address 264X to 0 bit2: reset address 26AX to 0 bit3: reset address 60XX to 0	65535
	09-44	Reserved		
	09-45	CANopen Master Function	0: Disable 1: Enable	0
	09-46	CANopen Master Address	1~127	100
	09-47 ~ 09-59	Reserved		
	09-60	Identifications for Communication Card	0: No communication card 1: DeviceNet Slave 2: Profibus-DP Slave 3: CANopen Slave/Master 4: Modbus-TCP Slave 5: Ethernet/IP Slave 6~8: Reserved	##
	09-61	Firmware Version of Communication Card	Read only	##
	09-62	Product Code	Read only	##
	09-63	Error Code	Read only	##
	09-64 ~ 09-69	Reserved		
,	09-70	Address of Communication Card	DeviceNet: 0-63 Profibus-DP: 1-125	1
·	09-71	Setting of DeviceNet Speed	Standard DeviceNet: 0: 125Kbps 1: 250Kbps 2: 500Kbps Non standard DeviceNet: (Delta Only) 0: 10Kbps 1: 20Kbps 2: 50Kbps 3: 100Kbps 4: 125Kbps 5: 250Kbps 5: 250Kbps 6: 500Kbps 7: 800Kbps 8: 1Mbps 0: Diaphle	2
	09-72	Other Setting of DeviceNet Speed 0: Disable In this mode, baud rate can only be 0,1,2,3 in standard DeviceNet speed 1: Enable In this mode, the baud rate of DeviceNet can be same as CANopen (0-8).		0
	09-73	Reserved		
	09-74	Reserved		
, [	09-75	IP Configuration of the Communication Card	0: Static IP 1: Dynamic IP (DHCP)	0
,    -	09-76	IP Address 1 of the Communication Card	0~255	0
	09-77	IP Address 2 of the Communication Card	0~255	0

	Pr.	Explanation	Settings	Factory Setting	
N	09-78	IP Address 3 of the Communication Card			
N	09-79	IP Address 4 of the Communication Card	0~255	0	
N	09-80	Address Mask 1 of the Communication Card	0~255	0	
N	09-81	Address Mask 2 of the Communication Card	0~255	0	
N	09-82	Address Mask 3 of the Communication Card	0~255	0	
N	09-83	Address Mask 4 of the Communication Card	0~255	0	
×	09-84	Getway Address 1 of the Communication Card	0~255	0	
N	09-85	Getway Address 2 of the Communication Card	0~255	0	
×	09-86	Getway Address 3 of the Communication Card	0~255	0	
×	09-87	Getway Address 4 of the Communication Card	0~255	0	
N	09-88	Password for Communication Card (Low word)	0~255	0	
×	09-89	Password for Communication Card (High word)	0~255	0	
N	09-90	Reset Communication Card	0: No function 1: Reset, return to factory setting	0	
M	09-91	Additional Setting for Communication Card	<ul> <li>Bit 0: Enable IP filter</li> <li>Bit 1: Enable to write internet parameters (1bit). This bit will change to disable when it finishes saving the internet parameter updates.</li> <li>Bit 2: Enable login password (1bit). When enter login password, this bit will be enabled. After updating the parameters of communication card, this bit will change to disable.</li> </ul>	0	
	09-92	Status of Communication Card	Bit 0: password enable When the communication card is set with password, this bit is enabled. When the password is clear, this bit is disabled.	0	

# **10 Speed Feedback Control Parameters**

IM: Induction Motor; PM: Permanent Magnet Motor

	Pr.	Explanation	Settings	Factory Setting
	10-00	Encoder Type Selection	0: Disable 1: ABZ 2: ABZ (Delta Encoder for Delta servo motor) 3: Resolver 4: ABZ/UVW 5: MI8 single phase pulse input	0
	10-01	Encoder Pulse	1~20000	600
	10-02	Encoder Input Type Setting	<ul> <li>0: Disable</li> <li>1: Phase A leads in a forward run command and phase</li> <li>B leads in a reverse run command</li> <li>2: Phase B leads in a forward run command and phase</li> <li>A leads in a reverse run command</li> <li>3: Phase A is a pulse input and phase B is a direction input. (low input=reverse direction, high input=forward direction)</li> <li>4: Phase A is a pulse input and phase B is a direction input. (low input=forward direction, high input=forward direction)</li> <li>5: Single-phase input</li> </ul>	0
,	10-03	Output Setting for Frequency Division (denominator)	1~255	1
	10-04	Electrical Gear at Load Side A1	1~65535	100
·	10-05	Electrical Gear at Motor Side B1	1~65535	100
,	10-06	Electrical Gear at Load Side A2	1~65535	100
ſ	10-07	Electrical Gear at Motor Side B2	1~65535	100
,	10-08	Treatment for Encoder/ Speed Observer Feedback Fault	0: Warn and keep operation 1: Warn and ramp to stop 2: Warn and coast to stop	2
	10-09	Detection Time of Encoder / Speed Observer Feedback Fault	0.0~10.0sec 0: No function	1.0
	10-10	Encoder/ Speed Observer Stall Level	0~120% 0: No function	115
	10-11	Detection Time of Encoder/ Speed Observer Stall	0.0 ~ 2.0sec	0.1
,	10-12	Treatment for Encoder/ Speed Observer Stall	0: Warn and keep operation 1: Warn and ramp to stop 2: Warn and coast to stop	2
, [	10-13	Encoder/ Speed Observer Slip Range	0~50% (0: disable)	50
	10-14	Detection Time of Encoder/ Speed Observer Slip	0.0~10.0sec	0.5
,	10-15	Treatment for Encoder/ Speed Observer Stall and Slip Error	0: Warn and keep operation 1: Warn and ramp to stop 2: Warn and coast to stop	2
	10-16	Pulse Input Type Setting	<ul> <li>0: Disable</li> <li>1: Phase A leads in a forward run command and phase</li> <li>B leads in a reverse run command</li> <li>2: Phase B leads in a forward run command and phase</li> <li>A leads in a reverse run command</li> <li>3: Phase A is a pulse input and phase B is a direction input. (L=reverse direction, H=forward direction).</li> <li>4: Phase A is a pulse input and phase B is a direction input. (L=forward direction, H=reverse direction).</li> </ul>	0
,	10-17	Electrical Gear A	1~65535	100

	Pr.	Explanation	Settings	Factory Setting		
×	10-18	Electrical Gear B	1~65535	100		
×	10-19	Positioning for Encoder Position	0~65535pulse	0		
×	10-20	Range for Encoder Position Attained	0~65535pulse	10		
×	10-21	Filter Time (PG2)	0~65.535 sec	0.100		
	10-22	Speed Mode (PG2)	0: Electronic Frequency 1: Mechanical Frequency (base on pole pair)	0		
	10-23	Reserved				
×	10-24	FOC&TQC Function Control	0~65535	0		
×	10-25	FOC Bandwidth of Speed Observer	1.0~100.0Hz	40.0		
×	10-26	FOC Minimum Stator Frequency	0.0~10.0%fN	2.0		
×	10-27	FOC Low-pass Filter Time Constant	1~1000ms	50		
×	10-28	FOC Excitation Current Rise Time	33~100%Tr	100		
×	10-29	Top Limit of Frequency Deviation	0.00~100.00Hz	20.00		
	10-30	Resolver Pole Pair	1~50	1		
×	10-31	I/F Mode, current command	0~150%Irated (Rated current % of motor)	40		
×	10-32	PM Sensorless Obeserver Bandwith for High Speed Zone	0.00~600.00Hz	5.00		
	10-33	Reserved				
×	10-34	PM Sensorless Observer Low-pass Filter Gain	0.00~655.35 Hz	1.00		
×	10-35	AMR (Kp)	0.00~3.00	2.00		
×	10-36	AMR (Ki)	0.00~3.00	0.20		
×	10-37	PM Sensorless Control Word	0000~FFFFh	0000		
	10-38	Reserved				
×	10-39	Frequency when switch from I/F Mode to PM sensorless mode.	0.00~600.00Hz	20.00		
×	10-40	Frequency when switch from PM sensorless observer mode to V/F mode.	0.00~600.00Hz	20.00		
*	10-41	I/F mode, low pass-filter time	0.0~6.0sec	0.2		
×	10-42	Initial Angle Detection Time	0~50ms	5		
	10-43	PG card version	0~655.35	Read only		
	10-44 ~ 10-48	Reserved				
	10-49	Zero voltage time while start up	00.000~60.000 sec	00.000		
	10-50	Reverse angle limit (Electrical angle)	0.00~30.00 degree	10.00		
	10-51	Injection Frequency	0~2000Hz	500		
	10-52	Injection Magnitude	0.0~200.0V	15/30		

### **11 Advanced Parameters**

IM: Induction Motor; PM: Permanent Magnet Motor

	Pr.	Explanation	Settings	Factory Setting
	11-00	System Control	bit 0: Auto tuning for ASR and APR bit 1: Inertia estimate (only for FOCPG mode) bit 2: Zero servo bit 3: Dead Time compensation closed Bit 7: Selection to save or not save the frequency Bit 8: Maximum speed of point to point position control	0
	11-01	Per Unit of System Inertia	1~65535 (256=1PU)	400
×	11-02	ASR1/ASR2 Switch Frequency	5.00~600.00Hz	7.00
*	11-03	ASR1 Low-speed Bandwidth	1~40Hz (IM)/ 1~100Hz (PM)	10
~	11-04	ASR2 High-speed Bandwidth	1~40Hz (IM)/ 1~100Hz (PM)	10
*	11-05	Zero-speed Bandwidth	1~40Hz (IM)/ 1~100Hz (PM)	10
~	11-06	ASR Control (P) 1	0~40Hz (IM)/ 1~100Hz (PM)	10
~	11-07	ASR Control (I) 1	0.000~10.000 sec	0.100
~	11-08	ASR Control ( P) 2	0~40Hz (IM)/ 0~100Hz (PM)	10
~	11-09	ASR Control (I) 2	0.000~10.000 sec	0.100
~	11-10	P Gain of Zero Speed	0~40Hz (IM)/ 0~100Hz (PM)	10
×	11-11	I Gain of Zero Speed	0.000~10.000 sec	0.100
~	11-12	Gain for ASR Speed Feed Forward	0~150%	0
~	11-13	PDFF Gain	0~200%	30
~	11-14	Low-pass Filter Time of ASR Output	0.000~0.350 sec	0.008
~	11-15	Notch Filter Depth	0~20db	0
×	11-16	Notch Filter Frequency	0.00~200.00Hz	0.0
N	11-17	Forward Motor Torque Limit	0~500%	500
~	11-18	Forward Regenerative Torque Limit	0~500%	500
×	11-19	Reverse Motor Torque Limit	0~500%	500
~	11-20	Reverse Regenerative Torque Limit	0~500%	500
*	11-21	Gain Value of Flux Weakening Curve for Motor 1	0~200%	90
*	11-22	Gain Value of Flux Weakening Curve for Motor 2	0~200%	90
*	11-23	Speed Response of Flux Weakening Area	0~150%	65
*	11-24	APR Gain	0.00~40.00Hz (IM)/ 0~100.00Hz (PM)	10.00
*	11-25	Gain Value of APR Feed Forward	0~100	30
~	11-26	APR Curve Time	0.00~655.35 sec	3.00
~	11-27	Max. Torque Command	0~500%	100
×	11-28	Source of Torque Offset	0: No function 1: Analog signal input (Pr.03-00~03-02) 2: Pr.11-29 3: Control by external terminal (Pr.11-30~11-32)	0

	Pr.	Explanation	Settings	Factory Setting
~	11-29	Torque Offset Setting	-100%~100%	0.0
~	11-30	High Torque Offset	-100%~100%	30.0
~	11-31	Middle Torque Offset	-100%~100%	20.0
~	11-32	Low Torque Offset	-100%~100%	10.0
~	11-33	Source of Torque Command	0: Digital keypad 1: RS-485 communication (Pr.11-34) 2: Analog input (Pr.03-00) 3: CANopen 4: Reserved 5: Communication extension card	0
~	11-34	Torque Command	-100.0~+100.0% (Pr.11-27*11-34)	0
~	11-35	Filter Time of Torque Command	0.000~1.000sec	0.000
	11-36	Speed Limit Selection	<ul> <li>0: Set by Pr.11-37 (Forward speed limit) and Pr.11-38 (Reverse speed limit)</li> <li>1: Set by Pr.11-37,11-38 and Pr.00-20 (Source of Master Frequency Command)</li> <li>2: Set by Pr.00-20 (Source of Master Frequency Command).</li> </ul>	0
~	11-37	Forward Speed Limit (torque mode)	0~120%	10
~	11-38	Reverse Speed Limit (torque mode)	0~120%	10
	11-39	Zero Torque Command Mode	0: Torque mode 1: Speed mode	0
×	11-40	Command Source of Point-to-Point Position Control	0: External terminal 1: Reserved 2: RS485 3: CAN 4: PLC 5: Communication card	0
	11-41	Reserved		-
~	11-42	System Control Flags	0000~FFFFh	0000
~	11-43	Max. Frequency of Point- to-Point Position Control	0.00~600.00Hz	10.00
~	11-44	Accel. Time of Point-to Point Position Control	0.00~655.35 sec	1.00
~	11-45	Decel. Time of Point-to Point Position Control	0.00~655.35 sec	3.00

# **Chapter 12 Description of Parameter Settings**

00 Drive Parameters

✓ This parameter can be set during operation.

**GG** - **GG** Identity Code of the AC Motor Drive

Factory Setting: #.#

Settings Read Only

**B C** - **C C** Display AC Motor Drive Rated Current

Factory Setting: #.#

Settings Read Only

- Pr. 00-00 displays the identity code of the AC motor drive. Using the following 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 Pr.00-00.
- The factory setting is the rated current for normal duty. Please set Pr.00-16 to 1 to display the rated current for the heavy duty.

230V Series										
Frame		A	۹.	В			С			
kW	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22
HP	1.0	2.0	3.0	5.0	7.5	10	15	20	25	30
Pr.00-00	4	6	8	10	12	14	16	18	20	22
Rated Current for Heavy Duty (A)	4.8	7.1	10	16	24	31	47	62	71	86
Rated Current for Normal Duty (A)	5	8	11	17	25	33	49	65	75	90
Frame	Γ	)		E		F				
kW	30	37	45	50	75	90				
HP	40	50	60	75	100	125				
Pr.00-00	24	26	28	30	32	34				
Rated Current for Heavy Duty (A)	114	139	171	204	242	329				
Rated Current for Normal Duty (A)	120	146	180	215	255	346				

460V Series														
Frame	A							В				С		
kW	0.75	1.5	2.2	3.7	4.0	) (	5.5	7.	5	11	15	18.5	22	30
HP	1	2	3	5	5		7.5	1	0	15	20	25	30	40
Pr.00-00	5	7	9	11	93	;	13	1	5	17	19	21	23	25
Rated Current for Heavy Duty (A)	2.9	3.8	5.7	8.1	9.	5	11	1	7	23	30	36	43	57
Rated Current for Normal Duty (A)	3.0	4.0	6.0	9.0	10	5	12	1	8	24	32	38	45	60
Frame	D0		D		E			F		G		Н		
kW	37	45	55	75	90	110	) 13	32	160	185	220	280	315	355
HP	50	60	75	100	125	150	) 1	75	215	250	300	375	425	475
Pr.00-00	27	29	31	33	35	37	3	9	41	43	45	47	49	51
Rated Current for Heavy Duty (A)	69	86	105	143	171	209	2	47	295	352	437	523	585	649
Rated Current for Normal Duty (A)	73	91	110	150	180	220	) 2	60	310	370	460	550	616	683

### **Parameter Reset**

Factory Setting: 0

Factory setting: 0

Factory setting: 3

- Settings 0: No Function
  - 1: Write protection for parameters
  - 5: Reset KWH display to 0
  - 6: Reset PLC (including CANopen Master Index)
  - 7: Reset CANopen Index (Slave)
  - 8: Reserve
  - 9: All parameters are reset to factory settings(base frequency is 50Hz)
  - 10: All parameters are reset to factory settings (base frequency is 60Hz)
- When it is set to 1, all parameters are read only except Pr.00-02~00-08 and it can be used with password setting for password protection. It needs to set Pr.00-02 to 0 before changing other parameter settings.
- When it is set to 9 or 10: all parameters are reset to factory settings. If password is set in Pr.00-08, input the password set in Pr.00-07 to reset to factory settings.
- When it is set to 5, KWH display value can be reset to 0 even when the drive is operating. Pr. 05-26, 05-27, 05-28, 05-29, 05-30 reset to 0.
- When it is set to 6: clear internal PLC program (includes the related settings of PLC internal CANopen master)
- When it is set to 7: reset the related settings of CANopen slave.
- When it is set to  $6 \cdot 7 \cdot 9 \cdot 10$ , please re-power the motor drive after setting.

## **G G G G Start-up Display Selection**

Settings 0: Display the frequency command (F)

- 1: Display the actual output frequency (H)
- 2: Display User define (U)
- 3: Output current (A)
- This parameter determines the start-up display page after power is applied to the drive. User defined choice display according to the setting in Pr.00-04.

## Content of Multi-function Display

Settings 0: Display output current (A) (Unit: Amps)

- 1: Display counter value (c) (Unit: CNT)
- 2: Display actual output frequency (H.) (Unit: Hz)
- 3: Display DC-BUS voltage (v) (Unit: Vdc)
- 4: Display output voltage (E) (Unit: Vac)
- 5: Display output power angle (n) (Unit: deg)
- 6: Display output power in kW (P) (Unit: Kw)
- 7: Display actual motor speed rpm (r = 00: positive speed; -00 negative speed) (Unit: rpm)

- 8: Display estimate output torque % (t = 00: positive torque; -00 negative torque) (t) (Unit: %)
- 9: Display PG feedback (G) (refer to Note 1) (Unit: PLS)
- 10: Display PID feedback (b) (Unit: %)
- 11: Display AVI in % (1.), 0~10V/4-20mA/0-20mA corresponds to 0~100% (Refer to Note 2) (Unit: %)
- 12: Display ACI in % (2.), 4~20mA/0~10V/0-20mA corresponds to 0~100% (Refer to Note 2) (Unit: %)
- 13: Display AUI in % (3.), -10V~10V corresponds to -100~100%(Refer to Note 2) (Unit: %)
- 14: Display the temperature of IGBT (i.) (Unit:  $^\circ\!\!\mathbb{C}$  )
- 15: Display the temperature of capacitance (c.) (Unit:  $^\circ C$ )
- 16: The status of digital input (ON/OFF) refer to Pr.02-12 (i) (Refer to Note3)
- 17: Display digital output status ON/OFF (Pr.02-18) (o) (refer to NOTE 4)
- 18: Display the multi-step speed that is executing (S)
- 19: The corresponding CPU pin status of digital input (d) (refer to NOTE 3)
- 20: The corresponding CPU pin status of digital output (0.) (refer to NOTE4)
- 21: Actual motor position (PG1 of PG card). When the motor direction changes or the drive stops, the counter will start from 0 (display value restarts counting from 0) (Max. 65535) (P.)
- 22: Pulse input frequency (PG2 of PG card) (S.)
- 23: Pulse input position (PG2 of PG card) (max. 65535) (q.)
- 24: Position command tracing error (E.)
- 25: Overload counting (0.00~100.00%) (o.) (Refer to Note 6) (Unit: %)
- 26: GFF Ground Fault (G.) (Unit: %)
- 27: DC Bus voltage ripple (r.) (Unit: %)
- 28: Display PLC register D1043 data (C) display in hexadecimal
- 29: Display PM motor pole section (EMC-PG01U application) (4.)
- 30 : Display output of user defined (U)
- 31 : H page x 00-05 Display user Gain(K)
- 32: Number of actual motor revolution during operation (PG card plug in and Z phase signal input) (Z.)
- 33: Motor actual position during operation (when PG card is connected)(q)
- 34: Operation speed of fan (F.) (Unit: %)
- 35: Control Mode display: 0= Speed control mode (SPD), 1= torque control mode (TQR) (t.)
- 36: Present operating carrier frequency of drive (Hz) (J.)
- 37: Reserved
- 38: Display drive status (6.) (Refer to Note 7)
- 40: Torque command (L.) (Unit: %)

- 41: KWH display (J) (Unit: KWH)
- 42: PID reference (h.) (Unit: %)
- 43: PID offset (o.) (Unit: %)
- 44: PID output frequency (b.) (Unit: Hz)
- 45: Hardware ID

## 

1. When Pr.10-01 is set to 1000 and Pr.10-02 is set to 1/2, the display range for PG feedback will be from 0 to 4000.

When Pr.10-01 is set to 1000 and Pr.10-02 is set to 3/4/5, the display range for PG feedback will be from 0 to 1000.

Home position: If it has Z phase, Z phase will be regarded as home position. Otherwise, home position will be the encoder start up position.

- 2. It can display negative values when setting analog input bias (Pr.03-03~03-10).
- Example: assume that AVI input voltage is 0V, Pr.03-03 is 10.0% and Pr.03-07 is 4 (Serve bias as the center).
- 3. Example: If REV, MI1 and MI6 are ON, the following table shows the status of the terminals. 0: OFF, 1: ON

Terminal	MI15	MI14	MI13	MI12	MI11	MI10	MI8	MI7	MI6	MI5	MI4	MI3	MI2	MI1	REV	FWD
Status	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0

MI10~MI15 are the terminals for extension cards (Pr.02-26~02-31).

If REV, MI1 and MI6 are ON, the value is 0000 0000 1000 0110 in binary and 0086h in HEX. When Pr.00-04 is set to "16" or "19", it will display "0086h" with LED U is ON on the keypad KPC-CE01. The setting 16 is the status of digital input by Pr.02-12 setting and the setting 19 is the corresponding CPU pin status of digital input, the FWD/REV action and the three-wire MI are not controlled by Pr.02-12. User can set to 16 to monitor digital input status and then set to 19 to check if the wire is normal.

4. Assume that RY1: Pr.02-13 is set to 9 (Drive ready). After applying the power to the AC motor drive, if there is no other abnormal status, the contact will be ON. The display status will be shown as follows.

N.O. switch status:

Terminal		Rese	erved			Rese	erved			Rese	erved		MO2	MO1	Reserved	RY2	RY1
Status	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

At the meanwhile, if Pr.00-04 is set to 17 or 20, it will display in hexadecimal "0001h" with LED U is ON on the keypad. The setting 17 is the status of digital output by Pr.02-18 setting and the setting 20 is the corresponding CPU pin status of digital output. User can set 17 to monitor the digital output status and then set to 20 to check if the wire is normal.

- 5. Setting 8: 100% means the motor rated torque. Motor rated torque = (motor rated power  $x60/2\pi$ )/motor rated speed
- 6. If Pr.00-04 = 25, when display value reaches 100.00%, the drive will show "oL" as an overload warning.
- 7. If Pr.00-04 = 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 on the drive.



Coefficient Gain in Actual Output Frequency

Factory Setting: 0

Factory Setting: #.#

This parameter is to set coefficient gain in actual output frequency. Set Pr.00-04= 31 to display the calculation result on the screen (calculation = output frequency \* Pr.00-05).

**30 - 35** Software Version

Settings Read only

Parameter Protection Password Input

Factory Setting: 0

Settings 1~9998, 10000~65535

Display 0~3 (the times of password attempts)

- This parameter allows user to enter their password (which is set in Pr.00-08) to unlock the parameter protection and to make changes to the parameter.
- Pr.00-07 and Pr.00-08 are used to prevent the personal mis-operation.
- When the user have forgotten the password, clear the setting by input 9999 and press ENTER key, then input 9999 again and press Enter within 10 seconds. After decoding, all the settings will return to factory setting.

✓ **30 - 38** Parameter Protection Password Setting

Factory Setting: 0

Settings 1~9998, 10000~65535

- 0: No password protection / password is entered correctly (Pr00-07)
- 1: Password has been set
- To set a password to protect your parameter settings. In the first time, password can be set directly. After setting, the value of 00-08 will become 1, which means password protection is activated. When the password is set, if any parameter setting needs to be changed, be sure to enter correct password in 00-07, and then the password will be inactivated temporarily with 00-08 changing to 0. At this time, parameters setting can be changed. After setting, re-power the motor drive, and password will be activated again.
- To cancel the password protection, after entering correct password in 00-07, 00-08 also needs to be set as 0 again to inactive password protection permanently. If not, password protection will be active after motor drive re-power.
- The keypad copy function will work normally only when the password protection is inactivated temporarily or permanently, and password set in 00-08 will not be copied to keypad. So when copying parameters from keypad to motor drive, the password need to be set manually again in the motor drive to active password protection.

### Password Decode Flow Chart

Password Setting 00-08	Password Forgotten	Password Incorrect 00-07
00-08		
Displays 01 after correct password is entered to Pr.00-08.	Enter 9999 and press ENTER, then enter 9999 again within 10 seconds and press ENTER. Then all parameters will reset to factory settings.	3 chances of password input: Incorrect password 1: displays "01" Incorrect password 2: displays "02" Incorrect password 3: "Pcode"(blinking) Keypad will be locked after 3 wrong attempted passwords. To re-activate the keypad, please
	¦ []	reboot the drive and input the correct password.
Decode Flow Chart		
00-08 Password Set		
00-07 Password Input		
· < Dr 00_08=0 >	Shut down th drive and re-apply power	
No		
Re-apply power.		
(The password is stil	ll valid)	
00-09 Rese	erved	
🗡 🕃 🕄 - 🕴 Conti	rol Mode	
		Factory Setting: 0
Settir	ngs 0: Speed mode	
	1: Point-to-Point position contro	I
	2: Torque mode	
	3: Home mode	
This parameter	er determines the control mode of	C2000 series AC motor drive.
Contra	rol of Speed Mode	
		Factory Setting: 0
Settir	ngs 0: VF (IM V/f control)	
	1: VFPG (IM V/f control+ End	coder)
	2: SVC(IM sensorless vector	control)
	3: FOCPG (IM FOC vector c	ontrol+ encoder)
	4: FOCPG (PM FOC vector	control + Encoder )
	5: FOC Sensorless (IM field	oriented sensorless vector control)
	6: PM Sensorless (PM field c	priented sensorless vector control)
	7: IPM Sensorless (Interior P	M field oriented sensorless vector control)

I This parameter determines the control method of the AC motor drive:

0: (IM V/f control): user can design proportion of V/f as required and can control multiple motors simultaneously.

1: (IM V/f control + Encoder): user can use optional PG card with encoder for the closed-loop speed control.

2: (IM Sensorless vector control): get the optimal control by the auto-tuning of motor parameters.

3: (IM FOC vector control+ encoder): besides torque increases, the speed control will be more accurate (1:1000).

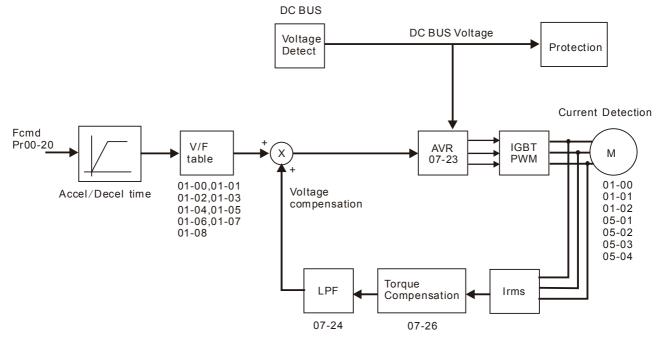
4: (PM FOC vector control + Encoder): besides torque increases, the speed control will be more accurate (1:1000).

5: FOC Sensorless: IM field oriented sensorless vector control

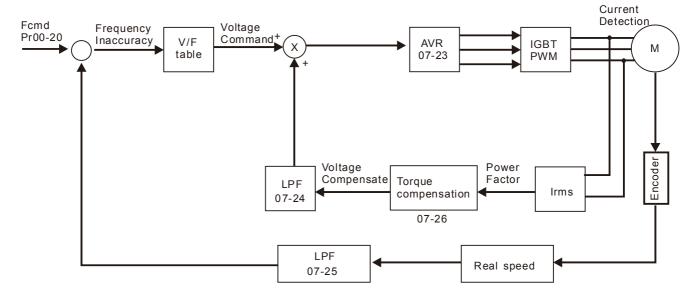
6: PM Sensorless (PM field oriented sensorless vector control)

7: IPM Sensorless (Interior PM field oriented sensorless vector control)

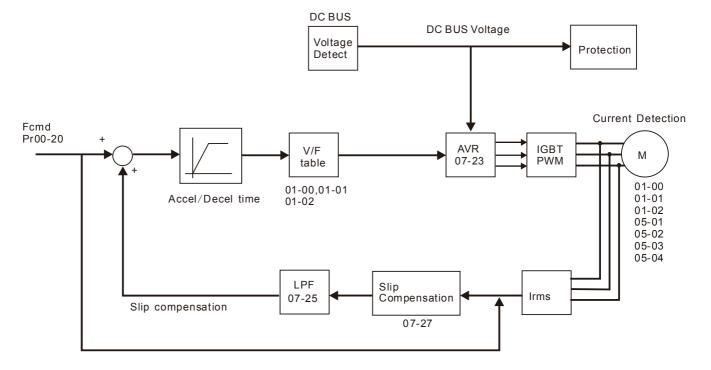
When 00-10=0, and set Pr.00-11 to 0, the V/F control diagram is shown as follows.



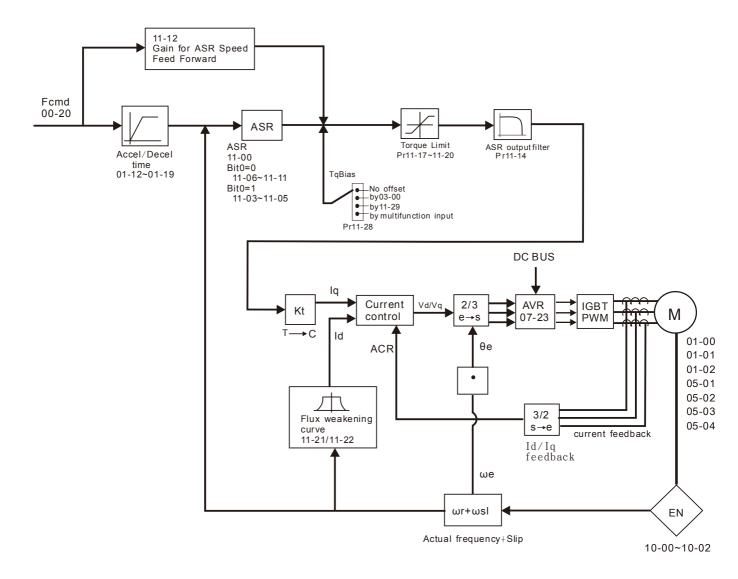
When 00-10=0, and set Pr.00-11 to 1, the V/F control + encoder diagram is shown as follows.



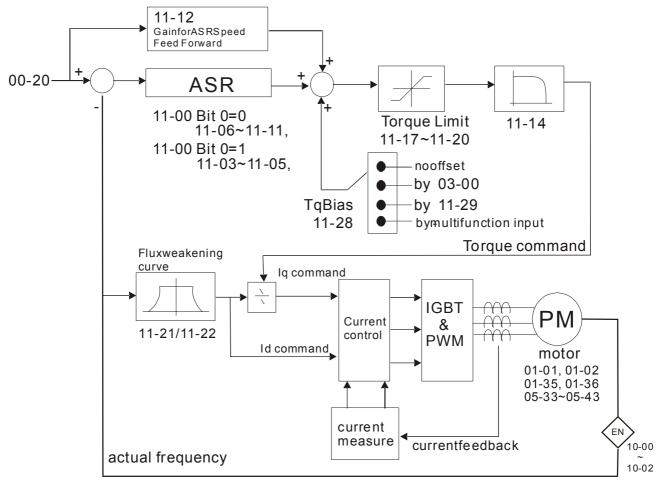
When 00-10=0, and set Pr.00-11 to 2, the sensorless vector control diagram is shown as follows.



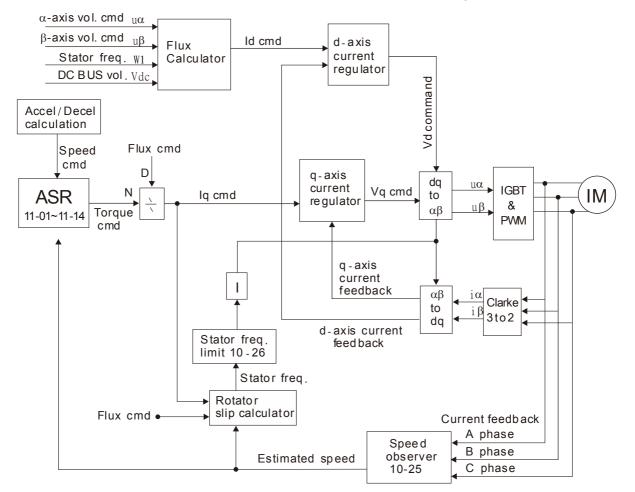
When 00-10=0, and set Pr.00-11 to 3, the IM FOCPG control diagram is shown as follows.



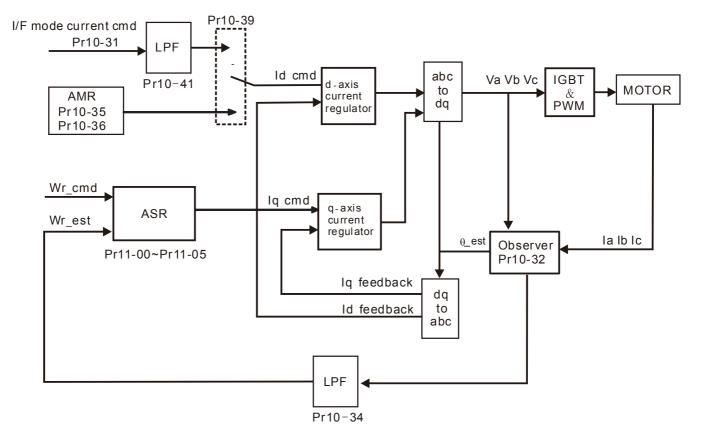
When 00-10=0, and set Pr.00-11 to 4, the PM FOCPG control diagram is shown as follows.



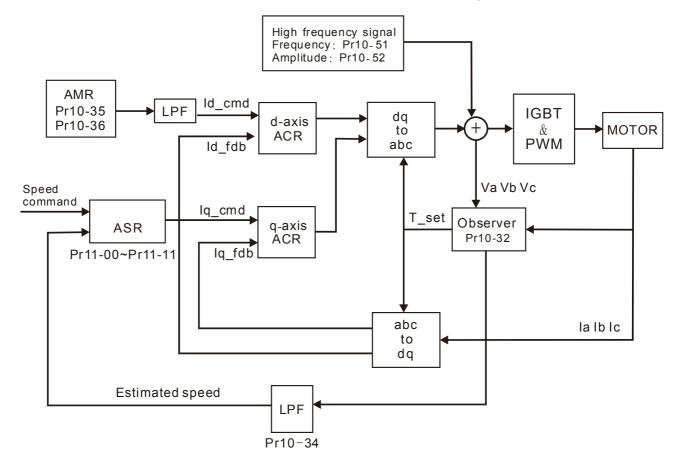
When 00-10=0, and set Pr.00-11 to 5, FOC sensorless (IM) control diagram is shown as follows.

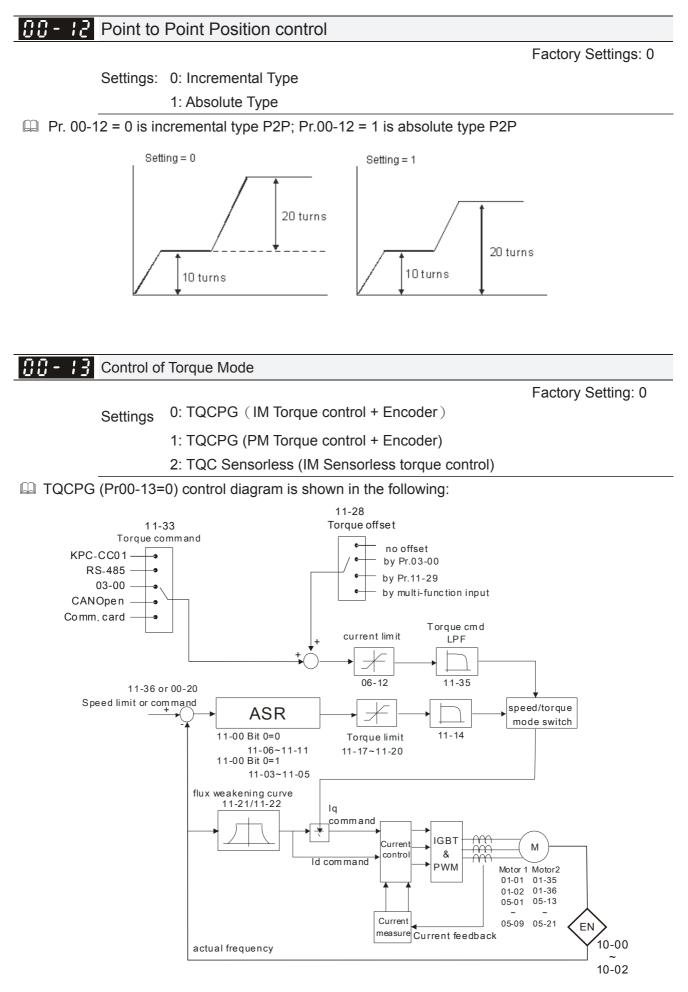


When 00-10=0, and set Pr.00-11 to 6, PM FOC sensorless control diagram is shown as follows:

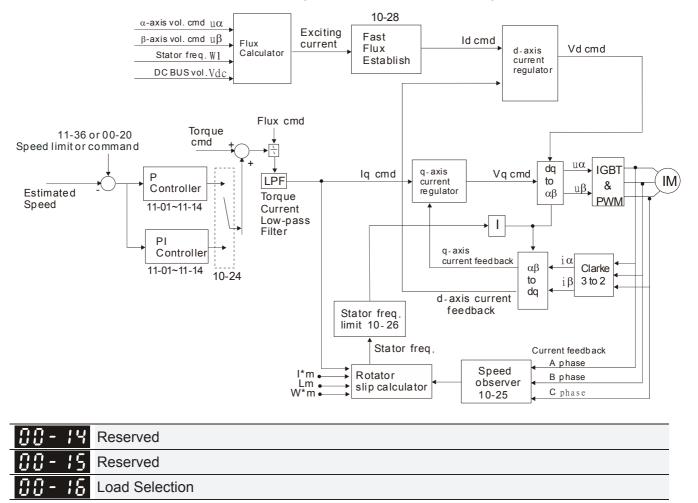


When 00-10=0, and set Pr.00-11 to 7, IPM FOC sensorless control diagram is shown as follows:





III TQC Sensorless (Pr00-13=2) control diagram is shown in the following:



Factory Setting: 0

Settings 0: Normal load 1: Heavy load

- Normal duty: over load ability is 160% rated output current in 3 second. Please refer to Pr.00-17 for the setting of carrier. Refer to chapter 9 (specifications) or Pr.00-01 for the rated current.
- Heavy duty: over load ability is 180% rated output current in 3 second. Please refer to Pr.00-17 for the setting of carrier wave. Refer to chapter 9 (specifications) or Pr.00-01 for the rated current.
- Pr.00-01 changes as the setting of Pr.00-16 changes. The default setting and maximum setting range of Pr.06-03, 06-04 will change as the setting of Pr.00-16 changes.
- In Normal Duty, the default setting of 06-03, 06-04 is 120%, maximum setting range is 160%. When DC voltage is higher than 700Vdc (460V series) or 350V(230V series), then the maximum setting range will be 145%
- In Heavy Duty, the default setting of 06-03, 06-04 is 150%, maximum setting range is 180%. When DC voltage is higher than 700Vdc (460V series) or 350V(230V series), then the maximum setting range will be 165%



Carrier Frequency

Factory setting: Table below

Settings $2 \sim 15 \text{kHz}$
---------------------------------

In This parameter determinates the PWM carrier frequency of the AC motor drive.

230V Series					
Models	1-15HP [0.75-11kW]	20-50HP [15-37kW]	60-125HP [45-90kW]		
Setting Range	02~15kHz	02~10kHz	02~09kHz		
Normal Duty Factory	8kHz	6kHz	4kHz		
Setting					
Heavy Duty Factory		2kHz	·		
Setting					

460V Series					
Models	1-20HP [0.75-15kW]	25-75HP [18.5-55kW]	100-600HP [75-450kW]		
Setting Range	02~15kHz	02~10kHz	02~09kHz		
Normal Duty Factory	8kHz	6kHz	4kHz		
Setting					
Heavy Duty Factory		2kHz	·		
Setting					

Carrier Frequency	Acoustic Noise	Electromagnetic Noise or Leakage Current	Heat Dissipation	Current Wave
1kHz	Significant	Minimal	Minimal	
8kHz	Ĩ	l Î	Î	
15kHz	↓	ļ	Ļ	-\\\\\ ↓
	Minimal	Significant	Significant	

- From the table, we see that the PWM carrier frequency has a significant influence on the electromagnetic noise, AC motor drive heat dissipation, and motor acoustic noise. Therefore, if the surrounding noise is greater than the motor noise, lower the carrier frequency is good to reduce the temperature rise. Although it is quiet operation in the higher carrier frequency, the entire wiring and interference resistance should be considerate.
- When the carrier frequency is higher than the factory setting, it needs to protect by decreasing the carrier frequency. See Pr.06-55 for the related setting and details.

CO- 18 Reserve	CC- 18 Reserved					
<b>33 - 13</b> PLC Cor	nmand Mask					
		Factory Setting:	Read Only			
Settings	Bit 0: Control command by PLC force control					
	Bit 1: Frequency command by PLC force contr	ol				
	Bit 2: Position command by PLC force control					
	Bit 3: Torque command by PLC force control					

III This parameter determines if frequency command or control command is occupied by PLC

## **G** - **2 G** Source of the Master Frequency Command (AUTO)

Factory Setting: 0

- Settings 0: Digital keypad
  - 1: RS-485 serial communication
  - 2: External analog input (Pr.03-00)
  - 3: External UP/DOWN terminal
  - 4: Pulse input without direction command (Pr.10-16 without direction)
  - 5: Pulse input with direction command (Pr.10-16)
  - 6: CANopen communication card
  - 7: Reserved
  - 8: Communication card (no CANopen card)
- $\square$  It is used to set the source of the master frequency in AUTO mode.
- Pr.00-20 and 00-21 are for the settings of frequency source and operation source in AUTO mode.
   Pr.00-30 and 00-31 are for the settings of frequency source and operation source in HAND mode.
   The AUTO/HAND mode can be switched by the keypad KPC-CC01 or multi-function input terminal (MI).
- The factory setting of frequency source or operation source is for AUTO mode. It will return to AUTO mode whenever power on again after power off. If there is multi-function input terminal used to switch AUTO/HAND mode. The highest priority is the multi-function input terminal. When the external terminal is OFF, the drive won't receive any operation signal and can't execute JOG.

**SS-2** Source of the Operation Command (AUTO)

Factory Setting: 0

Settings 0: Digital keypad

- 1: External terminals. Keypad STOP disabled.
- 2: RS-485 serial communication. Keypad STOP disabled.
- 3: CANopen card
- 4: Reserved
- 5: Communication card (not includes CANopen card)
- $\square$  It is used to set the source of the operation frequency in AUTO mode.
- When the operation command is controlled by the keypad KPC-CC01, keys RUN, STOP and JOG (F1) are valid.

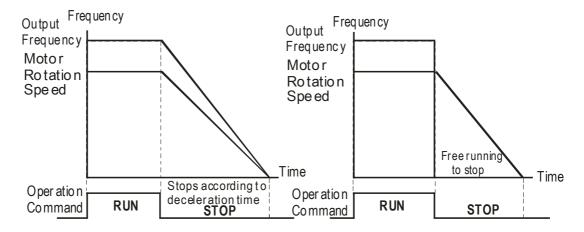
Stop Method

Factory Setting: 0

Settings 0: Ramp to stop

1:Coast to stop

The parameter determines how the motor is stopped when the AC motor drive receives a valid stop command.

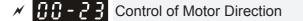


Rampto Stop and Coast to Stop

- Ramp to stop: the AC motor drive decelerates from the setting of deceleration time to 0 or minimum output frequency (Pr. 01-09) and then stop (by Pr.01-07).
- Coast to stop: the AC motor drive stops the output instantly upon a STOP command and the motor free runs until it comes to a complete standstill.

(1) It is recommended to use "ramp to stop" for safety of personnel or to prevent material from being wasted in applications where the motor has to stop after the drive is stopped. The deceleration time has to be set accordingly.

(2) If the motor free running is allowed or the load inertia is large, it is recommended to select "coast to stop". For example, blowers, punching machines and pumps



Factory Setting: 0

Settings 0: Enable forward/ reverse

- 1: Disable reverse
- 2: Disable forward
- This parameter enables the AC motor drives to run in the forward/reverse Direction. It may be used to prevent a motor from running in a direction that would consequently injure the user or damage the equipment.

**BB-24** Memory of Frequency Command

Factory Setting: Read Only

Settings Read only

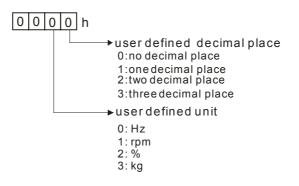
If keypad is the source of frequency command, when Lv or Fault occurs the present frequency command will be saved in this parameter.

✓ □□ - 2 5 User Defined Characteristics

Factory Setting: 0

Settings Bit 0~3: user defined decimal place 0000b: no decimal place 0001b: one decimal place 0010b: two decimal place 0011b: three decimal place Bit 4~15: user defined unit 000xh: Hz 001xh: rpm 002xh: % 003xh: kg 004xh: m/s 005xh: kW 006xh: HP 007xh: ppm 008xh: 1/m 009xh: kg/s 00Axh: kg/m 00Bxh: kg/h 00Cxh: lb/s 00Dxh: lb/m 00Exh: lb/h 00Fxh: ft/s 010xh: ft/m 011xh: m 012xh: ft 013xh: degC 014xh: degF 015xh: mbar 016xh: bar 017xh: Pa 018xh: kPa 019xh: mWG 01Axh: inWG 01Bxh: ftWG 01Cxh: psi 01Dxh: atm 01Exh: L/s 01Fxh: L/m 020xh: L/h 021xh: m3/s 022xh: m3/h 023xh: GPM 024xh: CFM xxxxh: Hz

- Bit 0~3: Control F page, unit of user defined value (Pr00-04 =d10, PID feedback) and the decimal point of Pr00-26 which supports up to 3 decimal points.
- Bit 4~15: Control F page, unit of user defined value (Pr00-04=d10, PID feedback) and the display units of Pr00-26.



## **BB - 28** Max. User Defined Value

Factory Setting: 0

Settings 0: Disable

0~65535 (when Pr.00-25 set to no decimal place) 0.0~6553.5 (when Pr.00-25 set to 1 decimal place) 0.0~655.35 (when Pr.00-25 set to 2 decimal place) 0.0~65.535 (when Pr.00-25 set to 3 decimal place)

When Pr.00-26 is NOT set to 0. The user defined value is enabled. The value of this parameter should correspond to the frequency setting at Pr.01-00.

Example:

When the frequency at Pr. 01-00=60.00Hz, the max. user defined value at Pr. 00-26 is 100.0%. That also means Pr.00-25 is set at 0021h to select % as the unit.

### 

The drive will display as Pr.00-25 setting when Pr.00-25 is properly set and Pr.00-26 is not 0.

User Defined Value

Factory Setting: Read only

Settings Read only

Pr.00-27 will show user defined value when Pr.00-26 is not set to 0.

- User defined function is valid when:
- 1. Pr.00-20 is set to digital keypad control
- 2. RS-285 communication input control.
- 3. PID function enable

### **Reserved**

**3 - 2 3** LOCAL/REMOTE Selection

Factory Setting: 0

Settings 0: Standard HOA function

- 1: Switching Local/Remote, the drive stops
- 2: Switching Local/Remote, the drive runs as the REMOTE setting for frequency and operation status
- 3: Switching Local/Remote, the drive runs as the LOCAL setting for frequency and operation status
- 4: Switching Local/Remote, the drive runs as LOCAL setting when switch to Local and runs as REMOTE setting when switch to Remote for frequency and operation status.
- The factory setting of Pr.00-29 is 0 (standard Hand-Off-Auto function). The AUTO frequency and source of operation can be set by Pr.00-20 and Pr.00-21, and the HAND frequency and source of operation can be set by Pr.00-30 and Pr.00-31. AUTO/HAND mode can be selected or switched by using digital keypad (KPC-CC01) or setting multi-function input terminal MI= 41, 42.
- When external terminal MI is set to 41 and 42 (AUTO/HAND mode), the settings Pr.00-29=1,2,3,4 will be disabled. The external terminal has the highest priority among all command, Pr.00-29 will always function as Pr.00-29=0, standard HOA mode.

- When Pr.00-29 is not set to 0, Local/Remote function is enabled, the top right corner of digital keypad (KPC-CC01) will display "LOC" or "REM" (the display is available when KPC-CC01 is installed with firmware version higher than version 1.021). The LOCAL frequency and source of operation can be set by Pr.00-20 and Pr.00-21, and the REMOTE frequency and source of operation can be set by Pr.00-30 and Pr.00-31. Local/Remote function can be selected or switched by using digital keypad (KPC-CC01) or setting external terminal MI=56. The AUTO key of the digital keypad now controls for the REMOTE function and HAND key now controls for the LOCAL function.
- When MI is set to 56 for LOC/REM selection, if Pr.00-29 is set to 0, then the external terminal is disabled.
- When MI is set to 56 for LOC/REM selection, if Pr.00-29 is not set to 0, the external terminal has the highest priority of command and the ATUO/HAND keys will be disabled.

## **GG - 3G** Source of the Master Frequency Command (HAND)

Factory Setting: 0

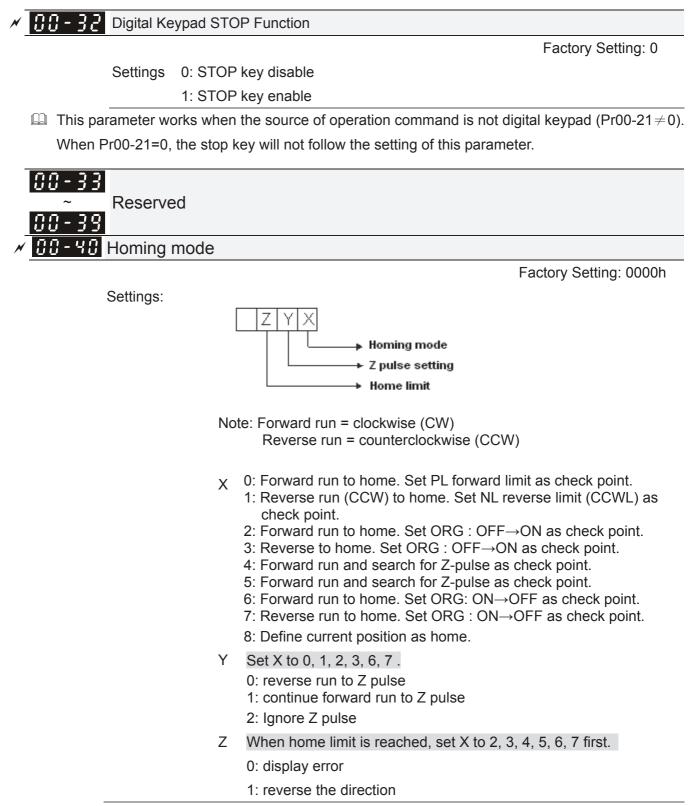
- Settings 0: Digital keypad
  - 1: RS-485 serial communication
  - 2: External analog input (Pr.03-00)
  - 3: External UP/DOWN terminal
  - 4: Pulse input without direction command (Pr.10-16 without direction)
  - 5: Pulse input with direction command (Pr.10-16)
  - 6: CANopen communication card
  - 7: Reserved
  - 8: Communication card (no CANopen card)

It is used to set the source of the master frequency in HAND mode.

### **Source of the Operation Command (HAND)**

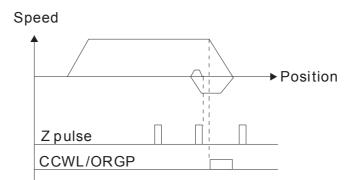
Factory Setting: 0

- Settings 0: Digital keypad
  - 1: External terminals. Keypad STOP disabled.
  - 2: RS-485 serial communication. Keypad STOP disabled.
  - 3: CANopen communication card
  - 4: Reserved
  - 5: Communication card (not include CANopen card
- It is used to set the source of the operation frequency in HAND mode.
- Pr.00-20 and 00-21 are for the settings of frequency source and operation source in AUTO mode.
   Pr.00-30 and 00-31 are for the settings of frequency source and operation source in HAND mode.
   The AUTO/HAND mode can be switched by the keypad KPC-CC01 or multi-function input terminal (MI).
- The factory setting of frequency source or operation source is for AUTO mode. It will return to AUTO mode whenever power on again after power off. If there is multi-function input terminal used to switch AUTO/HAND mode. The highest priority is the multi-function input terminal. When the external terminal is OFF, the drive won't receive any operation signal and can't execute JOG.



Homing action is control by Pr. 00-40, 00-41, 00-42 and 02-01~02-08.

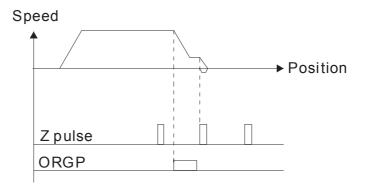
1. When Y=0, X=0 or Y=0, X=2



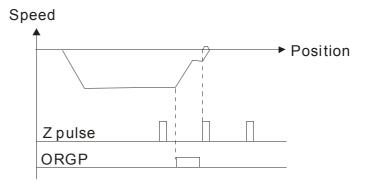
2. When Y=0, X=1 or Y=0, X=3



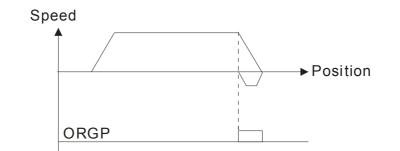
3. When Y=1, X=2



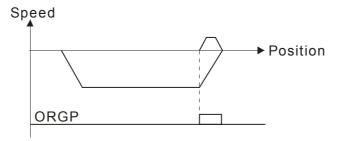
4. When Y=1, X=3



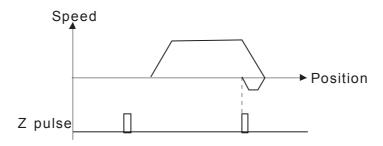
5. When Y=2, X=2



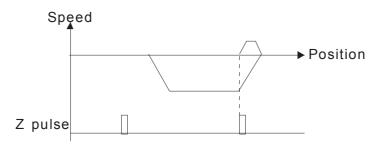
6. When Y=2, X=3



7. When Y=2, X=4

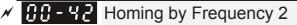


8. When Y=2, X=5



N CC-4 Homing by Frequency 1

Settings 0.00~600.00Hz



Factory Setting: 2.00

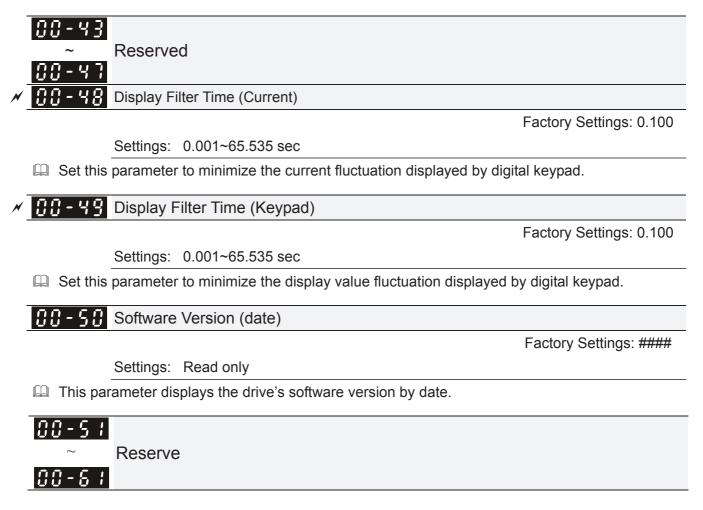
Factory Setting: 8.00

#### Settings 0.00~600.00Hz

Control by Multi-function Input Terminal Pr. 02-01~02-08 (44~47).

- 44: Reverse direction homing
- 45: Forward direction homing
- 46: Homing (ORG)
- 47: Homing function enabled

- If the drive is not control by CAN or PLC, set Pr.00-10 =1 (Contorl mode = P2P position control) and set external output terminal to 47 (homing function enable) for homing.
- When Pr.00-10 is set to 3, after homing is complete, user must set control mode setting Pr.00-10 to 1 in order to perform P2P position control.



# **Group 1 Basic Parameters**

✓ This parameter can be set during operation.

n + n n	Maximum Output Frequency	
$\cup$ $\cup$ $\cup$ $\cup$ $\cup$	Maximum Output Frequency	

Factory Setting: 60.00/50.00

Settings 00.00~600.00Hz

This parameter determines the AC motor drive's Maximum Output Frequency. All the AC motor drive frequency command sources (analog inputs 0 to +10V, 4 to 20mA, 0 to 20mAand ±10V) are scaled to correspond to the output frequency range.

**()** ! - **()** !Output Frequency of Motor 1 (base frequency and motor rated frequency)**()** ! - **35**Output Frequency of Motor 2 (base frequency and motor rated frequency)

Factory Setting: 60.00/50.00

Settings 0.00~600.00Hz

- This value should be set according to the rated frequency of the motor as indicated on the motor nameplate. If the motor is 60Hz, the setting should be 60Hz. If the motor is 50Hz, it should be set to 50Hz.
- **()** I **()** 2Output Voltage of Motor 1 (base frequency and motor rated frequency)**()** I **()** 2Output Voltage of Motor 2 (base frequency and motor rated frequency)

Factory Setting: 200.0/400.0

Settings 230V series: 0.0~255.0V

460V series: 0.0~510.0V

- This value should be set according to the rated voltage of the motor as indicated on the motor nameplate. If the motor is 220V, the setting should be 220.0. If the motor is 200V, it should be set to 200.0.
- There are many motor types in the market and the power system for each country is also difference. The economic and convenience method to solve this problem is to install the AC motor drive. There is no problem to use with the different voltage and frequency and also can amplify the original characteristic and life of the motor.

I - I - Mid-point Frequency 1 of Motor 1

Factory Setting: 3.00 Motor drive with 250HP and above: 1.50

Settings	0.00~600.00Hz
----------	---------------

Mid-point Voltage 1 of Motor 1

Factory Setting: 11.0/22.0 Motor drive with 250HP and above: 10.0

Settings 230V series: 0.0~240.0V 460V series: 0.0~480.0V

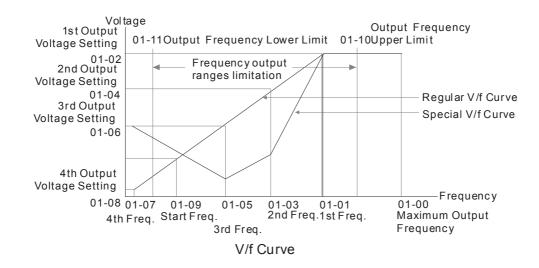
01-	Mid-point Frequency 1 of Motor 2	
		Factory Setting: 3.00 Motor drive with 250HP and above: 1.50
	Settings 0.00~600.00Hz	
<u> </u>	Mid-point Voltage 1 of Motor 2	
		Factory Setting: 11.0/22.0 Motor drive with 250HP and above: 10.0
	Settings 230V series: 0.0~240.0V	
	460V series: 0.0~480.0V	
8 - (	Mid-point Frequency 2 of Motor 1	
		Factory Setting: 0.50
	Settings 0.00~600.00Hz	
× 🛛 🖓 🕴 – 🕻	Mid-point Voltage 2 of Motor 1	
		Factory Setting: 2.0/4.0 Motor drive with 250HP
		and above: 2.0
	Settings 230V series: 0.0~240.0V	
	460V series: 0.0~480.0V	
8 1-	3 9 Mid-point Frequency 2 of Motor 2	
		Factory Setting: 0.50
	Settings 0.00~600.00Hz	
× 🕃 ¦ - '	Mid-point Voltage 2 of Motor 2	
		Factory Setting: 2.0/4.0 Motor drive with 250HP and above: 2.0
	Settings 230V series: 0.0~240.0V	
	460V series: 0.0~480.0V	
[]  -{	Min. Output Frequency of Motor 1	
	Settings 0.00~600.00Hz	Factory Setting: 0.00
× 8 :- (		
	Min. Output voltage of world 1	Factory Setting: 0.0/0.0
	Settings 230V series: 0.0~240.0V 460V series: 0.0~480.0V	Factory Setting. 0.0/0.0
8 1-4		
	Min. Output requeitey of Motor 2	Factory Setting: 0.00
	Settings 0.00~600.00Hz	Factory Setting. 0.00

## ✓ ☐ ! - Ч 2 Min. Output Voltage of Motor 2

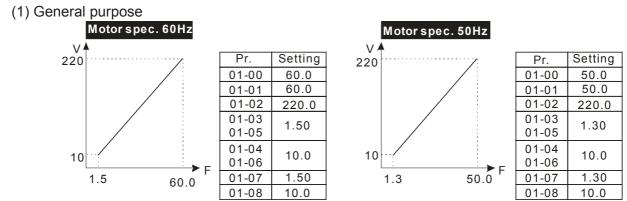
Factory Setting: 0.0/0.0

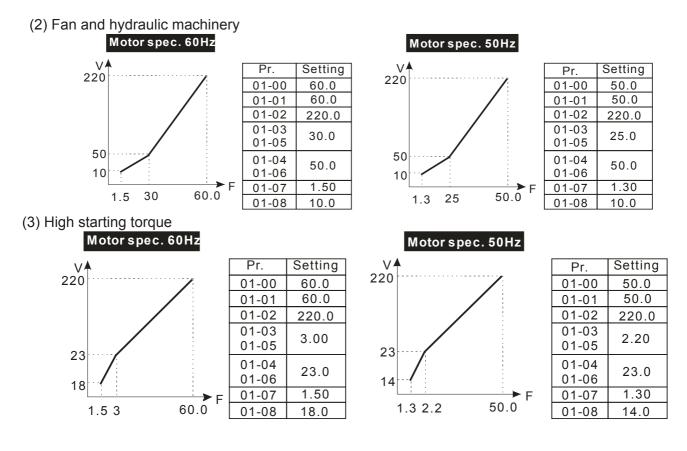
Settings 230V series: 0.0~240.0V 460V series: 0.0~480.0V

- ☑ V/f curve setting is usually set by the motor's allowable loading characteristics. Pay special attention to the motor's heat dissipation, dynamic balance, and bearing lubricity, if the loading characteristics exceed the loading limit of the motor.
- There is no limit for the voltage setting, but a high voltage at low frequency may cause motor damage, overheat, and stall prevention or over-current protection. Therefore, please use the low voltage at the low frequency to prevent motor damage.
- Pr.01-35 to Pr.01-42 is the V/f curve for the motor 2. When multi-function input terminals Pr.02-01~02-08 and Pr.02-26 ~Pr.02-31 are set to 14 and enabled, the AC motor drive will act as the 2nd V/f curve.
- The V/f curve for the motor 1 is shown as follows. The V/f curve for the motor 2 can be deduced from it.



### Common settings of V/f curve:





## **G !** - **G !** Start-Up Frequency

Factory Setting: 0.50

#### Settings 0.0~600.00Hz

- When start frequency is higher than the min. output frequency, drives' output will be from start frequency to the setting frequency. Please refer to the following diagram for details.
- E Fcmd=frequency command,

Fstart=start frequency (Pr.01-09),

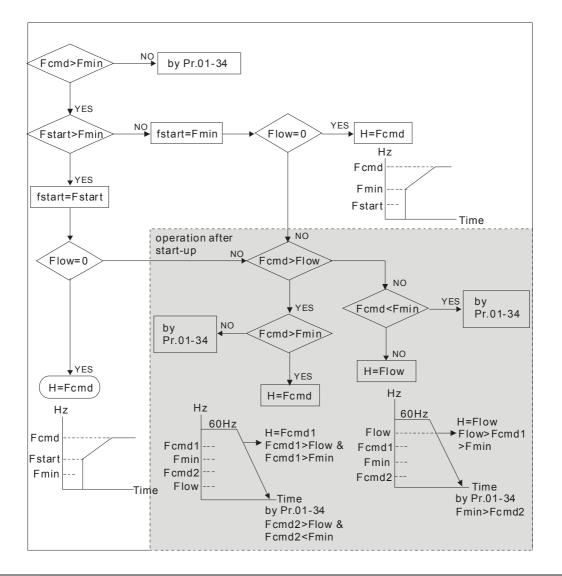
fstart=actual start frequency of drive,

Fmin=4th output frequency setting (Pr.01-07/Pr.01-41),

Flow=output frequency lower limit (Pr.01-11)

 $\Box \hspace{-0.5mm}\Box$  If Flow<Fcmd  $\, \cdot \, \,$  drive will run with Fcmd directly.

- If Flow>=Fcmd, drive will run with Fcmd firstly, then, accelerate to Flow according to acceleration time.
- The drive's output will stop immediately when output frequency has reach to Fmin during deceleration.



### ✓ ☐ ! - ! ☐ Output Frequency Upper Limit

Factory Setting: 600.00

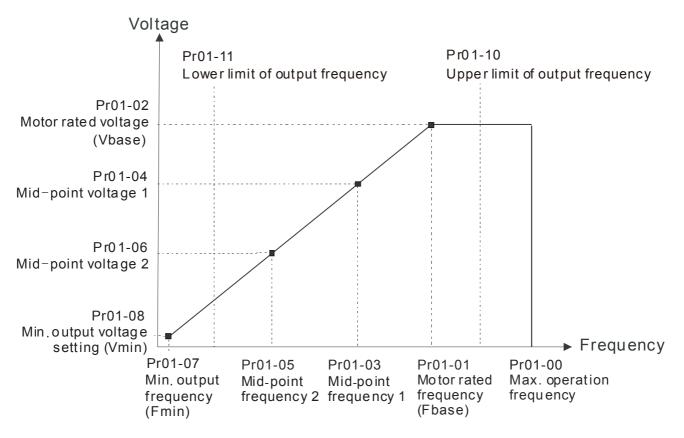
#### Settings 0.0~600.00Hz

✓ ☐ ! - ! ! Output Frequency Lower Limit

Factory Setting: 0.00

#### Settings 0.0~600.00Hz

- □ The upper/lower output frequency setting is used to limit the actual output frequency. If the frequency setting is higher than the upper limit (01-10), it will run with the upper limit frequency. If output frequency lower than output frequency lower limit (01-11) and frequency setting is higher than min. frequency (01-07), it will run with lower limit frequency. The upper limit frequency should be set to be higher than the lower limit frequency. Pr.01-10 setting must be ≥ Pr.01-11 setting.
- Upper output frequency will limit the max. Output frequency of drive. If frequency setting is higher than Pr.01-10, the output frequency will be limited by Pr.01-10 setting.
- When the drive starts the function of slip compensation (Pr.07-27) or PID feedback control, drive output frequency may exceed frequency command but still be limited by this setting.
- Related parameters: Pr.01-00 Max. Operation Frequency and Pr.01-11 Output Frequency Lower Limit



- Lower output frequency will limit the min. output frequency of drive. When drive frequency command or feedback control frequency is lower than this setting, drive output frequency will limit by the lower limit of frequency.
- When the drive starts, it will operate from min. output frequency (Pr.01-07) and accelerate to the setting frequency. It won't limit by lower output frequency setting.
- The setting of output frequency upper/lower limit is used to prevent personal misoperation, overheat due to too low operation frequency or damage due to too high speed.
- If the output frequency upper limit setting is 50Hz and frequency setting is 60Hz, max. output frequency will be 50Hz.
- If the output frequency lower limit setting is 10Hz and min. operation frequency setting (Pr.01-07) is 1.5Hz, it will operate by 10Hz when the frequency command is greater than Pr.01-07 and less than 10Hz. If the frequency command is less than Pr.01-07, the drive will be in ready status and no output.
- □ If the frequency output upper limit is 60Hz and frequency setting is also 60Hz, only frequency command will be limit in 60Hz. Actual frequency output may exceed 60Hz after slip compensation.

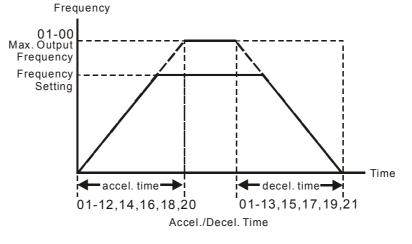
~	81-12	Accel. Time 1
N	0:1-13	Decel. Time 1
N	01-14	Accel. Time 2
N	01-15	Decel. Time 2
N	01-16	Accel. Time 3
N	[]  -  ]	Decel. Time 3
N	01-18	Accel. Time 4
N	01-19	Decel. Time 4
N	01-20	JOG Acceleration Time
×	1 2-1 0	JOG Deceleration Time

Factory Setting: 10.00/10.0 Motor drive with 30HP and above: 60.00/60.0

Settings Pr.01-45=0: 0.00~600.00 seconds

Pr.01-45=1: 0.00~6000.00 seconds

- The Acceleration Time is used to determine the time required for the AC motor drive to ramp from 0Hz to Maximum Output Frequency (Pr.01-00).
- The Deceleration Time is used to determine the time require for the AC motor drive to decelerate from the Maximum Output Frequency (Pr.01-00) down to 0Hz.
- The Acceleration/Deceleration Time is invalid when using Pr.01-44 Optimal Acceleration/Deceleration Setting.
- The Acceleration/Deceleration Time 1, 2, 3, 4 are selected according to the Multi-function Input Terminals settings. The factory settings are Accel./Decel. time 1.
- When enabling torque limits and stalls prevention function, actual accel./decel. time will be longer than the above action time.
- Please note that it may trigger the protection function (Pr.06-03 Over-current Stall Prevention during Acceleration or Pr.06-01 Over-voltage Stall Prevention) when setting of accel./decel. time is too short.
- Please note that it may cause motor damage or drive protection enabled due to over current during acceleration when the setting of acceleration time is too short.
- Please note that it may cause motor damage or drive protection enabled due to over current during deceleration or over-voltage when the setting of deceleration time is too short.
- It can use suitable brake resistor (see Chapter 06 Accessories) to decelerate in a short time and prevent over-voltage.
- When enabling Pr.01-24~Pr.01-27, the actual accel./decel. time will be longer than the setting.



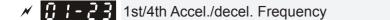


JOG Frequency

Factory Setting: 6.00

### Settings 0.00~600.00Hz

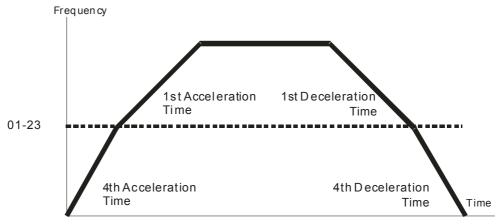
- Both external terminal JOG and key "F1" on the keypad KPC-CC01 can be used. When the jog command is ON, the AC motor drive will accelerate from 0Hz to jog frequency (Pr.01-22). When the jog command is OFF, the AC motor drive will decelerate from Jog Frequency to zero. The Jog Accel./Decel. time (Pr.01-20, Pr.01-21) is the time that accelerates from 0.0Hz to Pr.01-22 JOG Frequency.
- The JOG command can't be executed when the AC motor drive is running. In the same way, when the JOG command is executing, other operation commands are invalid.
- It does not support JOG function in the optional keypad KPC-CE01.



Factory Setting: 0.00

### Settings 0.00~600.00Hz

- The transition from acceleration/deceleration time 1 to acceleration/deceleration time 4, may also be enabled by the external terminals. The external terminal has priority over Pr. 01-23.
- When using this function, please set S-curve acceleration time as 0 if 4<sup>th</sup> acceleration time is set too short.



1st/4th Acceleration/Deceleration Frequency Switching

N	: I - 2 4 S-curve Acceleration Begin Time 1		
N	S-curve Acceleration Arrival Time 2		
N	3 - 28 S-curve Deceleration Begin Time 1		
N	S-curve Deceleration Arrival Time 2		
		 0	0.00/0.0

Factory Setting: 0.20/0.2

Settings Pr.01-45=0: 0.00~25.00 seconds

Pr.01-45=1: 0.00~250.0 seconds

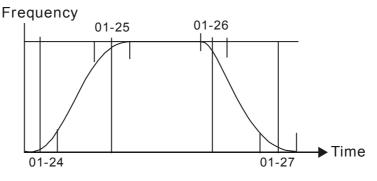
- It is used to give the smoothest transition between speed changes. The accel./decel. curve can adjust the S-curve of the accel./decel. When it is enabled, the drive will have different accel./decel. curve by the accel./decel. time.
- The S-curve function is disabled when accel./decel. time is set to 0.

 $\square$  When Pr.01-12, 01-14, 01-16, 01-18  $\ge$  Pr.01-24 and Pr.01-25,

The Actual Accel. Time = Pr.01-12, 01-14, 01-16, 01-18 + (Pr.01-24 + Pr.01-25)/2

 $\square$  When Pr.01-13, 01-15, 01-17, 01-19  $\ge$  Pr.01-26 and Pr.01-27,

The Actual Decel. Time = Pr.01-13, 01-15, 01-17, 01-19 + (Pr.01-26 + Pr.01-27)/2

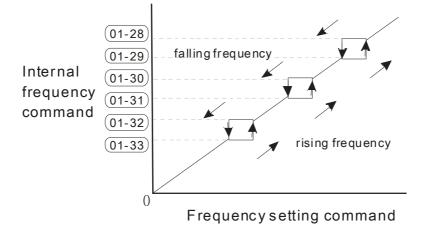


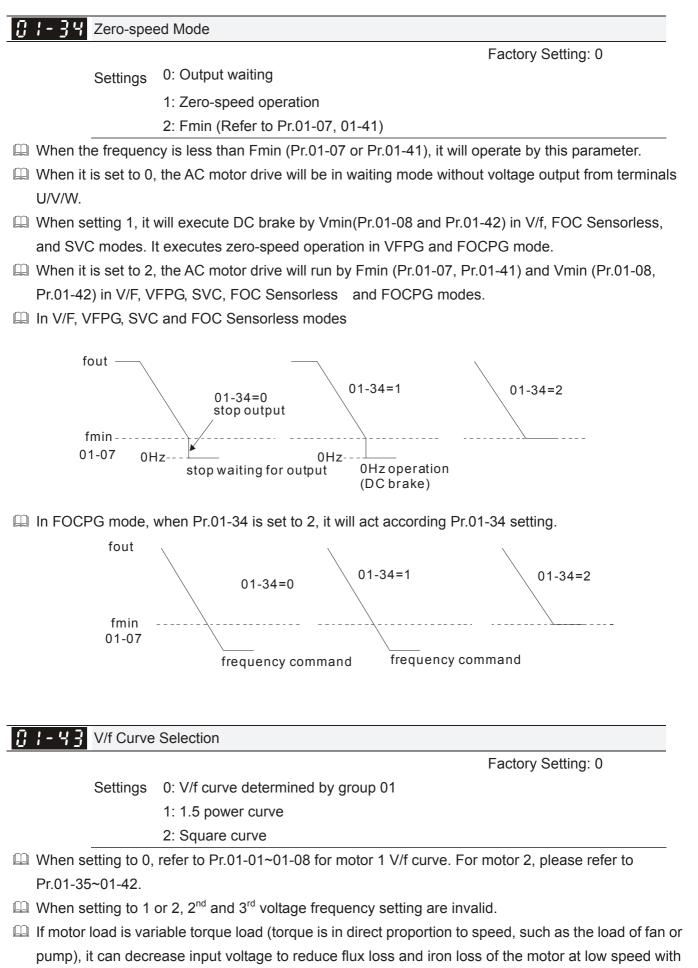
<b>3</b> 1 - 28 Skip Frequency 1 (upper limit)
I - 2 3       Skip Frequency 1 (lower limit)
I - 3 I       Skip Frequency 2 (upper limit)
Skip Frequency 2 (lower limit)
<b>3 ! - 3 ?</b> Skip Frequency 3 (upper limit)
<b>3 1 - 3 3</b> Skip Frequency 3 (lower limit)

Factory Setting: 0.00

#### Settings 0.00~600.00Hz

- These parameters are used to set the skip frequency of the AC drive. But the frequency output is continuous. There is no limit for the setting of these six parameters and can be used as required.
- The skip frequencies are useful when a motor has vibration at a specific frequency bandwidth. By skipping this frequency, the vibration will be avoided. It offers 3 zones for use.
- □ These parameters are used to set the skip frequency of the AC drive. But the frequency output is continuous. The limit of these six parameters is 01-28≥01-29≥01-30≥01-31≥01-32≥01-33. This function will be invalid when setting to 0.0.
- The setting of frequency command (F) can be set within the range of skip frequencies. In this moment, the output frequency (H) will be limited by these settings.
- When accelerating/decelerating, the output frequency will still pass the range of skip frequencies.

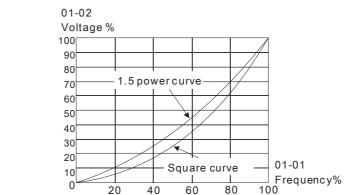




12-01-10

low load torque to raise the entire efficiency.

When setting higher power V/f curve, it is lower torque at low frequency and is not suitable for rapid acceleration/deceleration. It is recommended Not to use this parameter for the rapid acceleration/deceleration.



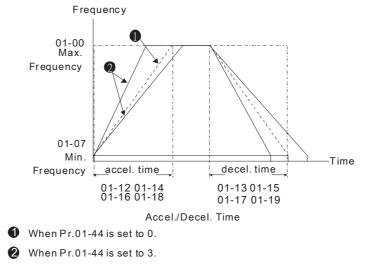
### メ 日 - イイイ Optimal Acceleration/Deceleration Setting

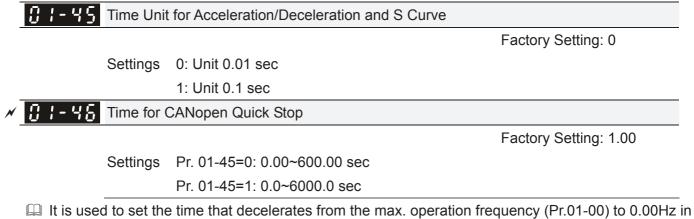
Factory Setting: 0

Settings 0: Linear accel./decel.

1: Auto accel., linear decel.

- 2: Linear accel., auto decel.
- 3: Auto accel./decel. (auto calculate the accel./decel. time by actual load)
- 4: Stall prevention by auto accel./decel. (limited by 01-12 to 01-21)
- Setting 0 Linear accel./decel.: it will accelerate/decelerate according to the setting of Pr.01-12~01-19.
- Setting to Auto accel./decel.: it can reduce the mechanical vibration and prevent the complicated auto-tuning processes. It won't stall during acceleration and no need to use brake resistor. In addition, it can improve the operation efficiency and save energy.
- Setting 3 Auto accel./decel. (auto calculate the accel./decel. time by actual load): it can auto detect the load torque and accelerate from the fastest acceleration time and smoothest start current to the setting frequency. In the deceleration, it can auto detect the load re-generation and stop the motor smoothly with the fastest decel. time.
- Setting 4 Stall prevention by auto accel./decel. (limited by 01-12 to 01-21): if the acceleration/deceleration is in the reasonable range, it will accelerate/decelerate by Pr.01-12~01-19. If the accel./decel. time is too short, the actual accel./decel. time is greater than the setting of accel./decel. time.





CANopen control

# **02 Digital Input/Output Parameter**

 $\checkmark$  This parameter can be set during operation.

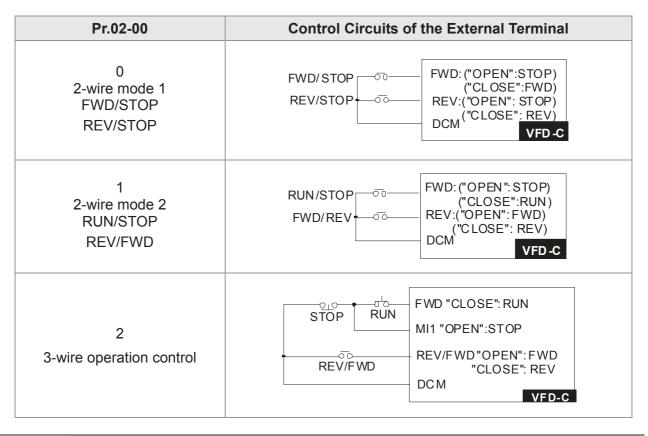
Factory Setting: 0

**2**-wire/3-wire Operation Control

Settings 0: 2 wire mode 1

- 1: 2 wire mode 2
  - 2: 3 wire mode

It is used to set the operation control method:



**(MI1= STOP command when in 3-wire operation control)**

Factory Setting: 1

**B** - **B** - **Multi-function Input Command 2 (MI2)** 

Factory Setting: 2

**B 2** - **B 3** Multi-function Input Command 3 (MI3)

Factory Setting: 3

**B? - <b>BY** Multi-function Input Command 4 (MI4)

Factory Setting: 4

<b>02 - 05</b> Multi-function Input Command 5 (MI5)
<b>02 - 05</b> Multi-function Input Command 6 (MI6)
12 - 17 Multi-function Input Command 7 (MI7)
2 - 38 Multi-function Input Command 8 (MI8)
<b>D2-25</b> Input terminal of I/O extension card (MI10)
12 - 27 Input terminal of I/O extension card (MI11)
<b>3</b> 2 - 28 Input terminal of I/O extension card (MI12)
<b>G2 - 29</b> Input terminal of I/O extension card (MI13)
<b>D</b> 2 - <b>3 D</b> Input terminal of I/O extension card (MI14)
12 - 3 / Input terminal of I/O extension card (MI15)

Factory Setting: 0

Settings

0: no function

1: multi-step speed command 1/multi-step position command 1

2: multi-step speed command 2/multi-step position command 2

3: multi-step speed command 3/multi-step position command 3

4: multi-step speed command 4/multi-step position command 4

5: Reset

6: JOG command (By KPC-CC01 or external control)

7: acceleration/deceleration speed not allow

8: the 1<sup>st</sup>, 2<sup>nd</sup> acceleration/deceleration time selection

9: the 3<sup>rd</sup>, 4<sup>th</sup> acceleration/deceleration time selection

10: EF Input (Pr.07-20)

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

12: Output stop

13: cancel the setting of the optimal acceleration/deceleration time

14: switch between motor 1 and motor 2

15: operation speed command from AVI

16: operation speed command from ACI

17: operation speed command from AUI

18: Emergency stop (Pr.07-20)

19: Digital up command

20: Digital down command

21: PID function disabled

22: Clear counter

23: Input the counter value (MI6)

24: FWD JOG command

25: REV JOG command

26: FOCG/TQC model selection

27: ASR1/ASR2 selection

28: Emergency stop (EF1)

29: Signal confirmation for Y-connection

30: Signal confirmation for  $\Delta$ -connection

31: High torque bias (Pr.11-30)

32: Middle torque bias (Pr.11-31)

33: Low torque bias (Pr.11-32)

34: Switch between multi-step position and multi-speed control

35: Enable position control

36: Enable multi-step position learning function (valid at stop)

37: Enable pulse position input command

38: Disable write EEPROM function

39: Torque command direction

- 40: Force coast to stop
- 41: HAND switch
- 42: AUTO switch
- 43: Enable resolution selection (Pr.02-48)
- 44: Reverse direction homing
- 45: Forward direction homing
- 46: Homing ORG
- 47: Homing function enable
- 48: Mechanical gear ratio switch
- 49: Drive enable
- 50: Master dEb action input
- 51: Selection for PLC mode bit0
- 52: Selection for PLC mode bit1
- 53: Trigger CANopen quick stop
- 54: Reserved
- 55: Brake release checking signal
- 56: Local/Remote Selection
- 57~70: Reserve
- Description: This parameter selects the functions for each multi-function terminal.
- The terminals of Pr.02-26~Pr.02-29 are virtual and set as MI10~MI13 when using with optional card EMC-D42A. Pr.02-30~02-31 are virtual terminals.
- When being used as a virtual terminal, it needs to change the status (0/1: ON/OFF) of bit 8-15 of Pr.02-12 by digital keypad KPC-CC01 or communication.
- If Pr.02-00 is set to 3-wire operation control. Terminal MI1 is for STOP contact. Therefore, MI1 is not allowed for any other operation.
- Summary of function settings (Take the normally open contact for example, ON: contact is closed, OFF: contact is open)

Settings	Functions	Descriptions
0	No Function	
1	Multi-step speed command 1/ multi-step position command 1	
2	Multi-step speed command 2/ multi-step position command 2	15 step speeds could be conducted through the digital status of the
3	Multi-step speed command 3/ multi-step position command 3	4 terminals, and 16 in total if the master speed is included. (Refer to Parameter set 4)
4	Multi-step speed command 4/ multi-step position command 4	
5	Reset	After the error of the drive is eliminated, use this terminal to reset the drive.

Settings	Functions	Descriptions					
6	JOG Command	This function is valid when the source of operation command is external terminals. Before executing this function, it needs to wait for the drive stop completely. During running, it can change the operation direction and STOP key on the keypad is valid. Once the external terminal receives OFF command, the motor will stop by the JOG deceleration time. Refer to Pr.01-20~01-22 for details.					
		01-07 Min. output frequency of motor 1 JOG accel. time 01-20 MIx-GND ON OFF					
7	Acceleration/deceleration Speed Inhibit	When this function is enabled, acceleration and deceleration is stopped. After this function is disabled, the AC motor drive starts to accel./decel. from the inhibit point. Frequency Setting frequency Accel. inhibit area Accel. inhibit area Accel. inhibit area Actual operation frequency Decel. inhibit area Actual operation frequency ON ON ON ON OFF					
8	The 1 <sup>st</sup> , 2 <sup>nd</sup> acceleration or deceleration time selection	The acceleration/deceleration time of the drive could be selected					
9	The 3 <sup>rd</sup> , 4 <sup>th</sup> acceleration or deceleration time selection	from this function or the digital status of the terminals; there are 4 acceleration/deceleration speeds in total for selection.					
10	EF Input (EF: External fault)	For external fault input. Motor drive will decelerate by Pr.07-20 setting, keypad will show EF. (It will have fault record when external fault occurs). Until the causes of fault are eliminated, the drive can keep running after resetting.					
11	External B.B. Input (Base Block)	When the contact of this function is ON, output of the drive will be cut off immediately, and the motor will be free run and keypad will display B.B. signal. Refer to Pr.07-08 for details.					

Settings	Functions	Descriptions							
12	Output Stop (Output pause)	If the contact of this function is ON, output of the drive will be cut off immediately, and the motor will then be free run. And once it is turned to OFF, the drive will accelerate to the setting frequency.							
13	Cancel the setting of the optimal accel./decel. time	Before using this function, Pr.01-44 should be set to 01/02/03/04 first. When this function is enabled, OFF is for auto mode and ON is for linear accel./decel.							
14	Switch between drive settings 1 and 2	When the contact of this function is ON: use motor 2 parameters. OFF: use motor 1 parameters.							
15	Operation speed command form AVI	When the contact of this function is ON, the source of the frequency will force to be AVI. (If the operation speed commands are set to AVI, ACI and AUI at the same time. The priority is $AVI > ACI > AUI$ )							
16	Operation speed command form ACI	When the contact of this function is ON, the source of the frequency will force to be ACI. (If the operation speed commands are set to AVI, ACI and AUI at the same time. The priority is $AVI > ACI > AUI$ )							
17	Operation speed command form AUI	When the contact of this function is ON, the source of the frequency will force to be AUI. (If the operation speed commands are set to AVI, ACI and AUI at the same time. The priority is AVI>ACI>AUI)							
18	Emergency Stop (07-20)	When the contact of this function is ON, the drive will ramp to stop by Pr.07-20 setting.							
19	Digital Up command	When the contact of this function is ON, the frequency will be increased and decreased. If this function is constantly ON, the frequency will be increased/decreased by Pr.02-09/Pr.02-10.							
20	Digital Down command	The frequency command returns to zero when the drive stops, and the display frequency is 0.00Hz. Select Pr11-00, Bit7=1, frequency is not saved.							
21	PID function disabled	When the contact of this function is ON, the PID function is disabled.							
22	Clear counter	When the contact of this function is ON, it will clear current counter value and display "0". Only when this function is disabled, it will keep counting upward.							
23	Input the counter value (multi-function input command 6)	The counter value will increase 1 once the contact of this function is ON. It needs to be used with Pr.02-19.							
24	FWD JOG command	This function is valid when the source of operation command is external terminals. When the contact of this function is ON, the drive will execute forward Jog command. When execute JOG command under torque mode, the drive will automatically switch to speed mode; after JOG command is done, the drive will return to torque mode.							

Settings	Functions	Descriptions							
		This function is valid when the source of operation command is external terminals.							
25	REV JOG command	When the contact of this function is ON the drive will execute reverse Jog command. When execute JOG command under torque mode, the drive will automatically switch to speed mode; after JOG command is done, the drive will return to torque mode.							
		When the contact of this function is ON: TQCPG mode.							
		When the contact of this function is OFF: FOCPG mode.							
		RUN/STOP command Multi fue time insut							
		Multi-function input terminal is set to 26 OFF ON OFF ON (torque/speed							
26	FOCPG/TQCPG mode selection	mode switch) speed speed limit speed speed limit 03-00~02=1 com mand (AVI/AUI/ACI is							
	Selection	frequency command) torque torque 03-00~02=2 limit torque limit torque							
		(AVI/AUI/ACI is command command							
		speed     speed     speed       Control     control     torque     control       mode     control     control     control							
		S witch timing for torque/speed control (00-10=0/4, multi-function input terminal is set to 26)							
27	ASR1/ASR2 selection	When the contact of this function is ON: speed will be adjusted by ASR 2 setting. OFF: speed will be adjusted by ASR 1 setting. Refer to Pr.11-02 for details.							
		When the contact is ON, the drive will execute emergency stop and display EF1 on the keypad. The motor won't run and be in the free run until the fault is cleared after pressing RESET" (EF: External Fault)							
		Frequency							
		Setting frequency							
28	Emergency stop (EF1)								
		Time							
		MIX-GND ON OFF ON							
		Reset ON OFF							
		Operation command ON							
29	Signal confirmation for Y-connection	When is the contact of this function is ON, the drive will operate by 1st V/f.							
30	Signal confirmation for $\Delta$ -connection	When the contact of this function is ON, the drive will operate by 2nd V/f.							
31	High torque bias								
32	Middle torque bias	Refer to Pr.11-30~11-32 for details.							
33	Low torque bias								

Settings	Functions	Descriptions									
		When the contact of this function is ON, the corresponding 15-step speed for the multi-function inputs 1-4 will be 15 positions. (Refer to Pr.04-16 to Pr.04-44)									
34	Switch between multi-step position and multi-speed control		s	node	mode 1 0-19 osition Home) mode	1 0 1 1 1 1 1 1 1 1 0 1 1 1 1 1 1 0 1 1 1 1 0	on mo	0 0 1 1 1 0 0 1 1 0 0 0 1 1 0 0 0 0 0 0	Speed mode	1 step	
				f	reque	ncy		ition	position 12		

Settings	Functions	Descriptions							
		When the contact of this function is ON, the AC motor drive will execute internal single-point position control according to the setting in Pr.10-19. This function is valid in FOCPG mode only.							
		Output frequency							
		PG	10-19						
		RUN							
		MI=d35 <sup>¯</sup>							
		MO=d39 <sup>-</sup>							
35	Enable single-point position control	MO=039_	Time						
	position control	Quitaut	$\wedge$						
		Output frequency							
		PG feedback₋							
		10-01 _ 10-02							
		RUN	RUN RUN						
		MI=d35_							
		MO=d39	Time						
		multi-function inputs	this function is ON/OFF, the drive will base the 1-4 ON/OFF status to find the corresponding and write current motor position into such -step position.						
			$\begin{array}{c} 1011_2 = 11 \\ \text{corresponds} \\ \text{to Pr.04-36} \\ \end{array} \begin{array}{c} 1010_2 = 10 \\ \text{corresponds to} \\ \text{Pr.04-34} \\ \end{array}$						
	Enable multi-step	MI=d1	1 0 0						
36	position learning function (valid at stop)	MI=d2	1 1 1						
		MI=d3	0 0 0						
		MI=d4	1 1 1						
		MI=d36							
		Writing the m into the Pr.0	Writing the motor position 4-36 Writing the motor position into the Pr.04-34						

Settings	Functions	Descriptions							
		When Pr.00-20 is set to 4 or 5 and the contact of this function is ON, the input pulse of PG card is position command. When using this function, it is recommended to set Pr.11-25 to 0. Example: please refer to the following diagram when using this faction with MI=d35 return to home position,.							
		RUN							
		MI=d35							
37	Full position control pulse command input	MO=d39							
57	enable	MI=d37							
		Pulse command Internal positioning							
		Output frequency Time							
38	Disable EEPROM write function (Parameters written disable)	When the contact of this function is ON, write to EEPROM is disabled. (Changed parameters will not be saved after power off)							
39	Torque command direction	For torque control (Pr.00-10=2), when torque command is AVI or ACI, the contact of this function is ON and it is negative torque.							
40	Force coast to stop	When the contact of this function is ON during the operation, the drive will free run to stop.							
41	HAND switch	<ol> <li>When MI is switched to off status, it executes a STOP command. , If MI is switched to off during operation, the drive will also stop.</li> </ol>							
		<ol> <li>Using keypad KPC-CC01 to switch between HAND/AUTO, the drive will stop first then switch to the HAND or AUTO status.</li> <li>On the digital keypad KPC-CC01, it will display current drive status (HAND/OFF/AUTO).</li> </ol>							
42	AUTO switch	Bit 1         Bit 0           OFF         0         0           AUTO         0         1           HAND         1         0           OFF         1         1							
43	Enable resolution selection	Refer to Pr.02-48 for details.							
44	Reverse direction NLhoming	Signal input for reverse direction limit switch. When this terminal of this function is ON, the drive will react to the setting in Pr.00-40, 00-41, 00-42 accordingly to execute homing in a reverse direction (counter clockwise). Note: NL means input terminal detection is negative-edge triggered or be regarded as NO(Normal Open)							

Settings	Functions	Descriptions								
45	Forward direction PL homing	Signal input for forward direction limit switch. When this terminal of this function is ON, the drive will react to the setting in Pr.00-40, 00-41, 00-42 accordingly to execute homing in a forward direction (clockwise). Note: PL means input terminal detection is postive-edge triggered or be regarded as NC(Normal Close)								
46	Homing ORG	will refe	ORG point input. When this terminal of this function is ON, the drive will refer to the setting in Pr.00-40, 00-41, 00-42 accordingly to execute homing.							
47	Homing function enable	the driv	0 = 3 (homing e will ignore th control.							
48	Mechanical gear ratio switch		his contact is ond group A2/					vill be		
49	Drive enable	When drive=enable, RUN command is valid. When drive= disable, RUN command is invalid. When drive is in operation, motor coast to stop. This function will interact with MO=51								
50	Master dEb action input	Input the message setting in this parameter when dEb occurs to Master. This will ensure dEb also occurs to Slave, then Master and Slave will stop simultaneously.								
51	Selection for PLC mode bit0		status able PLC func			Bit 1 0	Bit 0 0	_		
52	Selection for PLC mode bit1	Trig Trig	ger PLC to op ger PLC to sto function	eration (PLC	1)	0 0 1 1	0 1 0 1	-		
53	Enable CANopen quick stop		nis function is to quick stop.							
54	Reserved									
55	Brake release checking signal	This parameter needs to be used with P02-56. The main purpose is to make sure if mechanical brake works or not after triggering brake release command. If the action is right, mechanical brake will give signal to MI terminal. Please check time sequence chart for reference.								
56	LOCAL/REMOTE Selection	Use Pr.00-29 to select for LOCAL/REMOTE mode (refer to Pr.00-29). When Pr.00-29 is not set to 0, on the digital keypad KPC-CC01 it will display LOC/REM status. (It will display on the KPC-CC01 if the firmware version is above version 1.021). Bit 0 REM 0 LOC 1								

✓ **32-33** UP/DOWN Key Mode

Factory Setting: 0

Settings 0: Up/down by the accel/decel time

1: Up/down constant speed (Pr.02-10)

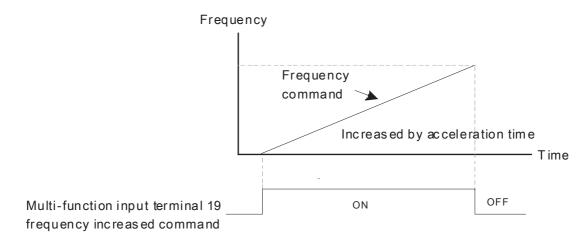


Constant speed. The Accel. /Decel. Speed of the UP/DOWN Key

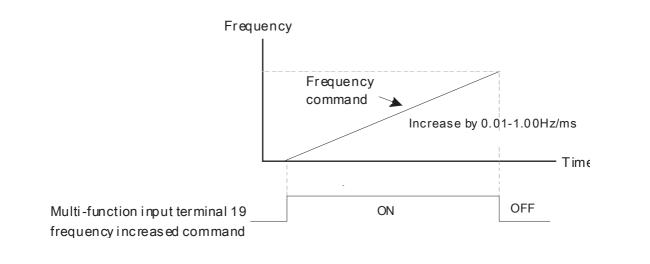
Factory Setting: 0.01

Settings 0.01~1.00Hz/ms

- These settings are used when multi-function input terminals are set to 19/20. Refer to Pr.02-09 and 02-10 for the frequency up/down command.
- Pr11-00, Bit7=1, frequency command is not saved. The frequency command returns to zero when the drive stops, and the display frequency is 0.00Hz. The frequency command increase/decrease by using Up/Down key is effective only when the drive is at Running status.
- Pr.02-09 set to 0: it will increase/decrease frequency command (F) by the setting of acceleration/deceleration (Pr.01-12~01-19)



Pr.02-09 set to 1: use multi-function input terminal ON/OFF to increase/decrease the frequency command(F) according to the setting of Pr.02.10(0.01~1.00Hz/ms).





Factory Setting: 0.005

# Settings 0.000~30.000 sec

- This parameter is used to set the response time of digital input terminals FWD, REV and MI1~MI8.
- It is used for digital input terminal signal delay and confirmation. The delay time is confirmation time to prevent some uncertain interference that would cause error in the input of the digital terminals. Under this condition, confirmation for this parameter would improve effectively, but the response time will be somewhat delayed.
- Description When using MI8 as encoder pulse feedback input, this parameter will not be referred.



Digital Input Operation Setting

Factory Setting: 0000

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

- I The setting of this parameter is in hexadecimal.
- This parameter is to set the status of multi-function input signal (0: Normal Open ; 1: Normal Close) and it is not affected by the SINK/SOURCE status.
- Bit0 is for FWD terminal, bit1 is for REV terminal and Bit2 to Bit15 is for MI1 to MI14.
- User can change terminal status by communicating.

For example, MI1 is set to 1 (multi-step speed command 1), MI2 is set to 2 (multi-step speed command 2). Then the forward + 2<sup>nd</sup> step speed command=1001(binary)=9 (Decimal). Pr.02-12=9 needs to be set by communication to run forward with 2nd step speed. No need to wire any multi-function terminal.

Bit15 Bit14 Bit13 Bit12 Bit11 Bit10 Bit9 Bit8 Bit7 Bit6 Bit5 Bit4 Bit3 Bit2 Bit1 Bit0 MI14 MI13 MI12 MI11 MI10 MI9 MI8 MI7 MI6 MI5 MI4 MI3 MI2 MI1

Through the Pr11-42, Bit 1, it could make setting of FWD/REV terminals whether are controlled by Pr02-12, Bit 0 & 1.

Multi-function Output 1 (Relay1)

Factory Setting: 11

Multi-function Output 2 (Relay2)

Factory Setting: 1

- ✓ B 2 15 Multi-function Output 3 (MO1)
- Multi-function Output 4 (MO2)
- × 82-36 Output terminal of I/O extension card (MO10) or (RA10)
- × 1912 23 Output terminal of I/O extension card (MO11) or (RA11)
- × 82-38 Output terminal of I/O extension card (MO12) or (RA12)
- × 82-39 Output terminal of I/O extension card (MO13) or (RA13)
- × 82-48 Output terminal of I/O extension card (MO14) or (RA14)
- 🗡 🚼 🤇 🎖 🚦 Output terminal of I/O extension card (MO15) or (RA15)
- × 82-42 Output terminal of I/O extension card (MO16)
- <u>≁ H2-43</u> Output terminal of I/O extension card (MO17)
- N D Y Output terminal of I/O extension card (MO18)
- M 12 45 Output terminal of I/O extension card (MO19)
- Output terminal of the I/O extension card (MO20) × R2 - 46

Factory Setting: 0

# Settings

0: No function

- 1: Operation Indication
- 2: Operation speed attained
- 3: Desired frequency attained 1 (Pr.02-22)
- 4: Desired frequency attained 2 (Pr.02-24)

- 5: Zero speed (Frequency command)
- 6: Zero speed, include STOP (Frequency command)
- 7: Over torque 1 (Pr.06-06~06-08)
- 8: Over torque 2 (Pr.06-09~06-11)
- 9: Drive is ready
- 10: Low voltage warning (LV) (Pr.06-00)
- 11: Malfunction indication
- 12: Mechanical brake release (Pr.02-32)
- 13: Overheat warning (Pr.06-15)
- 14: Software brake signal indication (Pr.07-00)
- 15: PID feedback error
- 16: Slip error (oSL)
- 17: Terminal count value attained (Pr.02-20; not return to 0)
- 18: Preliminary count value attained (Pr.02-19; returns to 0)
- 19: Base Block
- 20: Warning output
- 21: Over voltage warning
- 22: Over-current stall prevention warning
- 23: Over-voltage stall prevention warning
- 24: Operation mode indication
- 25: Forward command
- 26: Reverse command
- 27: Output when current >= Pr.02-33 (>= 02-33)
- 28: Output when current <= Pr.02-33 (<= 02-33)
- 29: Output when frequency  $\geq$  Pr.02-34 ( $\geq$  02-34)
- 30: Output when frequency <= Pr.02-34 (<= 02-34)
- 31: Y-connection for the motor coil
- 32:  $\triangle$ -connection for the motor coil
- 33: Zero speed (actual output frequency)
- 34: Zero speed include 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)
- 39: Position attained (Pr.10-19)
- 40: Speed attained (including Stop)
- 41: Multi-position attained
- 42: Crane function
- 43: Actual motor speed slower than Pr.02-47
- 44: Low current output (Pr.06-71 to Pr.06-73)
- 45: UVW Output Electromagnetic valve On/Off Switch
- 46: Master dEb action output

- 47: Closed brake output
- 48: Reserved
- 49: Homing action complete
- 50: Output for CANopen control
- 51: Output for communication card
- 52: Output for RS485
- 53~64: Reserved
- 65: Output for CANopen and RS485
- 66: SO contact A (N.O.)
- 67: Analog input signal level achieved
- 68: SO contact B (N.C.)
- In This parameter is used for setting the function of multi-function terminals.
- Pr.02-36~Pr.02-41 requires additional extension cards to display the parameters, the choices of optional cards are EMC-D42A and EMC-R6AA.
- The optional card EMC-D42A provides 2 output terminals and can be used with Pr.02-36~02-37.
- The optional card EMC-R6AA provides 6 output terminals and can be used with Pr.02-36~02-41.
- Summary of function settings (Take the normally open contact for example, ON: contact is closed, OFF: contact is open)

Settings	Functions	Descriptions
0	No Function	
1	Operation Indication	Active when the drive is not at STOP.
2	Master Frequency Attained	Active when the AC motor drive reaches the output frequency setting.
3	Desired Frequency Attained 1 (Pr.02-22)	Active when the desired frequency (Pr.02-22) is attained.
4	Desired Frequency Attained 2 (Pr.02-24)	Active when the desired frequency (Pr.02-24) is attained.
5	Zero Speed (frequency command)	Active when frequency command =0. (the drive should be at RUN mode)
6	Zero Speed with Stop (frequency command)	Active when frequency command =0 or stop.
7	Over Torque 1	Active when detecting over-torque. Refer to Pr.06-07 (over-torque detection level-OT1) and Pr.06-08 (over-torque detection time-OT1). Refer to Pr.06-06~06-08.
8	Over Torque 2	Active when detecting over-torque. Refer to Pr.06-10 (over-torque detection level-OT2) and Pr.06-11 (over-torque detection time-OT2). Refer to Pr.06-09~06-11.
9	Drive Ready	Active when the drive is ON and no abnormality detected.
10	Low voltage warn (Lv)	Active when the DC Bus voltage is too low. (refer to Pr.06-00 low voltage level)
11	Malfunction Indication	Active when fault occurs (except Lv stop).
12	Mechanical Brake Release (Pr.02-32)	When drive runs after Pr.02-32, it will be ON. This function should be used with DC brake and it is recommended to use contact "b" $(N.C)$ .
13	Overheat	Active when IGBT or heat sink overheats to prevent OH turn off the drive. (refer to Pr.06-15)
14	Software Brake Signal Indication	Active when the soft brake function is ON. (refer to Pr.07-00)

Settings	Functions	Descriptions
15	PID Feedback Error	Active when the feedback signal is abnormal.
16	Slip Error (oSL)	Active when the slip error is detected.
17	Terminal Count Value Attained (Pr.02-20; not return to 0)	Active when the counter reaches Terminal Counter Value (Pr.02-19). This contact won't active when Pr.02-20>Pr.02-19.
18	Preliminary Counter Value Attained (Pr.02-19; returns to 0)	Active when the counter reaches Preliminary Counter Value (Pr.02-19).
19	External Base Block input (B.B.)	Active when the output of the AC motor drive is shut off during base block.
20	Warning Output	Active when the warning is detected.
21	Over-voltage Warning	Active when the over-voltage is detected.
22	Over-current Stall Prevention Warning	Active when the over-current stall prevention is detected.
23	Over-voltage Stall prevention Warning	Active when the over-voltage stall prevention is detected.
24	Operation Mode Indication	Active when the operation command is controlled by external terminal. (Pr.00-21≠0)
25	Forward Command	Active when the operation direction is forward.
26	Reverse Command	Active when the operation direction is reverse.
27	Output when Current >= Pr.02-33	Active when current is >= Pr.02-33.
28	Output when Current < Pr.02-33	Active when current is < Pr.02-33
29	Output when frequency >= Pr.02-34	Active when frequency is >= Pr.02-34.
30	Output when Frequency < Pr.02-34	Active when frequency is <pr.02-34.< td=""></pr.02-34.<>
31	Y-connection for the Motor Coil	Active when PR.05-24=1, when frequency output is lower than Pr.05-23 minus 2Hz, continues longer than 05-25.
32	△-connection for the Motor Coil	Active when PR.05-24=1, when frequency output is higher than Pr.05-23 plus 2Hz, continues longer than 05-25.
33	Zero Speed (actual output frequency)	Active when the actual output frequency is 0. (the drive should be at RUN mode)
34	Zero Speed with Stop (actual output frequency)	Active when the actual output frequency is 0 or Stop.
35	Error Output Selection 1 (Pr.06-23)	Active when Pr.06-23 is ON.
36	Error Output Selection 2 (Pr.06-24)	Active when Pr.06-24 is ON.
37	Error Output Selection 3 (Pr.06-25)	Active when Pr.06-25 is ON.
38	Error Output Selection 4 (Pr.06-26)	Active when Pr.06-26 is ON.
39	Position Attained (Pr.10-19)	Active when the PG position control point reaches Pr.10-19.
40	Speed Attained (including zero speed)	Active when the output frequency reaches frequency setting or stop.

Settings	Functions	Descriptions								
		User can set any three multi-function input terminals to 41. The current position action status of these three terminals will be outputted. Example: if setting Pr.02-36~02-38 to 41 and only the multi-position of the second point has been done. Therefore, current status is RA (ON), RA (OFF) and MO1 (OFF). In this way, their status is 010. Bit0 is RA and so on.								
			MO2	MO1 Pr.02-16=41	RY2	RY1 Pr 02-13=41				
		Pr.04-16 Pr.04-18	0	0	0	1 0				
		Pr.04-20	0	0	1	1				
41	Multi-position Attained	Pr.04-22 Pr.04-24	0	1	0	0				
		Pr.04-26	0	1	1	0				
		Pr.04-28	0	1	1	1				
		Pr.04-30	1	0	0	0				
		Pr.04-32	1	0	0	1				
		Pr.04-34	1	0	1	0				
		Pr.04-36	1	0	1	1				
		Pr.04-38	1	1	0	0				
		Pr.04-40	1	1	0	1				
		Pr.04-42	1	1	1	0				
		Pr.04-44	1	1	1	1 2-33, Pr.02-34,				
42	Crane Function Motor Zero-speed	output curi	rent > Pr.02-33	3 and Time >	Pr.02-32.	> Pr.02-34 and lowing for your				
43	Output (Pr.02-47)	Active whe	en motor actua	al speed is les	s than Pr.02-	47.				
44	Low Current Output		on needs to be							
		MO=45 magnet 2. For bra Pr.02-3 enable/ level ex and Pr.0	cept 0 and set	etic contractor Il follow the dri MO=12 (mecl chanical brake king by set 07 Pr.07-02 = T2 C brake curren	ON/OFF swite ve status to be nanical brake delay time); th -01 (DC brake (DC brake tin t at stop). It is	ch), then the e ON or OFF. release), nen e current) to any ne at start up) recommend to				
45	UVW Phase Magnet Contractor ON/ OFF Switch	En Conta		ON ON U(T1) V(T2) W(T3) MOx=45		otor M				

Settings	Functions	Descriptions							
46	Master dEb signal output	When dEb arises at Master, MO will send a dEb signal to Slave. Then Slave will follow Master's command and decelerate to stop simultaneously.							
47	Brake Release at Stop	When drive stops, the corresponding multi-function termin be ON if the frequency is less than Pr.02-34. After it is ON, be OFF when brake delay time exceeds Pr.02-32. Output Frequency							
48	Reserved	10-047							
49	Homing Action Complete	Output when	homing action						
		If to control R	function output Y2, then the F table of the C Setting of related parameters	Pr02-14 = 50					
		RY1	P2-13 = 50	RW	The bit 0 at 2026-41				
		RY2	P2-14 = 50	RW	The bit 1 at 2026-41				
		MO1	P2-16 = 50	RW	The bit 2 at 2026-41				
		MO2	P2-17 = 50	RW	The bit 3 at 2026-41				
50	Output for CANopen control	MO10		5147	The bit 4 at 2026-41				
		RY10	P2-36 = 50	RW	The bit 5 at 2026-41				
		MO11		<b>D</b>	The bit 6 at 2026-41				
		RY11	P2-37 = 50	RW	The bit 7 at 2026-41				
		RY12	P2-38 = 50	RW	The bit 8 at 2026-41				
		RY13	P2-39 = 50	RW	The bit 9 at 2026-41				
		RY14	P2-40 = 50	RW	The bit 10 at 2026-41				
		RY15	P2-41= 50	RW	The bit 0 at 2026-41				
		Refer to Chap	oter 15-3-5 for	more inform	ation.				

Settings	Functions	Descriptions							
51	Output for RS-485	For	RS485 o	utput.					
			For communication output of communication cards (CMC-MOD01, CMC-EIP01, CMC-PN01 and CMC-DN01)						
			Physical erminal	re	ting of lated meters	Attribute	Corresponding Address		
			RY1	P2-1	3 = 51	RW	The Bit 0 of 2640		
			RY2	P2-1	4 = 51	RW	The Bit 1 of 2640		
				P2-1	5 = 51	RW	The Bit 2 of 2640		
52	Output for		MO1	P2-1	6 = 51	RW	The Bit 3 of 2640		
02	communication card		MO2	P2-1	7 = 51	RW	The Bit 4 of 2640		
			MO3	P2-1	8 = 51	RW	The Bit 5 of 2640		
			MO4	P2-1	9 = 51	RW	The Bit 6 of 2640		
			MO5	P2-2	20 = 51	RW	The Bit 7 of 2640		
			MO6	P2-2	21 = 51	RW	The Bit 8 of 2640		
			MO7	P2-22 = 51		RW	The Bit 9 of 2640		
			MO8	P2-23 = 51		RW	The Bit 10 of 2640		
53~64	Reserved								
65	Output for CANopen and RS485	To b	e control	output	of CANo	pen & RS48	5.		
		Г				Status of s	afety output		
66	SO contact A (N.O.)		Status of	drive		(MO=66)	N.C. (MO=68)		
			Norm	al	Broken circuit (Open)		Short circuit (Close)		
			STC	)	Short circuit		Broken circuit		
68	SO contact B (N.C.)	-			(Close) Short circuit		(Open) Broken circuit		
			STL1~S	STL3		Close)	(Open)		
67	Analog input signal level achieved	<ul> <li>Multi-function output terminals operate when analog input signal level is between high level and low level.</li> <li>03-44: Select the analog signal channel, AVI, ACI, and AUI which is going to be compared.</li> <li>03-45: The high level of analog input, factory setting is 50%.</li> <li>03-46: The low level of analog input, factory setting is 10%.</li> <li>If analog input &gt; 03-45, then multi-function output terminal operates.</li> <li>If analog input &lt; 03-46, then multi-function output terminal stops outputting.</li> </ul>							

### Example: Crane Application Output frequency<Pr02-58 Output frequency>=Pr02-34 Output or output current < Pr02-57 frequency, and output current>=Pr02-33 Multi-function output MO=42 (Active when Fcom>=Pr02-34, output current >Pr02-33. • 02-32 time>Pr02-32) 02-32 It is recommended to be used with Dwell function as shown in the following: Set Pr07-18=Pr02-58 and Set Pr07-16=Pr02-34 and output current < Pr02-57 output current >= Pr02-33 Pr07-18 Dwell frequency at decel. Pr07-16 Dwell frequencyat accel. Output frequency Pr07-15 Pr07-17 Dwell time Dwell time at decel. at accel. Multi-function output MO=42 (Active when

Fcom>=Pr02-34, output current >Pr02-33, time>Pr02-32) Brake delay time

✓ 82 - 18 Multi-function Output Setting

Factory Setting: 0000

Brake delay time

Pr02-32

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

I The setting of this parameter is in hexadecimal.

This parameter is set via bit setting. If a bit is 1, the corresponding multi-function output acts in the opposite way.

Example:

If Pr02-13=1 and Pr02-18=0, Relay 1 is ON when the drive runs and is open when the drive is stopped.

If Pr02-13=1 and Pr02-18=1, Relay 1 is open when the drive runs and is closed when the drive is stopped.

Bit setting

bit15	bit14	bit13	bit12	bit11	bit10	bit9	bit8	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
MO20	MO19	MO18	MO17	MO16	MO15	MO14	MO13	MO12	MO11	MO10	MO2	MO1	Reserved	RY2	RY1



Terminal Counting Value Attained (return to 0)

Factory Setting: 0

Settings	0~65500
Soungo	0 00000

- The counter trigger can be set by the multi-function terminal MI6 (set Pr.02-06 to 23). Upon completion of counting, the specified multi-function output terminal will be activated (Pr.02-13~02-14, Pr.02-36, 02-37 is set to 18). Pr.02-19 can't be set to 0.
- When the display shows c5555, the drive has counted 5,555 times. If display shows c5555•, it means that real counter value is between 55,550 to 55,559.
- Preliminary Counting Value Attained (not return to 0)

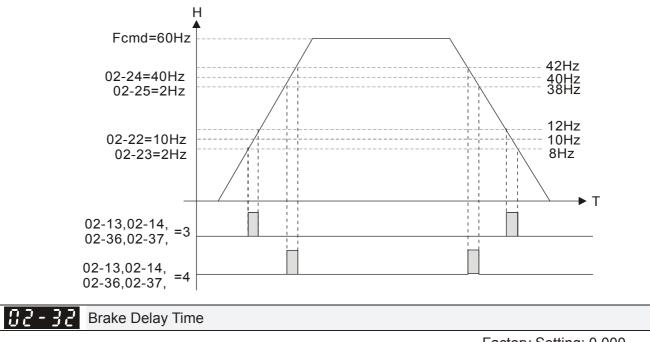
Factory Setting: 0

Settings 0~65500

When the counter value counts from 1 and reaches this value, the corresponding multi-function output terminal will be activated, provided one of Pr. 02-13, 02-14, 02-36, 02-37 set to 17 (Preliminary Count Value Setting). This parameter can be used for the end of the counting to make the drive runs from the low speed to stop.

	Display value       _0000       _0000       _0000       _0000       _0000       _0000       _0000       _0000       _ <t< th=""></t<>
	(output signal) Preliminary Counter Value RY1 Pr.02-13=17 02-13, 02-14, 02-36, 02-37 D2-02-02-02-02-02-02-02-02-02-02-02-02-02
	02-19=5 Terminal Counter Value 02-14=17 RY2 Pr.02-14=18
N	<b>3 2 - 2 1</b> Digital Output Gain(DFM)
	Factory Setting: 1
	Settings 1~166
	It is used to set the signal for the digital output terminals (DFM-DCM) and digital frequency output
	(pulse X work period=50%). Output pulse per second = output frequency X Pr.02-21.
N	<b>32-22</b> Desired Frequency Attained 1
	Factory Setting: 60.00/50.00
	Settings 0.00~600.00Hz
N	<b>32-23</b> The Width of the Desired Frequency Attained 1
	Factory Setting: 2.00
	Settings 0.00~600.00Hz
N	<b>32 - 24</b> Desired Frequency Attained 2
	Factory Setting: 60.00/50.00
	Settings 0.00~600.00Hz
N	<b>32 - 25</b> The Width of the Desired Frequency Attained 2
	Factory Setting: 2.00
	Settings 0.00~600.00Hz

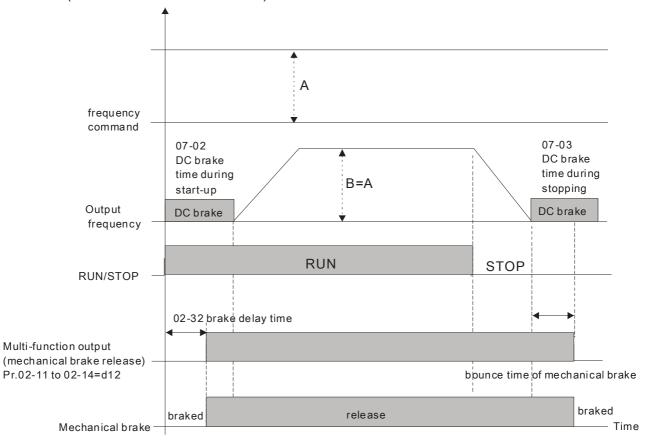
Once output frequency reaches desired frequency and the corresponding multi-function output terminal is set to 3 or 4 (Pr.02-13, 02-14, 02-36, and 02-37), this multi-function output terminal will be ON.



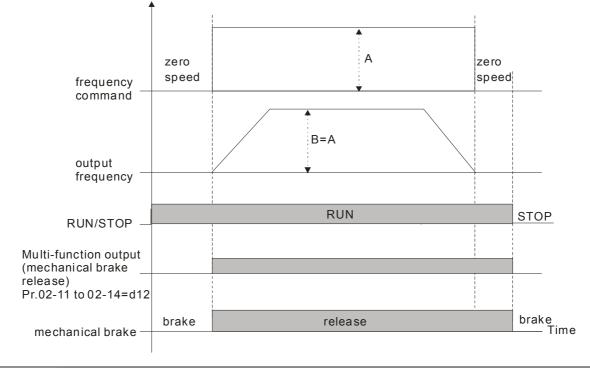
Settings 0.000~65.000 sec

Factory Setting: 0.000

When the AC motor drive runs after Pr.02-32 delay time, the corresponding multi-function output terminal (12: mechanical brake release) will be ON. It has to use this function with DC brake.



If this parameter is used without DC brake, it will be invalid. Refer to the following operation timing.



Output Current Level Setting for Multi-function Output Terminals

Factory Setting: 0

Settings 0~100%

- When output current is higher or equal to Pr.02-33, it will activate multi-function output terminal (Pr.02-13, 02-14, 02-16, and 02-17 is set to 27).
- When output current is lower or equal to Pr.02-33, it will activate multi-function output terminal (Pr.02-13, 02-14, 02-16, and 02-17 is set to 28).

Factory Setting: 3.00

Settings 0.00~600.00Hz

- When output frequency is higher or equal to Pr.02-34, it will activate the multi-function terminal (Pr.02-13, 02-14, 02-16, 02-17 is set to 29).
- When output frequency is lower or equal to Pr.02-34, it will activate the multi-function terminal (Pr.02-13, 02-14, 02-16, 02-17 is set to 30).

External Operation Control Selection after Reset and Activate

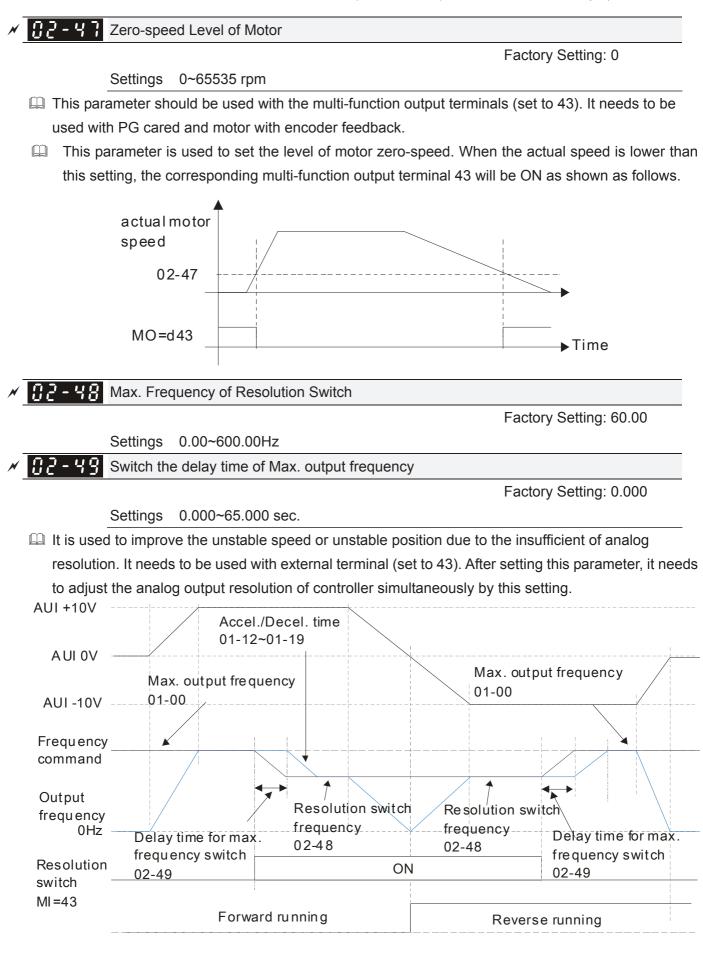
Factory Setting: 0

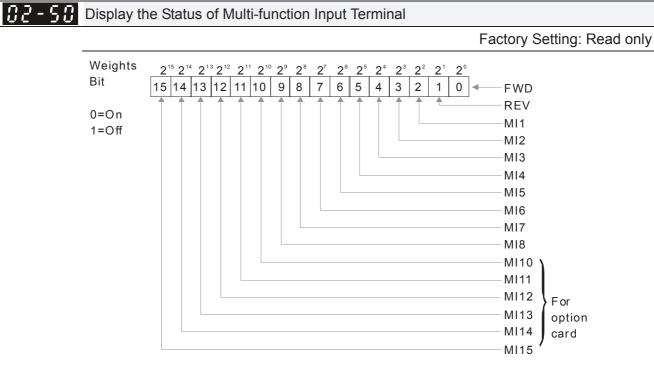
Settings 0: Disable

1: Drive runs if the run command still exists after reset or re-boots.

Setting 1:

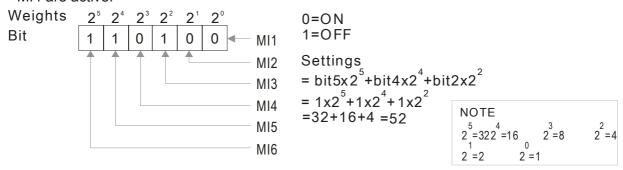
Status 1: After the drive is powered on and the external terminal for RUN keeps ON, the drive will run. Status 2: After clearing fault once a fault is detected and the external terminal for RUN keeps ON, the drive can run after pressing RESET key.





# General For Example:

If Pr.02-50 displays 0034h (Hex), i.e. the value is 52, and 110100 (binary). It means MI1, MI3 and MI4 are active.



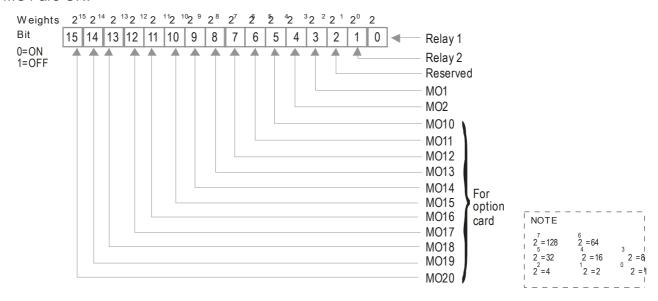


Status of Multi-function Output Terminal

Factory Setting: Read only

### Given For Example:

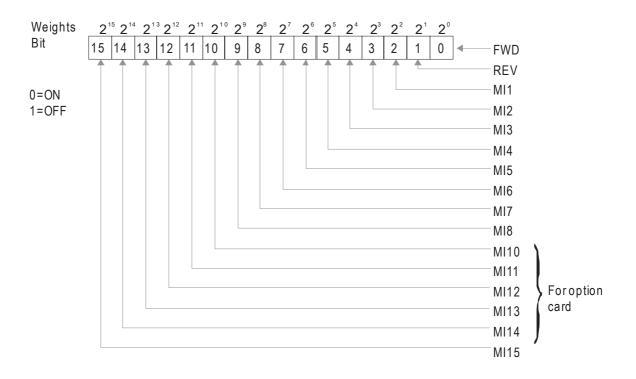
If Pr.02-51 displays 000Bh (Hex), i.e. the value is 11, and 1011 (binary). It means RY1, RY2 and MO1 are ON.



**B2-52** Display External Output terminal occupied by PLC

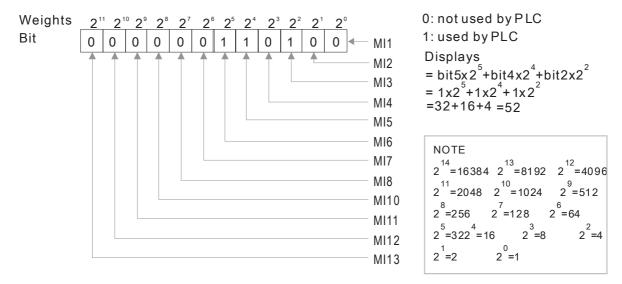
Factory Setting: Read only

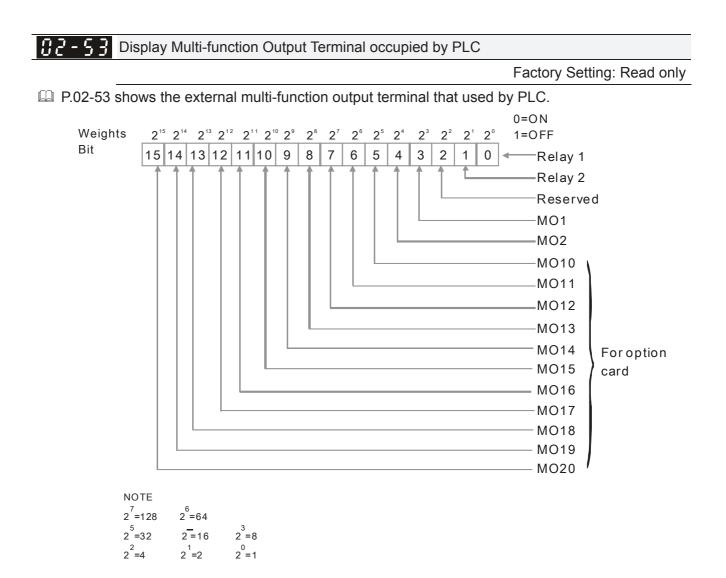
P.02-52 shows the external multi-function input terminal that used by PLC.



# Given For Example:

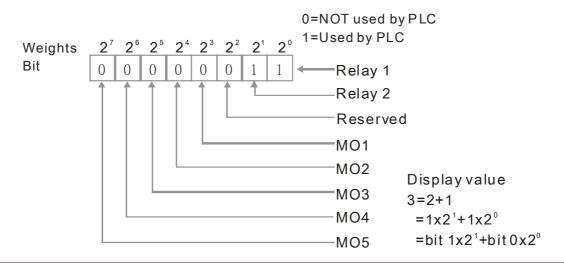
When Pr.02-52 displays 0034h(hex) and switching to 110100 (binary), it means MI1, MI3 and MI4 are used by PLC.





# General For Example:

If the value of Pr.02-53 displays 0003h (Hex), it means RY1and RY2 are used by PLC.



**B?** - **5H** Display the Frequency Command Executed by External Terminal

Factory Setting: Read only

## Settings Read only

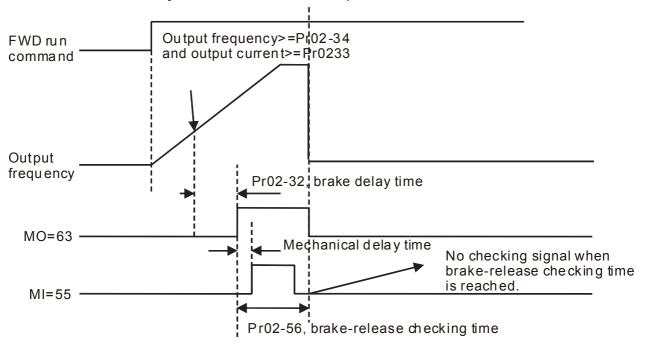
When the source of frequency command comes from the external terminal, if Lv or Fault occurs at this time, the frequency command of the external terminal will be saved in this parameter.

<b>32-55</b> Reserved	
<b>32-55</b> Release Brake Check	

Factory Setting: 0.000

Settings 0.000~65.000 sec.

□ The parameter needs to be used with MI=55. This is to be set for the time difference of mechanical brake delay time and actual brake operation.





82-57 Multi-function output terminal: Function 42: Brake Current Checking Point

Factory setting: 0



Multi-function output terminal: Function 42: Brake Frequency Checking Point

Factory setting: 0.00

Settings 0.00~655.35Hz

Settings 0~150%

- Pr02-32, Pr02-33, Pr02-34, Pr02-57 and Pr02-58 can be applied on setting up cranes. (Choose crane action #42 to set up multi-function output Pr02-13, Pr02-14, Pr02-16, and Pr02-17)
- When output current of a drive is higher than the setting of Pr02-33 Pivot Point of the Current (>=02-33) and when output frequency is higher than the setting of Pr02-34 Pivot Point of the Frequency (>= 02-34), choose #42 to set up Multi-function output Pr02-13, Pr02-14, Pr02-16 and Pr002-17 after the delay time set at Pr02-32.
- When the Pivot Point of the Current 's setting 02-57≠0 and when the output current of the drive is lower than the setting of Pr02-57 (<02-57), or when the output frequency is lower than the setting of Pr02-58 (<02-58), the disable the setting #42 of the multi-function output Pr02-13, Pr02-14, Pr02-16, Pr02-17
- When Pr02-57 = 0, the output current is lower than setting of Pr02-33 Pivot Point of the current (<02-33) or when output frequency is lower than the setting of Pr02-58(<02-58), disable the setting of #42 of the multi-function output Pr02-13, Pr02-14, Pr02-16, Pr02-17.

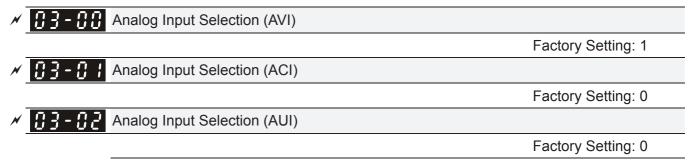
IO Card Type

Factory setting: Read only

Settings Read only

0: No IO Card	
1: EMC-BPS01 Card	
2: No IO Card	
3: No IO Card	
4: EMC-D611A Card	
5: EMC-D42A Card	
6: EMC-R6AA Card	
7: No IO Card	

# **03** Analog Input/Output Parameter *×* This parameter can be set during operation.

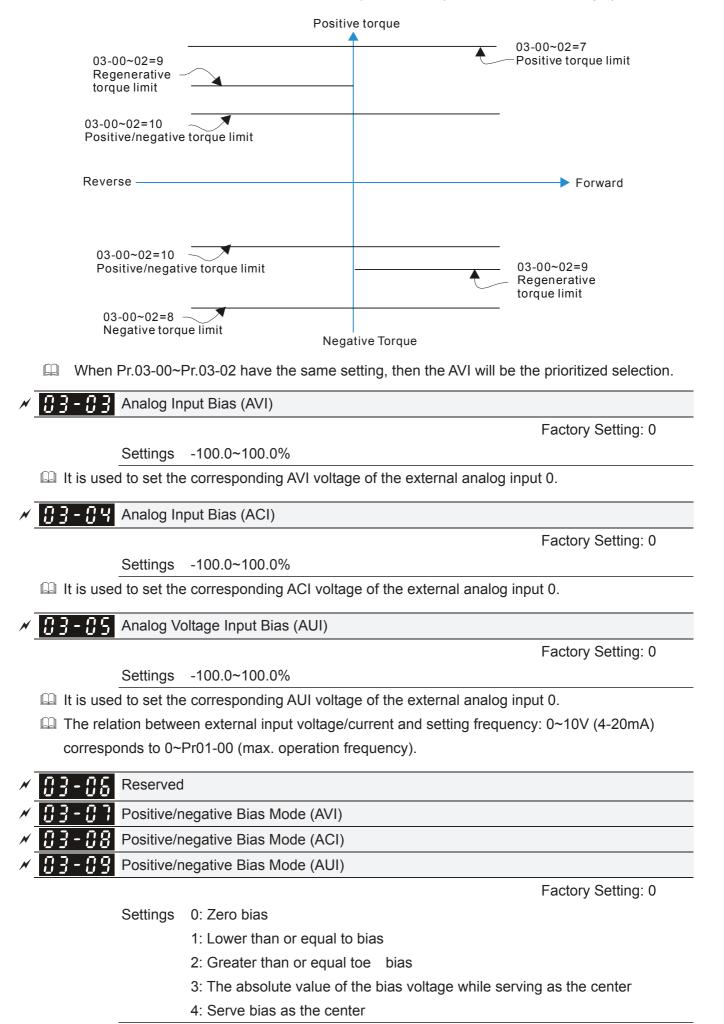


# Settings

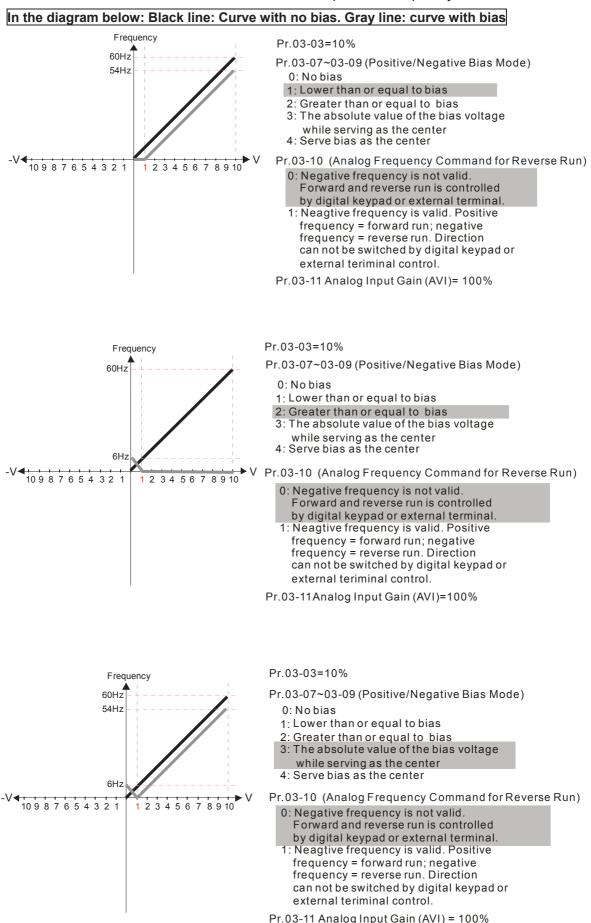
- 0: No function
- 1: Frequency command (speed limit under torque control mode)
- 2: Torque command (torque limit under speed mode)
- 3: Torque offset command
- 4: PID target value
- 5: PID feedback signal
- 6: PTC thermistor input value
- 7: Positive torque limit
- 8: Negative torque limit
- 9: Regenerative torque limit
- 10: Positive/negative torque limit
- 11: PT100 thermistor input value
- 12: Reserved
- 13: PID compensation value
- 14~20: Reserved
- When use analog input as PID reference value, Pr00-20 must set 2(analog input).
  - Setting method 1: Pr03-00~03-02 set 1 as PID reference input
  - Setting method 2: Pr03-00~03-02 set 4 as PID reference input

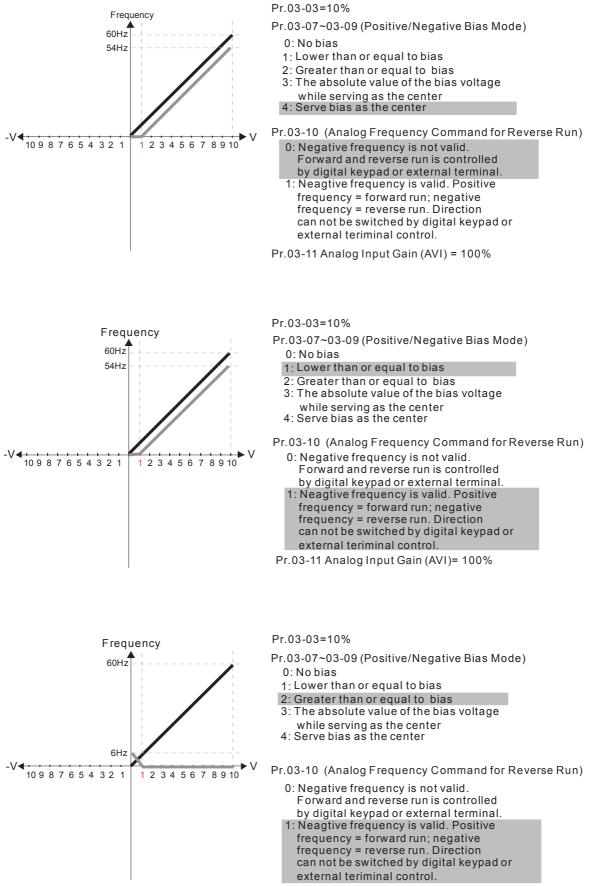
If the setting value 1 and set value 4 existed at the same time, AVI input has highest priority to become PID reference input.

- When use analog input as PID compensation value, Pr08-16 must set 1(Source of PID compensation is analog input). The compensation value can be observed via Pr08-17.
- When it is frequency command or TQC speed limit, the corresponding value for 0~±10V/4~20mA is 0 – max. output frequency(Pr.01-00)
- $\square$  When it is torque command or torque limit, the corresponding value for  $0 \sim \pm 10V/4 \sim 20$  mA is 0 -max. output torque (Pr.11-27).
- $\square$  When it is torque compensation, the corresponding value for  $0 \sim \pm 10V/4 \sim 20$  mA is 0 rated torque.

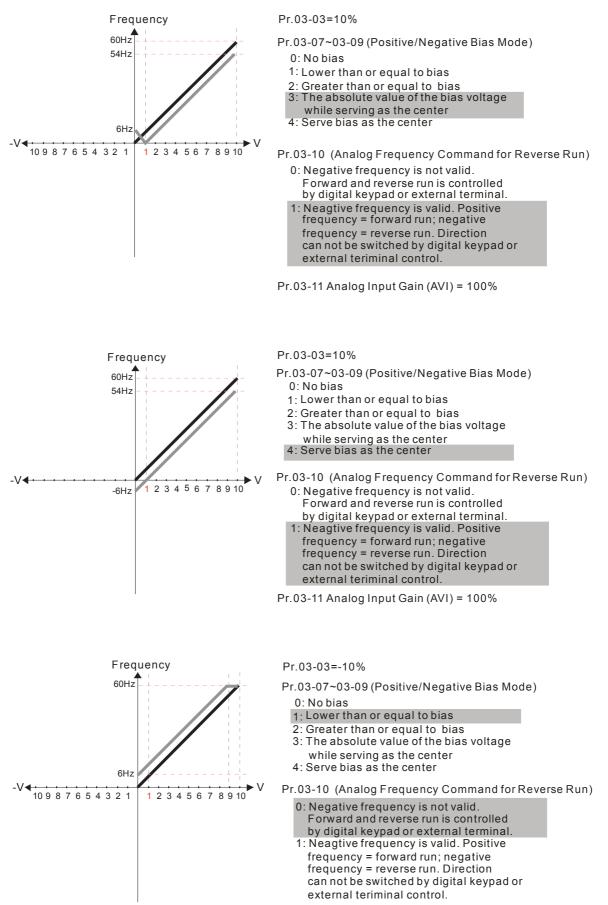


In a noisy environment, it is advantageous to use negative bias to provide a noise margin. It is recommended NOT to use less than 1V to set the operation frequency.

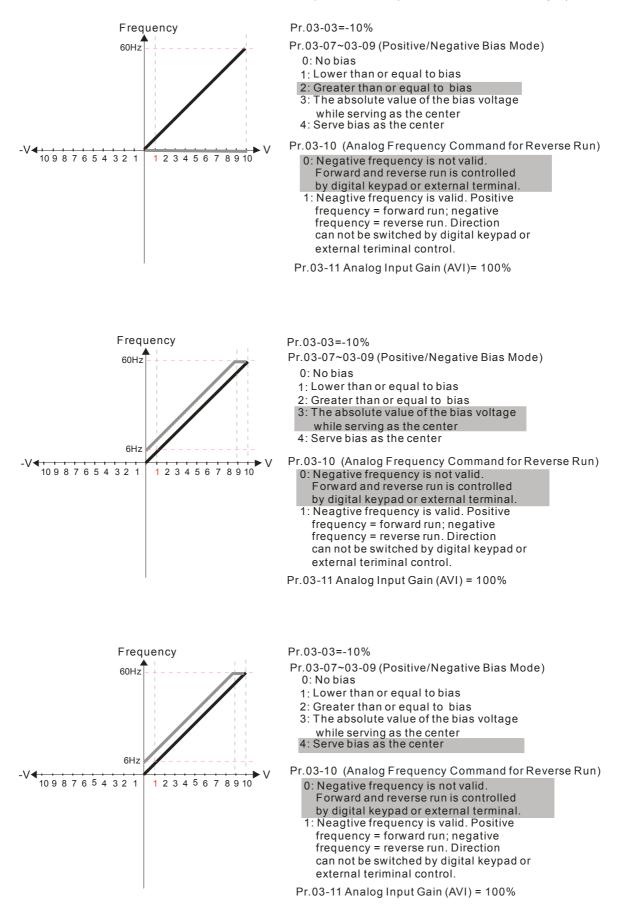


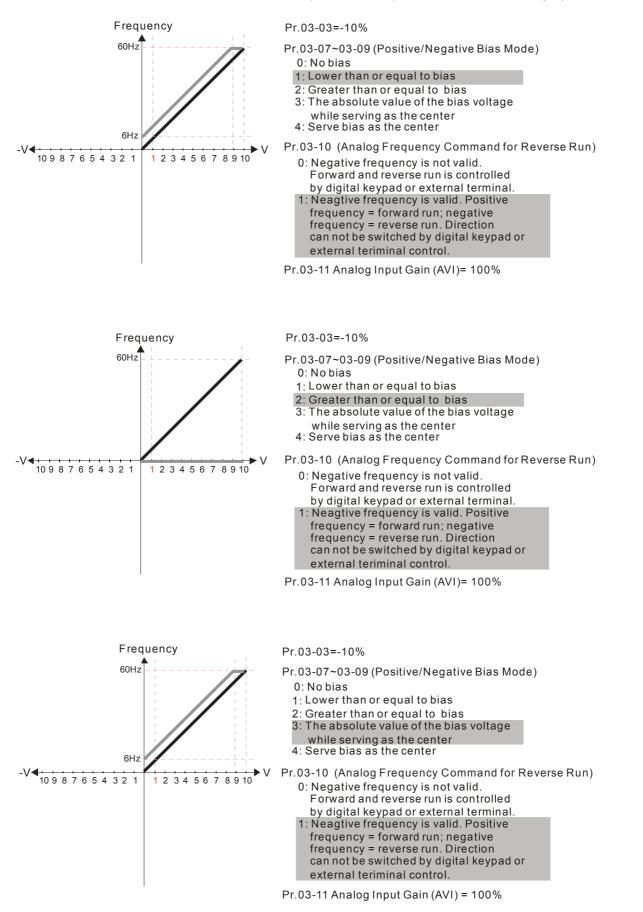


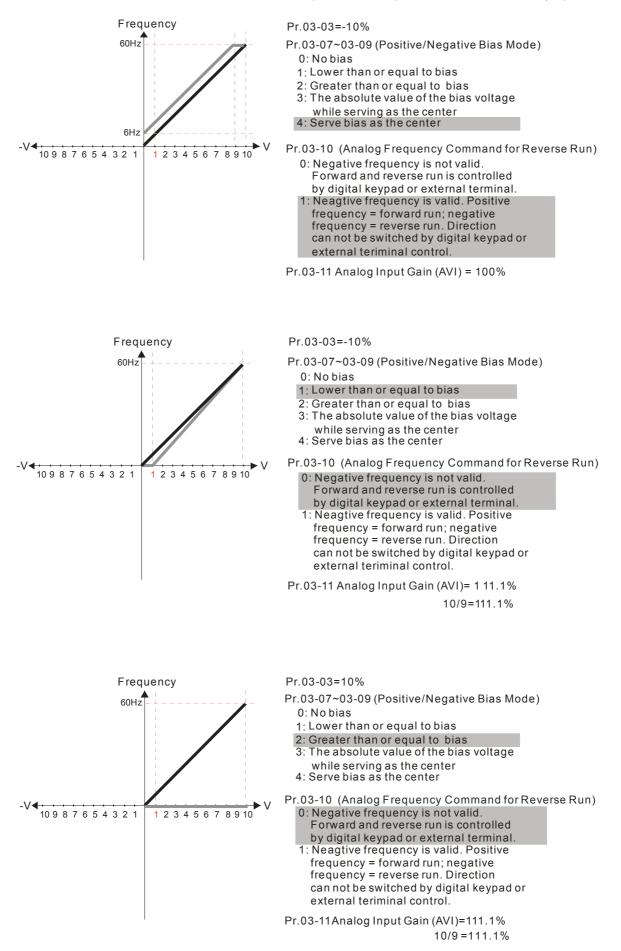
Pr.03-11Analog Input Gain (AVI)= 100%

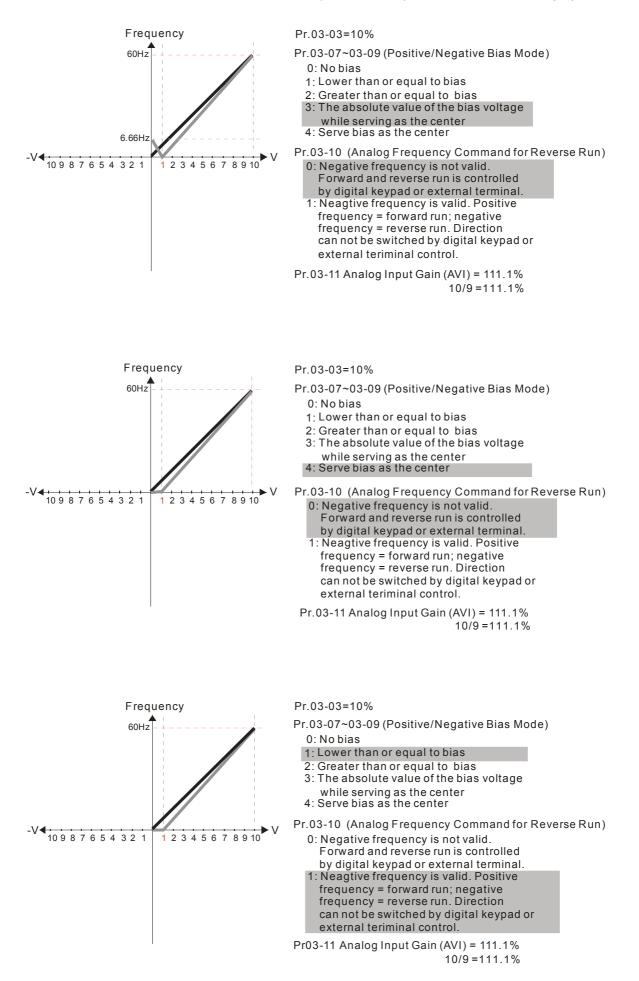


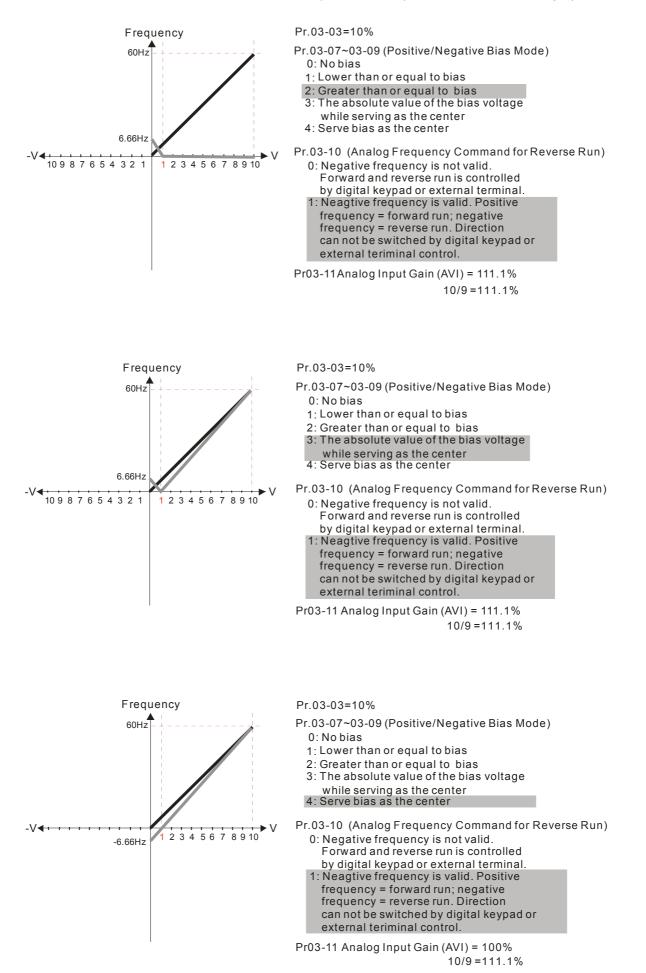
Pr.03-11 Analog Input Gain (AVI)= 100%

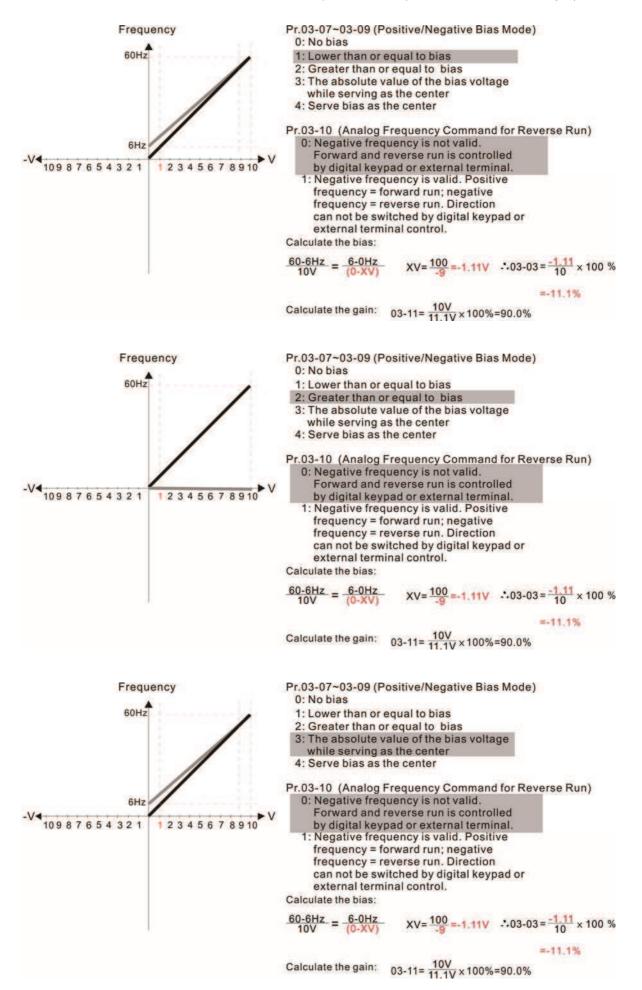


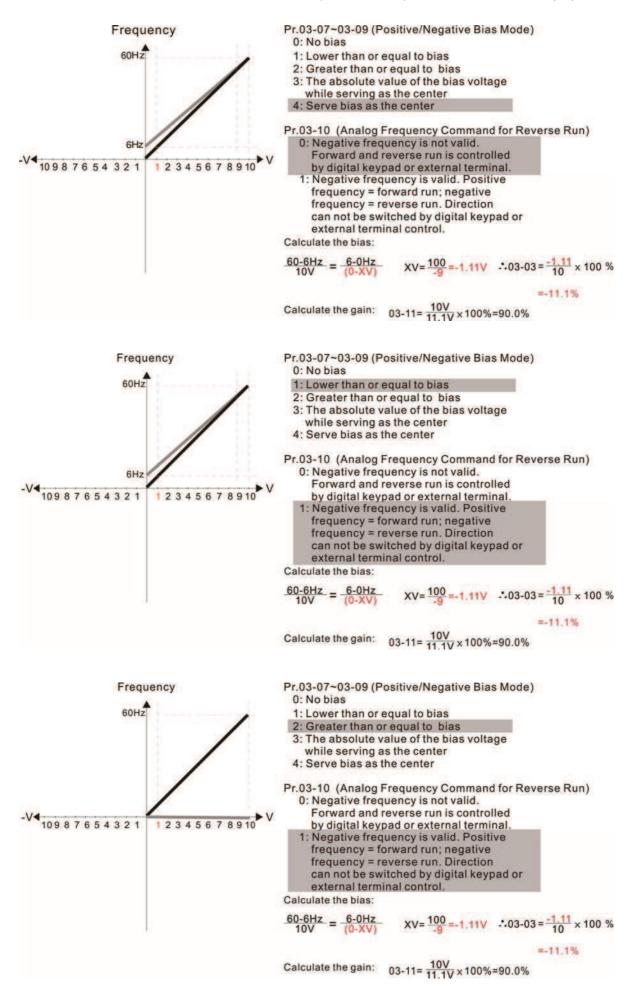


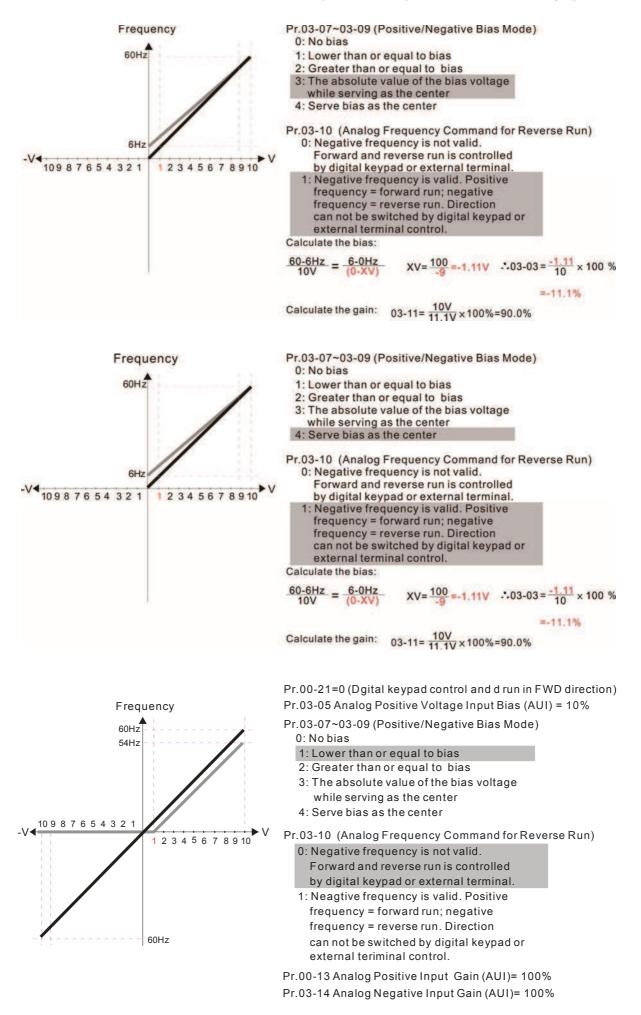


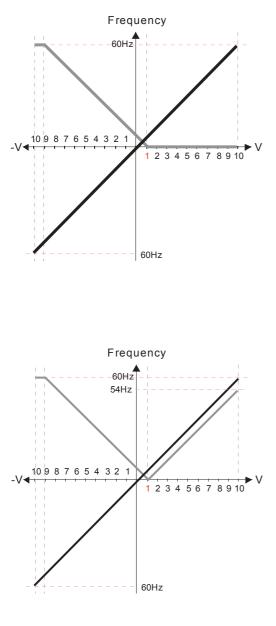


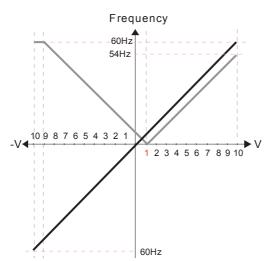












Pr.00-21=0 (Dgital keypad control and d run in FWD direction) Pr.03-05 Analog Positive Voltage Input Bias (AUI) = 10% Pr.03-07~03-09 (Positive/Negative Bias Mode)

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

Pr.03-10 (Analog Frequency Command for Reverse Run)

- 0: Negative frequency is not valid. Forward and reverse run is controlled by digital keypad or external terminal.
- 1: Neagtive frequency is valid. Positive frequency = forward run; negative frequency = reverse run. Direction can not be switched by digital keypad or external teriminal control.

Pr.00-13 Analog Positive Input Gain (AUI)= 100%

Pr.03-14 Analog Negative Input Gain (AUI)= 100%

Pr.00-21=0 (Dgital keypad control and d run in FWD direction) Pr.03-05 Analog Positive Voltage Input Bias (AUI) = 10%

- Pr.03-07~03-09 (Positive/Negative Bias Mode)
  - 0: No bias
  - 1: Lower than or equal to bias
  - 2: Greater than or equal to bias
  - 3: The absolute value of the bias voltage while serving as the center
  - 4: Serve bias as the center

Pr.03-10 (Analog Frequency Command for Reverse Run) 0: Negative frequency is not valid.

- Forward and reverse run is controlled
- by digital keypad or external terminal. 1: Neagtive frequency is valid. Positive
- frequency = forward run; negative frequency = reverse run. Direction can not be switched by digital keypad or external teriminal control.

Pr.00-13 Analog Positive Input Gain (AUI)= 100% Pr.03-14 Analog Negative Input Gain (AUI)= 100%

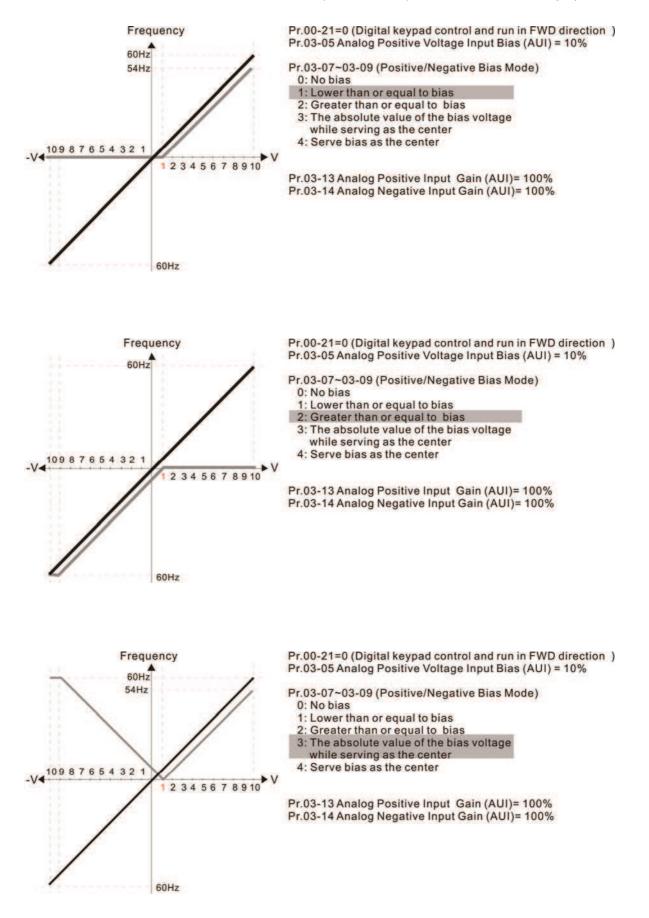
Pr.00-21=0 (Dgital keypad control and d run in FWD direction) Pr.03-05 Analog Positive Voltage Input Bias (AUI) = 10%

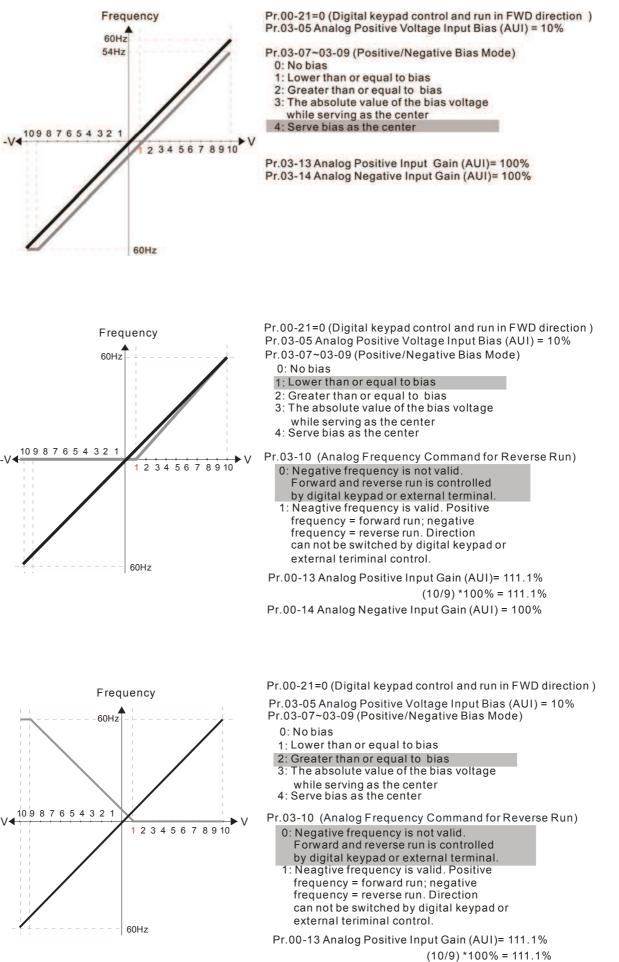
- Pr.03-07~03-09 (Positive/Negative Bias Mode) 0: No bias
  - 1: Lower than or equal to bias
  - 2: Greater than or equal to bias
  - 3: The absolute value of the bias voltage
  - while serving as the center

#### 4: Serve bias as the center

Pr.03-10 (Analog Frequency Command for Reverse Run)

- 0: Negative frequency is not valid.
  - Forward and reverse run is controlled by digital keypad or external terminal.
- 1: Neagtive frequency is valid. Positive frequency = forward run; negative frequency = reverse run. Direction can not be switched by digital keypad or external teriminal control.
- Pr.00-13 Analog Positive Input Gain (AUI)= 100%
- Pr.03-14 Analog Negative Input Gain (AUI)= 100%

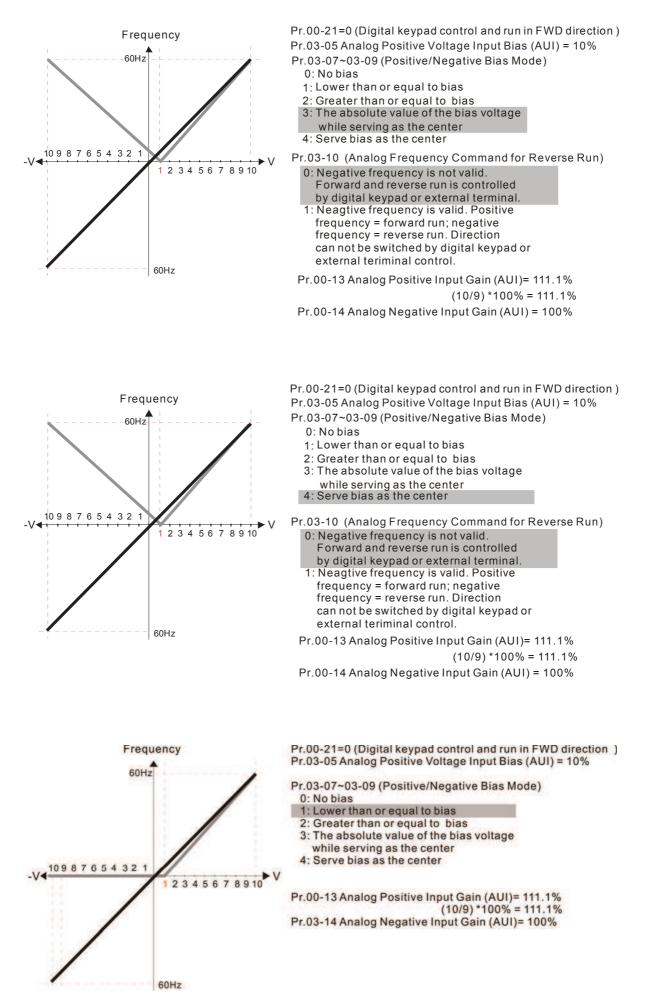


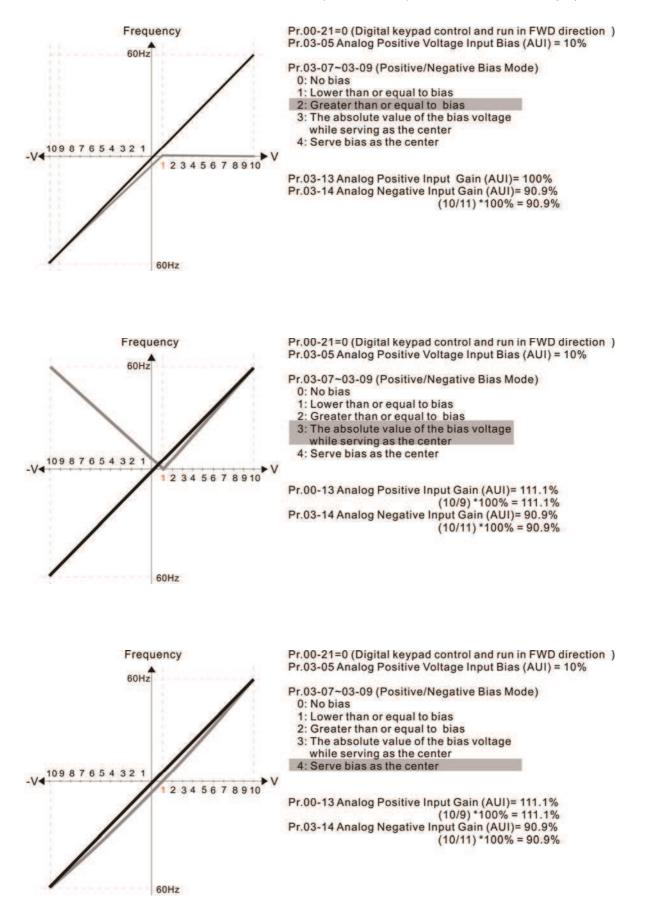


12-03-16

Pr.00-14 Analog Negative Input Gain (AUI) = 100%









Analog Frequency Command for Reverse Run

Factory Setting: 0

- Settings 0: Negative frequency is not valid. Forward and reverse run is controlled by digital keypad or external terminal.
  - 1: Negative frequency is valid. Positive frequency = forward run; negative frequency = reverse run. Run direction can not be switched by digital keypad or the external terminal control.
- Parameter 03-10 is used to enable reverse run command when a negative frequency (negative bias and gain) is input to AVI or ACI analog signal input (except AUI).
- Condition for negative frequency (reverse)
  - 1. Pr03-10=1
  - 2. Bias mode=Serve bias as center
  - 3. Corresponded analog input gain < 0(negative), make input frequency be negative.
- In using addition function of analog input (Pr03-18=1), when analog signal is negative after adding, this parameter can be set for allowing reverse or not. The result after adding will be restricted by "Condition for negative frequency (reverse)"

N	03-11	Analog Input Gain (AVI)
N	03-15	Analog Input Gain (ACI)

- Analog Positive Input Gain (AUI)
- Analog Negative Input Gain (AUI)

Factory Setting: 100.0

Settings -500.0~500.0%

Parameters 03-03 to 03-14 are used when the source of frequency command is the analog voltage/current signal.

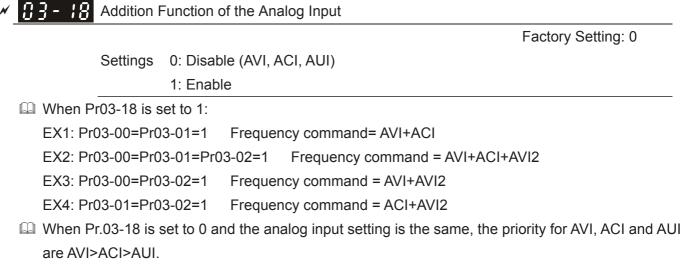
N	<b>33 - 15</b> Analog Input Filter Time (AVI)
N	<b>3 - 18</b> Analog Input Filter Time (ACI)
N	<b>3 - 11</b> Analog Input Filter Time (AUI)

Factory Setting: 0.01

Settings 0.00~20.00 sec

I These input delays can be used to filter noisy analog signal.

When the setting of the time constant is too large, the control will be stable but the control response will be slow. When the setting of time constant is too small, the control response will be faster but the control may be unstable. To find the optimal setting, please adjust the setting according to the control stable or response status.



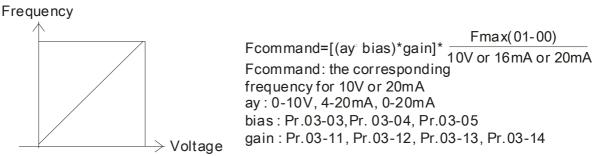


Fig. 2 - 13 Treatment to 4-20mA Analog Input Signal Loss

Factory Setting: 0

Settings 0: Disable

- 1: Continue operation at the last frequency
- 2: Decelerate to stop
- 3: Stop immediately and display ACE
- This parameter determines the behavior when 4~20mA signal is loss, when AVIc(Pr.03-28=2) or ACIc (03-29=0).
- When Pr.03-28 is not set to 2, it means the voltage input to AVI terminal is 0-10V or 0-20mA. At this moment, Pr.03-19 will be invalid.
- When Pr.03-29 is set to 1, it means the voltage input to ACI terminal is for 0-10V. At this moment, Pr.03-19 will be invalid.
- When setting is 1 or 2, it will display warning code "AnL" on the keypad. It will be blinking until the loss of the ACI signal is recovered.
- When the motor drive stops, the condition of warning does not exist, then the warning will disappear.



Multi-function Output 1 (AFM1)

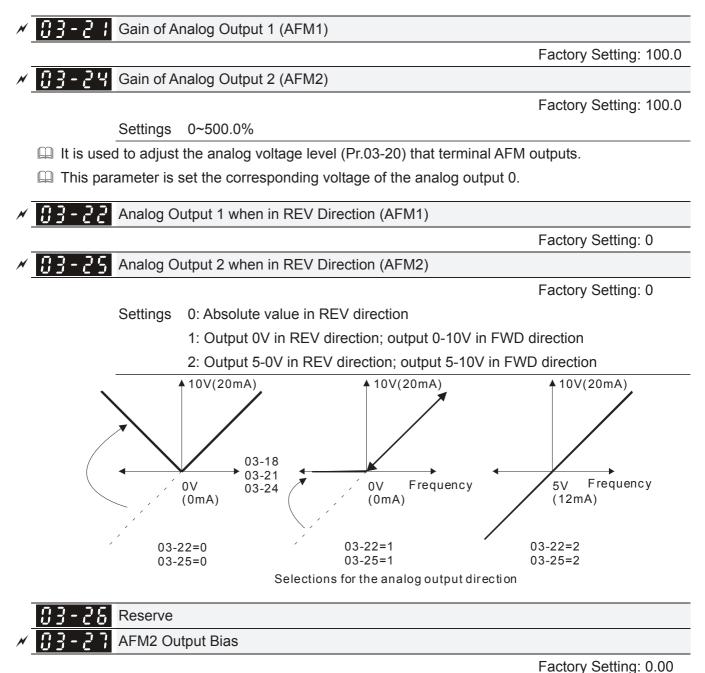
Factory Setting: 0

# Multi-function Output 2 (AFM2)

Factory Setting: 0

Settings 0~25

Settings	Functions	Descriptions
0	Output frequency (Hz)	Max. frequency Pr.01-00 is regarded as 100%.
1	Frequency command (Hz)	Max. frequency Pr.01-00 is regarded as 100%.
2	Motor speed (Hz)	600Hz is regarded as 100%
3	Output current (rms)	(2.5 X rated current) is regarded as 100%
4	Output voltage	(2 X rated voltage) is regarded as 100%
5	DC Bus Voltage	450V (900V)=100%
6	Power factor	-1.000~1.000=100%
7	Power	Rated power is regarded as 100%
8	Output torque	Full-load torque is regarded as 100%
9	AVI	0~10V=0~100%
10	ACI	0~20mA=0~100%
11	AUI	-10~10V=0~100%
12	q-axis current (Iq)	(2.5 X rated current) is regarded as 100%
13	q-axis feedback value (Iq)	(2.5 X rated current) is regarded as 100%
14	d-axis current (Id)	(2.5 X rated current) is regarded as 100%
15	d-axis feedback value (Id)	(2.5 X rated current) is regarded as 100%
16	q-axis voltage (Vq)	250V (500V) =100%
17	d-axis voltage(Vd)	250V (500V) =100%
18	Torque command	Rated torque is regarded as 100%
19	PG2 frequency command	Max. frequency Pr.01-00 is regarded as 100%.
20	Output for CANopen control	For CANopen analog output
21	RS485 analog output	For communication output (CMC-MOD01, CMC-EIP01 CMC-PN01, CMC-DN01)
22	Analog output for	For communication output (CMC-MOD01, CMC-EIP01,
~~	communication card	CMC-PN01, CMC-DN01)
		Pr.03-32 and Pr.03-33 controls voltage/current output
23	Constant voltage/current output	level
		0~100% of Pr.03-32 corresponds to 0~10V of AFM1.
24	Reserve	
25	CAN & 485 output	



Example 1, AFM2 0-10V is set output frequency, the output equation is

$$10V \times (\frac{\text{Output Frequency}}{01-00}) \times 03 - 24 + 10V \times 03 - 27$$

Example 2, AFM2 0-20mA is set output frequency, the output equation is

$$20\text{mA} \times (\frac{\text{Output Frequency}}{01 - 00}) \times 03 - 24 + 20\text{mA} \times 03 - 27$$

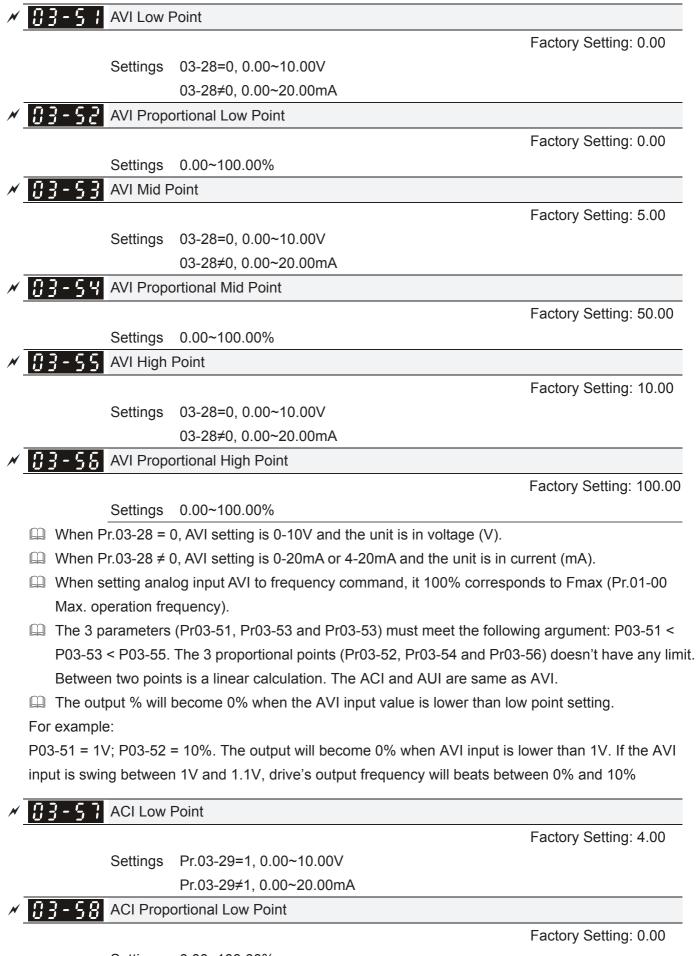
Example 3, AFM2 4-20mA is set output frequency, the output equation is

$$4\text{mA} + 16\text{mA} \times (\frac{\text{Output Frequency}}{01 - 00}) \times 03 - 24 + 16\text{mA} \times 03 - 27$$

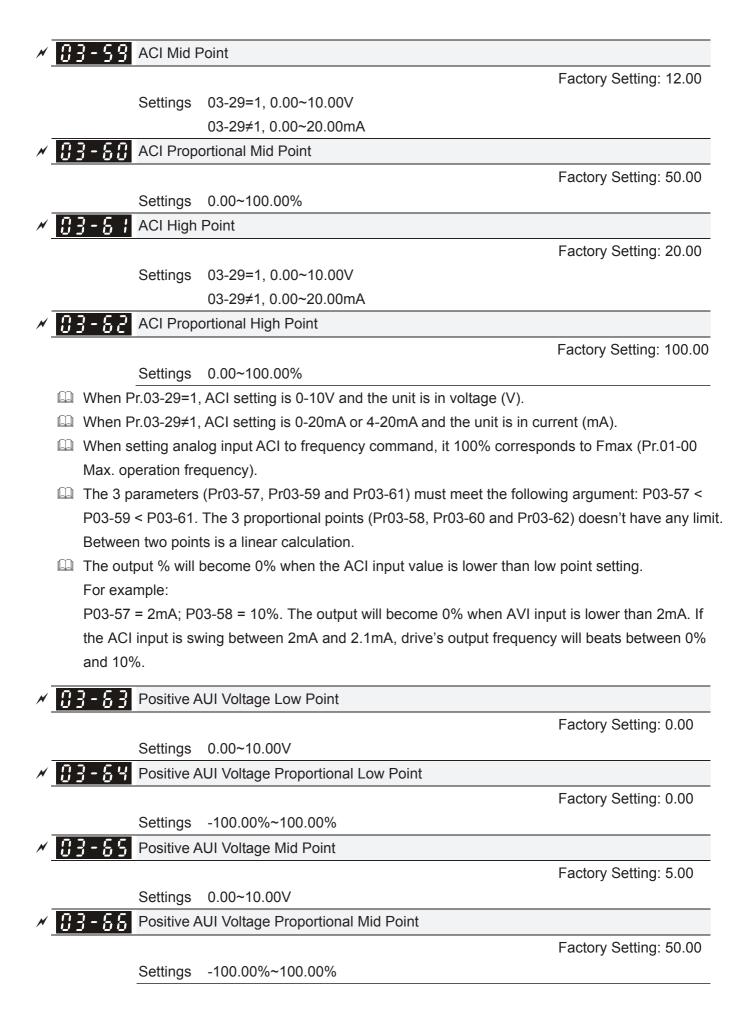
This parameter can set the corresponded voltage of 0 for analog output.

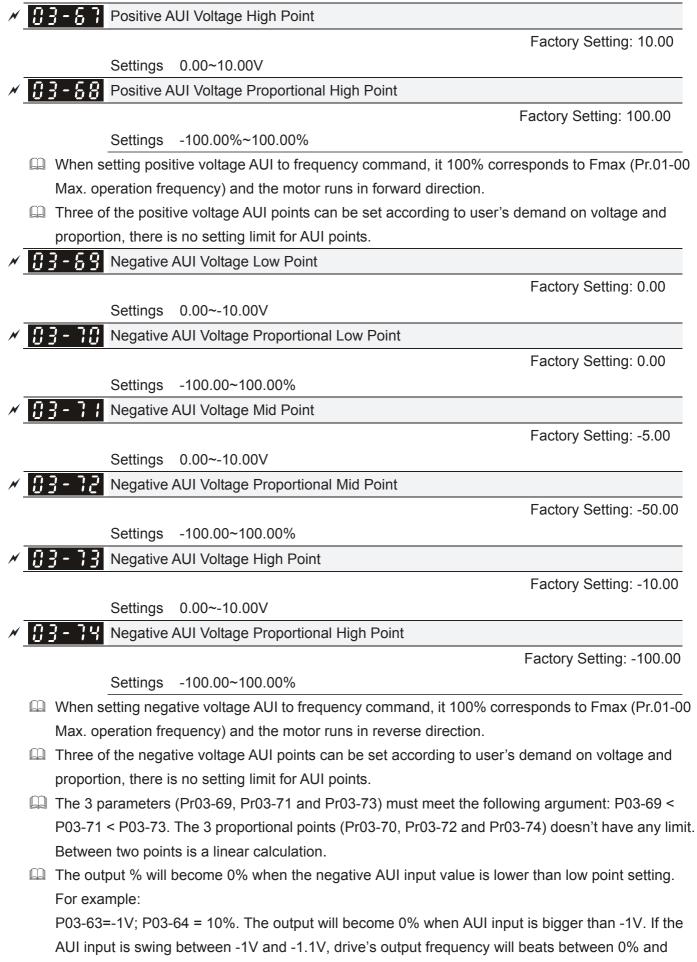
AVI Selec	ation
	Factory Setting: 0
Settings	0: 0-10V
Settings	1: 0-20mA
	2: 4-20mA
ACI Sele	
Cattinger	Factory Setting: 0
Settings	0: 4-20mA
	1: 0-10V
	2: 0-20mA
	e input mode, please check if the switch of external terminal (SW3, SW4)
corresponds to the	e setting of Pr.03-28~03-29.
Status of	PLC Output Terminal
	Factory Setting: ##
Settings	0~65535
	Monitor the status of PLC analog output terminals
P.03-30 shows the	e external multi-function output terminal that used by PLC.
	0=0N
Weights 2	<sup>15</sup> 2 <sup>14</sup> 2 <sup>13</sup> 2 <sup>12</sup> 2 <sup>11</sup> 2 <sup>10</sup> 2 <sup>9</sup> 2 <sup>8</sup> 2 <sup>7</sup> 2 <sup>6</sup> 2 <sup>5</sup> 2 <sup>4</sup> 2 <sup>3</sup> 2 <sup>2</sup> 2 <sup>1</sup> 2 <sup>0</sup> 1=OFF
Bit 15	
	AFM 2
NC	)TE
2 <sup>′</sup> = 5	=128 $2 = 64$ $4$ $3$
	=32 $2 = 16$ $2 = 8$ 0
2 =	
For Example:	
If the value of Pr.0	3-30 displays 0002h(Hex), it means AFM1and AFM2 are used by PLC.
	0=Not used by PLC
Weig	1=Used by PLC hts 2 <sup>7</sup> 2 <sup>6</sup> 2 <sup>5</sup> 2 <sup>4</sup> 2 <sup>3</sup> 2 <sup>2</sup> 2 <sup>1</sup> 2 <sup>0</sup>
-	Bit 0 0 0 0 0 0 1 0 ← AFM 1
	AFM 2
	Display value 2=1x2 <sup>1</sup> +0x2 <sup>0</sup>
	= bit $1 \times 2^1$ + bit $0 \times 2^0$
✓ 3 - 3 + AFM2 0-2	20mA Output Selection
	Factory Setting: 0
Sattings	0: 0-20mA output
Settings	
	1: 4-20mA output

	M1 DC output setting level	
✓ <a href="https://www.selfactures.com"></a>	M2 DC Output Setting Level	
		Factory Setting: 0.00
	tings 0.00~100.00%	
[]]-]Y Rese	serve	
✓ 83-35 AFM	M1 Filter Output Time	
~ 03-35 AFM	M2 Filter Output Time	
		Factory Setting: 0.01
Setti	tings 0.00~20.00 Seconds	
03-37		
	Serve	
03-43		
✓ () 3 - ЧЧ MOI	by AI level	
		Factory Setting: 0
Setti	tings 0: AVI	
	1: ACI	
	2: AUI	
✓ 83-45 ALU	Jpper level	
		Factory Setting: 50%
Setti	tings -100%~100%	
✓ 03-48 ALL	_ower level	
✓ 03-48 ALL		Factory Setting: 50%
	_ower level tings -100%~100%	Factory Setting: 50%
Setti		, c
Setti	tings -100%~100%	og signal level achieved.
Setti This function The MO activ	tings _100%~100% a requires working with Multi-function Output item "67" Analo	og signal level achieved.
Setti This function The MO activ the AI input is AI Upper leve	tings -100%~100% n requires working with Multi-function Output item "67" Analo ve when AI input level is higher than Pr03-45 AI Upper leve	og signal level achieved.
Setti This function The MO activ the AI input is	tings -100%~100% n requires working with Multi-function Output item "67" Analo ve when AI input level is higher than Pr03-45 AI Upper leve is lower that Pr03-46 AI Lower level.	og signal level achieved.
Setti This function The MO activ the AI input is AI Upper level C	tings -100%~100% n requires working with Multi-function Output item "67" Analo ve when AI input level is higher than Pr03-45 AI Upper leve is lower that Pr03-46 AI Lower level.	og signal level achieved.
Setti This function The MO activ the Al input is Al Upper leve C 3 - 4 7 ~ Res	tings -100%~100% n requires working with Multi-function Output item "67" Analove when AI input level is higher than Pr03-45 AI Upper levens lower that Pr03-46 AI Lower level. rel must be higher than AI Lower level serve	og signal level achieved.
Setti This function The MO activ the Al input is Al Upper leve C 3 - 4 7 ~ Res	tings -100%~100% n requires working with Multi-function Output item "67" Analo ve when AI input level is higher than Pr03-45 AI Upper leve is lower that Pr03-46 AI Lower level. rel must be higher than AI Lower level	og signal level achieved. I. The MO shutoffs when
Setti This function The MO activ the Al input is Al Upper leve C 3 - 4 7 Res C 3 - 4 9 Anal	tings -100%~100% n requires working with Multi-function Output item "67" Analo ve when AI input level is higher than Pr03-45 AI Upper leve is lower that Pr03-46 AI Lower level. rel must be higher than AI Lower level serve alog Input Curve Selection	og signal level achieved.
Setti This function The MO activ the Al input is Al Upper leve C 3 - 4 7 Res C 3 - 4 9 Anal	tings -100%~100% n requires working with Multi-function Output item "67" Analo ve when AI input level is higher than Pr03-45 AI Upper leve is lower that Pr03-46 AI Lower level. el must be higher than AI Lower level serve alog Input Curve Selection tings 0: Regular Curve	og signal level achieved. I. The MO shutoffs when
Setti This function The MO activ the Al input is Al Upper leve C 3 - 4 7 Res C 3 - 4 9 Anal	tings -100%~100% n requires working with Multi-function Output item "67" Analove when AI input level is higher than Pr03-45 AI Upper levels lower that Pr03-46 AI Lower level. The must be higher than AI Lower level serve alog Input Curve Selection tings 0: Regular Curve 1: 3 point curve of AVI	og signal level achieved. I. The MO shutoffs when
Setti This function The MO activ the Al input is Al Upper leve C 3 - 4 7 Res C 3 - 4 9 Anal	tings -100%~100% n requires working with Multi-function Output item "67" Analove when AI input level is higher than Pr03-45 AI Upper levels lower that Pr03-46 AI Lower level. rel must be higher than AI Lower level serve alog Input Curve Selection tings 0: Regular Curve 1: 3 point curve of AVI 2: 3 point curve of ACI	og signal level achieved. I. The MO shutoffs when
Setti This function The MO activ the Al input is Al Upper leve C 3 - 4 7 Res C 3 - 4 9 Anal	tings -100%~100% In requires working with Multi-function Output item "67" Analov ve when AI input level is higher than Pr03-45 AI Upper levels is lower that Pr03-46 AI Lower level. el must be higher than AI Lower level serve alog Input Curve Selection tings 0: Regular Curve 1: 3 point curve of AVI 2: 3 point curve of AVI 3: 3 point curve of AVI & ACI	og signal level achieved. I. The MO shutoffs when
Setti This function The MO activ the Al input is Al Upper leve C 3 - 4 7 Res C 3 - 4 9 Anal	tings -100%~100% n requires working with Multi-function Output item "67" Analove when AI input level is higher than Pr03-45 AI Upper levels lower that Pr03-46 AI Lower level. rel must be higher than AI Lower level serve alog Input Curve Selection tings 0: Regular Curve 1: 3 point curve of AVI 2: 3 point curve of ACI 3: 3 point curve of AVI & ACI 4: 3 point curve of AUI	og signal level achieved. I. The MO shutoffs when
Setti This function The MO activ the Al input is Al Upper leve C 3 - 4 7 Res C 3 - 4 9 Anal	tings -100%~100% n requires working with Multi-function Output item "67" Analove when AI input level is higher than Pr03-45 AI Upper levels s lower that Pr03-46 AI Lower level. rel must be higher than AI Lower level serve alog Input Curve Selection tings 0: Regular Curve 1: 3 point curve of AVI 2: 3 point curve of AVI 3: 3 point curve of AVI 4: 3 point curve of AVI 5: 3 point curve of AVI & AUI	og signal level achieved. I. The MO shutoffs when
Setti This function The MO activ the Al input is Al Upper leve C 3 - 4 7 Res C 3 - 4 9 Anal	tings -100%~100% n requires working with Multi-function Output item "67" Analove when AI input level is higher than Pr03-45 AI Upper levels lower that Pr03-46 AI Lower level. rel must be higher than AI Lower level serve alog Input Curve Selection tings 0: Regular Curve 1: 3 point curve of AVI 2: 3 point curve of ACI 3: 3 point curve of AVI & ACI 4: 3 point curve of AUI	og signal level achieved. I. The MO shutoffs when



Settings 0.00~100.00%





10%.

## 04 Multi-Step Speed Parameters

✓ This parameter can be set during operation.

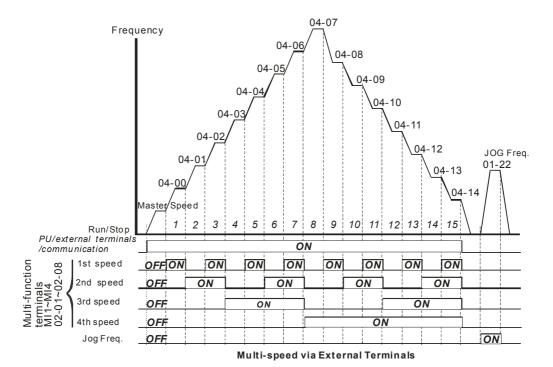
N	04-00	1st Step Speed Frequency
N	04-01	2nd Step Speed Frequency
N	04-02	3rd Step Speed Frequency
N	04-03	4th Step Speed Frequency
N	04-04	5th Step Speed Frequency
N	04-05	6th Step Speed Frequency
N	04-06	7th Step Speed Frequency
N	04-07	8th Step Speed Frequency
N	04-08	9th Step Speed Frequency
N	04-09	10th Step Speed Frequency
N	04-10	11th Step Speed Frequency
N	<u>[</u> ]4-;;	12th Step Speed Frequency
N	84-15	13th Step Speed Frequency
N	84-13	14th Step Speed Frequency
N	07-14	15th Step Speed Frequency

Factory Setting: 0.00

Settings 0.00~600.00Hz

□ The Multi-function Input Terminals (refer to setting 1~4 of Pr.02-01~02-08 and 02-26~02-31) are used to select one of the AC motor drive Multi-step speeds(max. 15 speeds). The speeds (frequencies) are determined by Pr.04-00 to 04-14 as shown in the following.

- The run/stop command can be controlled by the external terminal/digital keypad/communication via Pr.00-21.
- $\square$  Each one of multi-step speeds can be set within 0.00~600.00Hz during operation.
- Explanation for the timing diagram for multi-step speeds and external terminals The Related parameter settings are:
  - 1. Pr.04-00~04-14: setting multi-step speeds (to set the frequency of each step speed)
  - 2. Pr.02-01~02-08, 02-26~02-31: setting multi-function input terminals (multi-step speed 1~4)
    - Related parameters: 01-22 JOG Frequency, 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)



N	04-16	Position command 1 (pulse)
N	8-18	Position command 2 (pulse)
×	04-50	Position command 3 (pulse)
N	04-55	Position command 4 (pulse)
×	04-54	Position command 5 (pulse)
×	04-56	Position command 6 (pulse)
N	04-58	Position command 7 (pulse)
N	04-30	Position command 8 (pulse)
N	04-35	Position command 9 (pulse)
N	04-34	Position command 10 (pulse)
N	04-36	Position command 11 (pulse)
×	04-38	Position command 12 (pulse)
N	04-40	Position command 13 (pulse)
N	04-45	Position command 14 (pulse)
N	<u>ו</u> וּץ - ין ין	Position command 15 (pulse)

Factory Setting: 0

Settings -32767~32767

Please refer to Pr.02-01~02-08 (Multi-function Input Command) for description on setting 34 (Switch between multi-step position and multi-speed control) and setting 36 (Enable multi-step position learning function).

Multi-step position corresponding	MI4	MI3	MI2	MI1	Multi-step speed corresponding
10-19	0	0	0	0	Positioning for Encoder Position
04-16 Position command 1 (pulse)	0	0	0	1	04-00 1 <sup>st</sup> step speed frequency
04-18 Position command 2 (pulse)	0	0	1	0	04-01 2 <sup>nd</sup> step speed frequency
04-20 Position command 3 (pulse)	0	0	1	1	04-02 3 <sup>rd</sup> step speed frequency
04-22 Position command 4 (pulse)	0	1	0	0	04-03 4 <sup>th</sup> step speed frequency
04-24 Position command 5 (pulse)	0	1	0	1	04-04 5 <sup>th</sup> step speed frequency
04-26 Position command 6 (pulse)	0	1	1	0	04-05 6 <sup>th</sup> step speed frequency
04-28 Position command 7 (pulse)	0	1	1	1	04-06 7 <sup>th</sup> step speed frequency
04-30 Position command 8 (pulse)	1	0	0	0	04-07 8 <sup>th</sup> step speed frequency
04-32 Position command 9 (pulse)	1	0	0	1	04-08 9 <sup>th</sup> step speed frequency
04-34 Position command 10 (pulse)	1	0	1	0	04-09 10 <sup>th</sup> step speed frequency
04-36 Position command 11 (pulse)	1	0	1	1	04-10 11 <sup>th</sup> step speed frequency
04-38 Position command 12 (pulse)	1	1	0	0	04-11 12 <sup>th</sup> step speed frequency
04-40 Position command 13 (pulse)	1	1	0	1	04-12 13 <sup>th</sup> step speed frequency
04-42 Position command 14 (pulse)	1	1	1	0	04-13 14 <sup>th</sup> step speed frequency
04-44 Position command 15 (pulse)	1	1	1	1	04-14 15 <sup>th</sup> step speed frequency

×	84-15	Position command 1 (rotation)
N	04-17	Position command 2 (rotation)
N	04- 19	Position command 3 (rotation)
N	04-51	Position command 4 (rotation)
×	04-53	Position command 5 (rotation)
N	84-25	Position command 6 (rotation)
N	04-51	Position command 7 (rotation)
N	84-58	Position command 8 (rotation)
N	84-31	Position command 9 (rotation)
N	84-33	Position command 10 (rotation)
N	84-35	Position command 11 (rotation)
N	04-37	Position command 12 (rotation)
N	84-39	Position command 13 (rotation)
N	<u>[]</u> 4 - 4	Position command 14 (rotation)
N	04-43	Position command 15 (rotation)

To switch the target position of the external terminal, set multi-function input command, Pr.02-01=1, Pr.02-02=2, Pr.02-03=3, Pr.02-04= 4 by selecting the P2P target position via multi-step speed.
 Setting: Target Position = 04-15 × (10-01\*4) + 04-16

Multi-step Speed Status	Target Position of P2P			Maximum Speed of P2P			
0000		0		11-00 bit8=0	11-00 bit8=1		
0001	Position 1	04-15	04-16	11-43	04-00		
0010	Position 2	04-17	04-18		04-01		
0011	Position 3	04-19	04-20		04-02		
0100	Position 4	04-21	04-22		04-03		
0101	Position 5	04-23	04-24		04-04		
0110	Position 6	04-25	04-26		04-05		
0111	Position 7	04-27	04-28		04-06		
1000	Position 8	04-29	04-30	11-43	04-07		
1001	Position 9	04-31	04-32		04-08		
1010	Position 10	04-33	04-34		04-09		
1011	Position 11	04-35	04-36		04-10		
1100	Position 12	04-37	04-38		04-11		
1101	Position 13	04-39	04-40		04-12		
1110	Position 14	04-41	04-42		04-13		
1111	Position 15	04-43	04-44		04-14		

N	04-50	PLC Buffer	0					
N	04-5;	PLC Buffer	1					
N	04-52	PLC Buffer	2					
N	04-53	PLC Buffer	3					
N	04-54	PLC Buffer	4					
N	04-55	PLC Buffer	5					
N	04-56	PLC Buffer	6					
N	04-57	PLC Buffer	7					
N	04-58	PLC Buffer	8					
N	04-59	PLC Buffer	9					
×	04-60	PLC Buffer	10					
N	84-88	PLC Buffer	11					
N	84-88	PLC Buffer	12					
N	84-88	PLC Buffer	13					
N	84-88	PLC Buffer	14					
N	84-88	PLC Buffer	15					
N	84-88	PLC Buffer	16					
N	84-88	PLC Buffer	17					
×	84-88	PLC Buffer	18					
×	84-88	PLC Buffer	19					
-						ŀ	actory Se	tting: 0
		Settings		0~65535				-

The Pr 04-50~Pr04-69 can be combined with PLC or HMI programming for variety application.

## **05 Motor Parameters**

✓ This parameter can be set during operation.

Factory Setting: 0

- Settings 0: No function
  - 1: Rolling test for induction motor(IM) (Rs, Rr, Lm, Lx, no-load current) [motor running]
  - 2: Static test for induction motor [motor not running]
  - 3: No function
  - 4: Dynamic test for PM motor magnetic pole [motor running]
  - 5: Dynamic test for PM (SPM) motor [motor running]
  - 6: Rolling test for IM motor flux curve [motor running]
  - 12: FOC Sensorless inertia estimation [motor running]
  - 13: Static test for PM(IPM) motor

## Induction Motor

- This parameter can conduct motor parameters auto test. When setting as 1, motor will roll for more than one round; setting as 4, 5, 6, and 12, motor will roll less than one round.
- Press [Run] to begin auto tuning when the setting is done. The measured value will be written into motor 1 (Pr.05-05 ~05-09, Rs, Rr, Lm, Lx, no-load current) and motor 2 (Pr.05-17 to Pr.05-21) automatically.

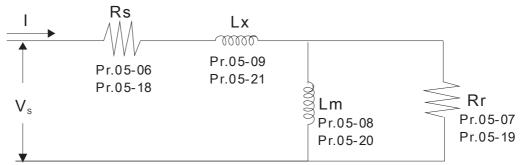
To begin AUTO-Tuning in rolling test:

- 1. Make sure that all the parameters are set to factory settings (Pr00-02=9 or 10) and the motor wiring is correct.
- 2. Make sure the motor has no-load before executing auto-tuning and the shaft is not connected to any belt or gear motor. It is recommended to set to 2 if the motor can't separate from the load.
- 3. Please set motor related parameters according to motor nameplate.

	Motor 1 Parameter	Motor 2 Parameter
Motor Rated Frequency	01-01	01-35
Motor Rated Voltage	01-02	01-36
Motor Full-load Current	05-01	05-13
Motor Rated Power	05-02	05-14
Motor Rated Speed	05-03	05-15
Motor Pole Numbers	05-04	05-16

- 4. Set Pr.05-00=1 and press [Run], the drive will begin auto-tuning. Please be aware of the motor that it starts spinning as [Run] is pressed.
- 5. When auto-tuning is completed, please check if the measured values are written into motor 1 (Pr.05-05 ~05-09) and motor 2 (Pr.05-17 ~05-21) automatically.

6. Mechanical equivalent circuit



- % If Pr.05-00 is set to 2 (static test), user needs to input the no-load current value of motor into Pr.05-05 for motor 1/Pr.05-17 for motor 2.
- Set Pr.05-00=6 to begin rolling test for IM motor flux curve. This function is available when the drive is in FOC/TQC Sensorless control. User may begin auto-tuning after setting up the motor information.
  - Set up Pr.01-01, 01-02, 05-01~05-04 according to the motor nameplate information •
  - ☑ Set Pr.05-00=6 and press [Run], make sure no loading is applied to the motor before setting Pr.05-00 to 6 and before performing auto-tuning.
- When Pr.05-00=12, the drive begins FOC Sensorless inertia estimation for IM motor. This function is available when the drive is in FOC/TQC Sensorless control. User may begin auto-tuning after setting up the motor information.
  - ☑ Note: Make sure the motor parameters (no-load current, Rs, Rr, Lm and Lx) of the drive are set before performing Pr.05-00=12 (auto-tuningfor FOC Sensorless interia estimation for IM motor).
  - 1. Set Pr.00-10=2 (torque mode)
- 2. Set Pr. 00-13=2 (TQCPG, Open-loop torque mode)
- 3. Set Pr. 05-00=12 and press [Run] to begin FOC Sensorless inertia measure
- 4. When the process of inertia estimation is completed, check Pr.11-01 (unit: PU Q8) and see if the measured value is acceptable.

Set up Sensorless FOC Mode

- 1. Set Pr.00-10 = 0 (speed mode)
- 2. Set Pr.00-11 = 5 (FOC sensorless mode)
- 3. Set bit0 of Pr.11-00 to 1 (use ASR gain function to automatically adjust the ASR bandwidth in Pr.11-03,11-04,11-05)

## 

- ☑ In torque/vector control mode, it is not recommended to have motors run in parallel.
- ☑ It is not recommended to use torque/vector control mode if motor rated power exceeds the rated power of the AC motor drive.
- ☑ When auto-tuning 2 motors, it needs to set multi-function input terminals (setting 14) or change Pr.05-22 for motor 1/motor 2 selection.
- ☑ The no-load current is usually 20~50% X rated current.
- The rated speed can not be greater than or equal to 120f/p (f = rated frequency Pr.01-01/01-35; P: number of motor poles Pr.05-04/05-16).

## Permanent Magnet Motor (PM)

Set Pr.05-00= 5 or 13 and press [Run] to begin auto tuning for PM motor. The measured values will be written into Pr.05-39 (Rs), Pr.05-40 & 41 (Ld & Lq) and Pr.05-43 (PM motor's Ke parameter).

To begin AUTO-Tuning for PM motor in rolling test:

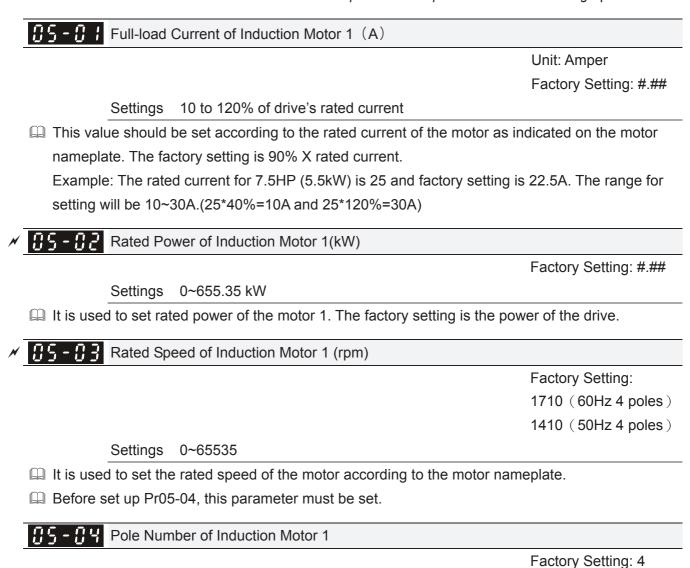
- 1. Make sure all the parameters are reset to factory setting and the motor wiring installation is correct.
- For PM motor, set Pr.05-33=1 for SPM or Pr.05-33=2 for IPM and complete the following settings according to your motor specifications, Pr.05-34 rated current, Pr.05-35 rated power, Pr.05-36 rated speed and Pr. 05-37 pole number. The acceleration time and deceleration time should be set according to your motor capacity.
- 3. Set Pr.05-00 to 5 and press [Run] to begin auto tuning for PM motor. Please be aware of the motor that it starts spinning as [Run] is pressed.
- 4. When auto-tuning is completed, please check if the measured values are written into Pr.05-39~05-41 and Pr.05-43 automatically.
  - Set Pr.05-00=4 and press [Run] to begin auto-tuning for PM motor PG offset angle. The measured value will be written into Pr.05-42 automatically.
  - ☑ Note 1: When execute auto-tuning for PM motor PG origin, please make sure the encoder setting are correct (Pr.10-00, 10-01, 10-02), otherwise the PG origin measure error and motor stall may occur.
  - ☑ Note 2: If PM motor runs in an opposite direction of the drive's command, switch any two of the UVW cable and re-connect, then execute PG origin search again. It is crucial to execute auto-tuning after the switch otherwise PG origin measure error and motor stall may occur.

Auto-tuning process for measuring PG offset angle of PM motor:

- 1. Set Pr.05-00=5 and press RUN, or manually input the values into Pr. 01-01, 05-34~-541 and Pr.05-43.
- 2. It is strongly suggested to remove the motor and unload before beings auto-tuning.
- 3. Set Pr.05-00=4 and press [Run] to begin auto-tuning. Please be aware of the motor that it starts spinning as [Run] is pressed.
- 4. When auto-tuning is completed, please check if the PG offset angle is written into Pr.05-42 automatically.

## 

When auto-tuning for PM motor is completed and the control mode setting is done, it is recommend to turn the drive's power off and restart again to ensure the drive operates according to the motor parameter settings.



Settings 2~20

It is used to set the number of motor poles (must be an even number).

- □ Set up Pr.05-04 after setting up Pr. 01-01 and Pr.05-03 to make sure motor operate normally.
- □ For example: the Pr05-04 factory setting range is "2~4". If use a 6 poles motor, to set up Pr01-01 and Pr05-03 according the motor nameplate, then the Pr05-04 setting range will become 2~6 automatically.

**BS - BS** No-load Current of Induction Motor 1 (A)

Unit: Amper

Factory Setting: #.##

Settings 0 to the factory setting in Pr.05-01

Definition The factory setting is 40% motor rated current.

Given For model with 110kW and above, default setting is 20% motor rated current.

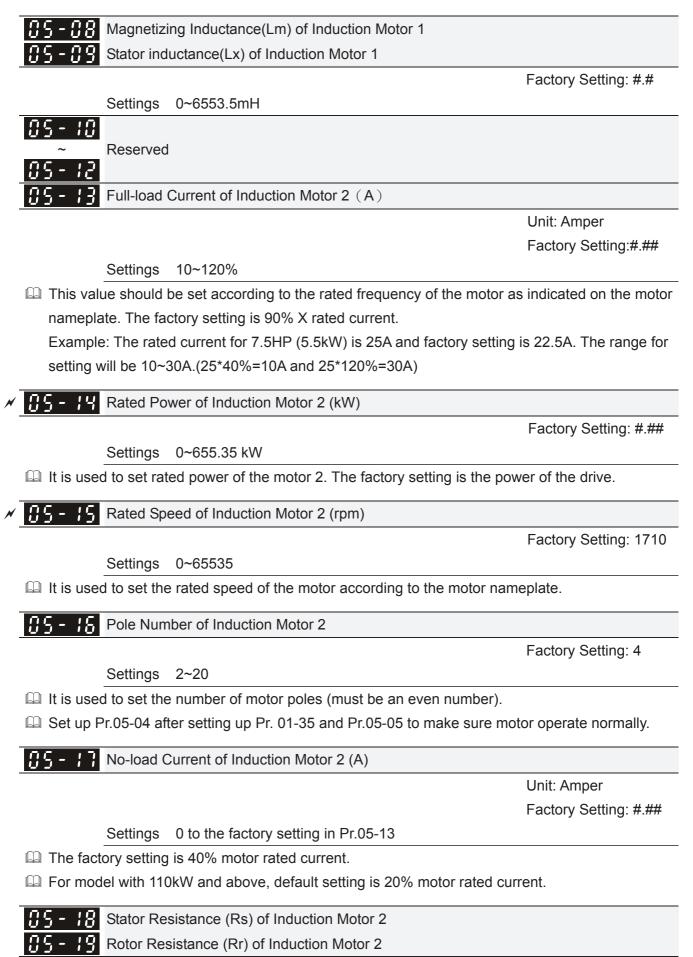


Stator Resistance(Rs) of Induction Motor 1

Rotor Resistance(Rr) of Induction Motor 1

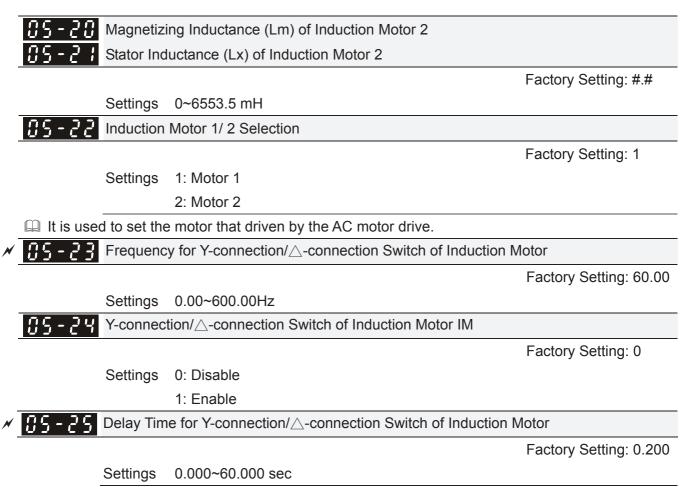
Factory Setting: #.###

Settings  $0~65.535\Omega$ 

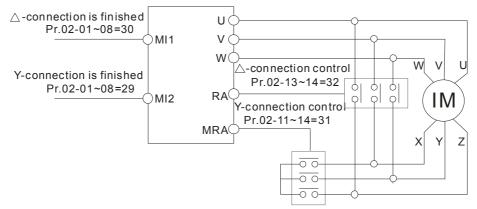


Settings 0~65.535Ω

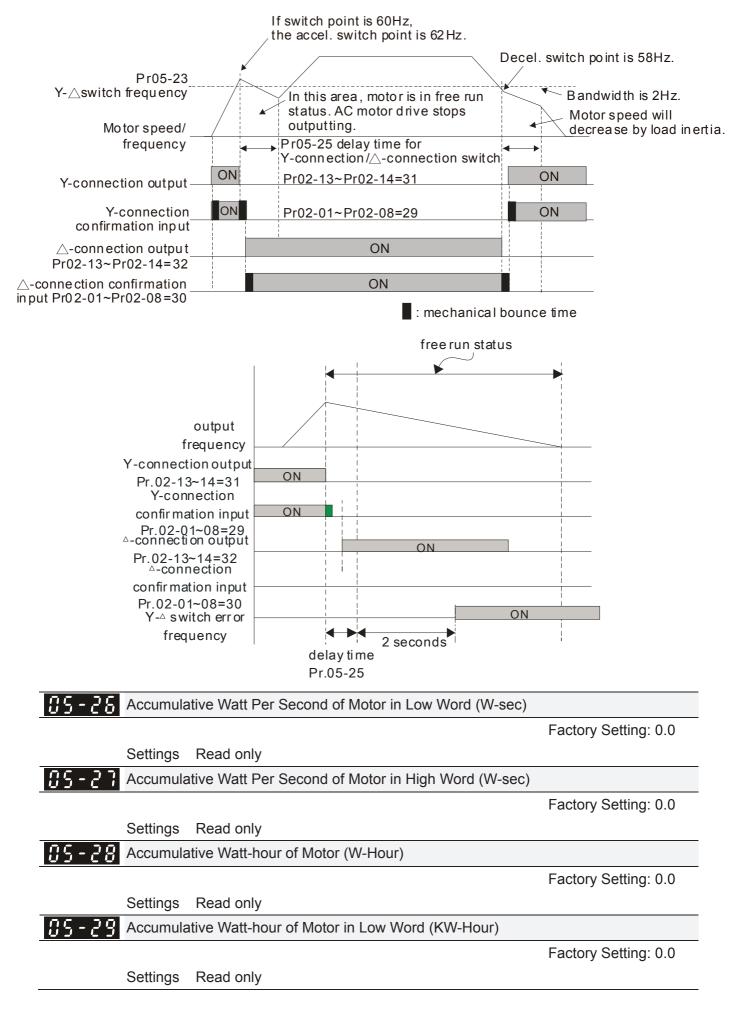
Factory Setting: #.###



- P.05-23 and Pr.05-25 are applied in the wide range motors and the motor coil will execute the switch of Y-connection/△-connection as required. (The wide range motors has relation with the motor design. In general, it has higher torque at low speed and Y-connection and it has higher speed at high speed and connection.
- $\square$  Pr.05-24 is used to enable/disable Y-connection/ $\Delta$  connection Switch.
- When Pr.05-24 is set to 1, the drive will select by Pr.05-23 setting and current motor frequency to switch motor to Y-connection or △- connection. At the same time, it will also affect motor parameters.
- $\square$  Pr.05-25 is used to set the switch delay time of Y-connection/ $\triangle$  connection.
- When output frequency reaches Y-connection/∆-connection switch frequency, drive will delay by Pr.05-25 before multi-function output terminals are active.



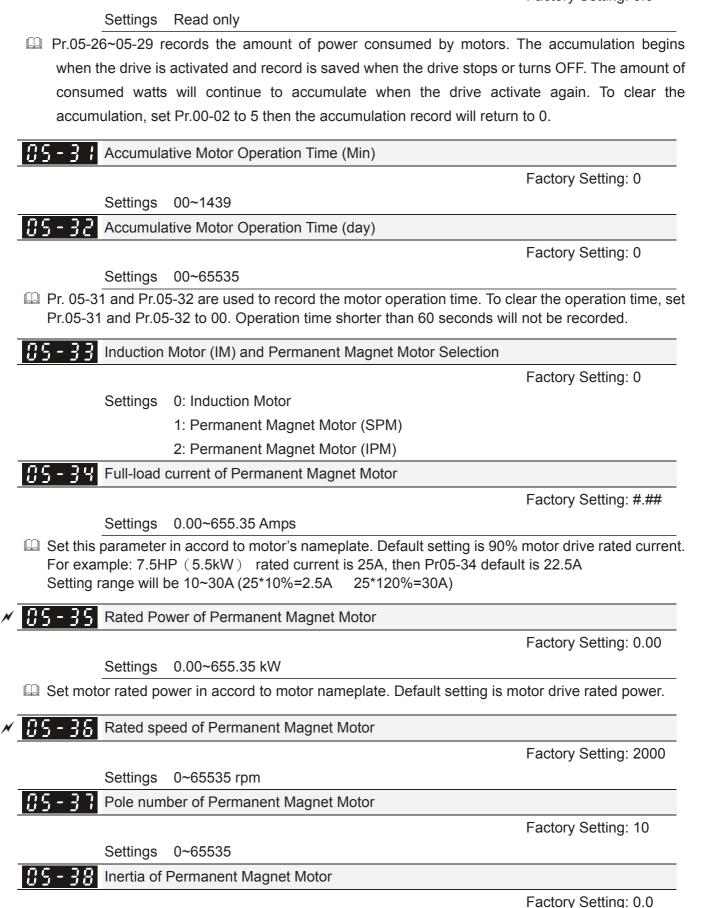
- Y- riangle connection switch: can be used for wide range motor
- Y -connection for low speed: higher torque can be used for rigid tapping
- riangle -connection for high speed: higher torque can be used for high-speed drilling





**35 - 36** Accumulative Watt-hour of Motor in High Word (KW-Hour)

Factory Setting: 0.0



0.0~6553.5 kg.cm<sup>2</sup> (0.0001kg.m<sup>2</sup>) Settings

Rated P (kW		0.4	0.75	1.5	2.2	3.7	5.5	7.5	9.3
Rotor in (kg.cn	ertia	1.2	3.0	6.6	15.8	25.7	49.6	82.0	121.6
Rated P (kW	)	11	14.1	18.2	27	33	40	46	54
Rotor in (kg.cn	-	177.0	211.0	265.0	308.0	527.0	866.0	1082.0	1267.6
Rated P (kW		Above 54							
Rotor in	,								
(kg.cn	-	1515.0							
			-						
85-39	Stator	Resistan	ce of PM N	Notor					
								Factory Se	ettina: 0.0
	Settin	as 0.000	)~65.535Ω	<b>)</b>					
00 10	-	•							
05-40	Perma	anent Mag	net Motor	Ld					
								Factory Se	etting: 0.00
	Settin	gs 0.00~	~655.35 m	Η					
85-41	Perma	anent Mag	net Motor	Lq					
								Factory Se	tting: 0.00
	Sottin	aa 0.00-	~655.35 m	ц					
	Settin	•							
05-42	PG O	ffset angle	e of PM Mo	otor					
							l	Factory Se	etting: 0
	Settin	gs 0.0~3	360.0°						
📖 When F	Pr 05-00	) is set to 4	1 the drive	- will deter	ct offset ar	ndle and w	rite into P	r 05-42	
		- 10 001 10 -	i, iio uiiv			igic and w		1.00 12.	
05-43	Ke pa	rameter o	f PM Moto	r					
							I	Unit: V/100	00rpm
								Factory Se	etting: 0
	Sottin	0.65	525					2	Ũ

Settings 0~65535

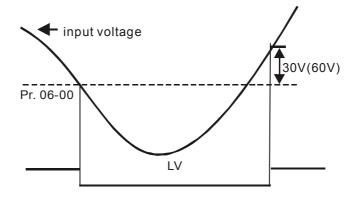
Default value will follow the chart

# **06 Protection Parameters**

✓ This parameter can be set during operation.

<b>US - UU</b> Low Volta	ge Level	
		Factory Setting:
Settings	230V Series:	
	Frame A ~D(including D0): 150.0~ 220.0 Vdc	180.0
	Frame E and above: 190.0~220.0V	200.0
	Frame A ~D(including D0):	
	460V Series: 300.0~440.0V	360.0
	Frame E and above: 380.0~440.0V	400.0

- This parameter is used to set the Low Voltage level. When the DC BUS voltage is lower than Pr06-00, drive will stop output and free to stop.
- If the drive is triggered LV fault during the operation, drive will stop output and free to stop. There are three LV faults, LvA (LV during acceleration), LvD (LV during deceleration), and LvN (LV in constant speed) which will be triggered in different stage of drive operation. These faults need to be reset manually to restart the drive, while setting restart after momentary power off function (Pr07-06, Pr07-07), the drive will restart automatically.
- If LV is triggered when the drive is in stop status, the fault is named LvS (LV during stop), which will not be recorded, and the drive will restart automatically when input voltage is 30Vdc (230V series) or 60Vdc (460V series) higher than LV level.





Factory Setting: 380.0/760.0

Settings 230V Series: 0.0~450.0V 460V Series:0.0~900.0V 0: Disabled

- When Pr.06-01 is set to 0.0, the over-voltage stall prevention function is disabled. When braking units or resistors are connected to the drive, this setting is suggested.
- When the setting is not 0.0, the over-voltage stall prevention is activated. This setting should refer to power supply system and loading. If the setting is too low, then over-voltage stall prevention will be easily activate, which may increase deceleration time.
- Related parameters: Pr01-13, Pr01-15, Pr01-17, Pr01-19 Decel. Time 1~4, Pr02-13~Pr02-14 Multiple-function output (Relay 1 and 2), Pr02-16~Pr02-17 Multiple-function output (MO1,2), and Pr06-02 selection for over-voltage stall prevention.

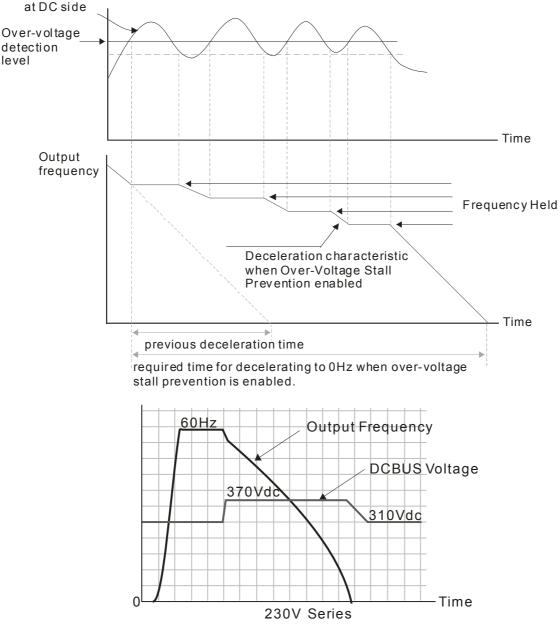


Selection for Over-voltage Stall Prevention

Factory Setting: 0

Settings0: Traditional over-voltage stall prevention1: Smart over-voltage prevention

- This function is used for the occasion that the load inertia is unsure. When it stops in the normal load, the over-voltage won't occur during deceleration and fulfill the setting of deceleration time. Sometimes, it may not stop due to over-voltage during decelerating to stop when increasing the load regenerative inertia. At this moment, the AC drive will auto add the deceleration time until drive stop.
- Pr 06-02 is set to 0: During deceleration, the DC bus voltage may exceed its maximum allowable value due to motor regeneration in some situation, such as loading inertia is too high or Decel. Time is set too short. When traditional over-voltage stall prevention is enabled, the drive will not decelerate further and keep the output frequency constant until the voltage drops below the setting value again.
- When Pr 06-02 is set to 1, the drive will maintain DCbus voltage when decelerating and prevent OV. High-voltage

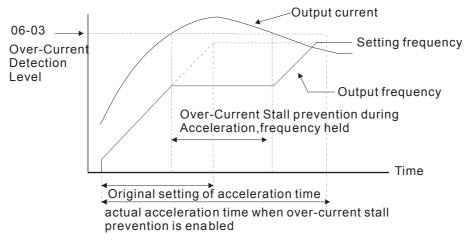


- When the over-voltage stall prevention is enabled, drive deceleration time will be larger than the setting.
- I When there is any problem as using deceleration time, refer to the following items to solve it.
  - 1. Add the suitable deceleration time.
  - 2. Add brake resistor (refer to Chapter 7-1 for details) to dissipate the electrical energy that regenerated from the motor as heat type.
- Related parameters: Pr01-13, Pr01-15, Pr01-17, Pr01-19 Decel. Time 1~4, Pr02-13~Pr02-14 Multiple-function output (Relay 1 and 2), Pr02-16~Pr02-17 Multiple-function output (MO1,2), and Pr06-01 over-voltage stall prevention.

## ✓ 3 5 - 3 3 Over-current Stall Prevention during Acceleration

SettingsNormal duty: 0~160% (100%: drive's rated current)Factory Setting: 120Heavy duty: 0~180% (100%: drive's rated current)Factory Setting: 150

- I This parameter only works in VF, VFPG, and SVC control mode.
- If the motor load is too large or drive acceleration time is too short, the AC drive output current may increase abruptly during acceleration and it may cause motor damage or trigger protection functions (OL or OC). This parameter is used to prevent this situation.
- During acceleration, the AC drive output current may increase abruptly and exceed the value specified by Pr.06-03 due to rapid acceleration or excessive load on the motor. When this function is enabled, the AC drive will stop accelerating and keep the output frequency constant until the current drops below the maximum value.
- When the over-current stall prevention is enabled, drive acceleration time will be larger than the setting.
- When the Over-Current Stall Prevention occurs due to too small motor capacity or in the factory setting, please decrease Pr.06-03 setting.
- When there is any problem by using acceleration time, refer to the following items to solve it.
- Related parameters: Pr.01-12, 01-14, 01-16, 01-18 (settings of accel. time 1~4), Pr.01-44
  - 1. dd the suitable acceleration time.
  - 2. Setting Pr.01-44 Optimal Acceleration/Deceleration Setting to 1, 3 or 4 (auto accel.)
- Optimal Acceleration/Deceleration Setting, Pr.02-13~02-14 (Multi-function Output 1 RY1, RY2), Pr.
   02-16~02-17 Multi-function Output (MO1, 2)

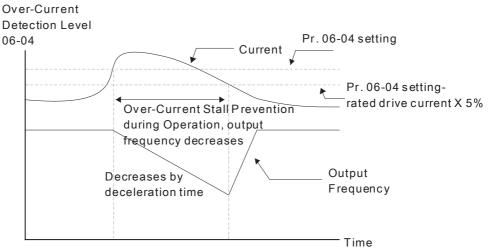




Over-current Stall Prevention during Operation

SettingsNormal duty: 0~160% (100%: drive's rated current)Factory Setting: 120Heavy duty: 0~180% (100%: drive's rated current)Factory Setting: 150

- This parameter only works in VF, VFPG, and SVC control mode.
- It is a protection for drive to auto decrease output frequency when the motor is over-load abruptly during motor constant operation.
- If the output current exceeds the setting specified in Pr.06-04 when the drive is operating, the drive will decrease its output frequency (according to Pr.06-05) to prevent the motor stall. If the output current is lower than the setting specified in Pr.06-04, the drive will accelerate (according to Pr.06-05) again to catch up with the set frequency command value.



over-current stall prevention during operation

✓ 🕂 🗄 - 🕂 5 Accel./Decel. Time Selection of Stall Prevention at Constant Speed

Factory Setting: 0

Settings 0: by current accel/decel time

- 1: by the 1st accel/decel time
  - 2: by the 2nd accel/decel time
  - 3: by the 3rd accel/decel time
  - 4: by the 4th accel/decel time
  - 5: by auto accel/decel

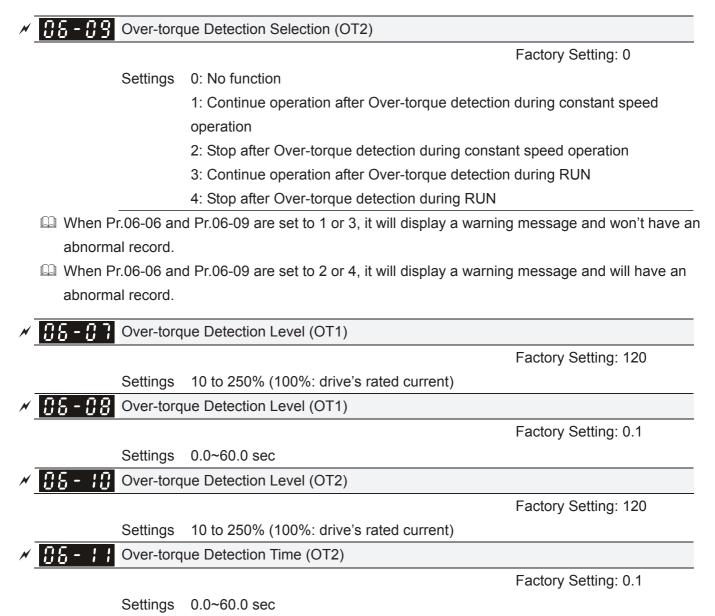
It is used to set the accel./decel. time selection when stall prevention occurs at constant speed.

**Over-torque Detection Selection (OT1)** 

Factory Setting: 0

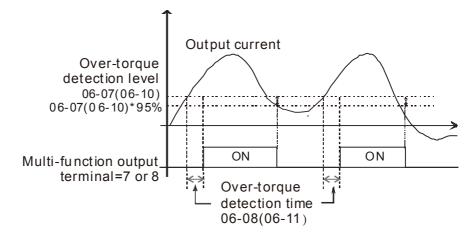
Settings 0: No function

- 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

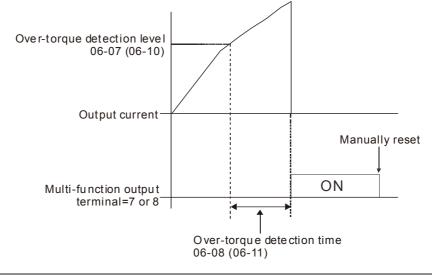


When the output current exceeds the over-torque detection level (Pr06-07 or Pr06-10) and also exceeds Pr06-08 or Pr06-11, the over torque detection will follow the setting of Pr06-06 and Pr06-09.

When Pr06-06 or Pr06-09 is set to 1 or 3, the motor drive will have the ot1/ot2 warning after Over Torque Detection, while the motor drive will keep running. The warning will be off only until the output current is smaller than the 5% of the over-torque detection level (Pr06-07 and Pr06-10).



When Pr06-06 or Pr06-09 is set to 2 or 4, the motor drive will have the ot1/ot2 fault after Over Torque Detection. Then the motor drive stop running until it is manually reset.





```
Factory Setting: 170
```

```
Settings 0~250% (100%: drive's rated current)
```

Pr.06-12 sets the maximum output current of the drive. Pr.06-12 and Pr.11-17 ~ Pr.11-20 are used to set the drive's output current limit. When the drive is in VF, SVC or VFPG control mode, output frequency will decreases as the output current reaches current limit. It acts as current stall prevention.

N	<b>B</b> - <b>B</b> Electronic Thermal Relay Selection (Motor 1)
N	<b>BE</b> - 2 C Electronic Thermal Relay Selection (Motor 2)

Factory Setting: 2

Settings 0: Special motor (with external forced cooling)

1: Self-cooled motor (so motor with fan on the shaft)

2: Disable

- It is used to prevent self-cooled motor overheats under low speed. User can use electronic thermal relay to limit driver's output power.
- Setting as 0 is suitable for special motor (motor fan using independent power supply). For this kind of motor, the cooling capacity is not related to motor speed obviously. So the action of electronic thermal relay will remain stable in low speed, which can ensure the motor's load capability in low speed.
- Setting as 1 is suitable for standard motor (motor fan is fixed on the rotor shaft). For this kind of motor, the cooling capacity is low in low speed, and the action of electronic thermal relay will reduce the action time, which ensure the life of motor.
- When the power ON/OFF is often switched, even setting as 0 or 1 can bot protect the motor well. It is because when the power is switched off, the electronic thermal relay protection will be reset. If there are several motors connected to one motor drive, please install electronic thermal relay in each motor respectively.



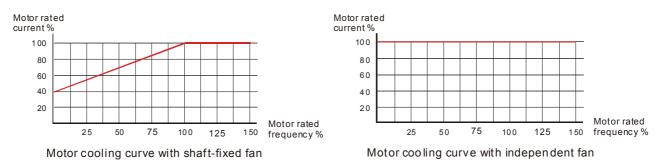
Electronic Thermal Characteristic for Motor 1

Electronic Thermal Characteristic for Motor 2

Factory Setting: 60.0

Settings 30.0~600.0 sec

- The parameter is set by the 150% of motor rated current and the setting of Pr.06-14 and Pr.06-28 to prevent the motor damaged from overheating. When it reaches the setting, it will display "EoL1/EoL2" and the motor will be in free running.
- This parameter is to set the action time of electronic thermal relay. It works based on the I2t characteristic curve of electronic thermal relay, output frequency and current of motor drive, and operation time to prevent motor from over-heat.



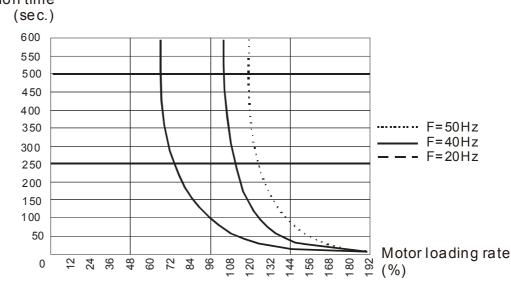
- Dependence on the setting of Pr06-13/Pr06-27.
  - 1. 06-13 or 06-27 is set 0 (using special motor) :

When output current of motor drive is higher than 150% of motor current (refer to motor cooling curve with independent fan), motor drive will start to count the time. When the accumulated time exceeds Pr06-14 or 06-28, electronic thermal relay will act.

2. 06-13 or 06-27 is set 0 (using standard motor) :

When output current of motor drive is higher than 150% of motor current (refer to motor cooling curve with shaft-fixed fan), motor drive will start to count the time. When the accumulated time exceeds Pr06-14 or 06-28, electronic thermal relay will act.

The real electronic thermal relay action time will adjust with drive output current (shown as motor loading rate). When the current is high, the action time is short; when the current is high, the action time is short. Please refer to following chart:



Operation time (sec.)



Heat Sink Over-heat (OH) Warning

Factory Setting: 105.0

```
Settings 0.0~110.0°C
```

- When using heavy duty or advanced control mode, the OH warning will be disabled if Pr06-15 remains as default. When the temperature reaches 100°C, motor drive will stop with IGBT over-heat fault.
- $\square$  When using normal duty or general control mode, the OH warning will be disabled if Pr06-15 is set to 110°C. When the temperature reaches 110°C, motor drive will stop with IGBT over-heat fault.

Factory Setting: 50

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

When operation frequency is larger than Pr.01-01; e.g. Pr06-03=150%, Pr. 06-04=100% and Pr. 06-16=80%:

Calculate the Stall Prevention Level during acceleration: Pr.06-03 \* Pr.06-16=150x80%=120%. Calculate the Stall Prevention Level at constant speed: Pr.06-04 \* Pr.06-16=100x80%=80%.

<b>36 - 17</b> Fault Record 1 (Present Fault Record)
<b>36 - 18</b> Fault Record 2
<b>36 - 19</b> Fault Record 3
<b>36-23</b> Fault Record 4
<b>36-2</b> Fault Record 5
<b>38-22</b> Fault Record 6

## Settings

- 0: No fault record
- 1: Over-current during acceleration (ocA)
- 2: Over-current during deceleration (ocd)
- 3: Over-current during constant speed(ocn)
- 4: Ground fault (GFF)
- 5: IGBT short-circuit (occ)
- 6: Over-current at stop (ocS)
- 7: Over-voltage during acceleration (ovA)
- 8: Over-voltage during deceleration (ovd)
- 9: Over-voltage during constant speed (ovn)
- 10: Over-voltage at stop (ovS)
- 11: Low-voltage during acceleration (LvA)
- 12: Low-voltage during deceleration (Lvd)
- 13: Low-voltage during constant speed (Lvn)
- 14: Stop mid-low voltage (LvS)
- 15: Phase loss protection (OrP)
- 16: IGBT over-heat (oH1)
- 17: Capacitance over-heat (oH2) (for 40hp above)

- 18: tH1o (TH1 open: IGBT over-heat protection error)
- 19: tH2o (TH2 open: capacitance over-heat protection error)
- 20: Reserved
- 21: Drive over-load (oL)
- 22: Electronics thermal relay 1 (EoL1)
- 23: Electronics thermal relay 2 (EoL2)
- 24: Motor PTC overheat (oH3) (PTC)
- 25: Reserved
- 26: Over-torque 1 (ot1)
- 27: Over-torque 2 (ot2)
- 28: Low current (uC)
- 29: Home limit error (LMIT)
- 30: Memory write-in error (cF1)
- 31: Memory read-out error (cF2)
- 32: Reserved
- 33: U-phase current detection error (cd1)
- 34: V-phase current detection error (cd2)
- 35: W-phase current detection error (cd3)
- 36: Clamp current detection error (Hd0)
- 37: Over-current detection error (Hd1)
- 38: Over-voltage detection error (Hd2)
- 39: occ IGBT short circuit detection error (Hd3)
- 40: Auto tuning error (AUE)
- 41: PID feedback loss (AFE)
- 42: PG feedback error (PGF1)
- 43: PG feedback loss (PGF2)
- 44: PG feedback stall (PGF3)
- 45: PG slip error (PGF4)
- 46: PG ref loss (PGr1)
- 47: PG ref loss (PGr2)
- 48: Analog current input loss (ACE)
- 49: External fault input (EF)
- 50: Emergency stop (EF1)
- 51: External Base Block (bb)
- 52: Password error (PcodE)
- 53: Reserved
- 54: Communication error (CE1)
- 55: Communication error (CE2)
- 56: Communication error (CE3)
- 57: Communication error (CE4)

- 58: Communication Time-out (CE10)
- 59: PU Time-out (CP10)
- 60: Brake transistor error (bF)
- 61: Y-connection/ \_- connection switch error (ydc)
- 62: Decel. Energy Backup Error (dEb)
- 63: Slip error (oSL)
- 64: Electromagnet switch error (ryF)
- 65: PG Card Error (PGF5)
- 66~67: Reserved
- 68: Sensorless estimated speed have wrong direction
- 69: Sensorless estimated speed is over speed
- 70: Sensorless estimated speed deviated
- 71: Reserved
- 72: STO Loss 1
- 73: External safety gate S1
- 74~75: Reserved
- 76: STO
- 77: STO Loss 2
- 78: STO Loss 3
- 79: Uocc U phase over current (Detection begins as RUN is pressed, software protection)
- 80: Vocc V phase over current (Detection begins as RUN is pressed, software protection)
- 81: Wocc W phase over current (Detection begins as RUN is pressed, software protection)
- 82: OPHL U phase output phase loss
- 83: OPHL Vphase output phase loss
- 84: OPHL Wphase output phase loss
- 85: PG-02U ABZ hardware disconnection
- 86: PG-02U UVW hardware disconnection
- 87~88: Reserved
- 89: Initial rotor position detection error
- 90: Inner PLC function is forced to stop
- 91~100: Reserved
- 101: CGdE CANopen software disconnect1
- 102: CHbE CANopen software disconnect2
- 103: CSYE CANopen synchronous error
- 104: CbFE CANopen hardware disconnect
- 105: CIdE CANopen index setting error
- 106: CAdE CANopen slave station number setting error
- 107: CFrE CANopen index setting exceed limit
- 108~110: Reserved
- 111: InrCOM Internal communication overtime error

112: PM sensorless shaft Lock error

113: Software OC

- B When the fault occurs and force stopping, it will record in this parameter.
- At stop with low voltage Lv (LvS warn, no record). During operation with mid-low voltage Lv (LvA, Lvd, Lvn error, will record).
- Setting 62: when dEb function is enabled, the drive will execute dEb and record to the Pr.06-17 to Pr.06-22 simultaneously.

N	<b>36-23</b> Fault Output Option 1	
N	B   P     Fault Output Option 2	
N	<b>CS-25</b> Fault Output Option 3	
N	<b>CS-25</b> Fault Output Option 4	

Factory Setting: 0

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

These parameters can be used with multi-function output (set to 35-38) for the specific requirement. When the fault occurs, the corresponding terminals will be activated (It needs to convert binary value to decimal value to fill in Pr.06-23 to Pr.06-26).

Fault Cada	Bit0	Bit1	Bit2	Bit3	Bit4	Bit5	Bit6
Fault Code	current	Volt.	OL	SYS	FBK	EXI	CE
0: No fault							
1: Over-current during acceleration (ocA)	•						
2: Over-current during deceleration (ocd)	•						
3: Over-current during constant speed(ocn)	•						
4: Ground fault (GFF)	•						
5: IGBT short-circuit (occ)	•						
6: Over-current at stop (ocS)	•						
7: Over-voltage during acceleration (ovA)		•					
8: Over-voltage during deceleration (ovd)		•					
9: Over-voltage during constant speed (ovn)		•					
10: Over-voltage at stop (ovS)		•					
11: Low-voltage during acceleration (LvA)		•					
12: Low-voltage during deceleration (Lvd)		•					
13: Low-voltage during constant speed (Lvn)		•					
14: Stop mid-low voltage (LvS)		•					
15: Phase loss protection (OrP)		•					
16: IGBT over-heat (oH1)			•				
17: Capacitance over-heat (oH2)			•				
18: tH1o (TH1 open)			•				
19: tH2o (TH2 open)			•				
20: Reserved							
21: Drive over-load (oL)			•				

#### Bit0 Bit1 Bit2 Bit3 Bit4 Bit5 Bit6 Fault Code current Volt. OL SYS FBK EXI CE 22: Electronics thermal relay 1 (EoL1) • 23: Electronics thermal relay 2 (EoL2) • 24: Motor PTC overheat (oH3) (PTC) 25: Reserved 26: Over-torque 1 (ot1) • 27: Over-torque 2 (ot2) • 28: Low current (uC) • 29: Home limit error (LMIT) 30: Memory write-in error (cF1) • 31: Memory read-out error (cF2) • 32: Reserved 33: U-phase current detection error (cd1) 34: V-phase current detection error (cd2) • 35: W-phase current detection error (cd3) ۲ 36: Clamp current detection error (Hd0) • 37: Over-current detection error (Hd1) 38: Over-voltage detection error (Hd2) • 39: occ IGBT short circuit detection error (Hd3) • 40: Auto tuning error (AUE) • 41: PID feedback loss (AFE) 42: DC foodbook orror (DCE1)

## Chapter 12 Description of Parameter Settings | C2000 Series

42: PG feedback error (PGF1)			•		
43: PG feedback loss (PGF2)			•		
44: PG feedback stall (PGF3)			•		
45: PG slip error (PGF4)			•		
46: PG ref loss (PGr1)			•		
47: PG ref loss (PGr2)			•		
48: Analog current input loss (ACE)			•		
49: External fault input (EF)				•	
50: Emergency stop (EF1)				•	
51: External Base Block (bb)				•	
52: Password error (PcodE)		•			
53: Reserved					
54: Communication error (CE1)					•
55: Communication error (CE2)					•
56: Communication error (CE3)					•
57: Communication error (CE4)					•
58: Communication Time-out (CE10)					•
59: PU Time-out (CP10)					•

## Chapter 12 Description of Parameter Settings | C2000 Series

Fault Code	Bit0	Bit1	Bit2	Bit3	Bit4	Bit5	Bit6
	current	Volt.	OL	SYS	FBK	EXI	CE
60: Brake transistor error (bF)						•	
61: Y-connection/						•	
(ydc)							
62: Decel. Energy Backup Error (dEb)		•					
63: Slip error (oSL)						•	
64: Electromagnet switch error (ryF)						•	
65 : PG Card Error (PGF5)						•	
66~67: Reserved							
68: Sensorless estimated speed have wrong							
direction							
69: Sensorless estimated speed is over speed							
70: Sensorless estimated speed deviated							
71: Reserved							
72: STO Loss 1				•			
73: External safety gate S1				•			
74~75: Reserved							
76: STO				•			
77: STO Loss 2				•			
78: STO Loss 3				•			
79: U phase over current (Uocc)	•						
80: V phase over current (Vocc)	•						
81: W phase over current (Wocc)	•						
82: OPHL U phase output phase loss	•						
83: OPHL Vphase output phase loss	•						
84: OPHL Wphase output phase loss	•						
85: PG-02U ABZ hardware disconnection					•		
86: PG-02U UVW hardware disconnection					•		
87~88: Reserved	1				1		
89: Initial rotor position detection error							
90: Inner PLC function is forced to stop							
91~100: Reserved	·						
101: CGdE CANopen software disconnect1							•
102: CHbE CANopen software disconnect2							•
103: CSYE CANopen synchronous error							•
104: CbFE CANopen hardware disconnect							•
105: CIdE CANopen index setting error							•
106: CAdE CANopen slave station number setting error							•
107: CFrE CANopen index setting exceed limit							•

## Chapter 12 Description of Parameter Settings | C2000 Series

Fault Code		Bit1	Bit2	Bit3	Bit4	Bit5	Bit6
Fault Code	current	Volt.	OL	SYS	FBK	EXI	CE
108~110: Reserved							-
111: InrCOM Internal communication overtime error							•
112: PM sensorless shaft Lock error							
113: Software OC							

## ✓ ☐ 5 - 2 9 PTC (Positive Temperature Coefficient) Detection Selection

Factory Setting: 0

Settings 0: Warn and keep operating

- 1: Warn and ramp to stop
- 2: Warn and coast to stop
- 3: No warning

Pr.06-29 setting defines how the will drive operate after PTC detection.

✓ 36 - 38 PTC Level

Factory Setting: 50.0

It needs to set AVI/ACI/AUI analog input function Pr.03-00~03-02 to 6 (P.T.C. thermistor input value).

It is used to set the PTC level, and the corresponding value for 100% is max. analog input value.

Frequency Command for Malfunction

Settings 0.0~100.0%

Factory Setting: Read only

Settings 0.00~655.35Hz

When malfunction occurs, use can check the frequency command. If it happens again, it will overwrite the previous record.

**G** - **G** Output Frequency at Malfunction

Factory Setting: Read only

Settings 0.00~655.35Hz

When malfunction occurs, use can check the current frequency command. If it happens again, it will overwrite the previous record.

**Output Voltage at Malfunction** 

Factory Setting: Read only

Settings 0.0~6553.5V

When malfunction occurs, user can check current output voltage. If it happens again, it will overwrite the previous record.

**DC** Voltage at Malfunction

Factory Setting: Read only

Settings 0.0~6553.5V

When malfunction occurs, user can check the current DC voltage. If it happens again, it will overwrite the previous record.



Output Current at Malfunction

Factory Setting: Read only

Settings 0.00~655.35Amp

When malfunction occurs, user can check the current output current. If it happens again, it will overwrite the previous record.

IGBT Temperature at Malfunction

Settings 0.0~6553.5℃

When malfunction occurs, user can check the current IGBT temperature. If it happens again, it will

overwrite the previous record.

Capacitance Temperature at Malfunction

Factory Setting: Read only

Factory Setting: Read only

Settings -3276.7~3276.7℃

When malfunction occurs, user can check the current capacitance temperature. If it happens again, it will overwrite the previous record.

**Motor Speed in rpm at Malfunction** 

Factory Setting: Read only

Settings -3276.7~3276.7 rpm

When malfunction occurs, user can check the current motor speed in rpm. If it happens again, it will overwrite the previous record.

**Torque Command at Malfunction** 85-33

Factory Setting: Read only

Settings -3276.7~3276.7

When malfunction occurs, user can check the current torque command. If it happens again, it will overwrite the previous record.

06-40 Status of Multi-function Input Terminal at Malfunction

Factory Setting: Read only

Settings 0000h~FFFFh

Status of Multi-function Output Terminal at Malfunction 66

Factory Setting: Read only

Settings 0000h~FFFFh

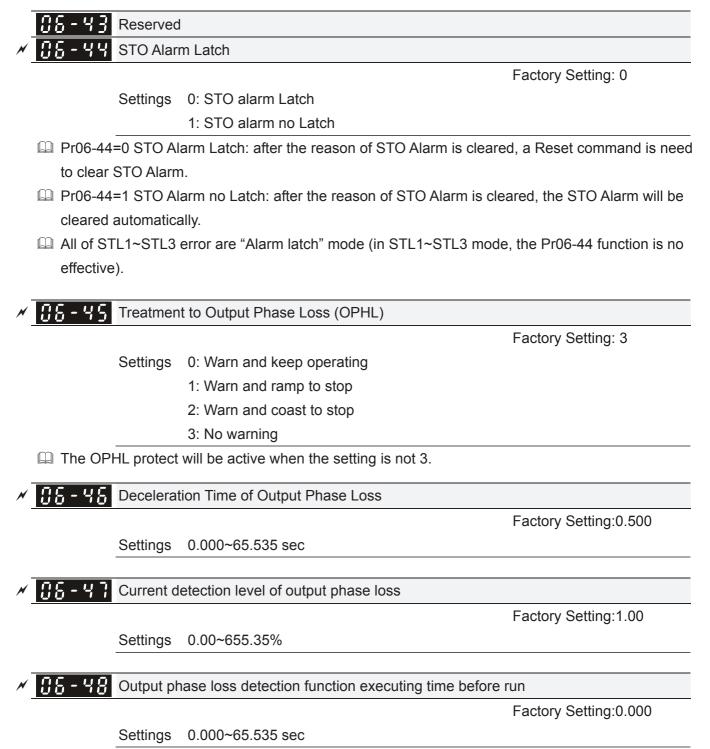
I When malfunction occurs, user can check the status of multi-function input/output terminals. If it happens again, it will overwrite the previous record.

Drive Status at Malfunction

Factory Setting: Read only

Settings 0000H~FFFFh

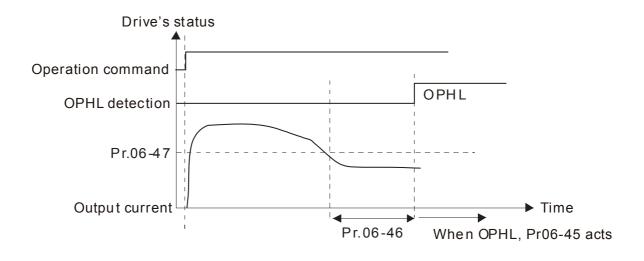
When malfunction occurs, please check the drive status (communication address 2119H). If malfunction happens again, the previous record will be overwritten by this parameter.



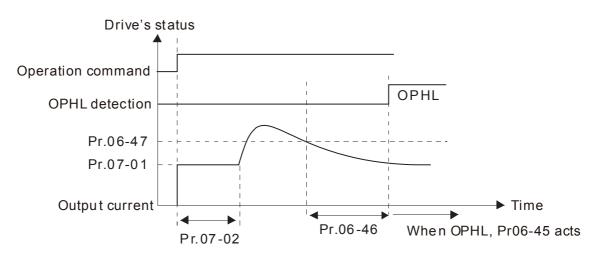
When Pr06-48 is 0, OPHL detection function will be disabled

Status 1 : Motor drive is in operation

Any phase is less than Pr06-47 setting level, and exceeds Pr06-46 setting time, motor drive will perform Pr06-45 setting.



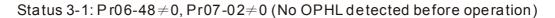
Status 2 : Motor drive is in stop; Pr06-48=0 ; Pr07-02≠0 After motor drive starts, DC brake will be applied in accord to Pr07-01 and Pr07-02. During this period, OPHL detection will not be conducted. After DC brake, motor drive starts to run, and conducts the OPHL protection as mentioned in status 1.

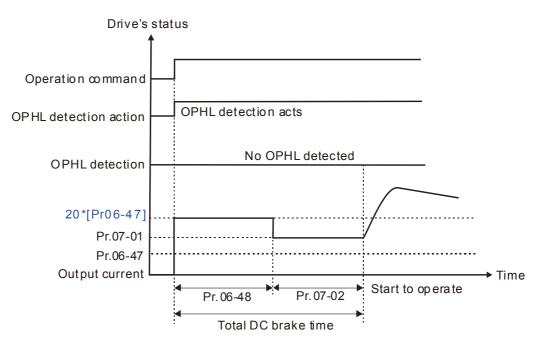


Status 3: Motor drive is in stop; Pr06-48 $\neq$ 0 ; Pr07-02 $\neq$ 0

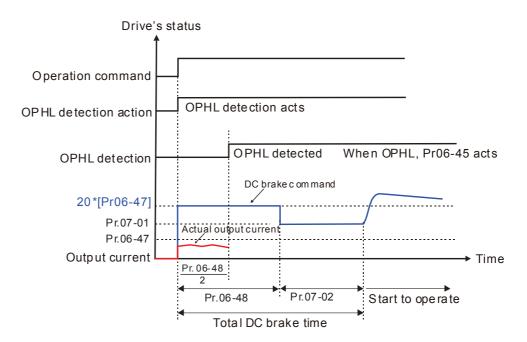
When motor drive starts, it will perform Pr06-48 and then Pr07-02 (DC brake). DC brake current level in this status includes two parts, one is 20 times of Pr06-47 setting value in Pr06-48 setting time, and Pr07-02 setting value in Pr07-01 setting time. Total DC brake time is T=Pr06-48+Pr07-02.

In this period, if OPHL happens, motor drive starts to count until Pr06-48/2, motor drive will perform Pr06-45 setting.





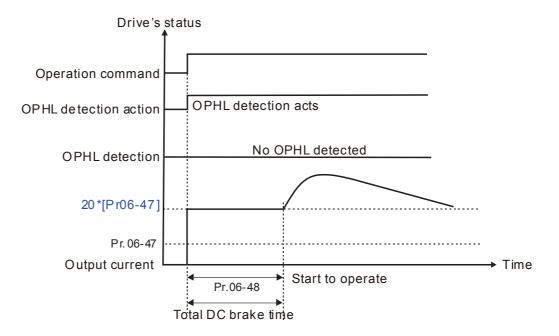
Status 3-2:  $Pr06-48 \neq 0$ ,  $Pr07-02 \neq 0$  (OPHL detected before operation)



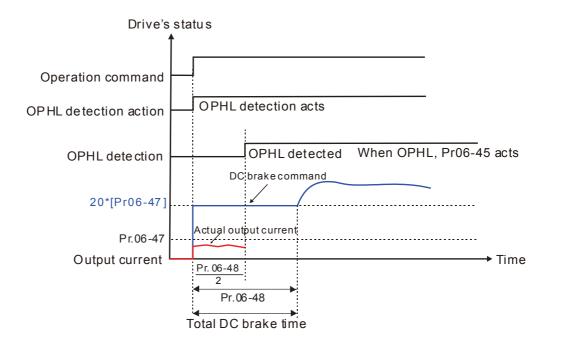
Status 4: Motor drive is in stop; Pr06-48 $\neq$ 0; Pr07-02=0

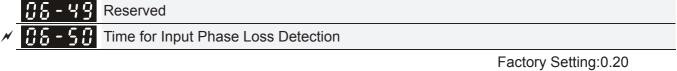
When motor drive starts, it will perform Pr06-48 as DC brake. The DC brake current level is 20 times of Pr06-47 setting value. In this period, if OPHL happens, motor drive starts to count until Pr06-48/2, motor drive will perform Pr06-45 setting.

Status 4-1:  $Pr06-48 \neq 0$ , Pr07-02=0 (No OPHL detected before operation)

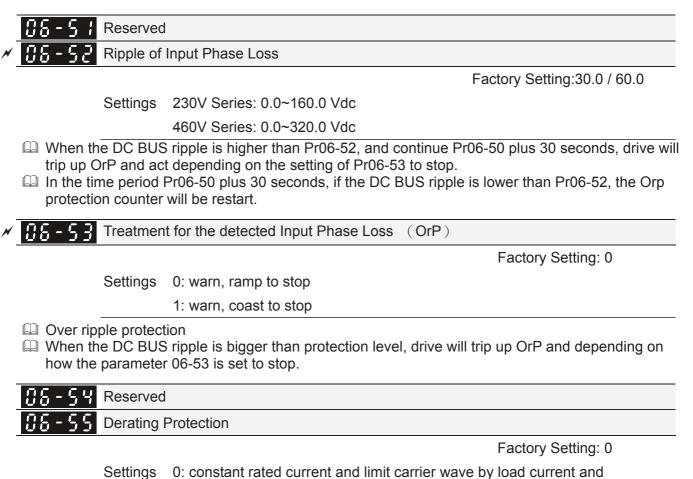


Status 4-2:  $Pr06-48 \neq 0$ , Pr07-02=0 (OPHL detected before operation)





Settings 0.00~600.00 sec



- temperature
  - 1: constant carrier frequency and limit load current by setting carrier wave
  - 2: constant rated current(same as setting 0), but close current limit

## Setting 0:

When the rated current is constant, carrier frequency (Fc) outputted by PWM will auto decrease according to surrounding temperature, overload output current and time. If overload situation is not frequent and only cares the carrier frequency operated with the rated current for a long time and carrier wave changes during short overload, it is recommended to set to 0.

Refer to the following diagram for the level of carrier frequency. Take VFD007C43A in normal duty as example, surrounding temperature 50oC with independent installation and UL open-type. When the carrier frequency is set to 15kHz, it corresponds to 72% rated output current. When it outputs higher than the value, it will auto decrease the carrier frequency. If the output is 83% rated current and the carrier frequency will decrease to 12kHz. In addition, it will also decrease the carrier frequency when overload. When the carrier frequency is 15kHz and the current is 120%\*72%=86% for a minute, the carrier frequency will decrease to the factory setting.

Getting 1:

It is used for the fixed carrier frequency and prevents the carrier wave changes and motor noise caused by the surrounding temperature and frequent overload.

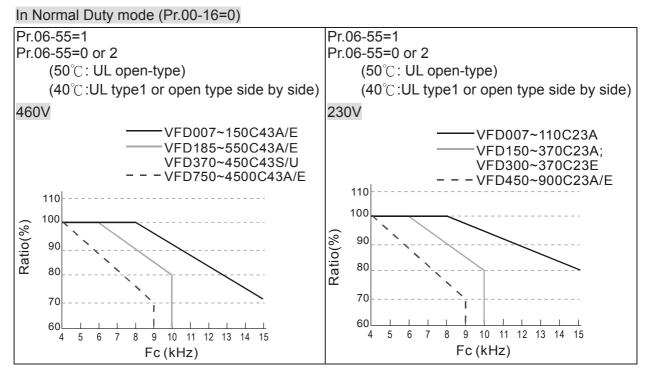
Refer to the following for the derating level of rated current. Take VFD007C43A in normal duty as example, when the carrier frequency keeps in 15kHz and the rated current is decreased to 72%, it will have OL protection when the current is 120%\*72%=86% for a minute. Therefore, it needs to operate by the curve to keep the carrier frequency.

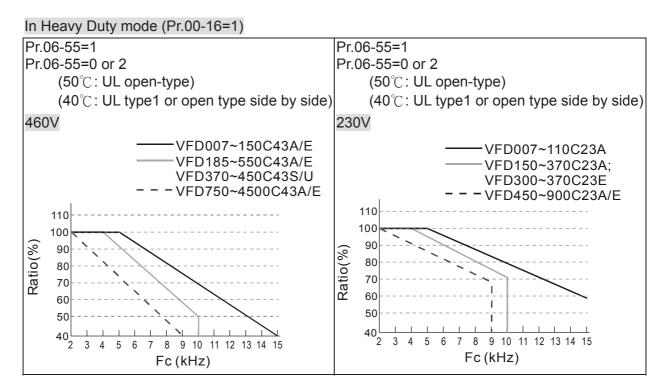
Setting 2:

It sets the protection method and action to 0 and disables the current limit for the Ratio\*160% of output current in the normal duty and Ratio\*180% of output current in the heavy duty. The advantage is that it can provide higher output current when the setting is higher than the factory setting of carrier frequency. The disadvantage is that it decreases carrier wave easily when overload.

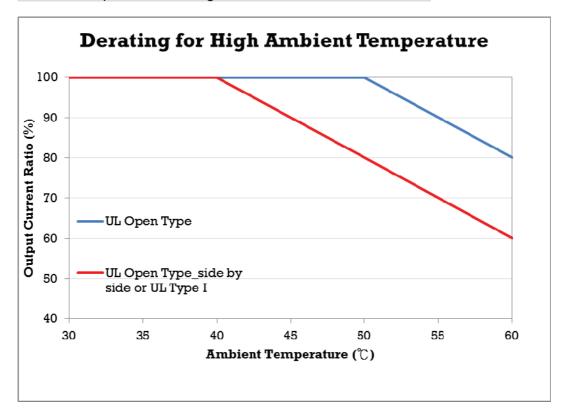
- It should be used with Pr. 00-16 and Pr.00-17 for setting.
- Ambient temperature will also affect the derating, please refer to ambient temperature derating curve.

General Control Derating Curve (Pr00-10=1 and Pr0011=0~3)

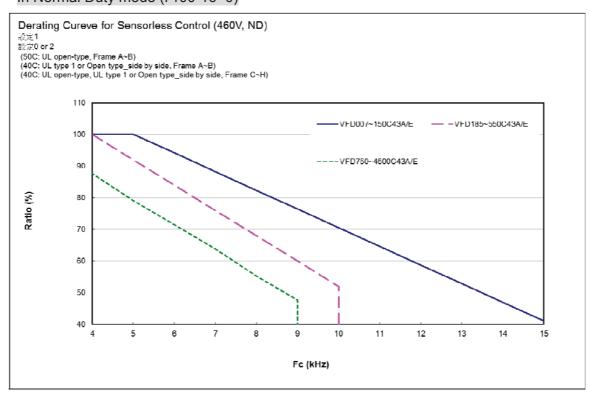


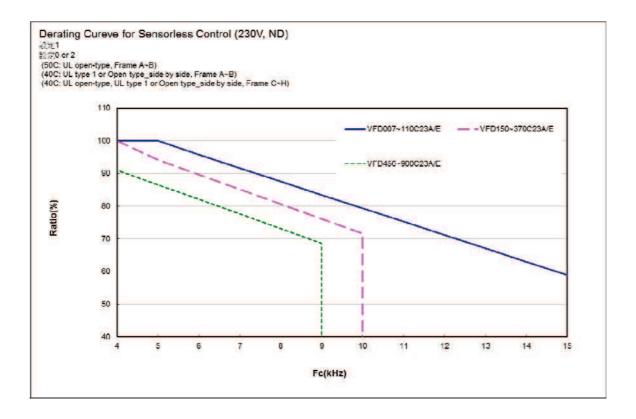


Ambient Temperature derating Curve for General Control Model

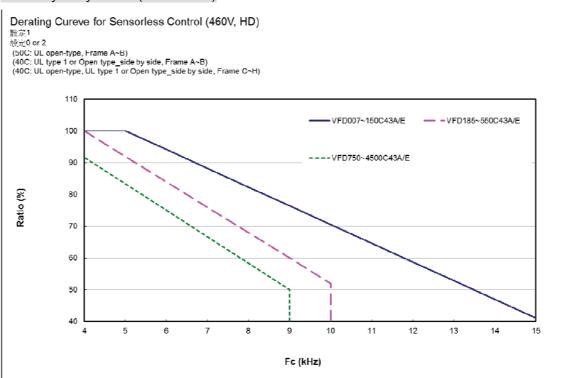


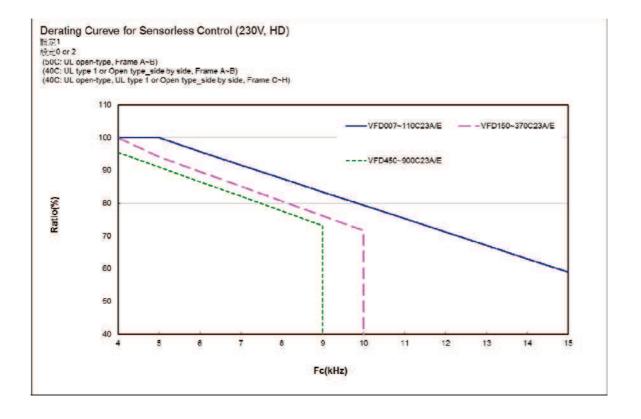
# Advanced Control Derating Curve (Pr00-10=1, and Pr00-11=4~7; or Pr00-10=3, and Pr00-13=1~3) In Normal Duty mode (Pr00-16=0)

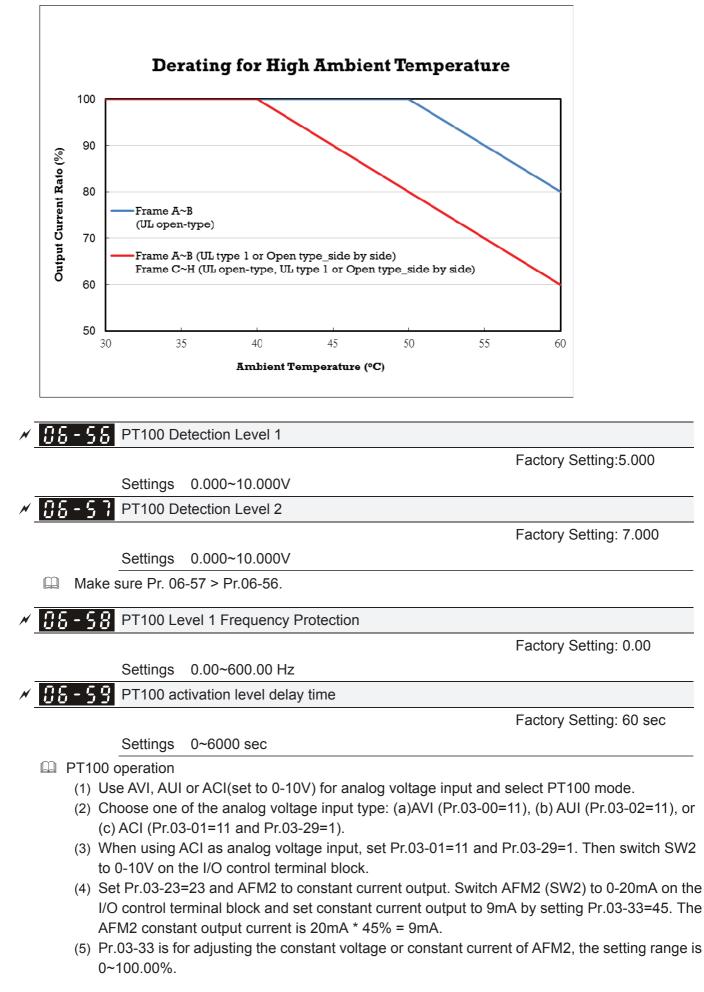




#### In Heavy Duty mode (Pr00-16=1)

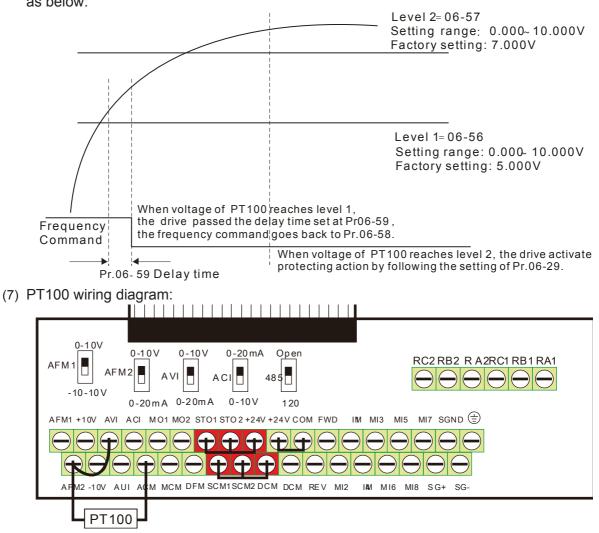






Ambient Temperature derating Curve for Advanced Control Mode

(6) There are two types of action level for PT100. The diagram of PT protecting action is shown as below:





Description when Pr.06-58=0.00Hz, PT100 function is disabled.

Example:

A PT100 is installed to the drive. If motor temperature reaches  $135^{\circ}$  (275°F) or higher, the drive will decrease motor frequency to the setting of Pr.06-58. Motor will operate at this frequency (Pr.06-58) till the motor temperature decreases to  $135^{\circ}$  (275°F) or lower. If motor temperature exceeds  $150^{\circ}$  (302°F), the motor will decelerate to stop and outputs an 'OH3' warning.

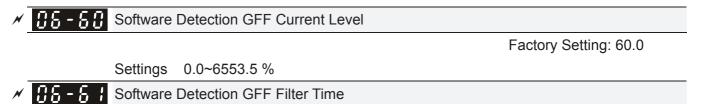
Set up process:

- 1. Switch AFM2 (SW2) to 0-20mA on the I/O control terminal block. (Refer to Figure 1, PT100 wiring diagram)
- 2. Wiring (Refer to Figure 1, PT100 wiring diagram):

Connect external terminal AFM2 to (+) Connect external terminal ACM to (-) Connect external terminals AFM2 and AVI to short-circuit

- 3. Set Pr.03-00=11 or Pr.03-23=23 or Pr.03-33=45%(9mA)
- Refer to RTD temperature and resistance comparison table Temperature=135°C, resistance=151.71Ω; Input current: 9mA, Voltage: approximately: 1.37Vdc Temperature=150°C, resistance=157.33Ω; Input current:9mA, Voltage: approximately: 1.42Vdc

- 5. Set Pr.06=56=1.37 and Pr.06-58=10Hz. When RTD temperature increases to 135°C or higher, the drive will decelerate to the selected frequency. When Pr.06-58=0, the drive will not run.
- 6. Set Pr.06-57=1.42 and Pr.06-29=1 (warning and decelerate to stop). When RTD temperature increases to 150°C or higher, the drive will decelerate to stop and outputs an 'OH3' warning.



Settings 0.00~655.35 sec

- When the motor drive detects the unbalanced three-phase out current is higher than the setting of Pr06-60, GFF protection will be activated. Then the motor drive will stop outputting.
- When 3-phase current output unbalance value has exceeds Pr06-60 setting, drive will trip up GFF and stop output immediately.

<b>SS-S2</b> Reserved
<b>38-83</b> Fault Record 1 (day)
<b>38-85</b> Fault Record 2 (day)
<b>38-87</b> Fault Record 3 (day)
<b>36-59</b> Fault Record 4 (day)

Factory Setting: Read only

Factory Setting: 0.10

#### Settings 0~65535 days

Solution   Solution     Fault Record 1 (min)
<b>SS-SS</b> Fault Record 2 (min)
<b>35 - 58</b> Fault Record 3 (min)
<b>35 - 73</b> Fault Record 4 (min)

Factory Setting: Read only

Settings 0~1439 min

When there is any malfunctions in motor drive operation, Pr06-17~22 will record 6 malfunctions recently, and Pr06-63~70 can record the operation time for 4 malfunctions in sequence. It can help to check if there is any wrong with the drive according to the recorded internal time.

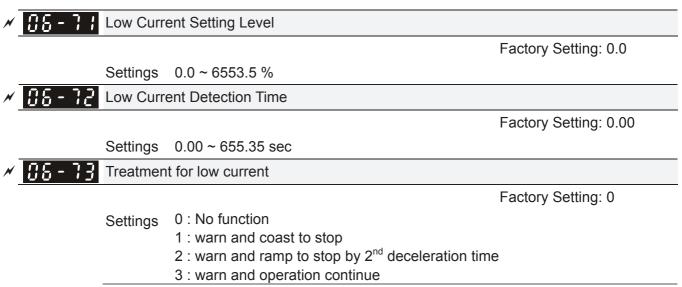
For example: The first error: ocA occurs in 1000 minutes after motor drive start operation. The second error: ocd happens after another 1000 minutes. The 4<sup>th</sup> error: ocA happens after another 1000 minutes. Then, the 5<sup>th</sup> error is ocd, happening 1000 minutes following 4<sup>th</sup> error. Last, 6<sup>th</sup> error ocn happens 1000 minutes after 5<sup>th</sup> error.

Then Pr06-17~Pr06-22 and Pr06-63~Pr06-70 will be:

Chapter 12 Description of Parameter Settings | C2000 Series

	1 <sup>st</sup> fault	2 <sup>nd</sup> fault	3 <sup>rd</sup> fault	4 <sup>th</sup> fault	5 <sup>th</sup> fault	6 <sup>th</sup> fault
06-17	ocA	ocd	ocn	ocA	ocd	ocn
06-18	0	ocA	ocd	ocn	ocA	ocd
06-19	0	0	ocA	ocd	ocn	ocA
06-20	0	0	0	ocA	ocd	ocn
06-21	0	0	0	0	ocA	ocd
06-22	0	0	0	0	0	ocA
06-63	1000	560	120	1120	680	240
06-64	0	1	2	2	3	4
06-65	0	1000	560	120	1120	680
06-66	0	0	1	2	2	3
06-67	0	0	1000	560	120	1120
06-68	0	0	0	1	2	2
06-69	0	0	0	1000	560	120
06-70	0	0	0	0	1	2

From time record, it can be known that the last fault (Pr06-17) happened after the drive run for 4days and 240 minutes.



The drive will operate as the setting of Pr.06-73 when output current is lower than the setting of Pr.06-71 and when low current continues for a period longer than the setting of Pr.06-72. This parameter can also be used with external multi-function output terminal 44 (MO44) for low current output.

In the low current detection function will not be executed when drive is at sleep or standby status.

## 07 Special Parameters

✓ This parameter can be set during operation.

## ✓ ☐ ☐ - ☐ ☐ Software Brake Level

Factory Setting: 380.0/760.0

Settings 230V series: 350.0~450.0Vdc 460V series: 700.0~900.0Vdc

- This parameter sets the DC-bus voltage at which the brake chopper is activated. Users can choose the suitable brake resistor to have the best deceleration. Refer to Chapter 7 Accessories for the information of the brake resistor.
- It is only valid for the models below 30kW of 460 series and 22kW of 230 series.

## ✓ ☐ ☐ - ☐ ↓ DC Brake Current Level

Factory Setting: 0

## Settings 0~100%

- This parameter sets the level of DC Brake Current output to the motor during start-up and stopping. When setting DC Brake Current, the Rated Current is regarded as 100%. It is recommended to start with a low DC Brake Current Level and then increase until proper holding torque has been attained.
- When it is in FOCPG control mode, DC brake is zero-speed operation. It can enable DC brake function by setting to any value. The drive will output an appropriate current to meet the actual need.

## DC Brake Time at RUN

Factory Setting: 0.0

## Settings 0.0~60.0 sec

The motor may be in the rotation status due to external force or itself inertia. If the drive is used with the motor at this moment, it may cause motor damage or drive protection due to over current. This parameter can be used to output DC current before motor operation to stop the motor and get a stable start. This parameter determines the duration of the DC Brake current after a RUN command. When it is set to 0.0, it is invalid.

## ✓ [] ] - [] ] DC Brake Time at Stop

Factory Setting: 0.0

## Settings 0.0~60.0 sec

- The motor may be in the rotation status after drive stop outputting due to external force or itself inertia and can't stop accurately. This parameter can output DC current to force the motor drive stop after drive stops to make sure that the motor is stop.
- This parameter determines the duration of the DC Brake current during stopping. To DC brake at stop, this function will be valid when Pr.00-22 is set to 0 or 2. When setting to 0.0, it is invalid.
- Related parameters: Pr.00-22 Stop Method, Pr.07-04 Start-point for DC Brake

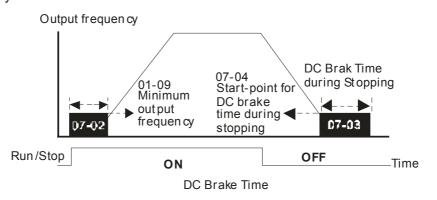


DC Brake Frequency at STOP

Factory Setting: 0.00

#### Settings 0.00~600.00Hz

This parameter determines the frequency when DC Brake will begin during deceleration. When this setting is less than start frequency (Pr.01-09), the start-point for DC brake will start from the min. frequency.



- DC Brake at Start-up is used for loads that may move before the AC drive starts, such as fans and pumps. Under such circumstances, DC Brake can be used to hold the load in position before setting it in motion.
- DC Brake at stop is used to shorten the stopping time and also to hold a stopped load in position, such as crane or cutting machine.
- DC Brake at Start-up is used for loads that may move before the AC drive starts, such as fans and pumps. Under such circumstances, DC Brake can be used to hold the load in position before setting it in motion.
- DC Brake at stop is used to shorten the stopping time and also to hold a stopped load in position, such as crane or cutting machine.

× 87-85 Voltage Incrasing Gain

Factory Setting: 100

## Settings 1~200%

When the user is using speed tracking, adjust Pr07-05 to slow down the increasing of voltage if there are errors such as oL or oc.

Compared a start after Momentary Power Loss

Factory Setting: 0

Settings 0: Stop operation

- 1: Speed search for last frequency command
- 2: Speed search for the minimum output frequency
- This parameter determines the operation mode when the AC motor drive restarts from a momentary power loss.
- The power connected to the drive may power off momentarily due to many reasons. This function allows the drive to keep outputting after power is on again after power off and won't cause drive stops.

- Setting 1: Operation continues after momentary power loss, speed search starts with the Master Frequency reference value after drive output frequency and motor rotator speed is synchronous. The motor has the characteristics of big inertia and small obstruction. For example, in the equipment with big inertia wheel, it doesn't need to wait to execute operation command until wheel is complete stop after re-start to save time.
- Setting 2: Operation continues after momentary power loss, speed search starts with the minimum output frequency after drive output frequency and motor rotator speed is synchronous. The motor has the characteristics of small inertia and bigger obstruction.
- In PG control mode, the AC motor drive will execute the speed search function automatically by the PG speed when this setting isn't set to 0.

## Maximum Power Loss Duration

Factory Setting: 2.0

Settings 0.0~20.0 sec

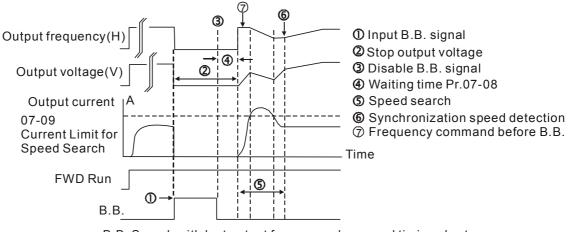
- If the duration of a power loss is less than this parameter setting, the AC motor drive will resume operation. If it exceeds the Maximum Allowable Power Loss Time, the AC motor drive output is then turned off (coast stop).
- □ The selected operation after power loss in Pr.07-06 is only executed when the maximum allowable power loss time is ≤5 seconds and the AC motor drive displays "LU". But if the AC motor drive is powered off due to overload, even if the maximum allowable power loss time is ≤5 seconds, the operation mode as set in Pr.07-06 is not executed. In that case it starts up normally.

## Base block Time

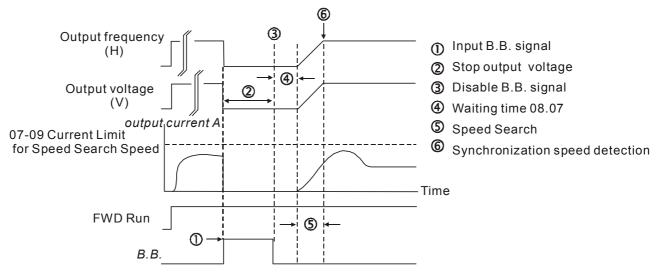
Factory Setting: 0.5

## Settings 0.1~5.0 sec

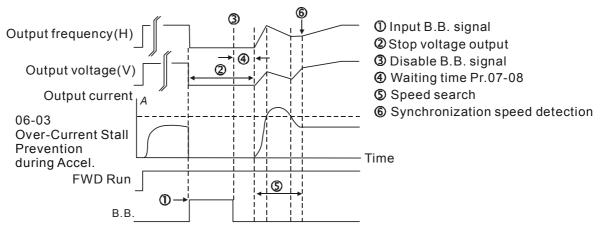
When momentary power loss is detected, the AC drive will block its output and then wait for a specified period of time (determined by Pr.07-08, called Base-Block Time) before resuming operation. This parameter should be set at a value to ensure that any residual regeneration voltage from the motor on the output has disappeared before the drive is activated again.



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



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



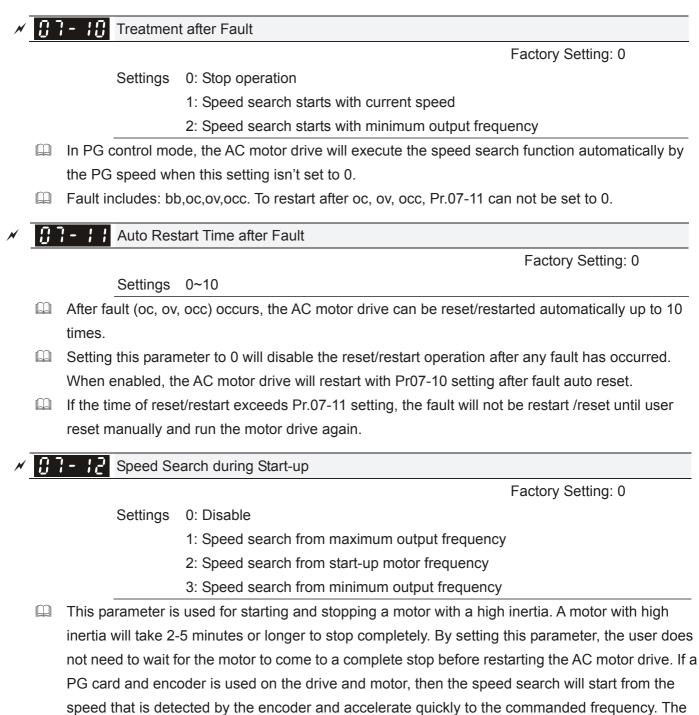
B.B. Search with minimum output frequency upward timing chart

## ✓ ☐ 7 - ☐ 9 Current Limit for Speed Search

Factory Setting: 100

#### Settings 20~200%

- Following a momentary power loss, the AC motor drive will start its speed search operation only if the output current is greater than the value set by Pr.07-09.
- When executing speed search, the V/f curve is operated by group 1 setting. The maximum current for the optimum accel./decel. and start speed search is set by Pr.07-09.
- The maximum speed search level will affect the synchronous time. It will get the synchronization faster when this parameter is set to larger value. But too large value may activate overload protection.



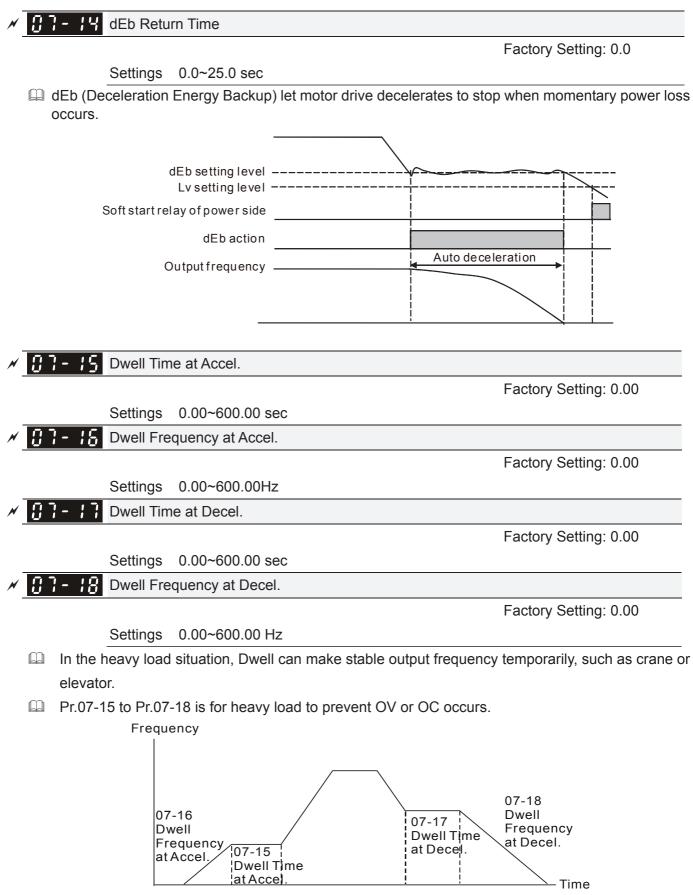
- output current is set by the Pr.07-09.
- In PG control mode, the AC motor drive will execute the speed search function automatically by the PG speed when this setting isn't set to 0.
- ✓ ☐ ☐ / 子 Decel. Time at Momentary Power Loss (dEb function)

Factory Setting: 0

Settings 0: Disable

1~6: Auto Deceleration

In This parameter is used for the decel. time selection for momentary power loss.



Dwell at accel./decel.



Factory Setting: 0

#### Settings 0: Fan always ON

- 1: 1 minute after the AC motor drive stops, fan will be OFF
- 2: When the AC motor drive runs, the fan is ON. When the AC motor drive stops, the fan is OFF
- 3: Fan turns ON when preliminary IGBT temperature (around 60°C) is attained.
- 4: Fan always OFF
- Description: This parameter is used for the fan control.
- Setting 0: Fan will be ON as the drive's power is turned ON.
- Setting 1: 1 minute after AC motor drive stops, fan will be OFF
- Setting 2: AC motor drive runs and fan will be ON. AC motor drive stops and fan will be OFF.
- Setting 3: Fan run according to IGBT and capacitance temperature. Fan will be ON when IGBT temperature is higher than 60oC. Fan will be OFF, when capacitance temperature is lower than 40oC.
- Setting 4: Fan is always OFF

## ✓ ☐ ☐ - 2 ☐ Emergency Stop (EF) & Force Stop

Factory Setting: 0

- Settings 0: Coast to stop
  - 1: Stop by 1<sup>st</sup> deceleration time
  - 2: Stop by 2<sup>nd</sup> deceleration time
  - 3: Stop by 3<sup>rd</sup> deceleration time
  - 4: Stop by 4<sup>th</sup> deceleration time
  - 5: System Deceleration (According to original deceleration time)
  - 6: Automatic Deceleration (Pr01-46)
- When the multi-function input terminal is set to 10(EF) or 18(Emergency stop) and is activated, the drive will stop according to the setting in Pr.07-20.

✓ ☐ ☐ - 2 ↓ Auto Energy-saving Operation

Factory Setting: 0

Settings 0: Disable

1: Enable

- When Pr.07-21 is set to 1, the acceleration and deceleration will operate with full voltage. During constant speed operation, it will auto calculate the best voltage value by the load power for the load. This function is not suitable for the ever-changing load or near full-load during operation.
- When the output frequency is constant, i.e. constant operation, the output voltage will auto decrease by the load reduction. Therefore, the drive will operate with min. power, multiplication of voltage and current.



Factory Setting: 100

#### Settings 10~1000%

- When Pr. 07-21 is set to 1, this parameter can be used to adjust the gain of energy-saving. The factory setting is 100%. If the result is not good, it can adjust by decreasing the setting. If the motor oscillates, it should increase the setting value.
- At some special application such as High speed spindle, the motor temperature rise is been highly concern. Thus, when the motor is not working with load, the motor current will requested to reduce to a lower level. To Lowering this parameter setting can meet this requirement.

✓ ☐ 7 - 2 3 Auto Voltage Regulation(AVR) Function

Factory Setting: 0

Settings 0: Enable AVR

- 1: Disable AVR
- 2: Disable AVR during deceleration
- The rated voltage of the motor is usually 220V/200VAC 60Hz/50Hz and the input voltage of the AC motor drive may vary between 180V to 264 VAC 50Hz/60Hz. Therefore, when the AC motor drive is used without AVR function, the output voltage will be the same as the input voltage. When the motor runs at voltages exceeding the rated voltage with 12% 20%, its lifetime will be shorter and it can be damaged due to higher temperature, failing insulation and unstable torque output.
- AVR function automatically regulates the AC motor drive output voltage to the motor rated voltage. For instance, if V/f curve is set at 200 VAC/50Hz and the input voltage is at 200V to 264VAC, then the motor Output Voltage will automatically be reduced to a maximum of 200VAC/50Hz. If the input voltage is at 180V to 200VAC, output voltage to motor and input power will be in direct proportion.
- Setting 0: when AVR function is enabled, the drive will calculate the output voltage by actual DC-bus voltage. The output voltage won't be changed by DC bus voltage.
- Setting 1: when AVR function is disabled, the drive will calculate the output voltage by DC-bus voltage. The output voltage will be changed by DC bus voltage. It may cause insufficient/over current.
- Setting 2: the drive will disable the AVR during deceleration, such as operated from high speed to low speed.
- When the motor ramps to stop, the deceleration time is longer. When setting this parameter to 2 with auto acceleration/deceleration, the deceleration will be quicker.
- When it is in FOCPG or TQCPG, it is recommended to set to 0 (enable AVR).
- Filter Time of Torque Command (V/F and SVC control mode)

Factory Setting: 0.020

## Settings 0.001~10.000 sec

When the setting is too long, the control will be stable but the control response will be delay. When the setting is too short, the response will be quickly but the control may be unstable. User can adjust the setting by the control and response situation.



**Filter Time of Slip Compensation (V/F and SVC control mode)** 

Factory Setting: 0.100

#### Settings 0.001~10.000 sec

It can set Pr.07-24 and 07-25 to change the response time of compensation.

If Pr.07-24 and 07-25 are set to 10seconds, the response time of compensation is the slowest. But the system may be unstable when the setting is too short.

```
7 1 1 - 2 5 Torque Compensation Gain (V/F and SVC control mode)
```

Factory Setting: 0 (1 in SVC mode)

## Settings 0~10

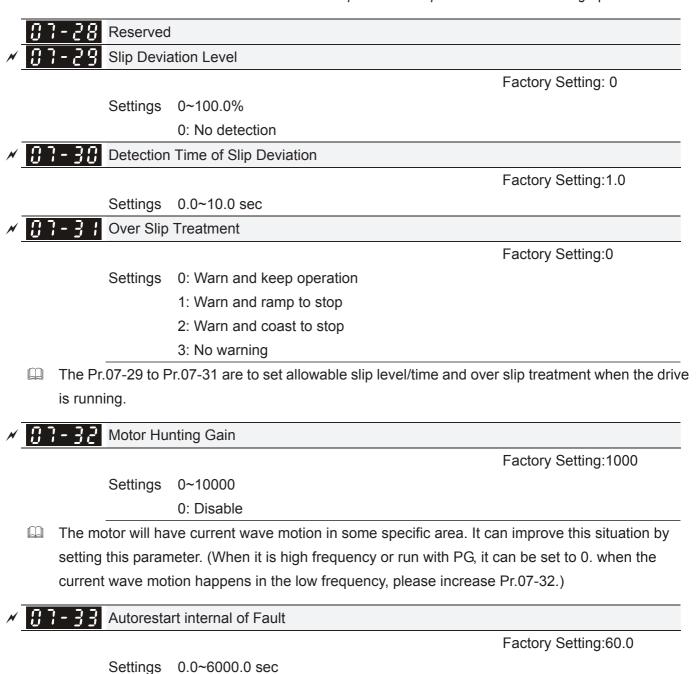
- When the motor load is large, a part of drive output voltage is absorbed by the resistor of stator winding and causes insufficient voltage at motor induction and result in over output current and insufficient output torque. It can auto adjust output voltage by the load and keep the air gap magnetic fields stable to get the optimal operation.
- In the V/F control, the voltage will be decreased in direct proportion when the frequency is decreased. It'll cause decrease torque at low speed due to small AC resistor and the same DC resistor. Therefore, Auto torque compensation function will increase the output voltage in the low frequency to get higher start torque.
- When Pr.07-26 is set to large, it may cause motor overflux and result in too large output current, motor overheat or triggers protection function.

Slip Compensation Gain (V/F and SVC control mode)

Factory Setting: 0.00

## Settings 0.00~10.00

- The induction motor needs the constant slip to produce magnetic torque. It can be ignore in the higher motor speed, such as rated speed or 2-3% slip.
- In the operation with variable frequency, the slip and the synchronous frequency will be in reverse proportion to produce the same magnetic torque. That is the slip will be larger with the reduction of synchronous frequency. The motor may stop when the synchronous frequency is decreased to a specific value. Therefore, the slip serious affects the accuracy of motor speed at low speed.
- In another situation, when the drive uses with induction motor, the slip will be increased by the increasing load. It also affects the accuracy of motor speed.
- This parameter can be used to set compensation frequency and reduce the slip to close the synchronous speed when the motor runs in the rated current to raise the drive accuracy. When the drive output current is larger than Pr.05-05 No-load Current of Induction Motor 1 (A), the drive will compensation the frequency by this parameter.
- When the control method (Pr.00-11) is changed from V/f mode to vector mode, this parameter will auto be set to 1.00. Otherwise, it will be set to 0.00. Please do the compensation of slip after overload and acceleration. The compensation value should be increased from small to large gradually. That is to add the output frequency with motor rated slip X Pr.07-27 Slip Compensation Gain when the motor is rated load. If the actual speed ratio is slow than expectation, please increase the setting. Otherwise, decrease the setting.



When a reset/restart after fault occurs, the drive will regards Pr.07-33 as a time boundary and beging counting the numbers of faults occur within this time period. Within the period, if numbers of faults occurred did not exceed the setting in Pr.07-11, the counting will be cleared and starts from 0 when next fault occurs. However, if the numbers of faults occurred within this time period have exceed the setting in Pr.07-11, user will need to press RESET key manually for the drive to operate again.

## 08 High-function PID Parameters

✓ This parameter can be set during operation.

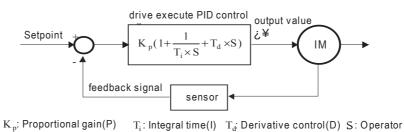
## ✓ **38 - 33** Input Terminal for PID Feedback

Factory Setting:0

- Settings 0: No function
  - 1: Negative PID feedback: on analogue input acc. To setting 5 of Pr. 03-00 to Pr.03-02.
  - 2: Negative PID feedback from PG card (Pr.10-02, skip direction)
  - 3: Negative PID feedback from PG card (Pr.10-02)
  - 4: Positive PID feedback from external terminal AVI (Pr.03-00)
  - 5: Positive PID feedback from PG card (Pr.10-02, skip direction)
  - 6: Positive PID feedback from PG card (Pr.10-02)
  - 7: Negative PID feeback from communication protocol
  - 8: Positive PID feedback from communication protocol
- Negative feedback means: +target value feedback. It is used for the detection value will be increased by increasing the output frequency.
- When Pr.03-00 to Pr.03-02 have the same setting, then the AVI will be the prioritized selection.
- Positive feedback means: -target value + feedback. It is used for the detection value will be decreased by increasing the output frequency.
- When Pr08-00≠7 neither ≠8, input value is disabled. The value of the setting remain the same after the derive is off.

Common applications for PID control

- ☑ Flow control: A flow sensor is used to feedback the flow data and performs accurate flow control.
- ☑ Pressure control: A pressure sensor is used to feedback the pressure data and performs precise pressure control.
- Air volume control: An air volume sensor is used to feedback the air volume data to have excellent air volume regulation.
- ☑ Temperature control: A thermocouple or thermistor is used to feedback temperature data for comfortable temperature control.
- ☑ Speed control: A speed sensor or encoder is used to feedback motor shaft speed or input another machines speed as a target value for closed loop speed control of master-slave operation. Pr.10.00 sets the PID set point source (target value).
- ✓ PID control operates with the feedback signal as set by Pr.10.01 either 0~+10V voltage or 4-20mA current.
- PID control loop:



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- Concept of PID control
  - Proportional gain(P): the output is proportional to input. With only proportional gain control, there will always be a steady-state error.
  - 2. Integral time(I):

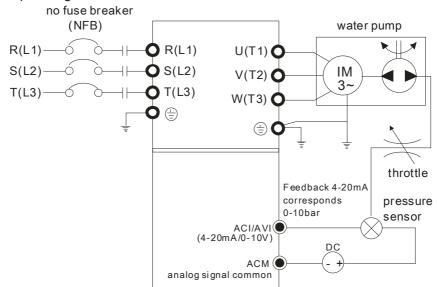
the controller output is proportional to the integral of the controller input. To eliminate the steady-state error, an "integral part" needs to be added to the controller. The integral time decides the relation between integral part and error. The integral part will be increased by time even if the error is small. It gradually increases the controller output to eliminate the error until it is 0. In this way a system can be stable without steady-state error by proportional gain control and integral time control.

3. Differential control(D):

the controller output is proportional to the differential of the controller input. During elimination of the error, oscillation or instability may occur. The differential control can be used to suppress these effects by acting before the error. That is, when the error is near 0, the differential control should be 0. Proportional gain(P) + differential control(D) can be used to improve the system state during PID adjustment.

When PID control is used in a constant pressure pump feedback application:

Set the application's constant pressure value (bar) to be the set point of PID control. The pressure sensor will send the actual value as PID feedback value. After comparing the PID set point and PID feedback, there will be an error. Thus, the PID controller needs to calculate the output by using proportional gain(P), integral time(I) and differential time(D) to control the pump. It controls the drive to have different pump speed and achieves constant pressure control by using a 4-20mA signal corresponding to 0-10 bar as feedback to the drive.



- 1. Pr.00-04 is set to 10 (Display PID analog feedback signal value (b) (%))
- 2. Pr.01-12 Acceleration Time will be set as required
- 3. Pr.01-13 Deceleration Time will be set as required
- 4. Pr.00-21=0 to operate from the digital keypad
- 5. Pr.00-20=0, the set point is controlled by the digital keypad
- 6. Pr.08-00=1 (Negative PID feedback from analog input)
- 7. ACI analog input Pr. 03-01 set to 5, PID feedback signal.

8. Pr.08-01-08-03 will be set as required8.1 If there is no vibration in the system, increase Pr.08-01(Proportional Gain (P))

- 8.2 If there is no vibration in the system, reduce Pr.08-02(Integral Time (I))
- 8.3 If there is no vibration in the system, increase Pr.08-03(Differential Time(D))
- Refer to Pr.08-00 to 08-21 for PID parameters settings.

✓ ☐ ☐ - ☐ ↓ Proportional Gain (P)

Factory Setting:80.0

#### Settings 0.0~500.0

When the setting is 1.0, it means Kp gain is 100%; setting is 0.5, Kp gain means 50%.

- It is used to eliminate the system error. It is usually used to decrease the error and get the faster response speed. But if the value is set too high, it may cause the system oscillation and instability.
- If the other two gains (I and D) are set to zero, proportional control is the only one effective.

✓ ☐ B - ☐ 2 Integral Time (I)

Factory Setting:1.00

Settings 0.00~100.00 sec 0.00: Disable

- The integral controller is used to eliminate the error during stable system. The integral control doesn't stop working until error is 0. The integral is acted by the integral time. The smaller integral time is set, the stronger integral action will be. It is helpful to reduce overshoot and oscillation to make a stable system. At this moment, the decreasing error will be slow. The integral control is often used with other two controls to become PI controller or PID controller.
- This parameter is used to set the integral time of I controller. When the integral time is long, it will have small gain of I controller, the slower response and bad external control. When the integral time is short, it will have large gain of I controller, the faster response and rapid external control.
- When the integral time is too small, it may cause system oscillation.
- If the integral time is set as 0.00, Pr.08-02 will be disabled.

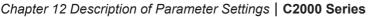
Derivative Control (D)

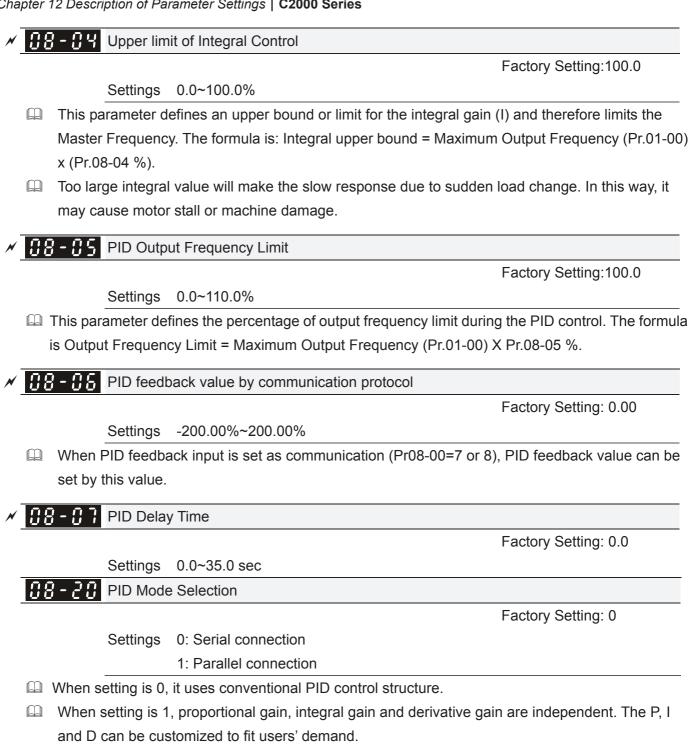
Factory Setting:0.00

#### Settings 0.00~1.00 sec

The differential controller is used to show the change of system error and it is helpful to preview the change of error. So the differential controller can be used to eliminate the error to improve system state. With the suitable differential time, it can reduce overshoot and shorten adjustment time. However, the differential operation will increase the noise interference. Please note that too large differential will cause big noise interference. Besides, the differential shows the change and the output of the differential will be 0 when there is no change. Therefore, the differential control can't be used independently. It needs to be used with other two controllers to make a PD controller or PID controller.

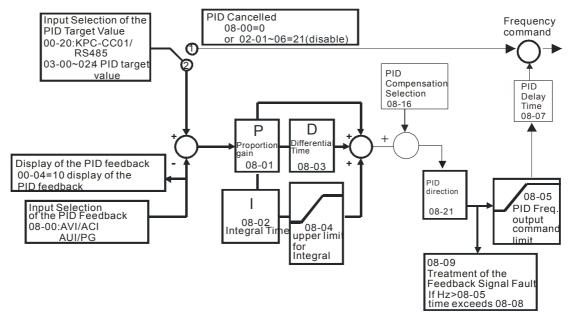
- This parameter can be used to set the gain of D controller to decide the response of error change. The suitable differential time can reduce the overshoot of P and I controller to decrease the oscillation and have a stable system. But too long differential time may cause system oscillation.
- The differential controller acts for the change of error and can't reduce the interference. It is not recommended to use this function in the serious interference.



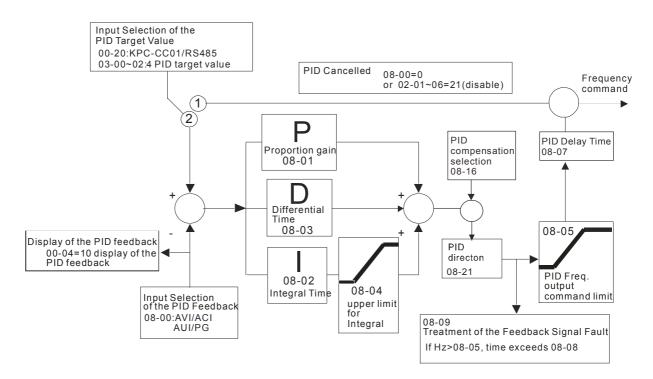


- Pr.08-07 determines the primary low pass filter time when in PID control. Setting a large time constant may slow down the response rate of drive.
- Output frequency of PID control will filter by primary low pass function. This function could filtering a mix frequencies. A long primary low pass time means filter degree is high and vice versa.
- Inappropriate setting of delay time may cause system error.
- PI Control: controlled by the P action only, and thus, the deviation cannot be eliminated entirely. To eliminate residual deviations, the P + I control will generally be utilized. And when the PI control is utilized, it could eliminate the deviation incurred by the targeted value changes and the constant external interferences. However, if the I action is excessively powerful, it will delay the responding toward the swift variation. The P action could be used solely on the loading system that possesses the integral components.

- PD Control: when deviation occurred, the system will immediately generate some operation load that is greater than the load generated single handedly by the D action to restrain the increment of the deviation. If the deviation is small, the effectiveness of the P action will be decreasing as well. The control objects include occasions with integral component loads, which are controlled by the P action only, and sometimes, if the integral component is functioning, the whole system will be vibrating. On such occasions, in order to make the P action's vibration subsiding and the system stabilizing, the PD control could be utilized. In other words, this control is good for use with loadings of no brake functions over the processes.
- PID Control: Utilize the I action to eliminate the deviation and the D action to restrain the vibration, thereafter, combine with the P action to construct the PID control. Use of the PID method could obtain a control process with no deviations, high accuracies and a stable system.
- Serial connection



#### Parallel connection





Settings 0.0~3600.0 sec

Feedback Signal Detection Time

Pr.08-08 is valid only for ACI 4-20mA.

This parameter sets the detection time of abnormal PID derative. If detection time is set to 0.0, detection function is disabled.

Feedback Signal Fault Treatment

Factory Setting: 0

Settings 0: Warn and keep operation

- 1: Warn and ramp to stop
- 2: Warn and coast to stop
- 3: Warn and operate at last frequency

Description of the second seco

AC motor drive acts when the feedback signals analog PID feedback is abnormal.

**B** - **B** Sleep Reference

Settings 0.00~600.00Hz

Factory Setting: 0.00

Setting value of Pr08-10 determines if sleep reference and wake-up reference is enable or disable. When Pr08-10 = 0, it means disable. When  $08-10 \neq 0$ , it means enable.

✓ 38 - 11 Wake-up Reference

Factory Setting: 0.00

Settings 0.00~600.00Hz

- When Pr08-18 = 0, the unit of Pr08-10 and that of Pr08-11 become frequency. The settings then become 0 ~ 600.0 Hz.
- When Pr08-18=1, the unit of Pr08-10 and that of Pr08-11 switch to percentage. The settings then switch to 0~200.00%.
- And the percentage is based on the input command not maximum. E.g. If the maximum is 100 Kg, the command now is 30kg, if 08-11=40%, it is 12kg.
- $\square$  The same to 08-10.

38 - 12 Sleep Time

Factory Setting: 0.0

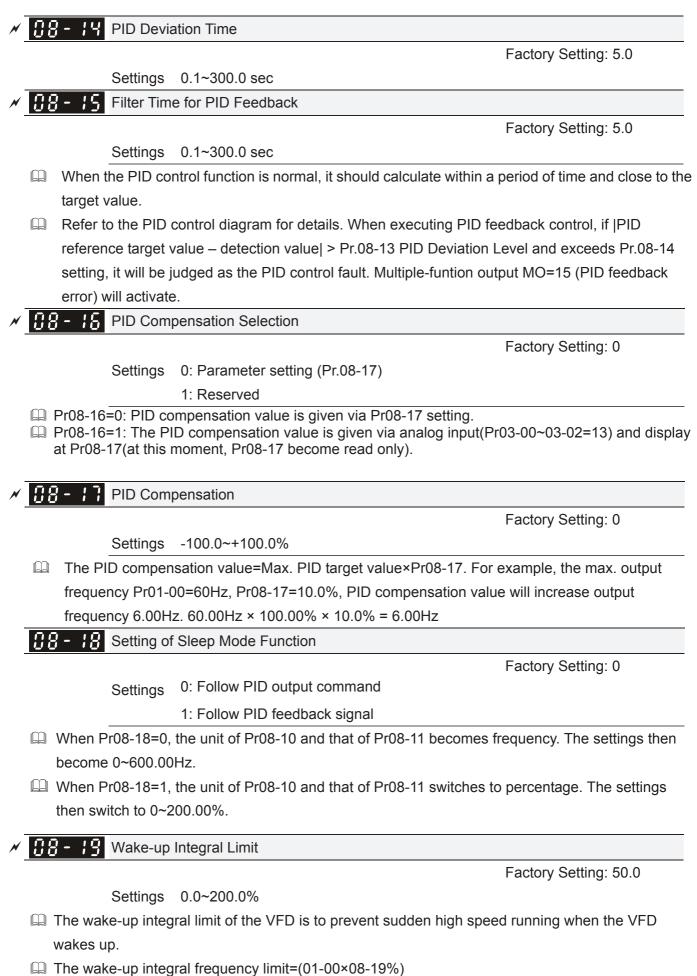
Settings 0.00~6000.0 sec

When the frequency command is smaller than the sleep frequency and less than the sleep time, the frequency command is equal to the sleep frequency. However the frequency command remains at 0.00Hz until the frequency command becomes equal to or bigger than the wake-up frequency.

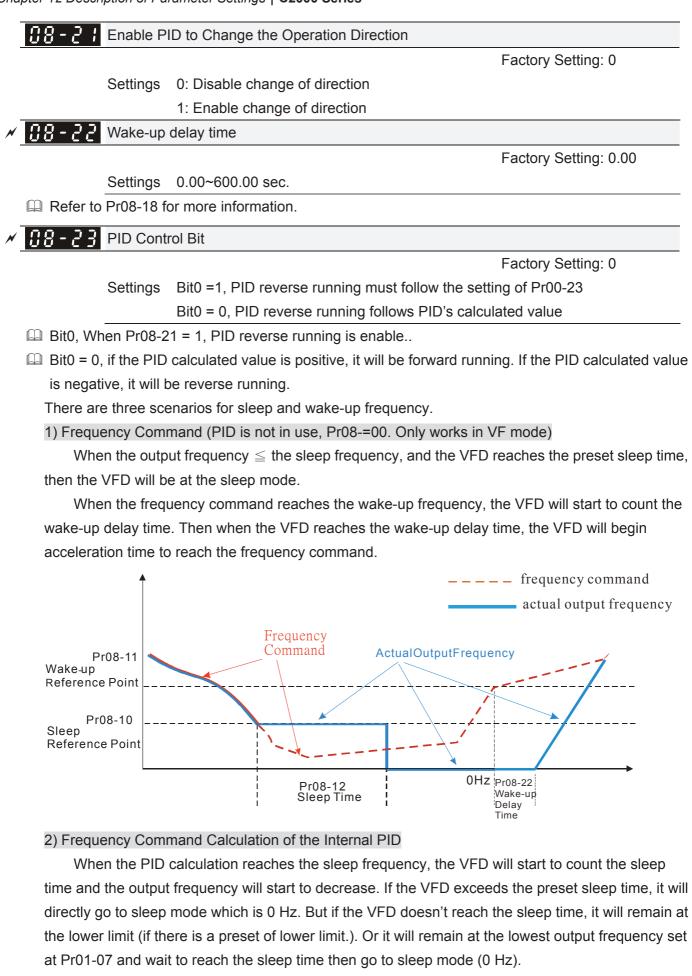
**B - 13** PID Deviation Level

Settings 1.0~50.0%

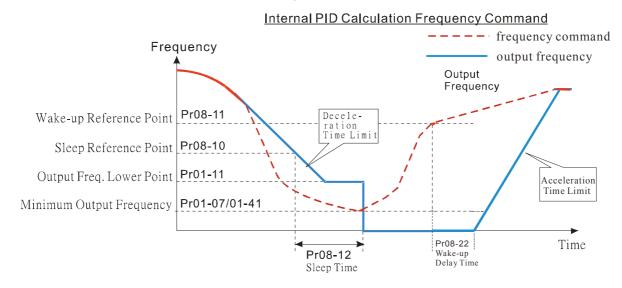
Factory Setting: 10.0



Depict The Pr08-19 is used to reduce the reaction time from sleep to wake-up.



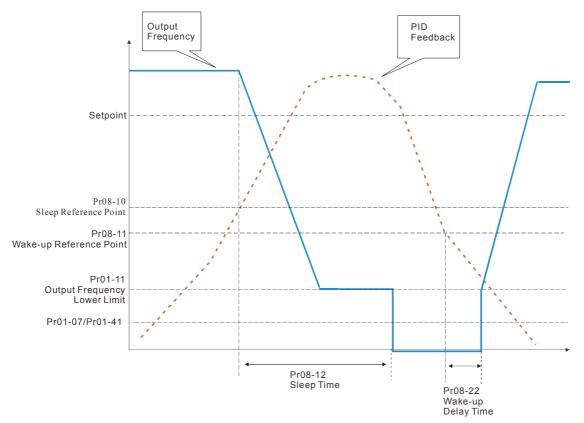
When the calculated frequency command reaches the wake-up frequency, the VFD will start to count the wake-up delay time. Once reaching the wake-up delay time, the VFD will start the acceleration time to reach the PID frequency command.



#### 3) PID Feedback Rate Percentage (Use PID, Pr08-00 ≠ 0 and Pr08-18=1)

When the PID feedback rate reaches the sleep level percentage, the VFD starts to count the sleep time. The output frequency will also decrease. If the VFD exceeds the preset sleep time, it will go to sleep mode which is 0 Hz. But if the VFD doesn't reach the sleep time, it will remain at the lower limit (if there is a preset of lower limit.). Or it will remain at the lowest output frequency set at Pr01-07 and wait to reach the sleep time then go to sleep mode (0 Hz).

When PID feedback value reaches the wake up percentagethe motor drive will start to count the wake up delay time. Once reaches the wake up delay time, the motor drives starts the accelerating time to reach PID frequency command



## **09 Communication Parameters**

✓ The parameter can be set during the operation.





Factory Setting: 1



✓ 🕂 🖞 - 🗍 📅 COM1 Communication Address

If the AC motor drive is controlled by RS-485 serial communication, the communication address for this drive must be set via this parameter and each AC motor drive's communication address must be different.



Factory Setting: 9.6

Settings 4.8~115.2Kbits/s

This parameter is for set up the RS485 communication transmission speed.

**COM1** Transmission Fault Treatment

Factory Setting: 3

- Settings 0: Warn and keep operation
  - 1: Warn and ramp to stop
  - 2: Warn and coast to stop
  - 3: No warning and continue operation
- This parameter is to set the reaction of MODBUS transmission errors with the host. Detection time can be set in Pr09-03.

COM1 Time-out Detection

Factory Setting: 0.0

Settings 0.0~100.0 sec

0.0: Disable

It is used to set the communication transmission time-out..

COM1 Communication Protocol

Factory Setting: 1

Settings 1: 7, N, 2 for ASCII 2: 7, E, 1 for ASCII 3: 7, O, 1 for ASCII 4: 7, E, 2 for ASCII 5: 7, O, 2 for ASCII 6: 8, N, 1 for ASCII 7: 8, N, 2 for ASCII

8: 8, E, 1 for ASCII

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

- Control by PC or PLC (Computer Link)
- A VFD-C2000 can be set up to communicate on Modbus networks using one of the following modes: ASCII (American Standard Code for Information Interchange) or RTU (Remote Terminal Unit).Users can select the desired mode along with the RS-485 serial port communication protocol in Pr.09-00.
- MODBUS ASCII (American Standard Code for Information Interchange) : Each byte data is the combination of two ASCII characters. For example, a 1-byte data: 64 Hex, shown as '64' in ASCII, consists of '6' (36Hex) and '4' (34Hex).

### 1. Code Description

Communication protocol is in hexadecimal, ASCII: "0", "9", "A", "F", every 16 hexadecimal represent ASCII code. For example:

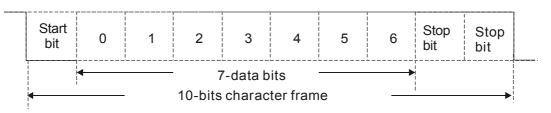
Character	ʻ0'	'1'	'2'	'3'	'4'	'5'	'6'	'7'
ASCII code	30H	31H	32H	33H	34H	35H	36H	37H

Character	'8'	ʻ9'	'A'	'B'	'C'	'D'	'E'	'F'
ASCII code	38H	39H	41H	42H	43H	44H	45H	46H

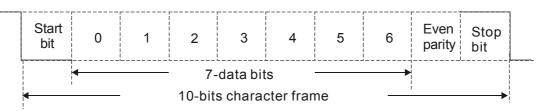
### 2. Data Format

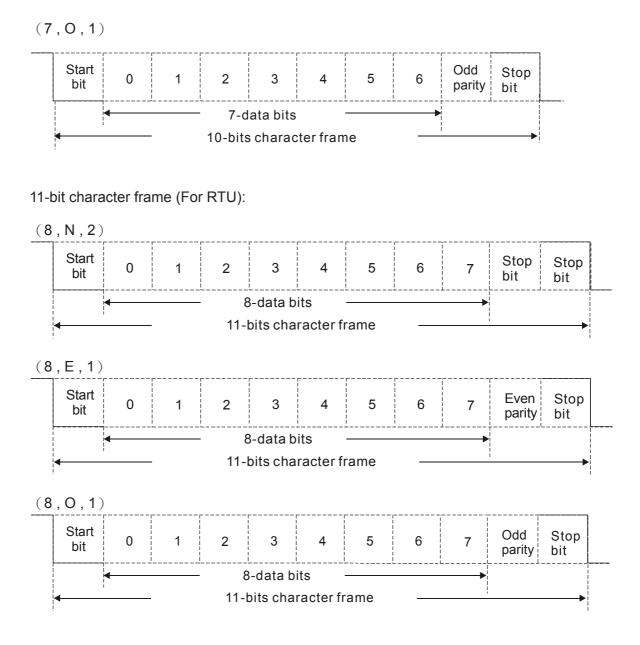
10-bit character frame (For ASCII):

(7, N, 2)









### 3. Communication Protocol

Communication Data Frame: ASCII mode

STX	Start character = ':' (3AH)
Address Hi	Communication address:
Address Lo	8-bit address consists of 2 ASCII codes
Function Hi	Command code:
Function Lo	8-bit command consists of 2 ASCII codes
DATA (n-1)	Contents of data:
	<ul> <li>Nx8-bit data consist of 2n ASCII codes</li> <li>n&lt;=16, maximum of 32 ASCII codes</li> </ul>
DATA 0	
LRC CHK Hi	LRC check sum:
LRC CHK Lo	8-bit check sum consists of 2 ASCII codes
END Hi	End characters:
END Lo	END1= CR (0DH), END0= LF(0AH)

A silent interval of more than 10 ms		
Communication address: 8-bit address		
Command code: 8-bit command		
Contents of data:		
n×8-bit data, n<=16		
CRC check sum:		
16-bit check sum consists of 2 8-bit characters		
A silent interval of more than 10 ms		

### Communication Data Frame: RTU mode

### Address (Communication Address)

Valid communication addresses are in the range of 0 to 254. A communication address equal to 0, means broadcast to all AC drives (AMD). In this case, the AMD will not reply any message to the master device.

00H: broadcast to all AC drives 01H: AC drive of address 01 0FH: AC drive of address 15 10H: AC drive of address 16

FEH: AC drive of address 254

### Function (Function code) and DATA (data characters)

The format of data characters depends on the function code.

03H: read data from register

06H: write single register

Example: reading continuous 2 data from register address 2102H, AMD address is 01H.

#### ASCII mode:

Command Me	ssage:	Response Mes	ssage
STX	( . ) -	STX	(_) -
Address	·0'	Address	<b>'</b> 0'
Address	'1'	Address	'1'
Function	·0'	Function	<b>'</b> 0'
Тапенон	'3'		'3'
	'2'	Number of register	<b>'</b> 0'
Starting register	'1'	(count by byte)	'4'
Starting register	·0'		'1'
	'2'	Content of starting register 2102H Content of register 2103H	'7'
	·0'		'7'
Number of register	·0'		<b>'</b> 0'
(count by word)	·0'		<b>'</b> 0'
	'2'		<b>'</b> 0'
LRC Check	'D'	Content of register 2103H	<b>'</b> 0'
EIG CHECK	'7'		<b>'</b> 0'
END	CR	LRC Check	'7'
LIND	LF		'1'
		END	CR
		LIND	LF

RTU mode:

Command Message:
------------------

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

06H: single write, write single data to register.

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

Command Me	ssage:	Response Me	ssage
STX	( . ) -	STX	(_) -
Address	·0'	Address	·0'
Address	'1'		'1'
Function	·0'	Function	·0'
Function	'6'	Function	'6'
	·0'		·0'
Target register	'1'	Target register	'1'
Target register	·0'		·0'
	·0'		·0'
Register content	'1'	Register content	'1'
	'7'		'7'
Register content	'7'		'7'
	·0'		·0'
LRC Check	'7'	LRC Check	'7'
	'1'		'1'
END	CR	END	CR
LIND	LF	LND	LF

RTU mode:

Command Mes	Command Message:		Response Message		
Address	01H	Address	01H		
Function	06H	Function	06H		
Taract register	01H	Toract register	01H		
Target register	00H	Target register	00H		
Bogistor content	17H	Pagistar contant	17H		
Register content	70H	Register content	70H		
CRC CHK Low	86H	CRC CHK Low	86H		
CRC CHK High	22H	CRC CHK High	22H		

10H: write multiple registers (write multiple data to registers) (at most 20 sets of data can be written simultaneously)

Example: Set the multi-step speed,

Pr.04-00=50.00 (1388H), Pr.04-01=40.00 (0FA0H). AC drive address is 01H.

### ASCII Mode

Command Mes	sage:	Response Mes	sage
STX	·	STX	(_) -
ADR 1	·0'	ADR 1	'0'
ADR 0	'1'	ADR 0	'1'
CMD 1	'1'	CMD 1	'1'
CMD 0	·0'	CMD 0	<b>'</b> 0'
	·0'		<b>'</b> 0'
Target register	'5'	Torget register	'5'
Target register	ʻ0'	Target register	<b>'</b> 0'
	<b>'</b> 0'		<b>'</b> 0'
	·0'		'0'
Number of register	·0'	Number of register (count by word)	<b>'</b> 0'
(count by word)	·0'		<b>'</b> 0'
	'2'		'2'
Number of register	·0'	LRC Check	'E'
(count by Byte)	'4'		'8'
	'1'	END	CR
The first data content	'3'	END	LF
The first data content	'8'		
-	'8'		
	<b>'</b> 0'		
The second data content	'F'		
The second data content	'A'		
	<b>'</b> 0'		
LRC Check	·9'		
	'A'		
END	CR		
END	LF		

#### RTU mode:

Command Message:		
ADR	01H	
CMD	10H	Γ
Torgot register	05H	Γ
Target register	00H	
Number of register	00H	Γ
(Count by word)	02H	
Quantity of data (Byte)	04	Γ
The first data content	13H	
The first data content	88H	
The second data content	0FH	
The second data content	A0H	
CRC Check Low	·9'	
CRC Check High	'A'	

#### Response Message:

	Jougo.
ADR	01H
CMD 1	10H
Target register	05H
Target register	00H
Number of register	00H
(Count by word)	02H
CRC Check Low	41H
CRC Check High	04H

### Check sum

### ASCII mode:

LRC (Longitudinal Redundancy Check) is calculated by summing up, module 256, and the values of the bytes from ADR1 to last data character then calculating the hexadecimal representation of the 2's-complement negation of the sum.

### For example,

01H+03H+21H+02H+00H+02H=29H, the 2's-complement negation of 29H is **<u>D7</u>**H.

### RTU mode:

CRC (Cyclical Redundancy Check) 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, putting the result in the CRC register.

### Step 3:

Examine the LSB of CRC register.

### Step 4:

If the LSB of CRC register is 0, shift the CRC register one bit to the right with MSB zero filling, then repeat step 3. If the LSB of CRC register is 1, shift the CRC register one bit to the right with MSB zero filling, Exclusive OR the CRC register with the polynomial value A001H, then repeat step 3.

### Step 5:

Repeat step 3 and 4 until eight shifts have been performed. When this is done, a complete 8-bit byte will have been processed.

### Step 6:

Repeat step 2 to 5 for the next 8-bit byte of the command message. Continue doing this until all bytes have been processed. The final contents of the CRC register are the CRC value. When transmitting the CRC value in the message, the upper and lower bytes of the CRC value must be swapped, i.e. the lower order byte will be transmitted first.

The following is an example of CRC generation using C language. The function takes two arguments:

Unsigned char\* data ← a pointer to the message buffer

Unsigned char length  $\leftarrow$  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 register CRC
      return reg_crc;
 }
```

### 4. Address list

Content	Register		Function	
AC drive parameters	GGnnH	1 <b>3</b> 1, 1		
		· · · · · ·	ample, the address of Pr 4-01 is 0401H.	
Command write only	2000H	Bit1~0	00B : No function	
			01B : Stop	
			10B : Run	
			11B : JOG+RUN	
		Bit3~2	Reserved	
		Bit5~4	00B : No function	
			01B : FWD	
			10B : REV	
			11B : Change direction	
		Bit7~6	00B: 1st accel/decel.	
			01B : 2nd accel/decel	
			10B: 3rd accel/decel	
			11B: 4th accel/decel	
		Bit11~8	000B: master speed	
			0001B: 1st Step Speed Frequency	
			0010B: 2nd Step Speed Frequency	
			0011B: 3rd Step Speed Frequency	
			0100B: 4th Step Speed Frequency	
			0101B: 5th Step Speed Frequency	
			0110B: 6th Step Speed Frequency	
			0111B: 7th Step Speed Frequency	
			1000B: 8th Step Speed Frequency	
			1001B: 9th Step Speed Frequency	
			1010B: 10th Step Speed Frequency	
			1011B: 11th Step Speed Frequency	
			1100B: 12th Step Speed Frequency	
			1101B: 13th Step Speed Frequency	

Content	Register		Function
			1110B: 14th Step Speed Frequency
			1111B: 15th Step Speed Frequency
		Bit12	1: Enable bit06-11 function
		Bit14~13	00B : No function
			01B : Operated by digital keypad
			10B : Operated by Pr.00-21 setting
			11B : Change operation source
		Bit15	Reserved
	2001H	Frequency	command(XXX.XXHz)
	2002H	Bit0	1 : EF (external fault) on
		Bit1	1 : Reset
		Bit2	1 : B.B ON
		Bit15~3	Reserved
Status monitor read	2100H	High byte:	Warn Code
only			Error Code
	2101H	Bit1~0	AC Drive Operation Status
			00B: Drive stops
			01B: Drive decelerating
			10B: Drive standby
		Bit2	11B: Drive operating 1 : JOG Command
		Bit4~3	Operation Direction
		DIL	00B: FWD run
			01B: From REV run to FWD run
			10B: REV run
			11B: From FWD run to REV run
		Bit8	1 : Master frequency controlled by communication
			interface
		Bit9	1 : Master frequency controlled by analog signal
		Bit10	1 : Operation command controlled by
			communication interface
		Bit11	1 : Parameter locked
		Bit12	1 : Enable to copy parameters from keypad
			Reserved
	2102H		(XXX.XX Hz)
	2103H	-	quency (XXX.XX Hz)
	2104H	· ·	rrent (XX.XXA) . When current is higher than
			vill shift decimal as (XXX.XA). The decimal can refer
	0.05	to High by	
	2105H		/oltage (XXX.XV)
	2106H	· ·	tage (XXX.XV)
	2107H		ep number of Multi-Step Speed Operation
	2108H	Reserved	- 1
	2109H	Counter va	
	210AH		
	210BH	•	rque (XXX.X%)
	210CH	Actual mo	tor speed (XXXXXrpm)
	210DH	Number of	f PG feed back pulses (0~65535)
	210EH	Number of PG2 pulse commands (0~65535)	
	210FH	Power output (X.XXX KWH)	
	2116H	Multi-funct	ion display (Pr.00-04)

Content	Register	Function
		Max. opeartion frequency (Pr.01-00) or Max. user defined
		value (Pr.00-26)
		When Pr00-26 is 0, this value is equal to Pr01-00 setting
	211BH	When Pr00-26 is not 0, and the command source is Keypad,
		this value = Pr00-24 * Pr00-26 / Pr01-00 When Pr00-26 is not 0, and the command source is 485, this
		value = Pr09-10 * Pr00-26 / Pr01-00
_	211FH	High byte: decimal of current value (display)
_		Display output current (A). When current is higher than
	2200H	655.35, it will shift decimal as (XXX.XA). The decimal can refer
		to High byte of 211F.
	2201H	Display counter value (c)
	2202H	Actual output frequency (XXXXXHz)
	2203H	DC-BUS voltage (XXX.XV)
	2204H	Output voltage (XXX.XV)
_	2205H	Power angle (XXX.X)
	2206H	Display actual motor speed kW of U, V, W (XXXXkW)
	2207H	Display motor speed in rpm estimated by the drive or encoder
	2207 11	feedback (XXXXXrpm)
	2208H	Display positive/negative output torque in %, estimated by the
		drive (t0.0: positive torque, -0.0: negative torque) (XXX.X%)
_	2209H	Display PG feedback (as Pr. 00-04 NOTE 1)
_	220AH	PID feedback value after enabling PID function (XXX.XX%)
	220BH	Display signal of AVI analog input terminal, 0-10V corresponds to 0.00~100.00% (1.) (as Pr. 00-04 NOTE 2)
	220CH	Display signal of ACI analog input terminal, 4-V20mA/0-10V corresponds to 0.00~100.00% (2.) (as Pr. 00-04 NOTE 2)
	220DH	Display signal of AUI analog input terminal, -10V~10V corresponds to -100.00~100% (3.) (as Pr. 00-04 NOTE 2)
—	220EH	IGBT temperature of drive power module (XXX.X°C)
_	220FH	The temperature of capacitance (XXX.X°C)
-	2210H	The status of digital input (ON/OFF), refer to Pr.02-12 (as Pr. 00-04 NOTE 3)
-	2211H	The status of digital output (ON/OFF), refer to Pr.02-18 (as Pr. 00-04 NOTE 4)
	2212H	The multi-step speed that is executing (S)
	2213H	The corresponding CPU pin status of digital input (d.) (as Pr. 00-04 NOTE 3)
	2214H	The corresponding CPU pin status of digital output (O.) (as Pr. 00-04 NOTE 4)
		Number of actual motor revolution (PG1 of PG card) (P.) it will
	2215H	start from 9 when the actual operation direction is changed or keypad display at stop is 0. Max. is 65535
	2216H	Pulse input frequency (PG2 of PG card) (XXX.XXHz)
-	2217H	Pulse input position (PG card PG2), maximum setting is 65535.
	2218H	Position command tracing error
	2219H	Display times of counter overload (XXX.XX%)
	221AH	GFF (XXX.XX%)
	221BH	DCbus voltage ripples (XXX.XV)
	221CH	PLC register D1043 data (C)
	221DH	Pole of Permanent Magnet Motor
	221EH	User page displays the value in physical measure
	221FH	Output Value of Pr.00-05 (XXX.XXHz)

Content	Register	Function	
	2220H	Number of motor tunrns when drive operates (keeping when drive stops, and reset to zero when operation)	
	2221H	Opeartion position of motor (keeping when drive stops, and reset to zero when operation)	
	2222H	Fan speed of the drive (XXX%)	
	2223H	Control mode of the drive 0: speed mode 1: torque mode	
	2224H	Carrier frequency of the drive (XXKHZ)	
	2225H	Reserve	
	2226H 2227H	Drive status bit 1~0 00b: No direction 01b: Forward 10b: Reverse bit 3~2 01b: Driver ready 10b: Error bit 4 0b: Motor drive did not output 1b: Motor drive did output bit 5 0b: No alarm 1b: Have Alarm Drive's estimated output torque(positive or negative direction) (XXXX Nt-m)	
	2228H	Torque command (XXX.X%)	
	2229H	KWH display (XXXX.X)	
	222AH	PG2 pulse input in Low Word	
	222BH	PG2 pulse input in High Word	
	222CH	Motor actual position in Low Word	
	222DH	Motor actual position in High Word	
	222EH	PID reference (XXX.XX%)	
	222FH		
	2230H	PID output frequency (XXX.XXHz)	

### 5. Exception response:

The AC motor drive is expected to return a normal response after receiving command messages from the master device. The following depicts the conditions when no normal response is replied to the master device.

The AC motor drive does not receive the messages due to a communication error; thus, the AC motor drive has no response. The master device will eventually process a timeout condition.

The AC motor drive receives the messages without a communication error, but cannot handle them. An exception response will be returned to the master device and an error message "CExx" will be displayed on the keypad of AC motor drive. The xx of "CExx" is a decimal code equal to the exception code that is described below.

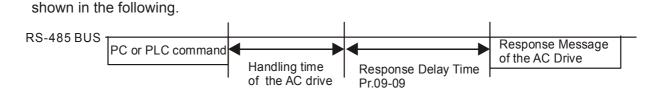
In the exception response, the most significant bit of the original command code is set to 1, and an exception code which explains the condition that caused the exception is returned.

Example:

ASCII mo	de:	RTU mode:	
STX	(.) -	Address	01H
Address	·0'	Function	86H
Address	'1'	Exception code	02H
Function	'8'	CRC CHK Low	C3H
Function	·6'	CRC CHK High	A1H
Execution and	·0'		
Exception code	'2'	_	
	'7'	_	
LRC CHK	'7'	_	
END	CR	_	
END	LF	_	

The explanation of exception codes:

Exception	Evaluation			
code	Explanation	Explanation		
1	Function code is not supported or unrecognized.			
2	Address is not supported or unrecognized.			
3	Data is not correct or unrecognized.			
4	Fail to execute this function code			
9-08				
	Response Delay Time			
	Factory Setting: 2.0	)		
S	Settings 0.0~200.0ms			
This para	ameter is the response delay time after AC drive receives communication comm	nand a		
ahawa in	the following			



### **B** - **H** Main Frequency of the Communication

Factory Setting: 60.00

### Settings 0.00~600.00Hz

When Pr.00-20 is set to 1 (RS485 communication). The AC motor drive will save the last frequency command into Pr.09-10 when abnormal turn-off or momentary power loss. After reboots the power, it will regard the frequency set in Pr.09-10 if no new frequency command is inputted. When frequence command of 485 is changed (the source of frequence command needs to be set as MODBUS), this parameter is also be changed.

-		
N	89-11	Block Transfer 1
N	09-12	Block Transfer 2
×	09-13	Block Transfer 3
N	09-14	Block Transfer 4
N	09-45	Block Transfer 5
N	89-16	Block Transfer 6
N	89-17	Block Transfer 7
N	09-18	Block Transfer 8
N	89-19	Block Transfer 9
N	88-88	Block Transfer 10
N	89-21	Block Transfer 11
N	88-88	Block Transfer 12
N	88-83	Block Transfer 13
N	89-24	Block Transfer 14
N N N N	09-20 15-20 55-20 85-20 80-23	Block Transfer 11         Block Transfer 12         Block Transfer 13



Block Transfer 15 Block Transfer 16

Factory Setting: 0

### Settings 0~65535

There is a group of block transfer parameter available in the AC motor drive (Pr.09-11 to Pr.09-26). Through communication code 03H, user can use them (Pr.09-11 to Pr.09-26) to save those parameters that you want to read.

09-27	
~ Reserved	
85-80	
<b>39-38</b> Communication Decoding Method	
	Factory Setting: 1

Settings 0: Decoding Method 1

1: Decoding Method 2

		Decoding Method 1	Decoding Method 2	
Source of	Digital Keypd	Digital keypad controls the drive action regardless decoding method 1 or 2.		
Operation	External Terminal	External terminal controls the drive action regardless decoding method 1 or 2.		
Control	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 ~ 2060-FFh	
	Communication Card	Refer to address: 2000h ~ 20FFh	Refer to address: 6000h ~ 60FFh	
	PLC	PLC commands the drive action regardless decoding method 1 or 2.		

### **39-3** Internal Communication Protocol

Factory Setting: 0

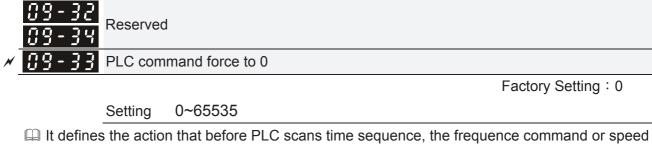
Settings

0: Modbus 485

-1: Internal Communication Slave 1

- -2: Internal Communication Slave 2
- -3: Internal Communication Slave 3
- -4: Internal Communication Slave 4
- -5: Internal Communication Slave 5
- -6: Internal Communication Slave 6
- -7: Internal Communication Slave 7
- -8: Internal Communication Slave 8
- -9: Reserve
- -10: Internal Communication Master
- -11: Reserve
- -12: Internal PLC Control
- When it is defined as internal communication, see CH16-10 for information on Main Control Terminal of Internal Communication.
- When it is defined as internal PLC control, see CH16-12 for Remote IO control application (by using MODRW).

Factory Setting : 0



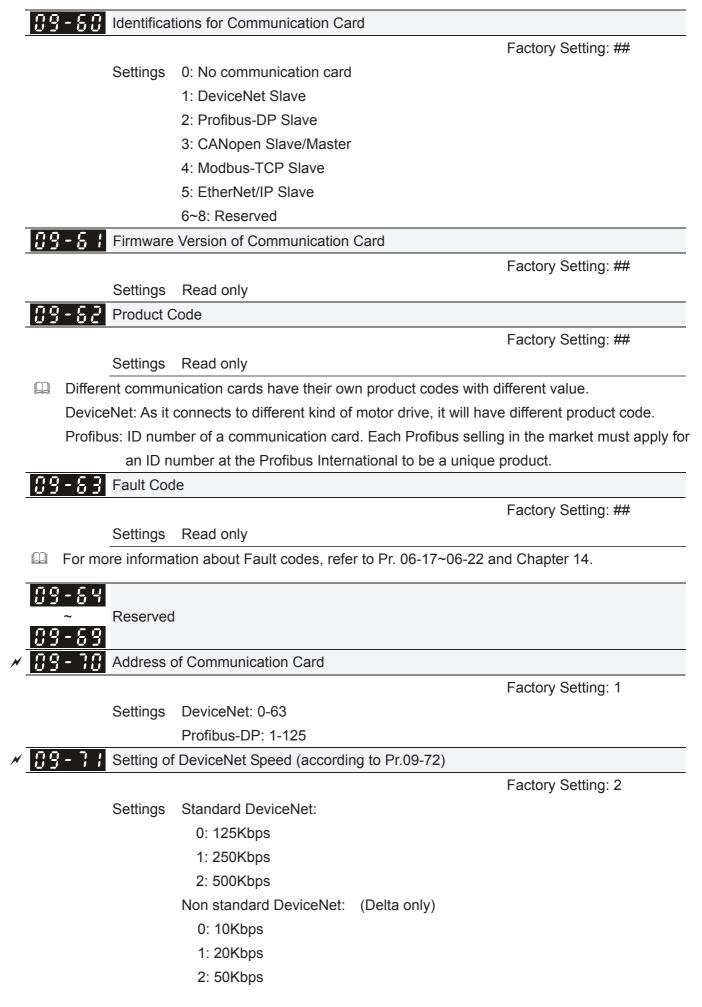
command needs to be cleared as 0 or not.

Bit	Explanation
Bit0	Before PLC scan, set up PLC target frequency=0
Bit1	Before PLC scan, set up the PLC target torque=0
Bit2	Before PLC scan, set up the speed limit of torque control mode=0

## **BB-35** PLC Address

			Factory Setting: 2
	Settings	1~254	
89-36	CANoper	Slave Address	
			Factory Setting: 0
	Settings	0: Disable	
		1~127	
89-37	CANoper	Speed	
			Factory Setting: 0
	Settings	0: 1M	
		1: 500k	
		2: 250k	
		3: 125k	
		4: 100k (Delta only)	
		5: 50k	
09-38	Reserved		
09-39	CANoper	Warning Record	
			Factory Setting: Read only
	Settings	bit 0: CANopen Guarding Time out	
		bit 1: CANopen Heartbeat Time out	
		bit 2: CANopen SYNC Time out	
		bit 3: CANopen SDO Time out	
		bit 4: CANopen SDO buffer overflow	
		bit 5: Can Bus Off	
		bit 6: Error protocol of CANOPEN	
		bit 7: Reserved	
		bit 8: The setting values of CANopen indexs are	fail
		bit 9: The setting value of CANopen address is fa	il
		bit10: The checksum value of CANopen indexs is	s fail

<u>09-</u> 40	CANoper	Decoding Method	
			Factory Setting: 1
	Settings	0: Delta defined decoding method	
		1: CANopen Standard DS402 protocol	
09-41	CANoper	Status	
			Factory Setting: 0
	Settings	0: Node Reset State	
	0	1: Com Reset State	
		2: Boot up State	
		3: Pre Operation State	
		4: Operation State	
		5: Stop State	
<u> 69 - 42</u>	CANoper	Control Status	
			Factory Setting: Read Only
	Settings	0: Not ready for use state	radioly cetting. Read only
	Octango	1: Inhibit start state	
		2: Ready to switch on state	
		3: Switched on state	
		4: Enable operation state	
		7: Quick stop active state	
		13: Err reaction activation state	
00 11 7		14: Error state	
<u>89-43</u>	Reset CA	Nopen Index	E 1 0 111 05505
	o		Factory Setting: 65535
	Settings:	bit0: reset address 20XX to 0	
		bit1: reset address 264X to 0	
		bit2: reset address 26AX to 0	
		bit3: reset address 60XX to 0	
<u> [] 9 - 4 4</u>	Reserved		
<u>89-45</u>	CANoper	Master Function	
			Factory Setting: 0
	Settings	0: Disable	
		1: Enable	
89-46	CANoper	Master Address	
			Factory Setting: 100
	Settings	1~127	
09-47			
~	Reserved		
89-59			



-					
2.	- 1	nr	או	h	nc
כ.	- 1	υι	JL	U	ps

- 4: 125Kbps
- 5: 250Kbps
- 6: 500Kbps
- 7: 800Kbps
- 8: 1Mbps

✓ **39-32** Other Setting of DeviceNet Speed

Factory Setting: 0

Settings 0: Standard DeviceNet

1: Non standard DeviceNet

It needs to use with Pr.09-71.

- $\square$  Setting 0: the baud rate can only be set to 0, 1, 2 or 3.
- Setting 1: setting of DeviceNet communication rate can be the same as CANopen (setting 0-8).

_	09-73	Reserved
_	09-74	Reserved
~	09-75	IP Configuration of the Communication Card

Factory Setting: 0

Settings 0: Static IP

1: DynamicIP (DHCP)

Setting 0: it needs to set IP address manually.

Setting 1: IP address will be auto set by host controller.

×	09-76	IP Address 1 of the Communication Card
×	09-77	IP Address 2 of the Communication Card
~	09-78	IP Address 3 of the Communication Card
N	09-79	IP Address 4 of the Communication Card

Factory Setting: 0

Settings 0~255

 $\square$  Pr.09-76~09-79 needs to use with communication card.

<u> </u>		tory Setting: 0
~	Address Mask 4 of the Communication Card	
×	Address Mask 3 of the Communication Card	
N	Address Mask 2 of the Communication Card	
N	Address Mask 1 of the Communication Card	

Settings 0~255

× 89-84	Getway A	Address 1 of the Communication Card		
× 89-85	Getway A	Getway Address 2 of the Communication Card		
× 88-88	Getway A	Getway Address 3 of the Communication Card		
× 83-87	Getway A	Getway Address 4 of the Communication Card		
		Factory Setting: 0		
	Settings	0~255		
× 09-88	Password	d for Communication Card (Low word)		
× <u>09-89</u>	Password	d for Communication Card (High word)		
		Factory Setting: 0		
	Settings	0~255		
× <u>89-98</u>	Reset Co	mmunication Card		
		Factory Setting: 0		
	Settings	0: Disable		
		1: Reset, return to factory setting		
<u>≁ 89-9 (</u>	Additiona	I Setting for Communication Card		
		Factory Setting: 1		
	Settings	Bit 0: Enable IP Filter		
		Bit 1: Internet parameters enable(1bit)		
		When IP address is set up, this bit need to be enabled to write down the		
		parameters. This bit will change to disable when it finishes saving the		
		update of internet parameters.		
		Bit 2: Login password enable(1bit)		
		When enter login password, this bit will be enabled. After updating the		
		parameters of communication card, this bit will change to disable.		
88-88	Status of	Communication Card		
		Factory Setting: 0		
	Settings	Bit 0: password enable		
		When the communication card is set with password, this bit is enabled.		
		When the password is clear, this bit is disabled.		

## **10 PID Control**

✓ This parameter can be set during operation.

Factory Setting: 0

In this parameter group, ASR is the abbreviation for Adjust Speed Regulator and PG is the abbreviation for Pulse Generator.



Settings 0: Disable

- 1: ABZ
- 2: ABZ (Delta encoder for Delta Servo motor)
- 3: Resolver
- 4: ABZ/UVW
- 5. MI8 single phase pulse input
- For PG extension card EMC-PG01L and EMC-PG01O, set Pr.10-00=1. These extension cards are for IM motor only.
- For EMC-PG01U, when setting Pr.10-00=2 (Delta encoder) make sure SW1 is switched to D (Delta type). If the setting for Pr.10-00, 10-01 and 10-02 has changed, please turn off the drive's power and reboots to prevent PM motor stall. This mode is suggested for PM motor.
- General For EMC-PG01R, when setting Pr.10-00=3 please also input 1024 ppr.
- For EMC-PG01U, when setting Pr.10-00=4 (Standard ABZ/UVW Encoder) make sure SW1 is switched to S (Standard Type). This mode is applicable for both IM and PM motor.
- When using MI8 single phase pulse input as frequency command, the Pr10-02 must set "5: Single-phase input". This only can be use with VF, VFPG, SVC, IM/PM FOC Sensor-less, IM/PM TQC Sensor-less control mode.
- When using MI8 single phase pulse as speed feedback, the drive must at VFPG control mode only.

**H** - **H H** Encoder Pulse

Factory Setting: 600

Settings 1~20000

A Pulse Generator (PG) or encoder is used as a sensor that provides a feedback signal of the motor speed. This parameter defines the number of pulses for each cycle of the PG control, i.e. the number of pulses for a cycle of A phase/B phase.

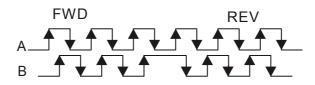
- This setting is also the encoder resolution. With the higher resolution, the speed control will be more accurate.
- An incorrect input to Pr.10-00 may result drive over current, motor stall, PM motor magnetic pole origin detection error. If Pr.10-00 setting has changed, please trace the magnetic pole again, set Pr.05-00=4 (static test for PM motor magnetic pole and PG origin again).



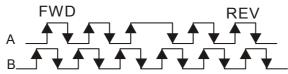
#### Factory Setting: 0

### Settings 0: Disable

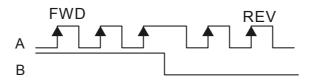
1: Phase A leads in a forward run command and phase B leads in a reverse run command



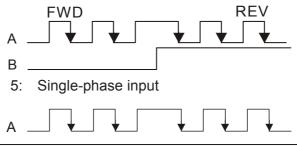
2: Phase B leads in a forward run command and phase A leads in a reverse run command



3: Phase A is a pulse input and phase B is a direction input. (L =reverse direction, H=forward direction)



4: Phase A is a pulse input and phase B is a direction input. (L=forward direction, H=reverse direction)



Output Setting for Frequency Division (denominator)

Factory Setting: 1

### Settings 1~255

This parameter is used to set the denominator for frequency division (for PG card EMC-PG01L or EMC-PG01O). For example, when it is set to 2 with feedback 1024ppr, PG output will be 1024/2=512ppr.

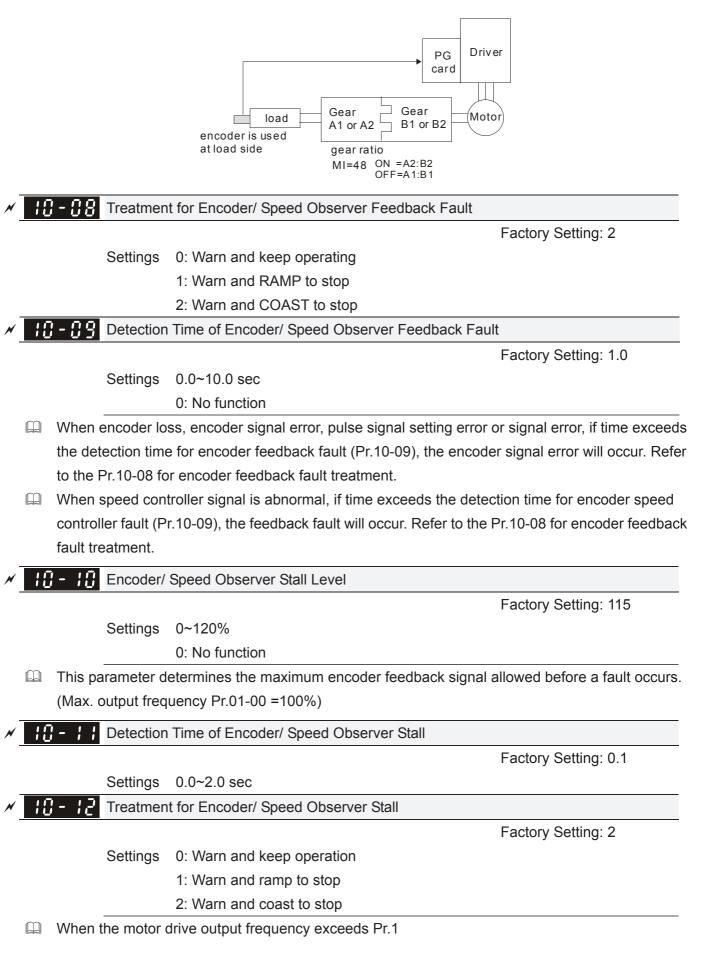
~	High - CH Electrical Gear at Load Side A1
N	10 - 05 Electrical Gear at Motor Side B1
×	IC - CS         Electrical Gear at Load Side A2
×	Image: Control of the sector of the

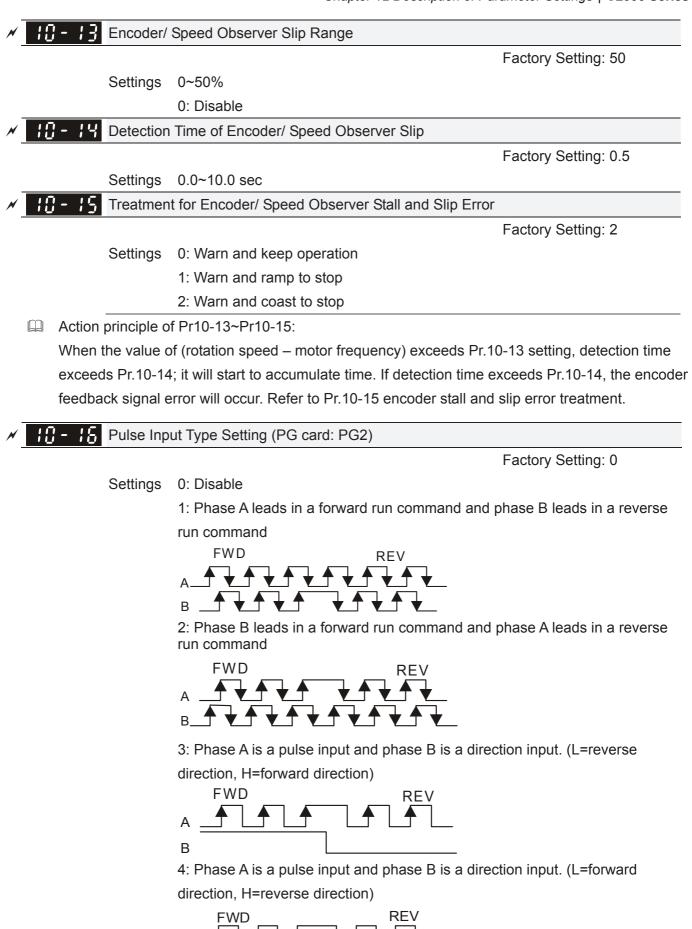
Factory Setting: 100

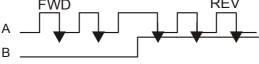
### Settings 1~65535

Parameters 10-04 to 10-07 can be used with the multi-function input terminal (set to 48) to switch to Pr.10-04~10-05 or Pr.10-06~10-07 as shown as follows

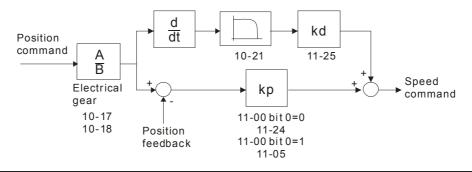
### Chapter 12 Description of Parameter Settings | C2000 Series

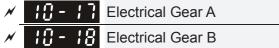






- When this setting is different from Pr.10-02 setting and the source of the frequency command is pulse input (Pr.00-20 is set to 4 or 5), it may have 4 times frequency problem.
   Example: Assume that Pr.10-01=1024, Pr.10-02=1, Pr.10-16=3, Pr.00-20=5, MI=37 and ON, it needs 4096 pulses to rotate the motor a revolution.
- Assume that Pr.10-01=1024, Pr.10-02=1, Pr.10-16=1, Pr.00-20=5, MI=37 and ON, it needs 1024 pulses to rotate the motor a revolution.
- Desition control diagram

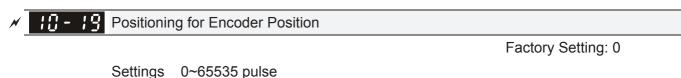




Factory Setting: 100

```
Settings 1~65535
```

Rotation speed = pulse frequency/encoder pulse (Pr.10-01) \* PG Electrical Gear A / PG Electrical Gear B.



Description of the internal position in the position mode.

It needs to be used with multi-function input terminal setting =35 (enable position control).

When it is set to 0, it is the Z-phase position of encoder.

✓ 10 - 20 Range for Encoder Position Attained

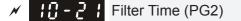
Factory Setting: 10

Settings 0~65535 pulse

In This parameter determines the range for internal positioning position attained.

### For example:

When the position is set by Pr.10-19 Positioning for Encoder Position and Pr.10-20 is set to 1000, it reaches the position if the position is within 990-1010 after finishing the positioning.



Factory Setting: 0.100

Settings 0.000~65.535 sec

When Pr.00-20 is set to 5 and multi-function input terminal is set to 37 (OFF), the pulse command will be regarded as frequency command. This parameter can be used to suppress the jump of speed command.



Speed Mode (PG2)

Factory Setting: 0

Factory Setting: 0

### Settings 0: Electronic Frequency

1: Mechanical Frequency (base on pole pair)

	Reserved	
N	FOC&TQC Function Control	

Settings 0~65535

Bit#	Description			
0	ASR control at sensorless torque 0:use PI as ASR; 1:use P as ASR			
1~10	NA			
11	Activate DC braking when executing zero torque command 0:ON, 1:OFF			
12	FOC Sensorless mode, cross zero means speed goes from negative to positive or positive to negative (forward to reverse direction or reverse to forward direction). 0: determine by stator frequency , 1: determine by speed command			
13	NA			
14	NA			
15	Direction control at open loop status 0: Switch ON direction control 1: Switch OFF direction control			

Except Bit=0 set to be used in closed loop, other Bit settings are for open loop.

FOC Bandwidth of Speed Observer

Factory Setting:40.0

Settings 20.0~100.0Hz

Setting speed observer to higher bandwidth could shorten the speed response time but will create greater noise interference during the speed observation.

✓ 18 - 28 FOC Minimum Stator Frequency

Factory Setting:2.0

### Settings 0.0~10.0%fN

This parameter is used to set the minimum level of stator frequency at operation status. This setting ensures the stability and accuracy of observer and avoid interferences from voltage, current and motor parameter. fN is motor rated frequency.

### FOC Low-pass Filter Time Constant

Factory Setting:50

Settings 1~1000ms

This parameter sets the low-pass filter time constant of a flux observer at start up. If the motor can not be activated during the high-speed operation, please lower the setting in this parameter.



**FOC Gain of Excitation Current Rise Time** 

Factory Setting:100

Settings 33~100% Tr (Tr: rotor time constant)

This parameter sets the drive's excitation current rise time when activates at sensiorless torque mode. When the drive's activation time is too long at torque mode, please adjust this parameter to a shorter time constant.



Factory Setting: 20.00

### Settings 0.00~200.00Hz

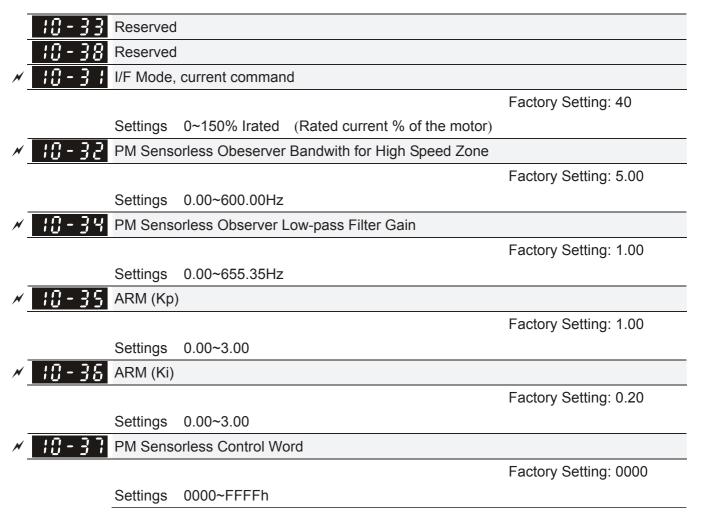
- Pr.10-29 is for setting the maximum of frequency deviation.
- When this parameter is set too large, resulting in abnormal PG feedback malfunction.
- If the application need higher setting of Pr10-29, please note that: Higher setting of Pr10-29 value will result in larger motor slip, which will cause PG Error (PGF3, PGF4) easily. In this case, set Pr10-10 and Pr10-13 as 0 will disable PGF3 and PGF4 detection, but it needs to make sure the PG wiring and application is correct. Or it may lose the instant PG protection. Too Higher Pr10-29 setting is not a common setting.

**10 - 30** Resolver Pole Pair

Factory Setting: 1

Settings 1~50

To use Pr.10-30 function, user must set Pr.10-00=3(Resolver Encoder) first.



Bit No.	Function	Description
0	Reserved	
1	Reserved	
2	Choose a control mode to statrt.	0 :Start by IF mode 1: Start by VF mode
3	Choose a mode to stop .	0 :Stop by IF mode 1 :Stop by VF mode
4	Reserved	
5	Choose a control mode to stop	0 : When lower than Pr10-40, coast to stop 1 : When lower than Pr10-40, ramp to stop
6	Reserved	
7	Reserved	

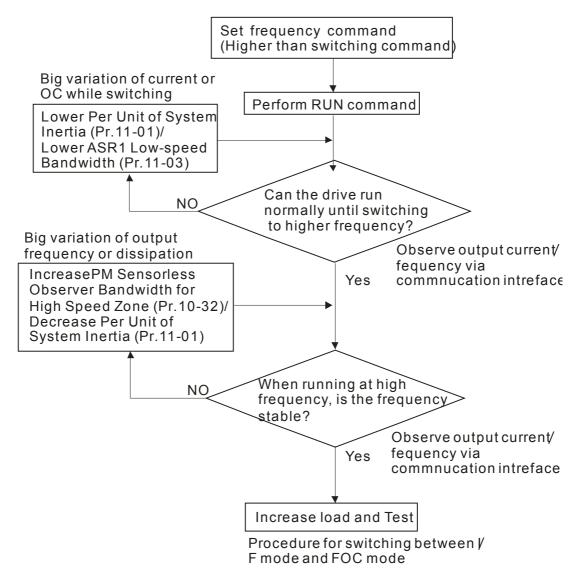
_					
~	-10	- 39	Frequenc	y Point when switch from I/F mode to PM Sensorle	ess mode
-					Factory Setting: 20.00
			Settings	0.00~600.00Hz	
•	18	- 40	Frequenc	y Point when switch from PM Sensorless Observa	tion mde to I/F mode
-					Factory Setting: 20.00
			Settings	0.00~600.00Hz	
~	10	-41	I/F mode,	low pass-filter time	
-					Factory Setting: 0.2
			Settings	0.0~6.0 sec	
~	10	- 42	Initial Ang	le Detection Time	
-					Factory Setting: 5
			Settings	0~20 ms	
		PM Se	ensorless (	l/f + FOC) Adjustment Procedure	
		1. Whe	en executi	ng Static test for PM(IPM) (05-00=13), VFD soft	ware can be used to monito

adjustment procedure. To download VFD Sotware go to:

http://www.delta.com.tw/product/em/download/download\_main.asp?act=3&pid=1&cid=1&tpid=3

- 2. Testing PM High Frequency Standstill VFD (calculating of Rs, Ld, Lg) Procedures:
  - A. Set control mode as VF mode (Pr00-10=0, Pr00-11=0)
  - B. Output Frequency of Motor 1 (Pr01-01)
  - C. Output Voltage of Motor 1 (Pr01-02)
  - D. Induction Motor and Permanent Magnet Motor Selection (Pr05-33=1 or 2)
  - E. Full-load current of Permanent Magnet Motor(Pr05-34
  - F. Set Static test for PM(IPM) (05-00=13), then run the drive.
- 3. Set control mode as PM sensorless Mode (Parameters 00-10=0, 00-11=6)
- 4. Set VFD Prameters
  - ☑ Pr05-35 Rated Power of Permanent Magnet Motor
  - ☑ Pr05-36 Rated speed of Permanent Magnet Motor
  - ☑ Pr05-37 Pole number of Permanent Magnet Motor
  - Pr05-38 Inertia of Permanent Magnet Motor

- 5. Set ASR Parameters
  - Pr11-00 bit0=1: Auto tuning for ASR and APR
  - ✓ Pr11-02 : ASR1/ASR2 Switch Frequency, it is recommended to set Pr10-39 higher than 10Hz.
  - ✓ Pr11-03: ASR1 Low-speed Bandwidth and Pr11-03, ASR2 High-speed Bandwidth. Do not set Low-speed Bandwith too high to avoid dissipation of the estimator.
- 6. Set speed estimator and speed control's parameter.
  - Pr10-39 Frequency when switch from I/F Mode to PM sensorless mode.
  - Pr10-32 PM Sensorless Obeserver Bandwith for High Speed Zone
- 7. Zero-load test
  - $\square$  Refer to switch point producedure of I/F and FOC as shown in the image below.



# IPM control method SOP

1. Set up IPM motor

Pr05-33=2

2. Set up motor parameter according to the motor Nameplate

Pr01-01 Output Frequency of Motor 1 (base frequency and motor rated frequency Pr01-02 Output Voltage of Motor 1 (base frequency and motor rated frequency) Pr05-34 Full-load current of Permanent Magnet Motor Pr05-35 Rated Power of Permanent Magnet Motor Pr05-36 Rated speed of Permanent Magnet Motor Pr05-37 Pole number of Permanent Magnet Motor

3. Execute Auto-tuning

Set upPr05-00=13 for IPM motor tuning and press Run(static-tuning). When the tuning is done, the following parameters will be obtained.

Pr05-39 Stator Resistance of PM Motor

Pr05-40 Permanent Magnet Motor Ld

- Pr05-41 Permanent Magnet Motor Lq
- 4. Set up control mode: Pr00-10=0 velocity mode, Pr00-11=7 IPM sensor-less
- 5. Turn OFF the power and power ON again.
- 6. Modify the ASR Kp and Ki according to system need.

- <b>:</b> () - 4 ]	PG Card	Version			
					Factory Setting: Read only
	Settings	0~655.35			
💭 Versi	on referenc	e:			
			PG02U	21.XX	
			PG01U	31.XX	
			PG010/PG01L	11.XX	
			PG020/PG02L	14.XX	
			PG01R	41.XX	
; <u>[]</u> - 43	}				
~	Reserv	е			
<u> :0 - 4</u> 8	3				
10-49	Zero vo	oltage time v	while start up		
					Fester ( Catting: 00.000

Factory Setting: 00.000 sec

### Settings 00.000~60.000 sec

- When the motor is in static status at the startup, the accuracy to estimate angles will be increased. In order to make the motor in "static status", the drive 3 phase U, V, W output 0V to motor to reach this goal. The Pr10-49 setting time is the length of time when three-phase output 0V.
- It is possible that even when this parameter is being applied but the motor at the installation site cannot go in to the "static status" caused by the inertia or by any external force. So, if the motor doesn't go into a completer "static status" in 0.2 sec, increase appropriately this setting value.
- This parameter is functional only when the setting of Pr07-12 Speed Search during Startup  $\neq 0$ .



- **S** Reverse angle limit (Electrical angle)

Factory Setting: 10.00 degree

#### Settings 0.00~30.00 degree

- While forward run is starting, if there is a sudden reverse run and the reverse angle is bigger than the Pr10-50 setting, then, drive will has a ScRv error.
- This parameter is valid only when Pr07-28 =11 Enable textile machine's function.

### III - 5 I Injection Frequency

### Settings 0~2000Hz

Factory Setting: 500 Hz

This parameter is a High Frequency Injection Command when the motor drive is under IPM HFI sensor-less control mode and it doesn't often need to be adjusted. But, if a motor's rated frequency (i.e. 400Hz) is too close to the frequency setting of this parameter (i.e. 500Hz), the accuracy of angles detected will be affected. Therefore, refer to the setting of Pr01-01 before adjusting this parameter.

## / IB-S2 Injection Magnitude

Factory Setting:15/30V

Settings 0.0~200.0V

- This parameter is the High Frequency Injection Command's amplitude when the motor drive is under IPM HFI sensor-less control mode.
- By increase the setting value of this parameter, the accuracy of angles detected will also be increased. However, if the setting value is too big, it will cause a louder electromagnetic noise.

## **11 Advanced Parameters**

✓ This parameter can be set during operation.

Factory Setting: 0

In this parameter group, ASR is the abbreviation for Adjust Speed Regulator

1		$\overline{n}$	System Control
- 1	1 -	$\boldsymbol{U}$	System Control

Settings	0: Auto tuning for ASR and APR	

- 1: Inertia estimate (only in FOCPG mode)
- 2: Zero servo

3: Dead time compensation closed

7: Selection to save or not save the freqeuncy

8: Maximum speed of point to point position control

Bit 0=0: Pr.11-06 to 11-11 will be valid and Pr.11-03~11-05 are invalid.

Bit 0=1: system will generate an ASR setting. At this moment, Pr.11-06~11-11 will be invalid and Pr.11-03~11-05 are valid.

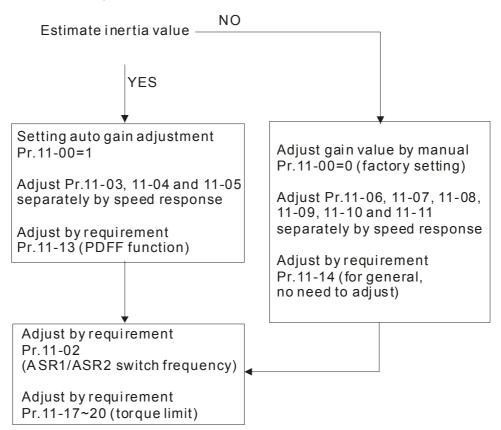
Bit 1=0: no function.

Bit 1=1: Inertia estimate function is enabled. (Bit 1 setting would not activate the estimation

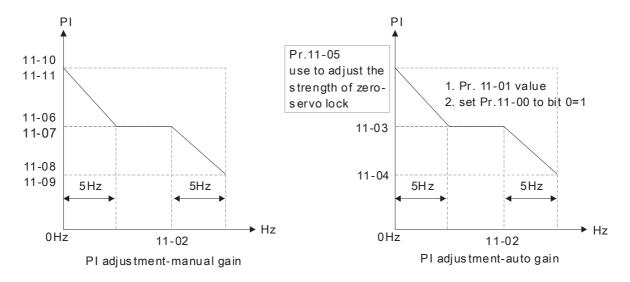
process, please set Pr.05-00=12 to begin FOC/TQC Sensorless inertia estimating)

Bit 2=0: no function.

Bit 2=1: when frequency command is less than Fmin (Pr.01-07), it will use zero servo function.



#### Chapter 12 Description of Parameter Settings | C2000 Series



Bit 7=0: frequency is saved before power turns off. When power turns on again, the display frequency will be the memorized frequency.

Bit 7=1: frequency is not saved before power turns off. When power turns ON again, the display frequency will be 0.00Hz.

Bit 8=0: maximum speed for point-to-point position control is control by the setting of Pr.11-43. Bit 8=1: maximum speed for point-to-point position control is control by the multi-step speed setting of the external terminal device. When multi-step speed of the external device is set to 0, the maximum operation speed will bet the setting of Pr.11-43.

### I - I Per Unit of System Inertia

Factory Setting: 400

Settings 1~65535 (256=1PU)

Degree To get the system inertia from Pr.11-01, user needs to set Pr.11-00 to bit1=1 and execute continuous forward/reverse running.

Unit of induction motor system inertia is 0.001kg-m^2:

Power	Setting	Power	Setting	Power	Setting
1HP	2.3	20HP	95.3	100HP	1056.5
2HP	4.3	25HP	142.8	125HP	1275.3
3HP	8.3	30HP	176.5	150HP	1900.0
5HP	14.8	40HP	202.5	175HP	2150.0
7.5HP	26.0	50HP	355.5	215HP	2800.0
10HP	35.8	60HP	410.8	300HP	3550.0
15HP	74.3	75HP	494.8		

The base value for induction motor system inertia is set by Pr.05-38 and the unit is in 0.001kg-m<sup>2</sup>.

ASR1/ASR2 Switch Frequency

Factory Setting: 7.00

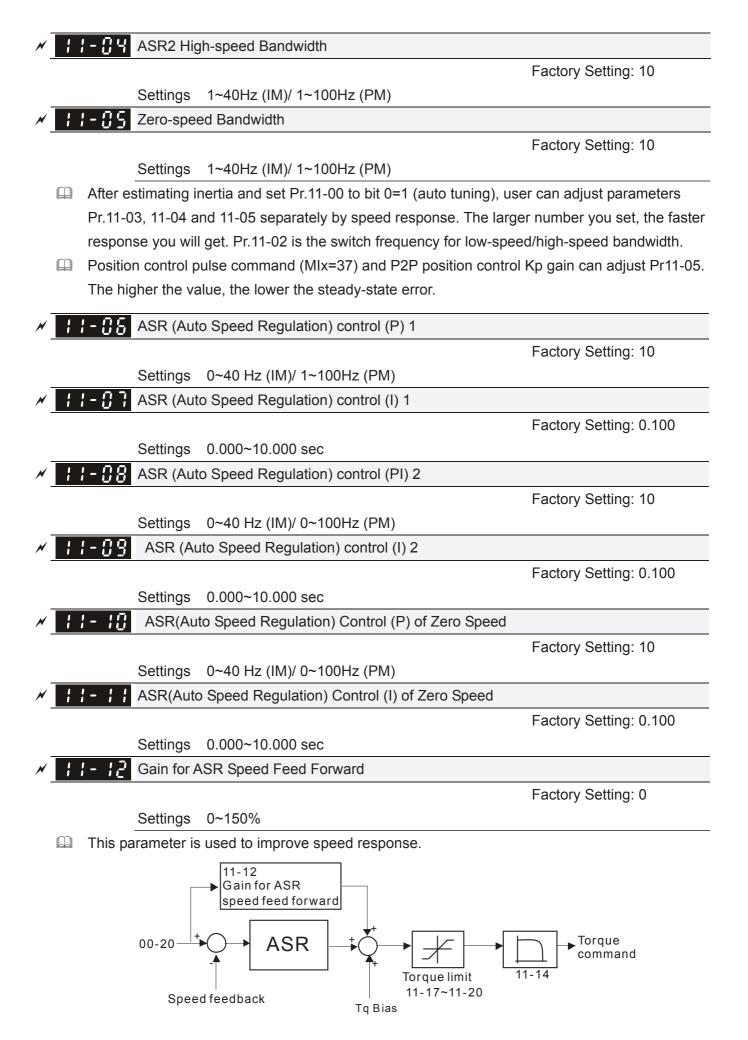
#### 5.00~600.00Hz Settings

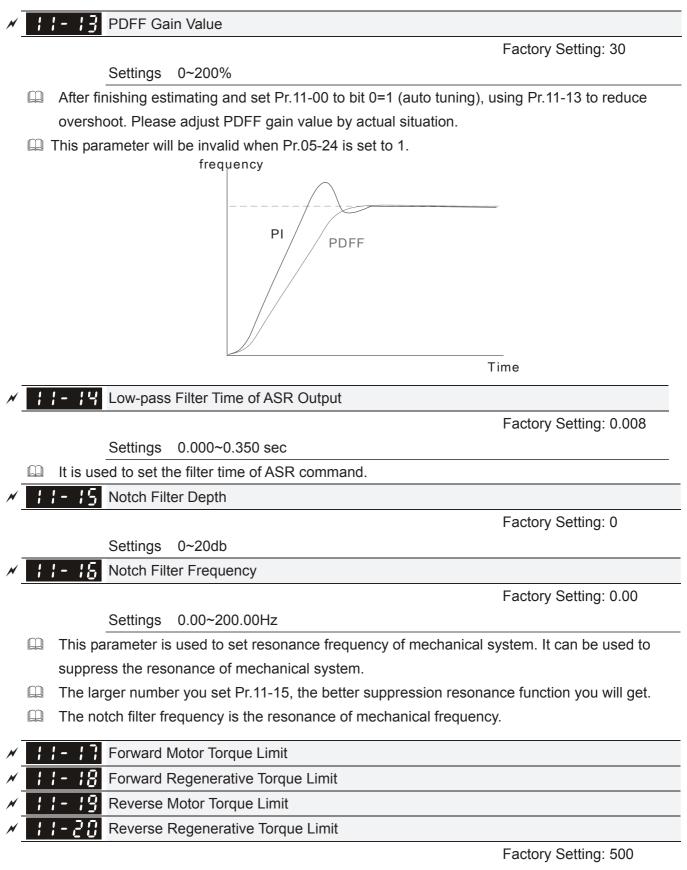


ASR1 Low-speed Bandwidth

Factory Setting: 10

1~40Hz (IM)/ 1~100Hz (PM) Settings





Settings 0~500%

The motor drive rated current is 100%. The settings for Pr.11-17 to Pr.11-20 will compare with Pr.03-00=7, 8, 9, 10. The minimum of the comparison result will be torque limit. Please refer the chart as below.

**Calculation equation for motor rated torque:** 

Motor rated torque= $\frac{T(N.M) = \frac{P(W)}{\omega(rad/s)}}{\omega(rad/s)}; P(W) \text{ value= Pr.05-02;}$  $\frac{RPM \times 2\pi}{60} = rad/s$ 

FOCPG and FOC sensor-less control mode The drive rated current=100%. The setting value of parameters Pr11-17~Pr11-20 will compare to

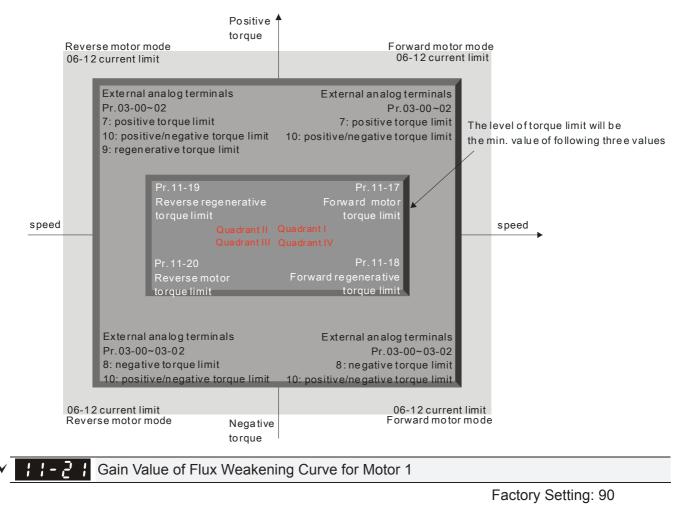
Pr03-00=7, 8, 9 and 10. The smallest value will become the torque limit value. Please refer to the torque limit diagram.

III TQCPG and TQC Sensor-less control mode

The drive rated current=100%. The setting value of parameters Pr11-17~Pr11-20 will compare to Pr06-12. The smallest value will become the torque limit value.

III VF, VFPG and SVC control mode

The Pr11-17~Pr11-20 are output current limit and its 100%=drive rated current. The smallest value between the Pr11-17~Pr11-20 and Pr06-12 will become output current limit. If the output current has reach this limit during acceleration or normal running, drive will enable "Over current Stall" function. Until the output frequence drops to limit value, drive can run normally.





I - 22 Gain Value of Flux Weakening Curve for Motor 2

Factory Setting: 90

Settings 0~200%

Pr.11-21 and 11-22 are used to adjust the output voltage of flux weakening curve.

## Chapter 12 Description of Parameter Settings | C2000 Series

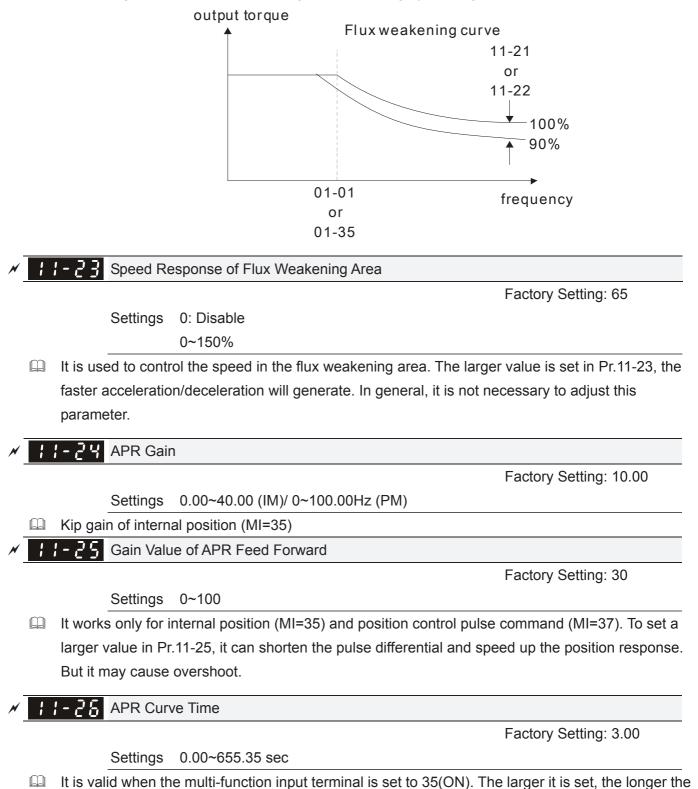
Generation For the spindle application, the adjustment method is

1. It is used to adjust the output voltage when exceeding rated frequency.

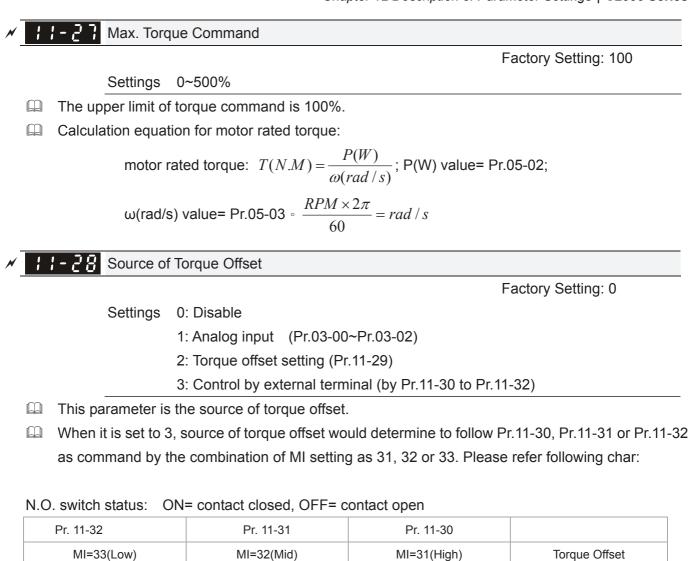
2. Monitor the output voltage

3. Adjust Pr.11-21 (motor 1) or Pr.11-22 (motor 2) setting to make the output voltage reach motor rated voltage.

4. The larger number it is set, the larger output voltage you will get.



position time will be.



MI=33(Low)	MI=32(Mid)	MI=31(High)	Torque Offset
OFF	OFF	OFF	None
OFF	OFF	ON	11-30
OFF	ON	OFF	11-31
OFF	ON	ON	11-30+11-31
ON	OFF	OFF	11-32
ON	OFF	ON	11-30+11-32
ON	ON	OFF	11-31+11-32
ON	ON	ON	11-30+11-31+11-32

## **I I** - **2 B** Torque Offset Setting

#### Factory Setting: 0.0

Settings -100.0%~100.0%

This parameter is torque offset. The motor rated torque is 100%.

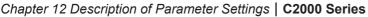
Calculation equation for motor rated torque:

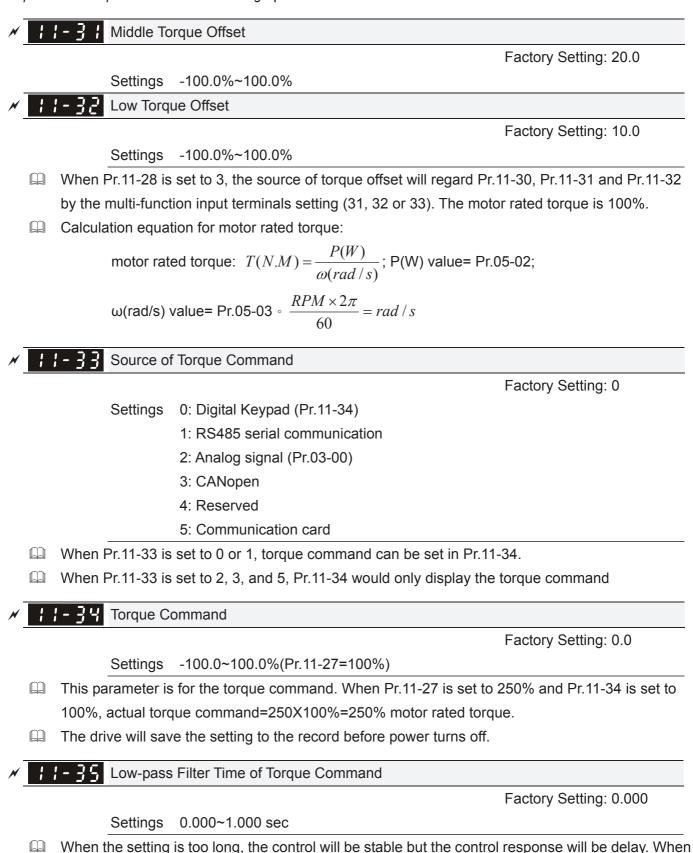
motor rated torque:  $T(N.M) = \frac{P(W)}{\omega(rad/s)}$ ; P(W) value= Pr.05-02;

$$\omega$$
(rad/s) value= Pr.05-03  $\circ \frac{RPM \times 2\pi}{60} = rad / s$ 

Settings -100.0%~100.0%

Factory Setting: 30.0





the setting is too long, the control will be stable but the control response will be delay. When the setting is too short, the response will be quickly but the control maybe unstable. User can adjust the setting by the control and response situation.

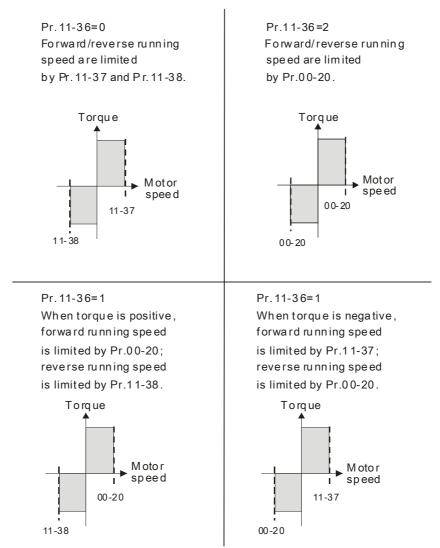
## **; ;** - **;** - **;** Speed Limit Selection

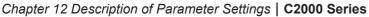
Factory Setting: 0

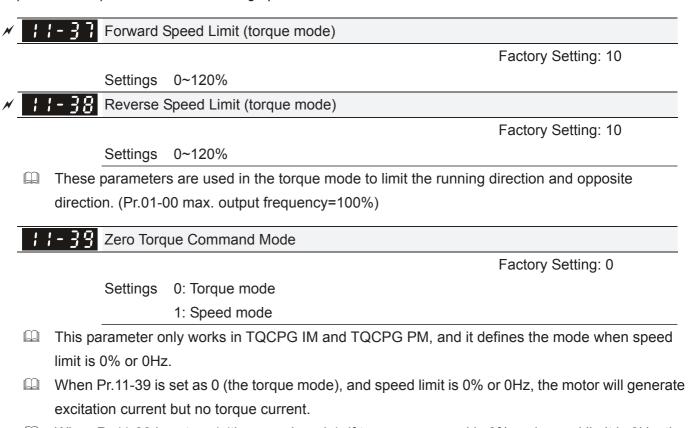
Settings 0: Set by Pr.11-37 (Forward speed limit) and Pr.11-38 (Reverse speed limit)
1: Set by Pr.11-37,11-38 and Pr.00-20 (Source of Master Frequency Command)

2: Set by Pr.00-20 (Source of Master Frequency Command).

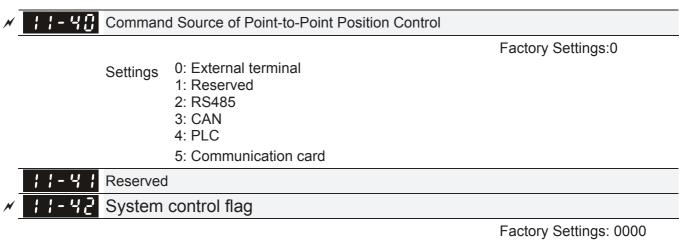
- Speed limit function: in TQCPG, when the motor speed is accelerated to speed limit value (Pr.11-36, 11-37 and 11-38), it will switch to speed control mode to stop acceleration.
- Pr11-36=1: When the torque command is positive, the forward speed limit is Pr00-20 and reverse speed limit is Pr11-38. When the torque command is negative, the forward speed limit is Pr11-37 and reverse speed limit is Pr00-20.
   Unwind application, Torque command direction is different to motor operating direction, this
- indicates that the motor is being load dragging. At this moment, the speed limit must be Pr11-37 or Pr11-38. When the torque command direction and speed limit have same direction, the speed limit will refer to the setting of Pr00-20
- About the keypad display, please refer to the "LED function Descriptions " in User manual chapter10 "Digital Keypad'. In torque control, F page of keypad display the present speed limit value.







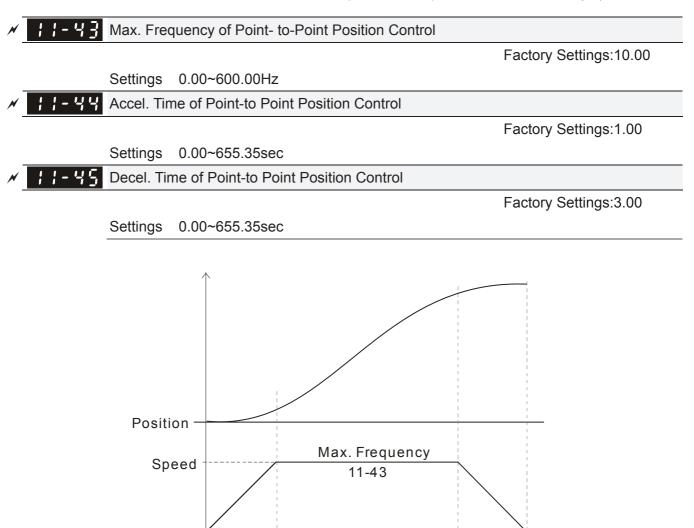
When Pr.11-39 is set as 1 (the speed mode), if torque command is 0% and speed limit is 0Hz, the AC motor drive can still produce torque current through speed controller (at this moment, the torque limit is Pr06-12) and the control mode will change from TQCPG to FOCPG mode. The motor will have a holding torque. If the speed command is not 0, motor drive will change to be 0.



## Settings 0000~FFFFh

Bit No.	Function	Description
0	Current limit selection of speed control at torque mode	<ul><li>0:Speed control at torque mode, the highest current limit is torque command.</li><li>1: Speed control at torque mode, the highest current limit is Pr06-12</li></ul>
1	FWD/REV action control	0: FWD/REV cannot be controlled by 02-12 bit 0 & 1 1: FWD/REV can be controlled by 02-12 bit 0&1
2~15	Reserved	

11-45 ◀ Decel. time



11-44

Accel. time

# **Chapter 13 Warning Codes**

<ul> <li>Warning</li> <li>CE01</li> <li>Comm. Error 1</li> <li>Display error signal</li> <li>Display error code The code is displayed as shown on KPC-CE01.</li> <li>Display error description</li> </ul>		
ID No.	Display on LCM Keypad	Descriptions
1	Warning CE01 Comm. Error 1	Modbus function code error
2	HAND Warning CE02 Comm. Error 2	Address of Modbus data is error
3	HAND Warning CE03 Comm. Error 3	Modbus data error
4	Warning CE04 Comm. Error 4	Modbus communication error
5	HAND Warning CE10 Comm. Error 10	Modbus transmission time-out
6	HAND Warning CP10 Keypad time out	Keypad transmission time-out
7	Warning SE1 Save Error 1	Keypad COPY error 1 Keypad simulation error, including communication delays, communication error (keypad recived error FF86) and parameter value error.
8	Warning SE2 Save Error 2	Keypad COPY error 2 Keypad simulation done, parameter write error
9	HAND Warning oH1 Over heat 1 warn	IGBT over-heating warning

ID No.	Display on LCM Keypad	Descriptions
10	HAND Warning oH2 Over heat 2 warn	Capacity over-heating warning
11	HAND Warning PID PID FBK Error	PID feedback error
12	Warning ANL Analog loss	ACI signal error When Pr03-19 is set to 1 and 2.
13	Warning UC Under Current	Low current
14	Warning AUE Auto-tune error	Auto tuning error
15	Warning PGFB PGFBK Warn	PG feedback error
16	Warning PGL PG Loss Warn	PG feedback loss
17	Warning oSPD Over Speed Warn	Over-speed warning
18	Warning DAvE Deviation Warn	Over speed deviation warning
19	Warning PHL Phase Loss	Phase loss
20	Warning ot1 Over Torque 1	Over torque 1
21	Warning ot2 Over Torque 2	Over torque 2

ID No.	Display on LCM Keypad	Descriptions
22	HAND Warning 0H3 Motor Over Heat	Motor over-heating
24	Warning oSL Over Slip Warn	Over slip
25	HAND Warning tUn Auto tuning	Auto tuning processing
28	Warning OPHL Output PHL Warn	Output phase loss
30	Warning SE3 Copy Model Err 3	Keypad COPY error 3 Keypad copy between different power range drive
36	Warning CGdn Guarding T-out	CAN guarding time-out 1
37	Warning CHbn Heartbeat T-out	CAN heartbeat time-out 2
38	Warning CSYn SYNC T-out	CAN synchrony time-out
39	Warning CbFn Can Bus Off	CAN bus off
40	Warning Cldn CAN/S ldx exceed	CAN index error
41	Warning CAdn CAN/S Addres set	CAN station address error
42	Warning CFrn CAN/S FRAM fail	CAN memory error

ID No.	Display on LCM Keypad	Descriptions
43	HAND Warning CSdn SDO T-out	CAN SDO transmission time-out
44	Warning CSbn Buf Overflow	CAN SDO received register overflow
45	Warning Cbtn Boot up fault	CAN boot up error
46	HAND Warning CPtn Error Protocol	CAN format error
47	Warning PIra RTC Adjust	Adjust RTC
50	Warning PLod Opposite Defect	PLC download error
51	Warning PLSv Save mem defect	Save error of PLC download
52	Warning PLdA Data defect	Data error during PLC operation
53	Warning PLFn Function defect	Function code of PLC download error
54	HAND Warning PLor Buf overflow	PLC register overflow
55	Warning PLFF Function defect	Function code of PLC operation error
56	Warning PLSn Check sum error	PLC checksum error

ID No.	Display on LCM Keypad	Descriptions
57	Warning PLEd No end command	PLC end command is missing
58	Warning PLCr PLC MCR error	PLC MCR command error
59	HAND Warning PLdF Download fail	PLC download fail
60	Warning PLSF Scane time fail	PLC scan time exceed
61	Warning PCGd CAN/M Guard err	CAN Master guarding error
62	HAND Warning PCbF CAN/M bus off	CAN Master bus off
63	HAND Warning PCnL CAN/M Node Lack	CAN Master node error
64	HAND Warning PCCt CAN/M Cycle Time	CAN/M cycle time-out
65	HAND Warning PCSF CAN/M SDO over	CAN/M SDOover
66	HAND Warning PCSd CAN/M Sdo Tout	CAN/M SDO time-out
67	HAND Warning PCAd CAN/M Addres set	CAN/M station address error
68	HAND Warning PCTo CAN/MT-Out	PLC/CAN Master Slave communication time out

ID No.	Display on LCM Keypad	Descriptions
70	Warning ECid ExCom ID failed	Duplicate MAC ID error Node address setting error
71	Warning ECLv ExCom pwr loss	Low voltage of communication card
72	Warning ECtt ExCom Test Mode	Communication card in test mode
73	Warning ECbF ExCom Bus off	DeviceNet bus-off
74	HAND Warning ECnP ExCom No power	DeviceNet no power
75	HAND Warning ECFF ExCom Facty def	Factory default setting error
76	HAND Warning ECiF ExCom Inner err	Serious internal error
77	HAND Warning ECio ExCom IONet brk	IO connection break off
78	HAND Warning ECPP ExCom Pr data	Profibus parameter data error
79	HAND Warning ECPi ExCom Conf data	Profibus configuration data error
80	Warning ECEF ExCom Link fail	Ethernet Link fail
81	HAND Warning ECto ExCom Inr T-out	Communication time-out for communication card and drive

ID No.	Display on LCM Keypad	Descriptions
82	Warning ECCS ExCom Inr CRC	Check sum error for Communication card and drive
83	Warning ECrF ExCom Rtn def	Communication card returns to default setting
84	HAND Warning ECo0 ExCom MTCP over	Modbus TCP exceed maximum communication value
85	HAND Warning ECo1 ExCom EIP over	EtherNet/IP exceed maximum communication value
86	Warning ECiP ExCom IP fail	IP fail
87	HAND Warning EC3F ExCom Mail fail	Mail fail
88	HAND Warning Ecby ExCom Busy	Communication card busy
90	HAND Warning CPLP CopyPLCPassWd	Copy PLC password error
91	HAND Warning CPL0 CopyPLCModeRd	Copy PLC Read mode error
92	HAND Warning CPL1 CopyPLCModeWt	Copy PLC Write mode error
93	HAND Warning CPLv CopyPLCVersion	Copy PLC Version error
94	HAND Warning CPLS CopyPLCSize	Copy PLC Capacity size error

## Chapter 13 Warning Codes | C2000 Series

ID No.	Display on LCM Keypad	Descriptions
96	Warning CPLt CopyPLCTimeOut	Copy PLC time out
101	HAND Warning ictn InrCOM Time Out	Internal communication is off

# **Chapter 14 Fault Codes and Descriptions**

	HAN
1	Warning
2	CE01
3	Comm. Error 1

Abbreviate error code The code is displayed as shown on KPC-CE01.

3 Display error description

\* Refer to setting of Pr06-17~Pr06~22.

ID*	Fault Name	Fault Descriptions	Corrective Actions
1	Fault ocA Oc at accel	Over-current during acceleration (Output current exceeds triple rated current during acceleration.)	<ol> <li>Short-circuit at motor output: Check for possible poor insulation at the output.</li> <li>Acceleration Time too short: Increase the Acceleration Time.</li> <li>AC motor drive output power is too small: Replace the AC motor drive with the next higher power model.</li> </ol>
2	Fault Ocd Oc at decel	Over-current during deceleration (Output current exceeds triple rated current during deceleration.)	<ol> <li>Short-circuit at motor output: Check for possible poor insulation at the output.</li> <li>Deceleration Time too short: Increase the Deceleration Time.</li> <li>AC motor drive output power is too small: Replace the AC motor drive with the next higher power model.</li> </ol>
3	HAND Fault ocn Oc at normal SPD	Over-current during steady state operation (Output current exceeds triple rated current during constant speed.)	<ol> <li>Short-circuit at motor output: Check for possible poor insulation at the output.</li> <li>Sudden increase in motor loading: Check for possible motor stall.</li> <li>AC motor drive output power is too small: Replace the AC motor drive with the next higher power model.</li> </ol>
4	Fault GFF Ground fault	Ground fault	<ul> <li>When (one of) the output terminal(s) is grounded, short circuit current is more than 50% of AC motor drive rated current, the AC motor drive power module may be damaged.</li> <li>NOTE: The short circuit protection is provided for AC motor drive protection, not for protecting the user.</li> <li>Check the wiring connections between the AC motor drive and motor for possible short circuits, also to ground.</li> <li>Check whether the IGBT power module is damaged.</li> <li>Check for possible poor insulation at the output.</li> </ul>
5	Fault OCC Short Circuit	Short-circuit is detected between upper bridge and lower bridge of the IGBT module	Return to the factory

ID*	Fault Name	Fault Descriptions	Corrective Actions
6	Fault ocS Oc at stop	Hardware failure in current detection	Return to the factory
7	Fault ovA Ov at accel	DC BUS over-voltage during acceleration (230V: DC 450V; 460V: DC 900V)	<ol> <li>Check if the input voltage falls within the rated AC motor drive input voltage range.</li> <li>Check for possible voltage transients.</li> <li>If DC BUS over-voltage due to regenerative voltage, please increase the acceleration time or add an optional brake resistor.</li> </ol>
8	Fault ovd Ov at decel	DC BUS over-voltage during deceleration (230V: DC 450V; 460V: DC 900V)	<ol> <li>Check if the input voltage falls within the rated AC motor drive input voltage range.</li> <li>Check for possible voltage transients.</li> <li>If DC BUS over-voltage due to regenerative voltage, please increase the Deceleration Time or add an optional brake resistor.</li> </ol>
9	Fault ovn Ov at normal SPD	DC BUS over-voltage at constant speed (230V: DC 450V; 460V: DC 900V)	<ol> <li>Check if the input voltage falls within the rated AC motor drive input voltage range.</li> <li>Check for possible voltage transients.</li> <li>If DC BUS over-voltage due to regenerative voltage, please increase the Deceleration Time or add an optional brake resistor.</li> </ol>
10	Fault ovS Ov at stop	Hardware failure in voltage detection	<ol> <li>Check if the input voltage falls within the rated AC motor drive input voltage range.</li> <li>Check for possible voltage transients.</li> </ol>
11	Fault LvA Lv at accel	DC BUS voltage is less than Pr.06-00 during acceleration	<ol> <li>Check if the input voltage is normal</li> <li>Check for possible sudden load</li> </ol>
12	Fault Lvd Lv at decel	DC BUS voltage is less than Pr.06-00 during deceleration	<ol> <li>Check if the input voltage is normal</li> <li>Check for possible sudden load</li> </ol>
13	Fault Lvn Lv at normal SPD	DC BUS voltage is less than Pr.06-00 in constant speed	<ol> <li>Check if the input voltage is normal</li> <li>Check for possible sudden load</li> </ol>
14	HAND Fault LvS Lv at stop	DC BUS voltage is less than Pr.06-00 at stop	<ol> <li>Check if the input voltage is normal</li> <li>Check for possible sudden load</li> </ol>

ID*	Fault Name	Fault Descriptions	Corrective Actions
15	Fault OrP Phase lacked	Phase Loss	Check Power Source Input if all 3 input phases are connected without loose contacts. For models 40hp and above, please check if the fuse for the AC input circuit is blown.
16	HAND Fault oH1 IGBT over heat	IGBT overheating IGBT temperature exceeds protection level	<ol> <li>Ensure that the ambient temperature falls within the specified temperature range.</li> <li>Make sure that the ventilation holes are not obstructed.</li> <li>Remove any foreign objects from the heatsinks and check for possible dirty heat sink fins.</li> <li>Check the fan and clean it.</li> <li>Provide enough spacing for adequate ventilation.</li> </ol>
17	Fault oH2 Heat Sink oH	Heatsink overheating Capacitance temperature exceeds cause heatsink overheating.	<ol> <li>Ensure that the ambient temperature falls within the specified temperature range.</li> <li>Make sure heat sink is not obstructed. Check if the fan is operating</li> <li>Check if there is enough ventilation clearance for AC motor drive.</li> </ol>
18	Fault tH1o Thermo 1 open	IGBT Hardware Error	Return to the factory
19	Fault tH2o Thermo 2 open	Capacitor Hardware Error	Return to the factory
21	Fault OL Over load	Overload The AC motor drive detects excessive drive output current.	<ol> <li>Check if the motor is overloaded.</li> <li>Take the next higher power AC motor drive model.</li> </ol>
22	Fault EoL1 Thermal relay 1	Electronics thermal relay 1 protection	<ol> <li>Check the setting of electronics thermal relay (Pr.06-14)</li> <li>Take the next higher power AC motor drive model</li> </ol>
23	Fault EoL2 Thermal relay 2	Electronics thermal relay 2 protection	<ol> <li>Check the setting of electronics thermal relay (Pr.06-28)</li> <li>Take the next higher power AC motor drive model</li> </ol>

ID*	Fault Name	Fault Descriptions	Corrective Actions
24	Fault oH3 Motor over heat	Motor overheating The AC motor drive detecting internal temperature exceeds the setting of Pr.06-30 (PTC level) or Pr.06-57 (PT100 level 2).	<ol> <li>Make sure that the motor is not obstructed.</li> <li>Ensure that the ambient temperature falls within the specified temperature range.</li> <li>Change to a higher power motor.</li> </ol>
26	Fault ot1 Over torque 1	These two fault codes will be displayed when output current exceeds the over-torque detection level (Pr.06-07 or Pr.06-10) and exceeds	<ol> <li>Check whether the motor is overloaded.</li> <li>Check whether motor rated current setting (Pr.05-01) is suitable</li> </ol>
27	Fault ot2 Over torque 2	over-torque detection (Pr.06-08 or Pr.06-11) and it is set to 2 or 4 in Pr.06-06 or Pr.06-09.	<ol> <li>Take the next higher power AC motor drive model.</li> </ol>
28	Fault uC Under torque	Low current detection	Check Pr.06-71, Pr.06-72, Pr.06-73.
29	Fault LMIT Limit Error	Limit error	
30	Fault cF1 EEPROM write err	Internal EEPROM can not be programmed.	<ol> <li>Press "RESET" key to the factory setting</li> <li>Return to the factory.</li> </ol>
31	Fault cF2 EEPROM read err	Internal EEPROM can not be read.	<ol> <li>Press "RESET" key to the factory setting</li> <li>Return to the factory.</li> </ol>
33	Fault cd1 las sensor err	U-phase error	Reboots the power. If fault code is still displayed on the keypad please return to the factory
34	Fault cd2 Ibs sensor err	V-phase error	Reboots the power. If fault code is still displayed on the keypad please return to the factory
35	Fault cd3 Ics sensor err	W-phase error	Reboots the power. If fault code is still displayed on the keypad please return to the factory

ID*	Fault Name	Fault Descriptions	Corrective Actions
36	HAND Fault Hd0 cc HW error	CC (current clamp)	Reboots the power. If fault code is still displayed on the keypad please return to the factory
37	Fault Hd1 Oc HW error	OC hardware error	Reboots the power. If fault code is still displayed on the keypad please return to the factory
38	Fault Hd2 Ov HW error	OV hardware error	Reboots the power. If fault code is still displayed on the keypad please return to the factory
39	Fault Hd3 occ HW error	Occ hardware error	Reboots the power. If fault code is still displayed on the keypad please return to the factory
40	Fault AUE Auto tuning err	Auto tuning error	<ol> <li>Check cabling between drive and motor</li> <li>Try again.</li> </ol>
41	Fault AFE PID Fbk error	PID loss (ACI)	<ol> <li>Check the wiring of the PID feedback</li> <li>Check the PID parameters settings</li> </ol>
42	Fault PGF1 PG Fbk error	PG feedback error	Check if encoder parameter setting is accurate when it is PG feedback control.
43	Fault PGF2 PG Fbk loss	PG feedback loss	Check the wiring of the PG feedback
44	Fault PGF3 PG Fbk over SPD	PG feedback stall	<ol> <li>Check the wiring of the PG feedback</li> <li>Check if the setting of PI gain and deceleration is suitable</li> <li>Return to the factory</li> </ol>
45	HAND Fault PGF4 PG Fbk deviate	PG slip error	<ol> <li>Check the wiring of the PG feedback</li> <li>Check if the setting of PI gain and deceleration is suitable</li> <li>Return to the factory</li> </ol>

ID*	Fault Name	Fault Descriptions	Corrective Actions
46	Fault PGr1 PG Ref error	Pulse input error	<ol> <li>Check the pulse wiring</li> <li>Return to the factory</li> </ol>
47	Fault PGr2 PG Ref loss	Pulse input loss	<ol> <li>Check the pulse wiring</li> <li>Return to the factory</li> </ol>
48	Fault ACE ACI loss	ACI loss	<ol> <li>Check the ACI wiring</li> <li>Check if the ACI signal is less than 4mA</li> </ol>
49	HAND Fault EF External fault	External Fault	<ol> <li>Input EF (N.O.) on external terminal is closed to GND. Output U, V, W will be turned off.</li> <li>Give RESET command after fault has been cleared.</li> </ol>
50	Fault EF1 Emergency stop	Emergency stop	<ol> <li>When the multi-function input terminals MI1 to MI6 are set to emergency stop, the AC motor drive stops output U, V, W and the motor coasts to stop.</li> <li>Press RESET after fault has been cleared.</li> </ol>
51	HAND Fault bb Base block	External Base Block	<ol> <li>When the external input terminal (B.B) is active, the AC motor drive output will be turned off.</li> <li>Deactivate the external input terminal (B.B) to operate the AC motor drive again.</li> </ol>
52	Hand Fault Pcod Password error	Password is locked.	Keypad will be locked. Turn the power ON after power OFF to re-enter the correct password. See Pr.00-07 and 00-08.
54	Fault CE1 PC err command	Illegal function code	Check if the function code is correct (function code must be 03, 06, 10, 63)
55	Fault CE2 PC err address	Illegal data address (00H to 254H)	Check if the communication address is correct
56	Fault CE3 PC err data	Illegal data value	Check if the data value exceeds max./min. value

ID*	Fault Name	Fault Descriptions	Corrective Actions	
57	Fault CE4 PC slave fault	Data is written to read-only address	Check if the communication address is correct	
58	Fault CE10 PC time out	Modbus transmission time-out		
59	Fault CP10 PU time out	Keypad transmission time-o	out	
60	Fault bF Braking fault	Brake resistor fault	If the fault code is still displayed on the keypad after pressing "RESET" key, please return to the factory.	
61	Fault ydc Y-delta connect	Y-connection/Δ-connectio n switch error	<ol> <li>Check the wiring of the Y-connection/Δ-connection</li> <li>Check the parameters settings</li> </ol>	
62	Fault dEb Dec. Energy back	When Pr.07-13 is not set to 0 and momentary power off or power cut, it will display dEb during accel./decel. stop.	<ol> <li>Set Pr.07-13 to 0</li> <li>Check if input power is stable</li> </ol>	
63	Fault oSL Over slip error	It will be displayed when slip exceeds Pr.05-26 setting and time exceeds Pr.05-27 setting.	<ol> <li>Check if motor parameter is correct (please decrease the load if overload</li> <li>Check the settings of Pr.05-26 and Pr.05-27</li> </ol>	
64	Fault ryF MC Fault	Electric valve switch error when executing Soft Start. (This warning is for frame E and higher frame of AC drives) Do not disconnect RST when drive is still operating.		
65	Fault PGF5 PG HW Error	Hardware error of PG Card Check if PG Card is insert to the right slot and parameter settings for encoder are accurate.		
68	Fault SdRv SpdFbk Dir Rev	sensorless. Solution Verify if the parameter settin	ent from the commanding direction deteced by the g of the motor drive is correct dwidth and verify if parameters relating to the sensorless	

ID*	Fault Name	Fault Descriptions Corrective Actions
69	Fault SdOr SpdFbk over SPD	Overspeed rotation detected by the sensorless Solution Verify if the parameter setting of the motor drive is correct Increase the estimator's bandwidth and verify if parameters relating to the sensorless are correct. Verify if the gains of the speed circuit is reasonable.
70	Fault SdDe SpdFbk deviate	Big difference between the rotating speed and the command deteced by the sensorless Solution Verify if the parameter setting of the motor drive is correct Increase the estimator's bandwidth and verify if parameters relating to the sensorless are correct. Verify if the gains of the speed circuit is reasonable.
72	HAND Fault STOL STOLoss 1	STO1~SCM1 internal hardware detect error
73	Fault S1 S1-emergy stop	Emergency stop for external safety
76	Fault STO STO	Safety Torque Off function active
77	Fault STOL STO Loss 2	STO2~SCM2 internal hardware detect error
78	Fault STOL STO Loss 3	STO1~SCM1 and STO2~SCM2 internal hardware detect error
79	Fault Uoc U phase oc	Phase U short circuit
80	Fault Voc V phase oc	Phase V short circuit

ID*	Fault Name	Fault Descriptions Corrective Actions
81	Fault Woc W phase oc	W phase short circuit
82	Fault OPHL U phase lacked	Output phase loss (Phase U)
83	Fault OPHL V phase lacked	Output phase loss (Phase V)
84	Fault OPHL W phase lacked	Output phase loss (Phase W)
85	Fault AboF PGABZ Line off	PG card ABZ signal loss Solution Verify if the parameter setting of PG card and PG card cable is correct.
86	Fault UvoF PG UVW Line off	PG card UVW signal loss Solution Verify if the parameter setting of PG card and PG card cable is correct.
89	Fault RoPd Rotor Pos. Error	Rotor position detection error Solution Verify if the UVW output cable are loss. Verify if the motor internal coil is broken. Verify if the drive UVW output are normal.
90	Fault Fstp For ce Stop	Internal PLC forced to stop Verify the setting of Pr.00-32
101	Fault CGdE Guarding T-out	CANopen guarding error
102	Fault CHbE Heartbeat T-out	CANopen heartbeat error

ID*	Fault Name	Fault Descriptions	Corrective Actions
103	Fault CSYE SYNC T-out	CANopen synchronous err	or
104	Fault CbFE Can bus off	CANopen bus off error	
105	Fault CIdE Can bus Index Err	CANopen index error	
106	Fault CAdE Can bus Add. Err	CANopen station address error	
107	Fault CFrE Can bus off	CANopen memory error	
111	Fault ictE InrCom Time Out	Internal communication tin	ne-out
112	Fault SfLK PMLess ShaftLock	Motor Shaft lock error(N zero) Solution Verify if the motor paran	lotor does not turn but the output frequency is not neter setting is correct.
113	Fault SwOc Software OC	Software OC protection	

# **Chapter 15 CANopen Overview**

Newest version is available at http://www.delta.com.tw/industrialautomation/

- 15.1 CANopen Overview
- 15.2 Wiring for CANopen
- 15.3 CANopen Communication Interface Description

15.3.1 CANopen Control Mode Selection

15.3.2 DS402 Standard Control Mode

- 15.3.3 By using Delta Standard (Old definition, only support speed mode)
- 15.3.4 By using Delta Standard (New definition)
- 15.3.5 DI/DO AI AO are controlled via CANopen
- 15.4 CANopen Supporting Index

15.5 CANopen Fault Code

15.6 CANopen LED Function

## Built-in EMC-COP01 card is included in VFDXXXC23E/VFDXXXC43E models.

The built-in CANopen function is a kind of remote control. Master can control the AC motor drive by using CANopen protocol. CANopen is a CAN-based higher layer protocol. It 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). And it also has network management data, including Boot-up message, NMT message, and Error Control message. Refer to CiA website <a href="http://www.can-cia.org/">http://www.can-cia.org/</a> for details. The content of this instruction sheet may be revised without prior notice. Please consult our distributors or download the most updated version at http://www.delta.com.tw/industrialautomation

### Delta CANopen supporting functions:

- Support CAN2.0A Protocol;
- Support CANopen DS301 V4.02;
- Support DSP-402 V2.0.

### Delta CANopen supporting services:

- PDO (Process Data Objects): PDO1~ PDO4
- SDO (Service Data Object):

Initiate SDO Download; Initiate SDO Upload; Abort SDO; SDO message can be us

SDO message can be used to configure the slave node and access the Object Dictionary in every node.

SOP (Special Object Protocol):

Support default COB-ID in Predefined Master/Slave Connection Set in DS301 V4.02; Support SYNC service; Support Emergency service.

■ NMT (Network Management):

Support NMT module control; Support NMT Error control; Support Boot-up.

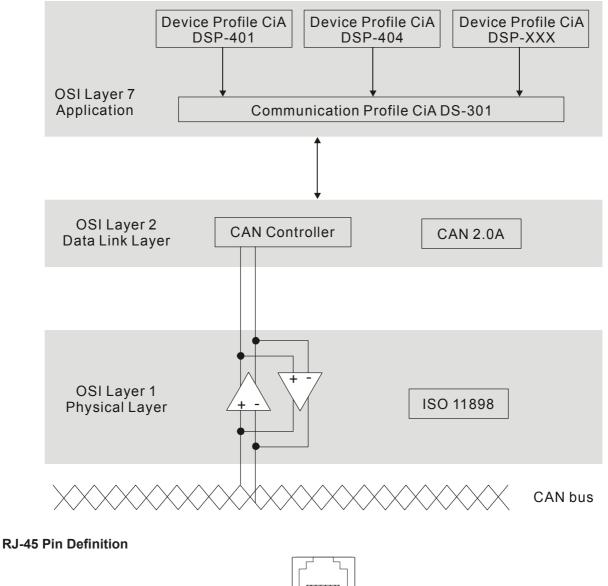
#### Delta CANopen not supporting service:

Time Stamp service

## **15.1 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. Version 4.02 of CANopen (CiA DS301) is standardized as EN50325-4. The CANopen specifications cover application layer and communication profile (CiA DS301), as well as a framework for programmable devices (CiA 302), recommendations for cables and connectors (CiA 303-1) and SI units and prefix representations (CiA 303-2).





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

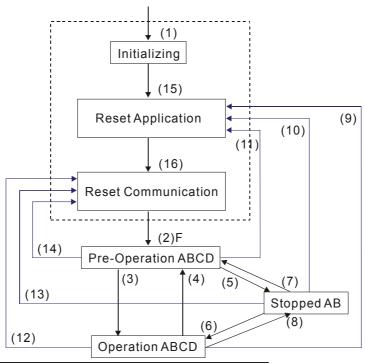
## **CANopen Communication Protocol**

It has services as follows:

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

## NMT (Network Management Object)

The Network Management (NMT) follows a Master/Slave structure for executing NMT service. Only one NMT master is in a network, and other nodes are regarded as slaves. All CANopen nodes have a present NMT state, and NMT master can control the state of the slave nodes. The state diagram of a node is shown as follows:



(1) After power is applied, it is auto in initialization state

- (2) Enter pre-operational state automatically
- (3) (6) Start remote node

(4) (7) Enter pre-operational state

(5) (8) Stop remote node

(9) (10) (11) Reset node

(12) (13) (14) Reset communication

(15) Enter reset application state automatically

(16) Enter reset communication state automatically

	Initializing	Pre-Operational	Operational	Stopped
PDO			0	
SDO		0	0	
SYNC		0	0	
Time Stamp		0	0	
EMCY		0	0	
Boot-up	0			
NMT		0	0	0

- A: NMT
- B: Node Guard
- C: SDO
- D: Emergency
- E: PDO
- F: Boot-up

## SDO (Service Data Objects)

SDO is used to access the Object Dictionary in every CANopen node by Client/Server model. One SDO has two COB-ID (request SDO and response SDO) to upload or download data between two nodes. No data limit for SDOs to transfer data. But it needs to transfer by segment when data exceeds 4 bytes with an end signal in the last segment.

The Object Dictionary (OD) is a group of objects in CANopen node. Every node has an OD in the system, and OD contains all parameters describing the device and its network behavior. The access path of OD is the index and sub-index, each object has a unique index in OD, and has sub-index if necessary. The request and response frame structure of SDO communication is shown as follows:

## PDO (Process Data Object)

PDO communication can be described by the producer/consumer model. Each node of the network will listen to the messages of the transmission node and distinguish if the message has to be processed or not after receiving the message. PDO can be transmitted from one device to one another device or to many other devices. Every PDO has two PDO services: a TxPDO and a RxPDO. PDOs are transmitted in a non-confirmed mode.

PDO Transmission type is defined in the PDO communication parameter index (1400h for the 1st RxPDO or 1800h for the 1st TxPDO), and all transmission types are listed in the following table:

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

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 doesn't support this transmission format.

Type number 255 indicates the data is asynchronous transmission.

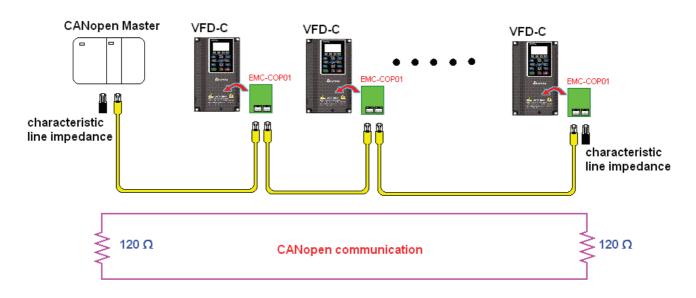
All PDO transmission data must be mapped to index via Object Dictionary.

## **EMCY (Emergency Object)**

When errors occurred inside the hardware, an emergency object will be triggered an emergency object will only be sent when an error is occurred. As long as there is nothing wrong with the hardware, there will be no emergency object to be served as a warning of an error message.

# **15.2 Wiring for CANopen**

An external adapter card: EMC-COP01 is used for CANopen wiring to connect CANopen to VFD C2000. The link is enabled by using RJ45 cable. The two farthest ends must be terminated with  $120\Omega$  terminating resistors.



# 15.3 CANopen Communication Interface Description

## **15.3.1 CANopen Control Mode Selection**

There are two control modes for CANopen; Pr.09-40 set to 1 is the factory setting mode DS402 standard and Pr.09-40 set to 0 is Delta's standard setting mode.

Actually, there are two control modes according to Delta's standard, one is the old control mode (Pr09-30=0).

This control mode can only control the motor drive under frequency control. Another mode is a new standard (Pr09-30=1)

This new control mode allows the motor drive to be controlled under all sorts of mode. Currently, C2000 support speed, torque, position and home mode.

The definition of relating control mode are:

CANopen	Control Mode									
Control		Speed		Torque	Po	sition	Home			
Mode Selection	Index	Description	Index	Description	Index	Description	Index	Description		
DS402 standard Pr. 09-40=1	6042-00	Target rotating speed (RPM)	6071-00	Target Torque (%)	607A-00	Target Position				
			6072-00	Max. Torque Limit(%)						
Delta Standard (Old definition) P09-40=1, P09-30=0	2020-02	Target rotating speed (Hz)								
Delta Standard (New definition)	2060-03	Target rotating speed (Hz)	2060-07	Target Torque (%)	2060-05	Target Position				
P09-40=0, P09-30=1	2060-04	Torque Limit (%)	2060-08	Speed Limit (Hz)						

CANopen Control Mode	Operation Control					
Selection	Index	Description				
DS402 standard	6040-00	Operation Command				
Pr. 09-40=1						
Delta Standard (Old definition) P09-40=1, P09-30=0	2020-01	Operation Command				
Delta Standard (New definition)	2060-01	Operation Command				
P09-40=0, P09-30=1						

CANopen Control Mode	Other					
Selection	Index	Description				
DS402 standard	605A-00	Quick stop processing mode				
Pr. 09-40=1	605C-00	Disable operation processing mode				
Delta Standard (Old definition)						
P09-40=1, P09-30=0						
Delta Standard (New						
definition)						
P09-40=0, P09-30=1						

However, you can use some index regardless DS402 or Delta's standard.

For example:

- 1. Index which are defined as RO attributes.
- 2. Index correspond to parameters such as (2000 ~200B-XX)
- 3. Accelerating/Decelerating Index: 604F 6050

## 15.3.2 DS402 Standard Control Mode

## 15.3.2.1 Related set up of ac motor drive (by following DS402 standard)

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

- 1. Wiring for hardware (refer to chapter 15-2 Wiring for CANopen)
- 2. Operation source setting: set Pr.00-21 to 3 for CANopen communication card control.
- 3. Frequency source setting: set Pr.00.20 to 6. (Choose source of frequency commend from CANopen setting.)
- 4. Source of torque setting is set by Pr.11-33. (Choose source of torque commend from CANopen setting.)
- 5. CANopen station setting: set Pr.09-36 (Choose source of position commend from CANopen setting.)
- 6. Set DS402 as control mode: Pr09-40=1
- CANopen station setting: set Pr.09-36 (Range of setting is 1~127. When Pr.09-36=0, CANopen slave function is disabled.) (Note: If error arise (CAdE or CANopen memory error) as station setting is completed, press Pr.00-02=7 for reset.)
- CANopen baud rate setting: set Pr.09.37 (CANBUS Baud Rate: 1M(0), 500K(1), 250K(2), 125K(3), 100K(4) and50K(5))
- Set multiple input functions to Quick Stop (it can also be enable or disable, default setting is disable). If it is necessary to enable the function, set MI terminal to 53 in one of the following parameter: Pr.02.01 ~Pr.02.08 or Pr.02.26 ~ Pr.02.31. (Note: This function is available in DS402 only.)

## **15.3.2.1** The status of the motor drive (by following DS402 standard)

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

## 3 blocks

Power Disable: That means without PWM output Power Enable: That means with PWM output Fault: One or more than one error has occurred.

## 9 status

Start: Power On

Not ready to switch on: The motor drive is initiating.

Switch On Disable: When the motor drive finishes the initiation, it will be at this mode.

Ready to switch on: Warming up before running.

Switch On: The motor derive has the PWM output now, but the reference commend is not effective.

Operate Enable: Able to control normally.

Quick Stop Active: When there is a Quick Stop request, you have to stop running the motor drive.

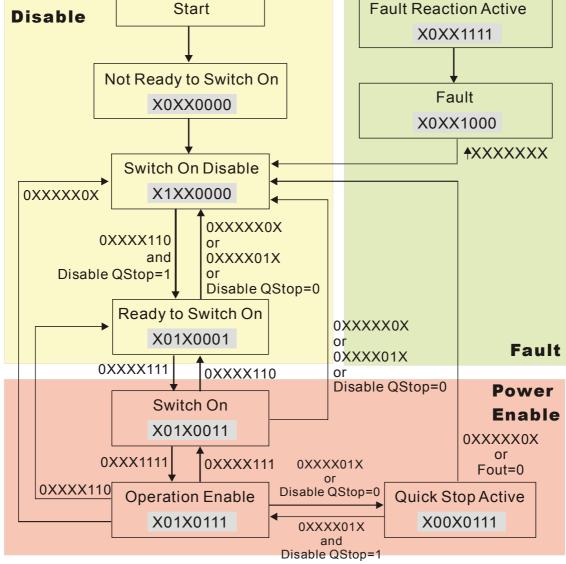
Fault Reaction Active: The motor drive detects conditions which might trigger error(s). Fault: One or more than errors has occurred to the motor drive.

Therefore, when the motor drive is turned on and finishes the initiation, it will remain at Ready to Switch on status. To control the operation of the motor drive, you need to change this status to Operate Enable status. The way to change it is to commend the control word's bit0 ~ bit3 and bit7 of the Index 6040H and to pair with Index Status Word (Status Word 0X6041). The control steps and index definition are described as 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 6	041												
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
	_									Ļ			
	Powe Disal			Sta	art				Fault R	eactio	n Activ	e	
				Ļ					>	(0XX1	111		



Set command 6040 =0xE, then set another command 6040 =0xF. Then the motor drive can be switched to Operation Enable. The Index 605A decides the dashed line of Operation Enable when the control mode changes from Quick Stop Active. (When the setting value is 1~3, this dashed line is active. But when the setting value of 605A is not 1~3, once he motor derive is switched to Quick Stop Active, it will not be able to switch back to Operation Enable.)

Index	Sub	Definition	Factory Setting	R/W	Size	Unit	PDO Map	Mode	note
605Ah	0	Quick stop option code	2	RW	S16		No		<ul> <li>0 : disable drive function</li> <li>1 :slow down on slow down ramp</li> <li>2: slow down on quick stop ramp</li> <li>5 slow down on slow down ramp and stay in QUICK STOP</li> <li>6 slow down on quick stop ramp and stay in QUICK STOP</li> <li>7 slow down on the current limit and stay in Quick stop</li> </ul>

Besides, when the control section switches from Power Enable to Power Disable, use 605C to define parking method.

Index	Sub	Definition	Factory Setting	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 of the drive function

### 15-3-2-3 Various mode control method (by following DS402 standard)

Control mode of C2000, supporting speed, torque, position and home control are described as below:

### Speed mode

- 1. Let Ac Motor Drive be at the speed control mode: Set Index6060 to 2.
- 2. Switch to Operation Enable mode: Set 6040=0xE, then set 6040=0xF.
- 3. To set target frequency: Set target frequency of 6042, since the operation unit of 6042 is rpm, there is a transformation:

 $n = f \times \frac{120}{p}$  n: rotation speed (rpm) (rounds/minute) P: motor's pole number (Pole)

f: rotation frequency (Hz)

For example:

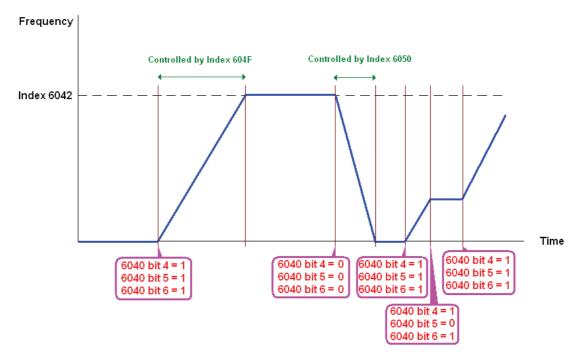
Set 6042H = 1500 (rpm), if the motor drive's pole number is 4 (Pr05-04 or Pr05-16), then the motor drive's operation frequency is 1500(120/4)=50Hz.

Besides, the 6042 is defined as a signed operation. The plus or minus sign means to rotate clockwise or counter clockwise

4. To set acceleration and deceleration: Use 604F(Acceleration) and 6050(Deceleration).

5. Trigger an ACK signal: In the speed control mode, the bit 6~4 of Index 6040 needs to be controlled. It is defined as below:

		Index 6040	SUM	
Speed mode	Bit 6	Bit 5	Bit 4	50W
Speed mode (Index 6060=2)	1	0	1	Locked at the current signal.
(Index 0000-2)	1	1	1	Run to reach targeting signal.
		Other		Decelerate to 0Hz.



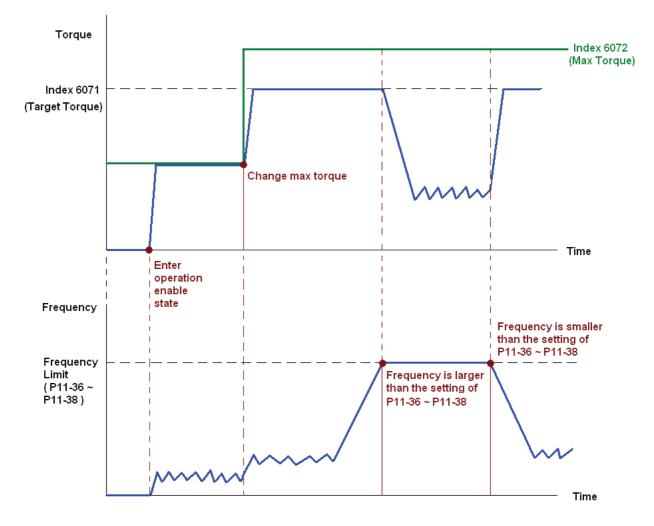
NOTE 01: To know the current rotation speed, read 6043. (unit: rpm)

NOTE 02: To know if the rotation speed can reach the targeting value; read bit 10 of 6041. (0: Not reached; 1: Reached)

### Torque mode

- 1. Let Ac Motor Drive be at the torque control mode: Set Index6060 = 4.
- 2. Switch the current mode to Operation Enable, set 6040 = 0xE, then set 6040 = 0xF.
- 3. To set targeting torque: Set 6071 as targeting torque and 6072 as the largest output torque.

Torquo modo		Index 6040		SUM
(Index 6060=4)	Bit 6	Bit 5	Bit 4	30101
(Index 0000-4)	Х	Х	Х	RUN to reach the targeting torque.



NOTE: The standard DS402 doesn't regulate the highest speed limit. Therefore if the motor drive defines the control mode of DS402, the highest speed will go with the setting of Pr11-36 to Pr11-38.

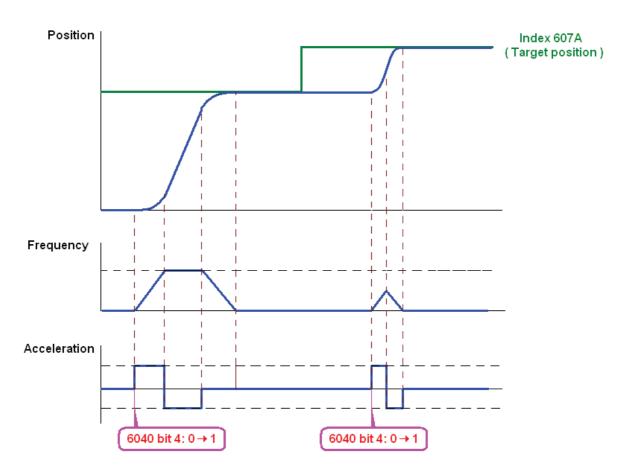
NOTE 01: To know the current torque, read 6077 (unit: 0.1%).

NOTE02: To know if reaching the targeting torque, read bit 10 of 6041. (0: Not reached; 1: Reached)

### **Position mode**

1. Set the parameter of a trapezium curve to define position control (Pr11-43 Max. Frequency of Point- to-Point Position Control, Pr11-44 Accel. Time of Point-to Point Position Control and Pr11-45 Decel. Time of Point-to Point Position Control)

- 2. Let Ac Motor Drive be at the position control mode: Then set Index 6060 = 1.
- 3. Switch the current mode to Operation Enable, set 6040 = 0xE and then set 6040 = 0xF.
- 4. To set targeting position: set 607A as the targeting position.
- 5. Trigger an ACK signal: Set 6040 = 0x0F then set 6040 = 0x1F. (Bit4 changes from 0 to 1).



NOTE 01: To know the current position, read 6064.

- NOTE 02: To know if the position reaches the targeting position, read bit 10 of 6041. (0: reached, 1: Not reached)
- NOTE 03: To know if the position is over the limited area, read bit 11 of 6041 (0: in the limit, 1: over the limit)

### Home mode

- 1. Set Pr00-12 to choose a home method.
- 2. Set the left and right limits correspond to the position of MI terminal.
- 3. To switch Ac Motor Drive control mode to Home mode: Set Index 6060 = 6.
- 4. To switch from current mode to Operation Enable: Set 6040 = 0xE, then set 6040 = 0xF.
- 5. To trigger an ACK signal: Set 6040 = 0x0F, then set 6040 = 0x1F (Bit4 changes from 0 to 1 and the motor drive will be back to home.)

Note 01: To know if the home mode is completed, read bit 12 of 6041. (0: reached, 1: Not reached)

### 15.3.3 By using Delta Standard (Old definition, only support speed mode)

### 15-3.3.1 Various mode control method (by following DS402 standard)

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

- 1. Wiring for hardware (Refer to chapter 15.2 Wiring for CANopen)
- 2. Operation source setting: set Pr.00-21 to 3 for CANopen communication card control.
- 3. Frequency source setting: set Pr.00.20 to 6. (Choose source of frequency commend from CANopen setting.)

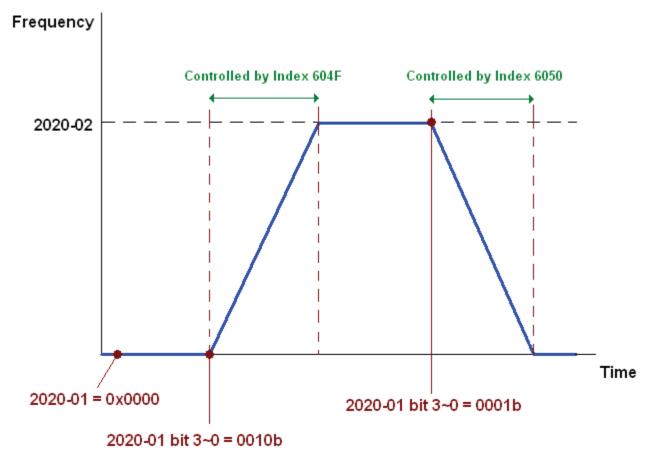
4. Set Delta Standard (Old definition, only support speed mode) as control mode: Pr. 09-40 = 0 and 09-30 = 0.

CANopen station setting: set Pr.09-36 (Range of setting is 1~127. When Pr.09-36=0, CANopen slave function is disabled.) (Note: If error arised (CAdE or CANopen memory error) as station setting is completed, press Pr.00-02=7 for reset.)

5. CANopen baud rate setting: set Pr.09.37 (CANBUS Baud Rate: 1M(0), 500K(1), 250K(2), 125K(3), 100K(4) and50K(5))

### 15-3-3-2 By speed mode

- 1. Set the target frequency: Set 2020-02, the unit is Hz, with a number of 2 decimal places. For example 1000 is 10.00.
- 2. Operation control: Set 2020-01 = 0002H for Running, and set 2020-01 = 0001H for Stopping.



### 15.3.4 By using Delta Standard (New definition)

15-3-4-1 Related set up of ac motor drive (Delta New Standard)

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

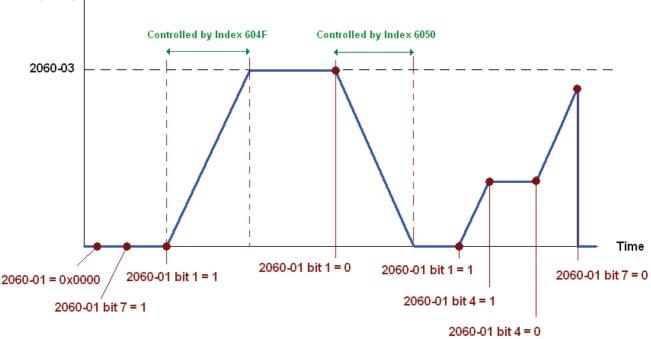
- 1. Wiring for hardware (Refer to chapter 15.2 Wiring for CANopen)
- 2. Operation source setting: set Pr.00-21 to 3 for CANopen communication card control.
- 3. Frequency source setting: set Pr.00.20 to 6. (Choose source of frequency commend from CANopen setting.)
- 4. Source of torque setting is set by Pr.11-33. (Choose source of torque commend from CANopen setting.)

- 5. CANopen station setting: set Pr.09-36 (Choose source of position commend from CANopen setting.)
- 6. Set Delta Standard (Old definition, only support speed mode) as control mode: Pr. 09-40 = 0 and 09-30 = 0.
- CANopen station setting: set Pr.09-36 (Range of setting is 1~127. When Pr.09-36=0, CANopen slave function is disabled.) (Note: If error arised (CAdE or CANopen memory error) as station setting is completed, press Pr.00-02=7 for reset.)
- CANopen baud rate setting: set Pr.09.37 (CANBUS Baud Rate: 1M(0), 500K(1), 250K(2), 125K(3), 100K(4) and50K(5))

### 15-3-4-2 Various mode control method (Delta New Standard)

### Speed Mode

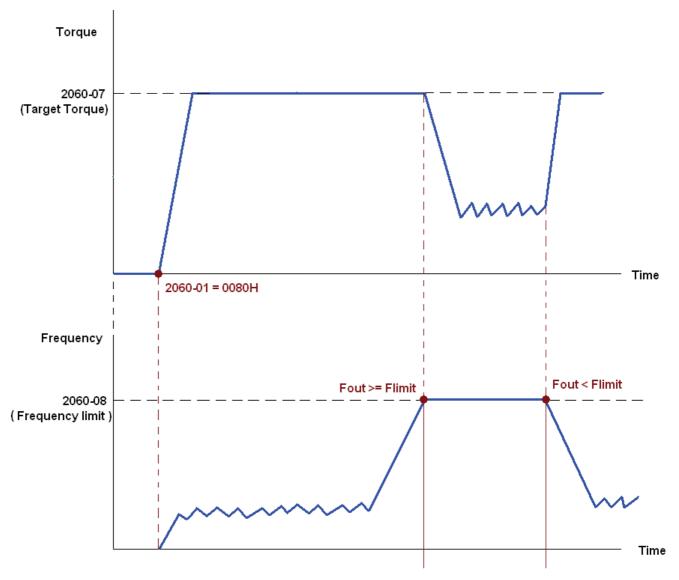
- 1. Let Ac Motor Drive be at the speed control mode: Set Index6060 = 2.
- 2. Set the target frequency: set 2060-03, unit is Hz, with a number of 2 decimal places. For example 1000 is 10.00Hz.
- 3. Operation control: set 2060-01 = 008H for Server on, and set 2060-01 = 0081H for Running.



## Frequency

### **Torque Mode**

- 1. Let Ac Motor Drive be at torque control mode: set Index 6060 = 4.
- 2. Set target torque: set 2060-07, unit is %, a number of 1 decimal place. For example 100 is 10.0%.
- 3. Operation control: Set 2060-01 = 0080H for Server on, then the motor drive will start to run to reach target torque.



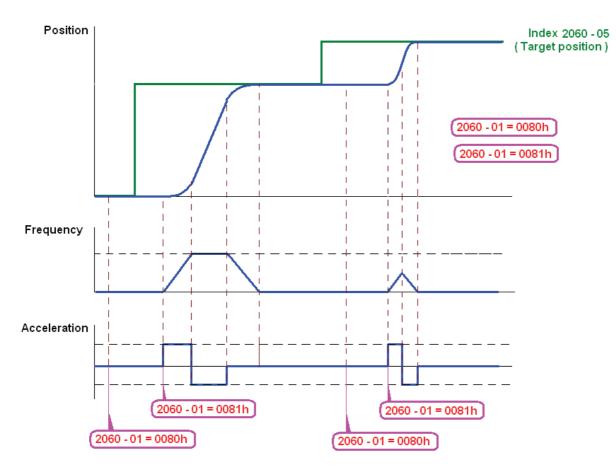
Note01 To know what the current torque is, read 2061-07 (unit is 0.1%).

Note02 To know if the torque can reach the setting value, read the bit 0 of 2061-01 (0: Not reached, 1: Reached).

Note 03: When doing torque output and if the motor drive's speed reaches the speed limit, the output torque will decrease to ensure the speed is under the limit.

#### **Position Mode**

- 1. Set the parameter of a trapezium curve to define position control (Pr11-43 Max. Position Control Frequency), Pr11-44 Accel. Time of Position Control, Pr11-45 Decel. Time of Position Control)
- 2. Let Ac motor drive be at the position control mode, set Index 6060 = 1.
- 3. Set 2060-01 = 0080h, then motor drive will have server on.
- 4. Set target position: set 2060-05 = target position.
- 5. Set 2060-01 =0081h to trigger the motor drive to run to the target position.
- 6. To move to another position, simply repeat step 3 to 5.



NOTE01: To know the current position, read 2061-05.

NOTE02: To know if reaching the target position, read bit 0 of 2061 (0: Not reached, 1: Reached).

### Home Mode

- 1. Set Pr00-12 to choose how to return home.
- 2. Set the left and right limits correspond to the position of MI terminal.
- 3. To switch C2000 control mode to Home mode: Set Index 6060 = 6.
- 4. Set 2060-01 = 0080h, then motor drive will have server on.
- 5. Set the ACK signal: set 2060-01 = 0081h, then the motor drive will start to go back home.

NOTE 01: To know if returning home is completed, read bit12 of 6041 (0: Not reached, 1: Reached).

### 15-3-5 DI/DO AI AO are controlled via CANopen

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

- 1. To set the DO to be controlled, define this DO to be controlled by CANopen. For example, set Pr02-14 to control RY2.
- 2. To set the DO to be controlled, define this AO to be controlled by CANopen. For example, set Pr03-23 to control AFM2.
- 3. To control the mapping index of CANopen. If you want to control DO, then you will need to control Index2026-41. If you want to control AO, then you will need to control 2026-AX. If you want to set RY2 as ON, set the bit 1 of Index 2026-41 =1, then RY2 will output 1. If you want to control AFM2 output = 50.00%, then you will need to set Index 2026-A2 =5000, then AFM2 will output 50%.

Mapping table of CANopen DI DO AI AO:

Terminal	Related Parameters	R/W	Mapping Index
FWD	==	RO	2026-01 bit 0
REV	==	RO	2026-01 bit 1
MI 1	==	RO	2026-01 bit 2
MI 2	==	RO	2026-01 bit 3
MI 3	==	RO	2026-01 bit 4
MI 4	==	RO	2026-01 bit 5
MI 5	==	RO	2026-01 bit 6
MI 6	==	RO	2026-01 bit 7
MI 7	==	RO	2026-01 bit 8
MI 8	==	RO	2026-01 bit 9
MI 10	==	RO	2026-01 bit 10
MI 11	==	RO	2026-01 bit 11
MI 12	==	RO	2026-01 bit 12
MI 13	==	RO	2026-01 bit 13
MI 14	==	RO	2026-01 bit 14
MI 15	==	RO	2026-01 bit 15

DI:

DO :

Terminal	<b>Related Parameters</b>	R/W	Mapping Index
RY1	P2-13 = 50	RW	2026-41 bit 0
RY2	P2-14 = 50	RW	2026-41 bit 1
RIZ	P2-15 = 50	RW	2026-41 bit 2
MO1	P2-16 = 50	RW	2026-41 bit 3
MO2	P2-17 = 50	RW	2026-41 bit 4
MO3	P2-18 = 50	RW	2026-41 bit 5
MO4	P2-19 = 50	RW	2026-41 bit 6

MO5	P2-20 = 50	RW	2026-41 bit 7
MO6	P2-21 = 50	RW	2026-41 bit 8
MO7	P2-22 = 50	RW	2026-41 bit 9
MO8	P2-23 = 50	RW	2026-41 bit 10

AI :

Terminal	<b>Related Parameters</b>	R/W	Mapping Index
AVI	==	RO	Value of 2026-61
ACI	==	RO	Value of 2026-62
AUI	==	RO	Value of 2026-63

### AO :

	Terminal	<b>Related Parameters</b>	R/W	Mapping Index
	AFM1	P3-20 = 20	RW	Value of 2026-A1
-	AFM2	P3-23 = 20	RW	Value of 2026-A2

# **15.4 CANopen Supporting Index**

C2000 Index:

Parameter index corresponds to each other as following:

Index	sub-Inc
Index	sub-Inc

2000H + Group member+1

dex

For example:

Pr.10.15 (Encoder Slip Error Treatment)

Group		member
10(0 <i>A</i> H)	-	15(0FH)
Index = 2000H +	0AH	= 200A
Sub Index = 0FH	l + 1H	I = 10H

C2000 Control Index:

### **Delta Standard Mode (Old definition)**

Index	Sub	Definition	Factory Setting	R/W	Size	Note
	0	Number	3	R	U8	
						Bit 1~0 00B:disable 01B:stop 10B:disable 11B: JOG Enable Bit3~2 Reserved Bit5~4 00B:disable
						01B: Direction forward 10B: Reverse 11B: Switch Direction
						Bit7~6 00B: 1 <sup>st</sup> step Accel. /Decel. 01B: 2 <sup>nd</sup> step Accel. /Decel. 10B: 3 <sup>rd</sup> step Accel. /Decel. 11B: 4 <sup>th</sup> step Accel. /Decel.
2020H	1	Control word	0	RW	U16	Bit11~8         0000B: Master speed           0001B: 1 <sup>st</sup> step speed         0010B: 2 <sup>nd</sup> step speed           0010B: 3 <sup>rd</sup> step speed         0011B: 3 <sup>rd</sup> step speed           0100B: 4 <sup>th</sup> step speed         0100B: 4 <sup>th</sup> step speed           0101B: 5 <sup>th</sup> step speed         0101B: 5 <sup>th</sup> step speed           0111B: 7 <sup>th</sup> step speed         0101B: 6 <sup>th</sup> step speed           1000B: 8 <sup>th</sup> step speed         1000B: 8 <sup>th</sup> step speed           1001B: 9 <sup>th</sup> step speed         1001B: 10 <sup>th</sup> step speed           1011B: 11 <sup>th</sup> step speed         1010B: 12 <sup>th</sup> step speed           1100B: 12 <sup>th</sup> step speed         1101B: 13 <sup>th</sup> step speed           1101B: 13 <sup>th</sup> step speed         1111B: 15 <sup>th</sup> step speed           1111B: 15 <sup>th</sup> step speed         1111B: 15 <sup>th</sup> step speed           1111B: 15 <sup>th</sup> step speed         1111B: 15 <sup>th</sup> step speed           Bit12         1: Enable the function of Bit6-11           Bit14~13         00B: no function

Index	Sub	Definition	Factory Setting	R/W	Size		Note
							10B: Operation command by Pr. 00-21 setting
							11B: Switch the source of
							operation command
						Bit 15	Reserved
	2	Freq. command (XXX.XXHz)	0	RW	U16		
						Bit0	1: E.F. ON
	3	Other trigger	0	RW	U16	Bit1	1: Reset
						Bit15~2	Reserved
2021H	0	Number	DH	R	U8		
	1	Error code	0	R	U16		
	2	AC motor drive status	0	R	U16	Bit 1~0	00B: stop
							01B: decelerate to stop
							10B: waiting for operation command
							11B: in operation
						Bit 2	1: JOG command
						Bit 4~3	00B: forward running
							01B: switch from reverse
							running to forward running
							10B: switch from forward
							running to reverse running
							11B: reverse running
						Bit 7~5	Reserved
						Bit 8	<ol> <li>master frequency command controlled by communication interface</li> </ol>
						Bit 9	1: master frequency command controlled by analog signal input
						Bit 10	1: operation command controlled by communication interface
						Bit 15~11	Reserved
	3	Freq. command (XXX.XXHz)	0	R	U16		
	4	Output freq. (XXX.XXHz)	0	R	U16		
		Output current (XX.XA)	0	R	U16		
		DC bus voltage (XXX.XV)	0	R	U16		
	7	Output voltage (XXX.XV)	0	R	U16		
	8	the current segment run by the multi-segment speed commend	0	R	U16		
	9	Reserved	0	R	U16		
		Display counter value (c)	0	R	U16		
	В	Display counter value (C) Display output power angle (XX.X°)	0	R	U16		
	С	Display output torque (XXX.X%)	0	R	U16		
	D	Display actual motor speed (rpm)	0	R	U16		
	E	Number of PG feed back pulses (0~65535)	0	R	U16		
	F	Number of PG2 pulse commands (0~65535)	0	R	U16		
	10	power output (X.XXXKWH)	0	R	U16		
2022H	0	Reserved	0	R	U16		
	1	Display output current	0	R	U16		

Index	Sub	Definition	Factory Setting	R/W	Size	Note
	2	Display counter value	0	R	U16	
	3	Display actual output frequency (XXX.XXHz)	0	R	U16	
	4	Display DC-BUS voltage (XXX.XV)	0	R	U16	
	5	Display output voltage (XXX.XV)	0	R	U16	
	6	Display output power angle (XX.X°)	0	R	U16	
	7	Display output power in kW	0	R	U16	
	8	Display actual motor speed (rpm)	0	R	U16	
	9	Display estimate output torque (XXX.X%)	0	R	U16	
	Α	Display PG feedback	0	R	U16	
	В	Display PID feedback value after enabling PID function in % (To 2 decimal places)	0	R	U16	
	С	Display signal of AVI analog input terminal, 0-10V corresponds to 0-100% (To 2 decimal places)	0	R	U16	
	D	Display signal of ACI analog input terminal, 4-V20mA/0-10V corresponds to 0-100% (To 2 decimal places)	0	R	U16	
	E	Display signal of AUI analog input terminal, -10V~10V corresponds to -100~100% (To 2 decimal places)	0	R	U16	
	F	Display the IGBT temperature of drive power module in °C	0	R	U16	
	10	Display the temperature of capacitance in °C	0	R	U16	
	11	The status of digital input (ON/OFF), refer to Pr.02-12	0	R	U16	
	12	The status of digital output (ON/OFF), refer to Pr.02-18	0	R	U16	
	13	Display the multi-step speed that is executing	0	R	U16	
	14	The corresponding CPU pin status of digital input	0	R	U16	
	15	The corresponding CPU pin status of digital output	0	R	U16	
	16	Number of actual motor revolution (PG1 of PG card). it will start from 9 when the actual operation direction is changed or keypad display at stop is 0. Max. is 65535	0	R	U16	
	17	Pulse input frequency (PG2 of PG card)	0	R	U16	
	18	Pulse input position (PG card PG2), maximum setting is 65535.	0	R	U16	
	19	Position command tracing error	0	R	U16	
	1A	Display times of counter overload (0.00~100.00%)	0	R	U16	

Index	Sub	Definition	Factory Setting	R/W	Size	Note
	1B	Display GFF in %	0	R	U16	
	1C	Display DCbus voltage ripples (Unit: Vdc)	0	R	U16	
	1D	Display PLC register D1043 data	0	R	U16	
	1E	Display Pole of Permanent Magnet 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	Number of motor turns when drive operates	0	R	U16	
	22	Operation position of motor	0	R	U16	
	23	Fan speed of the drive	0	R	U16	
	24	Control mode of the drive 0: speed mode 1: torque mode	0	R	U16	
	25	Carrier frequency of the drive	0	R	U16	

### CANopen Remote IO mapping

Index	Sub	R/W	Definition
2026H	01h	R	Each bit corresponds to the different input terminals
	02h	R	Each bit corresponds to the different input terminals
	03h~40h	R	Reserved
	41h	RW	Each bit corresponds to the different output terminals
	42h~60h	R	Reserved
	61h	R	AVI (%)
	62h	R	ACI (%)
	63h	R	AUI (%)
	64h~A0h	R	Reserved
	A1h	RW	AFM1 (%)
	A2h	RW	AFM2 (%)

### Delta Standard Mode (New definition)

Index	sub		Size	[	Descriptior	าร	Speed Mode	Desition Mode	Homo Modo	Torque Mede
muex	Sub	R/ VV	Size	bit	Definition	Priority	Speed Mode	Position Mode	Home Mode	Torque Mode
	00h	R	U8							
				0	Ack	4			Pulse 1: Return to home	
				1	Dir	4	0: FWD run command 1: REV run command			
				2						
2060h	01h	RW	U16	3	Halt		0: drive run till target speed is attained 1: drive stop by declaration setting			
					4	Hold		0: drive run till target speed is attained 1: frequency stop at current frequency		
				5	JOG		0:JOG OFF Pulse 1:JOG RUN			
				6	QStop		Quick Stop			

Index	cub		Sizo	Γ	Descriptions	Speed Mode	Position Mode	Home Mode	Torque Mode
muex	Sub	r./ v v	SIZE	bit	Definition Priority		Position Mode		Torque Mode
				7	Power	0:Power OFF 1:Power ON	0:Power OFF 1:Power ON	0:Power OFF 1:Power ON	0:Power OFF 1:Power ON
				14~8	Cmd SW	Multi-step frequency switching	Multi-step position switching		
				15		Pulse 1: Fault code cleared	Pulse 1: Fault code cleared	Pulse 1: Fault code cleared	Pulse 1: Fault code cleared
	02h	RW	U16						
	03h	RW	U16			Speed command (unsigned decimal)			
			U16						
			S32				Position command		
	06h	RW							
	07h	RW	U16						Torque command (signed decimal)
	08h	RW	U16						Speed limit (unsigned decimal)
				0	Arrive	Frequency attained	Position attained	Homing complete	Torque attained
				1	Dir	0: Motor FWD run 1: Motor REV run			
				2	Warn	Warning	Warning	Warning	Warning
	01h	R	U16	3	Error	Error detected	Error detected	Error detected	Error detected
				4					
				5	JOG	JOG	JOG	JOG	JOG
				6	QStop	Quick stop	Quick stop	Quick stop	Quick stop
2061h				7	Power On	Switch ON	Switch ON	Switch ON	Switch ON
				15~8					
	02h	R					• • • • •		
	03h		U16			Actual output frequency	Actual output frequency	Actual output frequency	Actual output frequency
	04h	R							
	05h		S32			Actual position (absolute)	Actual position (absolute)	Actual position (absolute)	Actual position (absolute)
	06h								
	07h	R	S16			Actual torque	Actual torque	Actual torque	Actual torque

### **DS402 Standard**

Index	Sub	Definition	Factory Setting	R/W	Size		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	R0	U16		Yes		
6040h	0	Control word	0	RW	U16		Yes		
6041h	0	Status word	0	R0	U16		Yes		
6042h	0	vl target velocity	0	RW	S16	rpm	Yes	vl	
6043h	0	vl velocity demand	0	RO	S16	rpm	Yes	vl	
6044h	0	vl control effort	0	RO	S16	rpm	Yes	vl	
604Fh	0	vl ramp function time	10000	RW	U32	1ms	Yes	vl	Unit must be: 100ms, and
6050h	0	vl slow down time	10000	RW	U32	1ms	Yes	vl	check if the setting is set to
6051h	0	vl quick stop time	1000	RW	U32	1ms	Yes	vl	0.
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

Index	Sub	Definition	Factory Setting	R/W	Size	Unit	PDO Map	Mode	Note
									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 of the drive function
6060h	0	Mode of operation	2	RW	S8		Yes		1: Profile Position Mode 2: Velocity Mode 4: Torque Profile Mode 6: Homing Mode
6061h	0	Mode of operation display	2	RO	S8		Yes		Same as above
6064h	0	pp Position actual value	0	RO	S32		Yes	рр	
6071h	0	tq Target torque	0	RW	S16	0.1%	Yes	tq	Valid unit: 1%
6072h	0	tq Max torque	150	RW	U16	0.1%	No	tq	Valid unit: 1%
6075h	0	tq Motor rated current	0	RO	U32	mA	No	tq	
6077h	0	tq torque actual value	0	RO	S16	0.1%	Yes	tq	
6078h	0	tq current actual value	0	RO	S16	0.1%	Yes	tq	
6079h	0	tq DC link circuit voltage	0	RO	U32	mV	Yes	tq	
607Ah	0	pp Target position	0	RW	S32	1	Yes	рр	

# **15.5 CANopen Fault Code**

Display	Fault code	Description	CANopen fault code	CANopen fault register (bit 0~7)
Fault ocA Oc at accel	0001H	Over-current during acceleration	2213 H	1
Fault ocd Oc at decel	0002H	Over-current during deceleration	2213 H	1
Fault Ocn Oc at normal SPD	0003H	Over-current during steady status operation	2214H	1
Fault GFF Ground fault	0004H	Ground fault. When (one of) the output terminal(s) is grounded, short circuit current is more than 50% of AC motor drive rated current. NOTE: The short circuit protection is provided for AC motor drive protection, not for protection of the user.	2240H	1
Fault OCC Short Circuit	0005H	Short-circuit is detected between upper bridge and lower bridge of the IGBT module.	2250H	1
Fault ocS Oc at stop	0006H	Over-current at stop. Hardware failure in current detection	2314H	1
Fault ovA Ov at accel	0007H	Over-current during acceleration. Hardware failure in current detection	3210H	2
Fault ovd Ov at decel	0008H	Over-current during deceleration. Hardware failure in current detection.	3210H	2
Fault ovn Ov at normal SPD	0009H	Over-current during steady speed. Hardware failure in current detection.	3210H	2
HAND Fault ovS Ov at stop	000AH	Over-voltage at stop. Hardware failure in current detection	3210H	2

Display	Fault code	Description	CANopen fault code	CANopen fault register (bit 0~7)
Fault LvA Lv at accel	000BH	DC BUS voltage is less than Pr.06.00 during acceleration.	3220H	2
Fault Lvd Lv at decel	000CH	DC BUS voltage is less than Pr.06.00 during deceleration.	3220H	2
HAND Fault Lvn Lv at normal SPD	000DH	DC BUS voltage is less than Pr.06.00 in constant speed.	3220H	2
Fault LvS Lv at stop	000EH	DC BUS voltage is less than Pr.06-00 at stop	3220H	2
Fault OrP Phase Lacked	000FH	Phase Loss Protection	3130H	2
HAND Fault oH1 IGBT over heat	0010H	IGBT overheat IGBT temperature exceeds protection level. 1~15HP: 90°C 20~100HP: 100°C	4310H	3
Fault oH2 Hear Sink oH	0011H	Heat sink overheat Heat sink temperature exceeds 90oC	4310H	3
HAND Fault tH1o Thermo 1 open	0012H	Temperature detection circuit error (IGBT) IGBT NTC	FF00H	3
Fault tH2o Thermo 2 open	0013H	Temperature detection circuit error (capacity module) CAP NTC	FF01H	3
Fault PWR Power RST OFF	0014H	Power RST off	FF02H	2

Display	Fault code	Description	CANopen fault code	CANopen fault register (bit 0~7)
HAND Fault oL Inverter oL	0015H	Overload. The AC motor drive detects excessive drive output current. NOTE: The AC motor drive can withstand up to 150% of the rated current for a maximum of 60 seconds.	2310H	1
Fault EoL1 Thermal relay 1	0016H	Electronics thermal relay 1 protection	2310H	1
Fault EoL2 Thermal relay 2	0017H	Electronics thermal relay 2 protection	2310H	1
Fault ot1 Over torque 1	001AH	These two fault codes will be displayed when output current exceeds the over-torque detection level (Pr.06.07 or	8311H	3
Fault ot2 Over torque 2	001BH	Pr.06.10) and exceeds over-torque detection (Pr.06.08 or Pr.06.11) and it is set 2 or 4 in Pr.06-06 or Pr.06-09.	8311H	3
Fault uC Under torque 1	001CH	Low current	8321H	1
Fault cF1 EEPROM write Err	001EH	Internal EEPROM can not be programmed.	5530H	5
Fault cF2 EEPROM read Err	001FH	Internal EEPROM can not be read.	5530H	5
Fault cd1 las sensor Err	0021H	U-phase error	FF04H	1
Fault cd2 Ibs sensor Err	0022H	V-phase error	FF05H	1
Fault cd3 Ics sensor Err	0023H	W-phase error	FF06H	1

Display	Fault code	Description	CANopen fault code	CANopen fault register (bit 0~7)
HAND Fault Hd0 cc HW Error	0024H	cc (current clamp) hardware error	FF07H	5
Fault Hd1 oc HW Error	0025H	oc hardware error	FF08H	5
Fault Hd2 ov HW Error	0026H	ov hardware error	FF09H	5
HAND Fault Hd3 GFF HW Error	0027H	GFF hardware error	FF0AH	5
Fault AUE Auto tuning Err	0028H	Auto tuning error	FF21H	1
Fault AFE PID Fbk Error	0029H	PID loss (ACI)	FF22H	7
Fault PGF1 PG Fbk Error	002AH	PG feedback error	7301H	7
Fault PGF2 PG Fbk Loss	002BH	PG feedback loss	7301H	7
Fault PGF3 PG Fbk Over SPD	002BH	PG feedback stall	7301H	7
Fault PGF4 PG Fbk deviate	002CH	PG slip error	7301H	7
Fault ACE ACI loss	0030H	ACI loss	FF25H	1

Display	Fault code	Description	CANopen fault code	CANopen fault register (bit 0~7)
Fault EF External Fault	0031H	External Fault When input EF (N.O.) on external terminal is closed to GND, AC motor drive stops output U, V, and W.	9000H	5
Fault EF1 Emergency stop	0032H	Emergency stop When the multi-function input terminals MI1 to MI6 are set to emergency stop, the AC motor drive stops output U, V, W and the motor coasts to stop.	9000H	5
Fault bb Base block	0033H	External Base Block When the external input terminals MI1 to MI16 are set as bb and active, the AC motor drive output will be turned off	9000H	5
Fault Pcod Password Error	0034H	Password will be locked if three fault passwords are entered	FF26H	5
Fault ccod SW code Error	0035H	Software error	6100H	5
Fault cE1 Modbus CMD err	0036H	Illegal function code	7500H	4
Fault cE2 Modbus ADDR err	0037H	Illegal data address (00H to 254H)	7500H	4
Fault cE3 Modbus DATA err	0038H	Illegal data value	7500H	4
Fault cE4 Modbus slave FLT	0039H	Data is written to read-only address	7500H	4
Fault cE10 Modbus time out	003AH	Modbus transmission timeout.	7500H	5

Display	Fault code	Description	CANopen fault code	CANopen fault register (bit 0~7)	
Fault cP10 Keypad time out	003BH	Keypad transmission timeout.	7500H	4	
Fault bF Braking fault	003CH	Brake resistor fault	7110H	4	
Fault ydc Y-delta connect	003DH	Motor Y-Δ switch error	3330H	2	
Fault dEb Dec. Energy back	003EH	Energy regeneration when decelerating	FF27H	2	
Fault oSL Over slip Error	003FH	Over slip error. Slip exceeds Pr.05.26 limit and slip duration exceeds Pr.05.27 setting.	FF28H	7	
Fault PGF5 PG HW Error	0041H	PG Card Error	FF29H	5	
Fault ocU Unknow Over Apm	0042H	over current caused by unknown reason	2310H	1	
Fault ovU Unknow Over volt.	0043H	over voltage caused by unknown reason	3210H	2	
Fault S1 S1-Emergy stop	0049H	external safety emergency stop	FF2AH	5	
Fault OPHL U phase lacked	0052H	U phase output phase loss	2331H	2	
Fault OPHL U phase lacked	0053H	V phase output phase loss	2332H	2	

Display	Fault code	Description	CANopen fault code	CANopen fault register (bit 0~7)	
Fault OPHL U phase lacked	0054H	W phase output phase loss	2333H	2	
Fault aocc A phase short	004FH	A phase short	FF2BH	1	
Fault bocc B phase short	0050H	B phase short	FF2CH	1	
Fault COCC C phase short	0051H	C phase short	FF2DH	1	
Fault CGdE Guarding T-out	0065H	Guarding time-out 1	8130H	4	
Fault CHbE Heartbeat T-out	0066H	Heartbeat time-out	8130H	4	
Fault CSyE SYNC T-out	0067H	CAN synchrony error	8700H	4	
Fault CbFE CAN/S bus off	0068H	CAN bus off	8140H	4	
Fault CIdE CAN/S Idx exceed	0069H	Can index exceed	8110H	4	
Fault CAdE CAN/S add. set	006AH	CAN address error	0x8100	4	
Fault CFdE CAN/S FRAM fail	006BH	CAN frame fail	0x8100	4	

# **15.6 CANopen LED Function**

There are two CANopen flash signs: RUN and ERR.

### RUN LED:

LED status	Condition	CANopen State
OFF		Initial
Blinking	ON-200 200 ms ms	Pre-Operation
Single flash	ON 200 200 100 ms ms ms ms	Stopped
ON		Operation

#### ERR LED:

LED status	Condition/ State
OFF	No Error
Single	One Message fail
flash	ON - 200 200 100 ms ms ms ms
Double	Guarding fail or heartbeat fail
flash	ON 200 200 200 100 ms ms ms ms ms
Triple flash	SYNC fail
	ON 200 200 200 200 100 ms ms m
ON	Bus off

# **16 PLC Function Applications**

16-1 **PLC Summary** 16-2 Notes before PLC use 16-3 Turn on 16-3-1 Connect to PC 16-3-2 I/O device explanation 16-3-3 Installation WPLSoft 16-3-4 Program writing 16-3-5 Program download 16-3-6 Program monitoring 16-4 Basic principles of PLC ladder diagrams 16-4-1 Schematic diagram of PLC ladder diagram program scanning 16-4-2 Introduction to ladder diagrams 16-4-3 Overview of PLC ladder diagram editing 16-4-4 Commonly-used basic program design examples 16-5 Various PLC device functions 16-5-1 Introduction to device functions 16-5-2 Introduction to special relay functions (special M) 16-5-3 Introduction to special register functions (special D) 16-5-4 PLC Communication address 16-6 Introduction to the Command Window 16-6-1 Overview of basic commands 16-6-2 Detailed explanation of basic commands 16-6-3 Overview of application commands Detailed explanation of applications commands 16-6-4 Detailed explanation of driver special applications 16-6-5 commands 16-7 Error display and handling 16-8 CANopen Master control applications 16-9 Explanation of various PLC mode controls (speed, torque, homing, and position) 16-10 Internal communications main node control 16-11 Count function using MI8 16-11-1 High-speed count function 16-11-2 Frequency calculation function 16-12 Modbus remote IO control applications (use MODRW) 16-13 Calendar

# 16-1 PLC Summary

## 16-1-1 Introduction

The commands provided by the C2000's built-in PLC functions, including the ladder diagram editing tool WPLSoft, as well as the usage of basic commands and applications commands, chiefly retain the operating methods of Delta's PLC DVP series.

## 16-1-2 WPLSoft ladder diagram editing tool

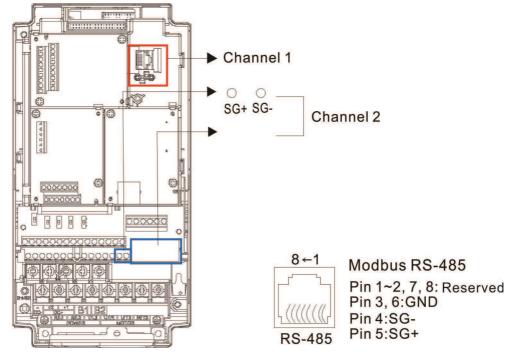
WPLSoft is Delta's program editing software for the DVP and C2000 programmable controllers in the Windows operating system environment. Apart from general PLC program design general Windows editing functions (such as cut, paste, copy, multiple windows, etc.), WPLSoft also provides many Chinese/English annotation editing and other convenience functions (such as registry editing, settings, file reading, saving, and contact graphic monitoring and settings, etc.).

Item	System requirements
Operating system	Windows 95/98/2000/NT/ME/XP
CPU	At least Pentium 90
Memory	At least 16MB (we recommend at least 32MB)
Hard drive	Hard drive capacity: at least 100MB free space
Hald unve	One optical drive (for use in installing this software)
Display	Resolution: 640×480, at least 16 colors; it is recommended that the screen
Display	area be set at 800×600 pixels
Mouse	Ordinary mouse or Windows-compatible device
Printer	Printer with a Windows driver program
RS-485 port	Must have at least an RS-485 port to link to the PLC
Suitable PLC	Delta's full DVP-PLC series, VFD-C2000 series
models	Deila S Iuli DVF-FLO Selles, VFD-02000 Selles

The following basic requirements that need to install WPLSoft editing software:

# 16-2 Notes before PLC use

- 1. The PLC has a preset communications format of 7,N,2,9600, with node 2; the PLC node can be changed in parameter 09-35, but this address may not be the same as the converter's address setting of 09-00.
- 2. The C2000 provides 2 communications serial ports that can be used to download PLC programs (see figure below). Channel 1 has a fixed communications format of 19200,8,N,2 RTU.



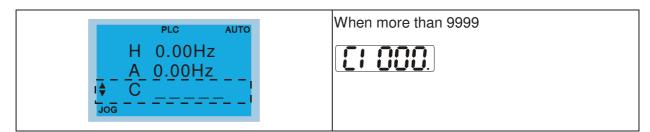
3. The client can simultaneously access data from the converter and internal PLC, which is performed through identification of the node. For instance, if the converter node is 1 and the internal PLC node is 2, then the client command will be

01 (node) 03 (read) 0400 (address) 0001 (1 data item), indicating that it must read the data in converter parameter 04-00

02 (node) 03 (read) 0400 (address) 0001 (1 data item), indicating that it must read the data in internal PLC X0

- 4. The PLC program will be disabled when uploading/downloading programs.
- 5. Please note when using WPR commands to write in parameters, values may be modified up to a maximum of 10<sup>9</sup> times, otherwise a memory write error will occur. The calculation of modifications is based on whether the entered value has been changed. If the entered value is left unchanged, the modifications will not increase afterwards. But if the entered value is different from before, the number of modifications will increase by one.
- 6. When parameter 00-04 is set as 28, the displayed value will be the value of PLC register D1043 (see figure below):

Digital Keypad KPC-CC01	Digital Keypad KPC-CE01
Can display 0~65535	0~9999
	[9990]



- 7. In the PLC Run and PLC Stop mode, the content 9 and 10 of parameter 00-02 cannot be set and cannot be reset to the default value.
- 8. The PLC can be reset to the default value when parameter 00-02 is set as 6.
- 9. The corresponding MI function will be disabled when the PLC writes to input contact X.
- 10. When the PLC controls converter operation, control commands will be entirely controlled by the PLC and will not be affected by the setting of parameter 00-21.
- 11. When the PLC controls converter frequency commands (FREQ commands), frequency commands will be entirely controlled by the PLC, and will not be affected by the setting of parameter 00-20 or the Hand ON/OFF configuration.
- 12. When the PLC controls converter frequency (TORQ commands), torque commands will be entirely controlled by the PLC, and will not be affected by the setting of parameter 11-33 or the Hand ON/OFF configuration.
- 13. When the PLC controls converter frequency (POS commands), position commands will be entirely controlled by the PLC, and will not be affected by the setting of parameter 11-40 or the Hand ON/OFF configuration.
- 14. When the PLC controls converter operation, if the keypad Stop setting is valid, this will trigger an FStP error and cause stoppage.

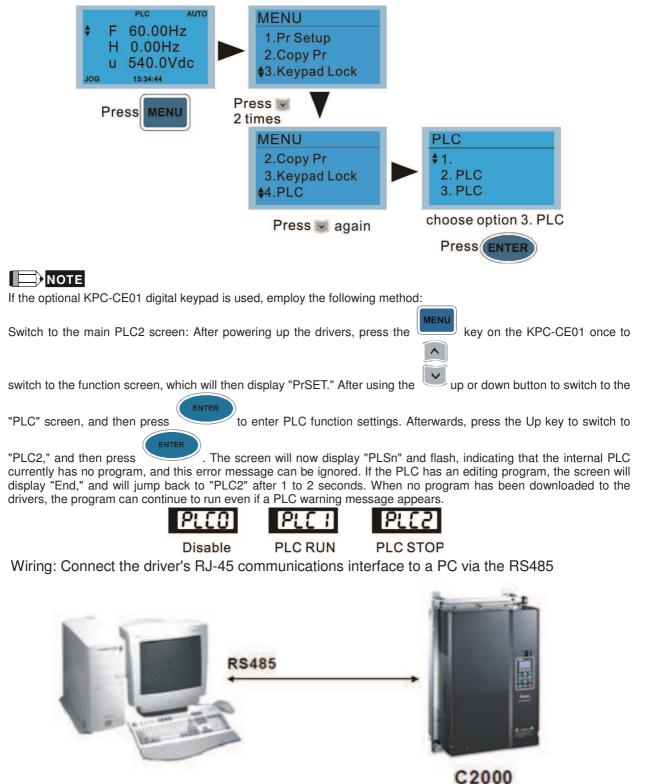
## 16-3 Turn on

2.

## 16-3-1 Connect to PC

Start operation of PLC functions in accordance with the following four steps

1. After pressing the Menu key and selecting 4: PLC on the KPC-CC01 digital keypad, press the Enter key (see figure below).



### 3. PLC function usage

method on KPC-CE01 digital keypad

PLC \$ 1.Disable 2.PLC Run 3.PLC Stop	item 2 and 1: No function ( 2: Enable PLC (	,		
Optional product: PLC fu	nction display	PLC 0 : Do not implement PLC functions		

PLC 2 : Initiate PLC Stop
 When the external multifunctional input terminals (MI1 to MI8) are in PLC Mode select bit0 (51) or PLC Mode select bit1 (52), and the terminal contact is closed or open, it will compulsorily switch to the PLC mode, and keypad switching will be ineffective. Corresponding actions are as follows:

PLC 1 : Initiate PLC Run

PLC	mode	PLC Mode select bit1(52)	PLC Mode select bit0 (51)
Using KPC-CC01	Using KPC-CE01	FEC Mode select bit (32)	FEC Mode select bito (51)
Disable	PLC 0	OFF	OFF
PLC Run	PLC 1	OFF	ON
PLC Stop	PLC 2	ON	OFF
Maintain previous	Maintain previous	ON	ON
state	state	ON	ON

Use of KPC-CE01 digital keypad to implement PLC functions

- When the PLC screen switches to the PLC1 screen, this will trigger one PLC action, and the PLC program start/stop can be controlled by communications via the WPL.
- ☑ When the PLC screen switches to the PLC2 screen, this will trigger one PLC stop, and the PLC program start/stop can be controlled by communications via the WPL.
- $\square$  The external terminal control method is the same as shown in the table above.

### 

- When input/output terminals (FWD REV MI1 to MI8 MI10 to 15, Relay1, Relay2 RY10 to RY15, MO1 to MO2 MO10 to MO11,) are included in the PLC program, these input/output terminals will only be used by the PLC. As an example, when the PLC program controls Y0 during PLC operation (PLC1 or PLC2), the corresponding output terminal relay(RA/RB/RC) will operate in accordance with the program. At this time, the multifunctional input/output terminal setting will be ineffective. Because these terminal functions are already being used by the PLC, the DI DO AO in use by the PLC can be determined by looking at parameter 02-52, 02-53, and 03-30.
- When the PLC's procedures use special register D1040, the corresponding AO contact AFM1 will be occupied, and AFM2 corresponding to special register D1045 will have the same situation.
- Parameter 03-30 monitors the state of action of the PLC function analog output terminal; Bit0 corresponds to the AFM1 action state, and Bit1 corresponds to the AFM2 action state.

## 16-3-2 I/O device explanation

### Input devices:

Serial	X0	X1	X2	X3	X4	X5	X6	X7	X10	X11	X12	X13	X14	X15	X16	X17
No.																
1	FWD	REV	MI1	MI2	MI3	MI4	MI5	MI6	MI7	MI8						
2											MI10	MI11	MI12	MI13	MI14	MI15
3											MI10	MI11	MI12	MI13		

1: Control I/O |

2: Expansion card EMC-D611A (D1022=4)

3: Expansion card EMC-D42A (D1022=5)

### Output devices:

Serial No.	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17
1	RY1	RY2		MO1	MO2											
2						MO10	MO11									
3						RY10	RY11	RY12	RY13	RY14	RY15					

1: Control I/O |

2: Expansion card EMC-D42A (D1022=5)

3: Expansion card EMC-R6AA (D1022=6)

## 16-3-3 Installation WPLSoft

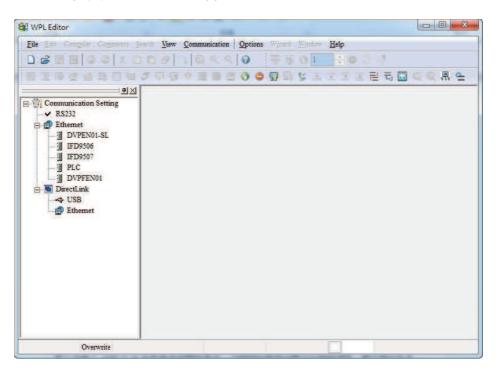
See Delta's website for WPLSoft editing software: <u>http://www.delta.com.tw/industrialautomation/</u>download.

## 16-3-4 Program writing

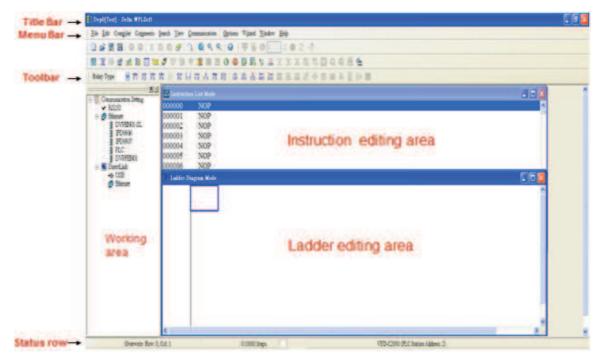
After completing installation, the WPLSoft program will be installed in the designated subfolder "C:\Program Files\Delta Industrial Automation\WPLSoft x.xx." The editing software can now be run by clicking on the WPL icon using the mouse.



The WPL editing window will appear after 3 seconds (see figure below). When running WPLSoft for the first time, before "New file" has been used, only the "File (F)," "Communications (C)," View (V)," "Options (O)," and "Help (H)" columns will appear on the function toolbar.



After running WPLSoft for the second time, the last file edited will open and be displayed in the editing window. The following figure provides an explanation of the WPLSoft editing software window:



Click on the colbar in the upper left part of the screen: opens new file (Ctrl+N)



You can also use "File (F)"=> New file (N) (Ctrl+N)

Eile Edit C	lompiler Comm
New	Ctrl+N
🚰 Open	Ctrl+O
Save	Ctrl+S
Save As	Ctrl+Alt+S

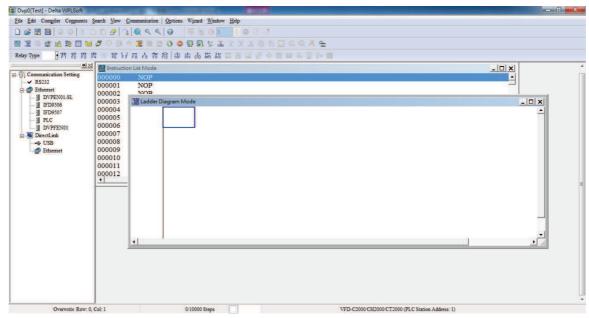
The "Device settings" window will appear after clicking. You can now enter the project title and filename, and select the device and communication settings to be used

Program Title	
Test	
Select	VFD-C2000/CH2000/C' -
Communication RS232 (COM	SE
File Name	VFD-C2000/CH2000/CT20 VFD-C200 VFD-CP2000
Dvp0	TP04P TP70P/TP70G
OK	Cancel

Communications settings: Perform settings in accordance with the desired communications method

Туре	RS232	*
Communication Sett	ing	
COM Port	COM3	ASCII
Data Length	7	RTU (8 bits
Parity	Even •	
Stop Bits	1 +	Auto-detect
Baud Rate	9600 -	
Station Address	1	Default
Ethernet Setting		
🔽 Assign IP	21.2	
Port	12346	
Baud Rate Decide	dby	
PLC Setting	i i di i	
C WPL Setting		
Setup Responding	g Time	
Times of Auto-ret	ry	3
Time Interval of A	uto-retry (sec.)	3 -

Press Confirm after completing settings and begin program editing. There are two program editing methods; you can choose whether to perform editing in the command mode or the ladder diagram mode.



In ladder diagram mode, you can perform program editing using the buttons on the function icon row

Eile Edit Comp	giler Comments Search View Communication Options Wizard Window Help
0 🖨 🖬 🗃	
	ABDEFERRATE CORDENESSEE SOORS
Relay Type	·····································
vp0[Test] - Delta WPLSoft	
	ts Search View Communication Options Wizzard Window Help
	balan (1999) - 20 - 20 - 20 - 20 - 20 - 20 - 20 - 2
Contraction of the second s	# # # # # # # # # # # # # # # # # # #
Communication Setting	비전 1월 Ladder Diagram Mode _ D X
- J UDYENOISL J UD9506 - J UD9506 - J PLC J DYPENOI D DYPENOI D Dectlak - UDPEC	

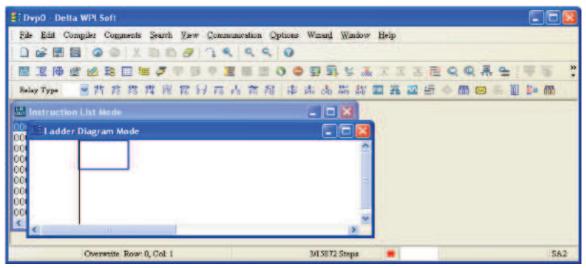
### **Basic Operation**

Example: Input the ladder diagram in the following figure

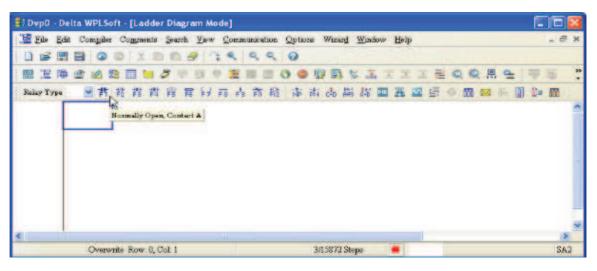
Γ	MO	'C YD	
1		( TD	2
1		END	٦
L		640	

Mouse operation and keyboard function key (F1 to F12) operation

1. The following screen will appear after a new file has been established:



2. Use the mouse to click on the always-open switch icon the function key F1:



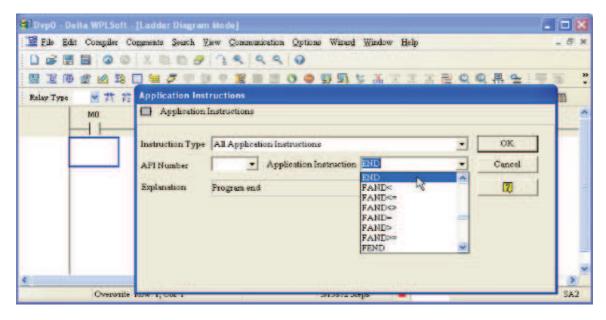
3. After the name of the input device and the comment dialog box have appeared, the device name (such as "M"), device number (such as "10"), and input comments (such as "auxiliary contact") can be selected; press the Confirm button when finished.

put Device Inst Constantly	opened conta	et	
Device Name	M		OK
Device Number	10		Cancel
Internal Relay			
Range	MD-M4095		
Comment	Internal Relay	r	

🚭 Dvp0 - Detta WPLSoft - [Ladder Dia	ram Mode)	
🔚 File Edit Compiler Comments Searc	. Yiew Communication Options Window Help	_@×
	9 3 4 4 4 9	
8 1 4 6 6 8 8 8 7 1	9 9 <b>2 3 4 0 0 9 9 5 4 3 5 3</b>	
Relay Type 💌 🎋 🏦 🎁 🏦	常好市内市粮 市市市耕市回路回归	• m 😖 🐇 📓 🖬 m
	ut Device Instruction Output soil evice Name Y OK evice Number 0 Cancel atput Relay	
	Range 19-4207 Comment Output Coal	
Overwrite Row 0, Col 2	3/15872 Steps 🛑	SA2

5. Click on application command icon 🗟 or press function key F6. Click on "All application"

commands" in the function classification field, and click on the End command in the application command pull-down menu, or use the keyboard to key in "End" in that field, and press the confirm button.



6. Click on the 📠 icon, which will compile the edited ladder diagram as a command program.

After compiling, the number of steps will appear on the left side of the busbar.

📲 Dvp0 - De	Ita WPLSoft - [Ladder Dia	gram Mode]			
📜 Bilo Edir	t Compiler Comments Sear	h Yew Communication Op	tions Wizard Windo	w Help	_ # ×
0 🗃 🖬	8 00 X 00	334440			
I III III 110			🗢 🗊 🖬 🖌 📷	XXXEQQ	# <b>4</b>   <b>7 8</b> .
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2		Delta WPLSoft 2010 Compiling is completed			
¢					
	Overwrite Row 0		3/15872 Steps		SA2

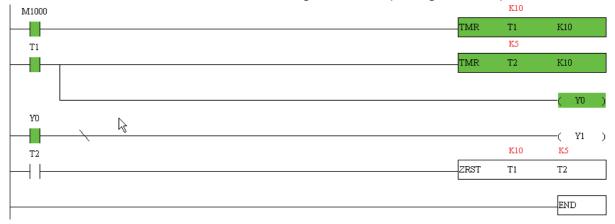
## 16-3-5 Program download

After inputting a program using WPLSoft, select compile . After completing compilation, select

the sto download a program. WPLSoft will perform program download with the online PLC in the communications format specified in communications settings.

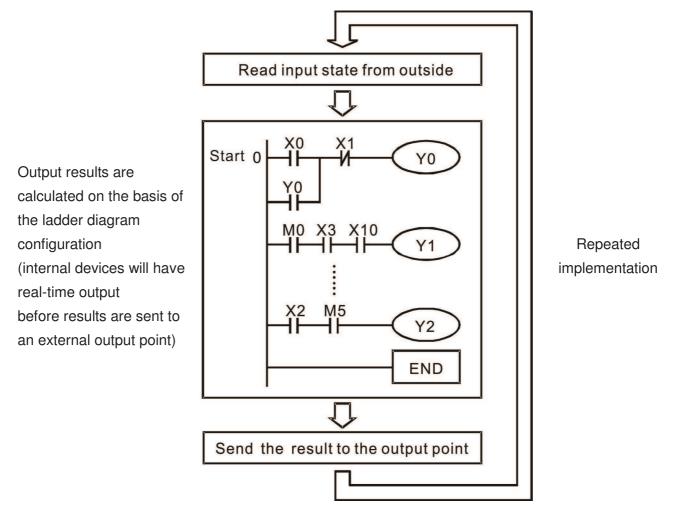
## 16-3-6 Program monitoring

While confirming that the PLC is in the Run mode, after downloading a program, click on *sin the communications menu and select start ladder diagram control (see figure below)* 



# 16-4 Basic principles of PLC ladder diagrams

16-4-1 Schematic diagram of PLC ladder diagram program scanning



## 16-4-2 Introduction to ladder diagrams

Ladder diagrams comprise a graphic language widely applied in automatic control, and employs common electrical control circuit symbols. After a ladder diagram editor has been used to create a ladder pattern, PLC program designed is completed. The use of a graphic format to control processes is very intuitive, and is readily accepted by personnel who are familiar with electrical control circuit technology. Many of the basic symbols and actions in a ladder diagram comprise commonly-seen electrical devices in conventional automatic control power distribution panels, such as buttons, switches, relays, timers, and counters.

Internal PLC devices: The types and quantities of internal PLC devices vary in different brands of products. Although these internal devices use the same names as conventional electrical control circuit elements such as relays, coils, and contacts, a PLC does not actually contain these physical devices, and they instead correspond to basic elements in the PLC's internal memory (bits). For instance, if a bit is 1, this may indicate that a coil is electrified, and if that bit is 0, it will indicate that the coil is not electrified. An NO contact (Normal Open, or contact a) can be used to directly read the value of the corresponding bit, and an NC contact (Normal Close, or contact b) can be used to obtain the inverse of the bit's value. Multiple relays occupy multiple bits, and 8 bits comprise one byte; two

bytes comprise one word, and two words comprise a double word. When multiple relays are processing at the same time (such as addition/subtraction or displacement, etc.), a byte, word, or double word can be used. Furthermore, a PLC contains two types of internal devices: a timer and a counter. It not only has a coil, but can count time and numerical values. Because of this, when it is necessary to process some numerical values, these values are usually in the form of bytes, words, or double words.

The various internal devices in a PLC all account for a certain quantity of storage units in the PLC's storage area. When these devices are used, the content of the corresponding storage area is red in the form of bits, bytes, or words.

Device type	Description of Function
Input Relay	<ul> <li>An input relay constitutes the basic unit of storage in a PLC's internal memory corresponding to an external input point (which serves as a terminal connecting with an external input switch and receiving external input signals). It is driven by external input signals, to which it assigns values of 0 or 1. A program design method cannot change the input relay status, and therefore cannot rewrite the corresponding basic units of an input relay, and WPLSoft cannot be used to perform compulsory On/Off actions. A relay's contacts (contacts a and b) can be used an unlimited number of times. An input relay with no input signal must be left idle and cannot be used for some other purpose.</li> <li>✓ Device indicated as: X0, X1, X7, X10, X11, etc. This device is expressed with the symbol "X," and a device's order is indicated with an octal number. Input point numbers are indicated in the main computer and in expansion devices.</li> </ul>
Output Relay	An output relay constitutes the basic unit of storage in a PLC's internal memory corresponding to an external output point (which connects with an external load). It may be driven by an input relay contact, a contact on another internal device, or its own contacts. It uses one NO contact to connect with external loads or other contacts, and, like input contacts, can use the contact an unlimited number of times. An output relay with no input signal will be idle, but may be used an internal relay if needed.
	Device indicated as: Y0, Y1, Y7, Y10, Y11, etc. This device is expressed with the symbol "Y," and a device's order is indicated with an octal number. Output point numbers are indicated in the main computer and in expansion devices.
Internal Relay	Internal relays have no direct connection with the outside. These relays are auxiliary relays inside a PLC. Their function is the same as that of an auxiliary (central) relay in an electrical control circuit: Each auxiliary relay corresponding to a basic unit of internal storage; they can be driven by input relay contacts, output relay contacts, and the contacts of other internal devices. An internal auxiliary relay's contact can also be used an unlimited number of times. Internal relays have no outputs to outside, and must output via an output point.
	Device indicated as: M0, M1 to M799, etc. This device is expressed as the symbol "M," expressed, and its order is expressed as a decimal number.
Counter	<ul> <li>A counter is used to perform counting operations. A count setting value (such as the number of pulses to be counted) must be assigned when a counter is used. A counter contains a coil, contact, and a counting storage device. When the coil goes from Off →to On, this indicates that the counter has an input pulse, and one is added to its count. There are 16 bits that can be employed by the user.</li> <li>☑ Device indicated as: C0, C1 to C79, etc. This device is expressed as the symbol "C," expressed, and its order is expressed as a decimal number.</li> </ul>

Introduction to the basic internal devices in a PLC

Device type	Description of Function
Timer	A timer is used to complete control of timing. The timer contains a coil, contact, and a time value register. When the coil is electrified, if the preset time is reached, the contact will be actuated (contact a will close, contact b will open), and the timer's fixed value be given by the set value. Timer has a regulated clock cycle (timing units: 100 ms). As soon as power to the coil is cut off, the contact will no longer be actuated (contact a will open, contact b will close), and the original timing value will return to zero.
	☑ Device indicated as: T0, T1 to T159, etc. The device is expressed as the symbol "T," and its order is expressed as a decimal number.
Data register	When a PLC is used to perform various types of sequence control and set time value and count value control, it most commonly perform data processing and numerical operations, and data registers are used exclusively for storage of data and various parameters. Each data register contains 16 bits of binary data, which means that it can store one word. Two data registers with adjacent numbers can be used to process double words.
	Device indicated as: D0, D1 to D399, etc. The device is expressed as the symbol "D," and its order is expressed as a decimal number.

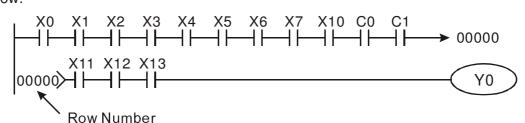
## Ladder diagram images and their explanation

Ladder diagram structures	•		Using Device
	NO switch, contact a		$X \mathrel{\scriptstyle{\vee}} Y \mathrel{\scriptstyle{\vee}} M \mathrel{\scriptstyle{\vee}} T \mathrel{\scriptstyle{\vee}} C$
V	NC switch, contact b	LDI	$X \mathrel{\scriptstyle{\vee}} Y \mathrel{\scriptstyle{\vee}} M \mathrel{\scriptstyle{\vee}} T \mathrel{\scriptstyle{\vee}} C$
	Series NO	AND	$X \mathrel{\scriptstyle{\vee}} Y \mathrel{\scriptstyle{\vee}} M \mathrel{\scriptstyle{\vee}} T \mathrel{\scriptstyle{\vee}} C$
	Series NC	ANI	$X \mathrel{\scriptstyle{\scriptstyle\vee}} Y \mathrel{\scriptstyle{\scriptstyle\vee}} M \mathrel{\scriptstyle{\scriptstyle\vee}} T \mathrel{\scriptstyle{\scriptstyle\vee}} C$
	Parallel NO	OR	$X \mathrel{\scriptstyle{\scriptstyle\vee}} Y \mathrel{\scriptstyle{\scriptstyle\vee}} M \mathrel{\scriptstyle{\scriptstyle\vee}} T \mathrel{\scriptstyle{\scriptstyle\vee}} C$
	Parallel NC	ORI	$X \mathrel{\scriptstyle{\scriptstyle\vee}} Y \mathrel{\scriptstyle{\scriptstyle\vee}} M \mathrel{\scriptstyle{\scriptstyle\vee}} T \mathrel{\scriptstyle{\scriptstyle\vee}} C$
	Positive edge-triggered switch	LDP	$X \mathrel{\scriptstyle{\scriptstyle\vee}} Y \mathrel{\scriptstyle{\scriptstyle\vee}} M \mathrel{\scriptstyle{\scriptstyle\vee}} T \mathrel{\scriptstyle{\scriptstyle\vee}} C$
	Negative edge-triggered switch	LDF	$X \mathrel{\scriptstyle{\vee}} Y \mathrel{\scriptstyle{\vee}} M \mathrel{\scriptstyle{\vee}} T \mathrel{\scriptstyle{\vee}} C$
	Positive edge-triggered series	ANDP	$X \mathrel{\scriptstyle{\vee}} Y \mathrel{\scriptstyle{\vee}} M \mathrel{\scriptstyle{\vee}} T \mathrel{\scriptstyle{\vee}} C$
	Negative edge-triggered series	ANDF	$X \mathrel{\scriptstyle{\vee}} Y \mathrel{\scriptstyle{\vee}} M \mathrel{\scriptstyle{\vee}} T \mathrel{\scriptstyle{\vee}} C$
	Positive edge-triggered parallel	ORP	$X \mathrel{\scriptstyle{\scriptstyle\vee}} Y \mathrel{\scriptstyle{\scriptstyle\vee}} M \mathrel{\scriptstyle{\scriptstyle\vee}} T \mathrel{\scriptstyle{\scriptstyle\vee}} C$
	Negative edge-triggered parallel	ORF	$X \mathrel{\scriptstyle{\scriptstyle\vee}} Y \mathrel{\scriptstyle{\scriptstyle\vee}} M \mathrel{\scriptstyle{\scriptstyle\vee}} T \mathrel{\scriptstyle{\scriptstyle\vee}} C$
	Block series	ANB	N/A

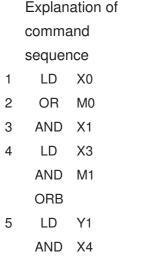
Ladder diagram structures	Explanation of commands	Command	Using Device
	Block parallel	ORB	N/A
	Multiple outputs	MPS MRD MPP	N/A
O	Coil driven output commands	OUT	Y ∘ M
	Some basic commands, applications commands	Some basic commands Applications commands	
	Inverted logic	INV	N/A

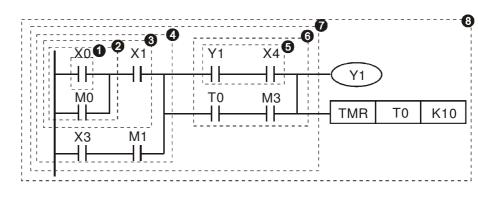
## 16-4-3 Overview of PLC ladder diagram editing

The program editing method begins from the left busbar and proceeds to the right busbar (the right busbar is omitted when editing using WPLSoft). Continue to the next row after completing each row; there is a maximum of 11 contacts on each row. If this is not sufficient, a continuous line will be will be generated to indicate the continued connection and more devices can be added. A continuous series of numbers will be generated automatically and identical input points can be used repeatedly. See figure below:



The ladder diagram programming method involves scanning from the upper left corner to the lower right corner. The coils and applications command computing box are handled in the output, and the ladder diagram is placed on the farthest right. Taking the figure below as an example, we can gradually analyze the procedural sequence of the ladder diagram. The number in the upper right corner gives the sequential order.

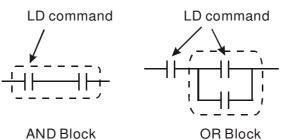




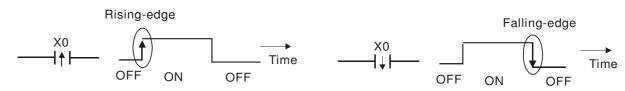
6 LD T0
AND M3
ORB ANB 8 OUT Y1
TMR T0 K10

Explanation of basic structure of ladder diagrams

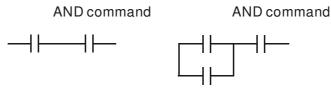
LD (LDI) command: An LD or LDI command is given at the start of a block.



LDP and LDF have this command structure, but there are differences in their action state. LDP, LDF only act at the rising or falling edge of a conducting contact. (see figure below):

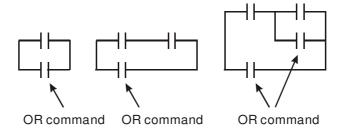


**AND (ANI) command:** A series configuration in which a single device is connected with one device or a block.



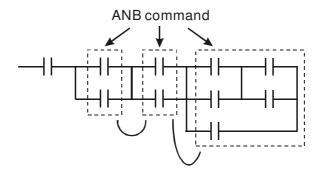
ANDP, ANDF also have structures like this, but their action occurs at the rising and falling edge.

**OR (ORI) command:** A single device is connected with one device or a block.

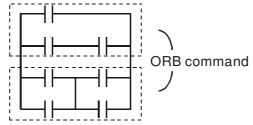


ORP, ORF also have identical structures, but their action occurs at the rising and falling edge.

**ANB command:** A configuration in which one block is in series with one device or block.



**ORB command:** A configuration in which one block is in parallel with one device or block.



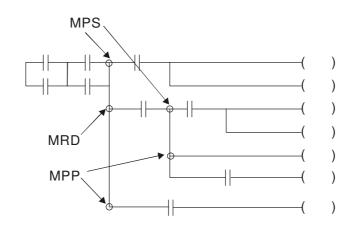
In the case of ANB and ORB operations, if a number of blocks are connected, they should be combined to form a block or network from the top down or from left to right.

**MPS, MRD, MPP commands:** Branching point memory for multiple outputs, enabling multiple, different outputs. The MPS command begins at a branching point, where the so-called branching point refers to the intersection of horizontal and vertical lines. We have to rely on the contact status along a single vertical line to determine whether the next contact can give a memory command. While each contact is basically able to give memory commands, in view of convenience and the PLC's capacity restrictions, this can be omitted from some places when converting a ladder diagram. The structure of the ladder diagram can be used to judge what kinds of contact memory commands are used.

MPS can be distinguished by use of the "T" symbol; this command can be used consecutively for up to 8 times. The MRD command is read from branching point memory; because logic states along any one vertical line must be the same, in order to continue analysis of other ladder diagrams, the original contact status must be read.

MRD can be distinguished by use of the " - symbol. The MPP command is read from the starting state of the uppermost branching point, and it is read from the stack (pop); because it is the final command along a vertical line, it indicates that the state of the vertical line can be concluded.

MPP can be distinguished by use of the "L" symbol. Although there should basically be no errors when using the foregoing analytical approach, the compiling program may sometimes omit identical state output, as shown in the following figure:



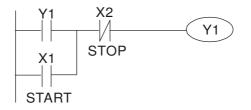
## 16-4-4 Commonly-used basic program design examples

#### Start, stop, and protection

Some applications may require a brief close or brief break using the buttons to start and stop equipment. A protective circuit must therefore be designed to maintain continued operation in these situations; this protective circuit may employ one of the following methods:

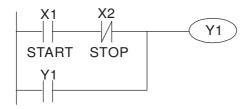
Example 1: Priority stop protective circuit

When the start NO contact X1=On, and the stop NC contact X2=Off, Y1=On; if X2=On at this time, coil Y1 will no longer be electrified, and this is therefore referred to as priority stop.



Example 2: Priority start protective circuit

When start NO contact X1=On, and the stop NC contact X2=Off, Y1=On, and coil Y1 will be electrified and protected. At this time, if X2=On, coil Y1 will still protect the contact and continue to be electrified, and this is therefore priority start.

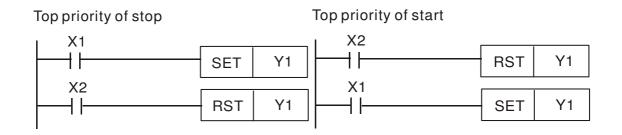


Example 3: Setting (SET) and reset (RST) command protective circuit

The following figure shows a protective circuit composed of RST and SET commands.

Priority stop occurs when the RST command is placed after the SET command. Because the PLC executes programs from the top down, at the end of the program, the state of Y1 will indicate whether coil Y1 is electrified. When X1 and X2 are both actuated, Y1 will lose power, and this is therefore priority stop.

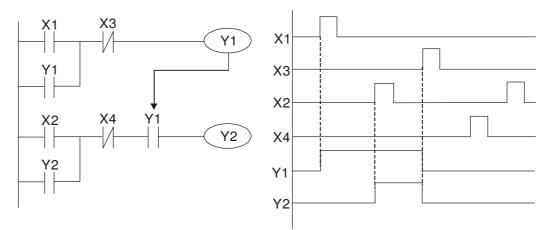
Priority start occurs when the SET command is placed after the RST command. When X1 and X2 are both actuated, Y1 will be electrified, and this is therefore priority start.



#### Commonly-used control circuits

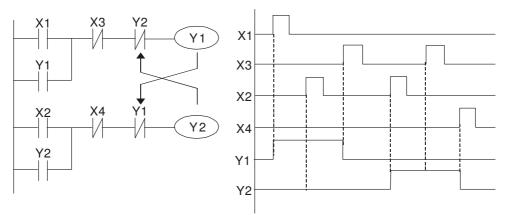
Example 4: Conditional control

X1, X3 are respectively start/stop Y1, and X2, X4 are respectively start/stop Y2; all have protective circuits. Because Y1's NO contact is in series with Y2's circuit, it becomes an AND condition for the actuation of Y2. The action of Y1 is therefore a condition for the action of Y2, and Y1 must be actuated before Y2 can be actuated.



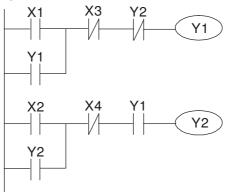
#### Example 5: Interlocking control

The figure below shows an interlocking control circuit. Depending on which of the start contacts X1, X2 is valid first, the corresponding output Y1 or Y2 will be actuated, and when one is actuated, the other will not be actuated. This implies that Y1 and Y2 cannot be actuated at the same time (interlocking effect). Even if both X1 and X2 are valid at the same time, because the ladder diagram program is scanned from the top down, it is impossible for Y1 and Y2 to be actuated at same time. This ladder diagram assigns priority only to Y1.



#### Example 6: Sequence control

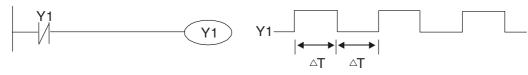
If the NC contact of Y2 in the interlocking control configuration of example 5 is put in series with the Y1 circuit, so that it is an AND condition for actuation of Y1 (see figure below), not only is Y1 a condition for the actuation of Y2 in this circuit, the actuation of Y2 will also stop the actuation of Y1. This configuration confirms the actuation order of Y1 and Y2.



#### Example 7: Oscillating circuit

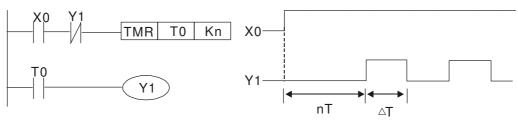
Oscillating circuit with a period of  $\Delta T + \Delta T$ 

The figure below shows a very simple ladder diagram. When starting to scan the Y1 NC contact, because the Y1 coil has lost power, the Y1 NC contact will be closed. When the Y1 coil is then scanned, it will be electrified, and the output will be 1. When the Y1 NC contact is scanned in the scanning cycle, because Y1 coil is electrified, the Y1 NC contact will be open, the Y1 coil will then lose power, and the output will be 0. Following repeated scanning, the output of Y1 coil will have an oscillating waveform with a period of  $\Delta T(On) + \Delta T(Off)$ .



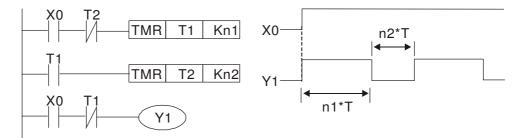
Oscillating circuit with a period of  $nT+\Delta T$ 

The program of the ladder diagram shown below uses timer T0 to control coil Y1's electrified time. After Y1 is electrified, it causes timer T0 to close during the next scanning cycle, which will cause the output from Y1 to have the oscillating waveform shown in the figure below. Here n is the timer's decimal setting value, and T is the clock cycle of the timer.



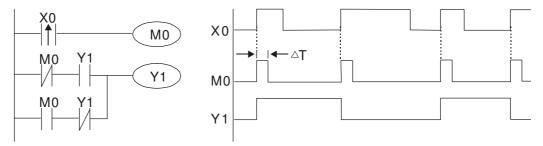
#### Example 8: Flashing circuit

The following figure shows an oscillating circuit of a type commonly used to cause an indicator light to flash or a buzzers to buzz. It uses two timers to control the On and Off time of Y1 coil. Here n1, n2 are the timing set values of T1 and T2, and T is the clock cycle of the timer.



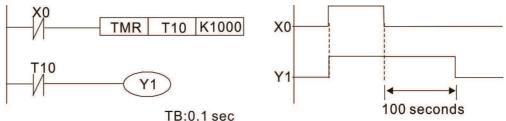
#### Example 9: Triggering circuit

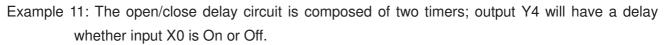
In the figure below, a command consisting of the differential of the rising edge of X0 causes coil M0 to generate a single pulse for  $\Delta T$  (length of one scanning cycle), and coil Y1 is electrified during this scanning cycle. Coil M0 loses power during the next scanning cycle, and NC contact M0 and NC contact Y1 are both closed. This causes coil Y1 to stay in an electrified state until there is another rising edge in input X0, which again causes the electrification of coil M0 and the start of another scanning cycle, while also causing coil Y1 to lose power, etc. The sequence of these actions can be seen in the figure below. This type of circuit is commonly used to enable one input to perform two actions in alternation. It can be seen from the time sequence in the figure below that when input X0 is a square wave signal with a period of T, the output of coil Y1 will be a square wave signal with a period of 2T.



#### Example 10: Delay circuit

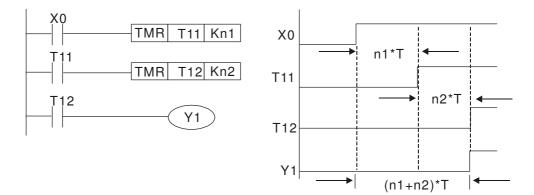
When input X0 is On, because the corresponding NC contact will be Off, the timer T10 will be in no power status, and output coil Y1 will be electrified. T10 will receive power and begin timing only after input X0 is Off, and output coil Y1 will be delayed for 100 sec. (K1000\*0.1 sec. =100 sec.) before losing power; please refer to the sequence of actions in the figure below.





#### Example 12: Extended timing circuit

In the circuit in the figure on the left, the total delay time from the moment input X0 closes to the time output Y1 is electrified is  $(n1+n2)^{*}T$ , where T is the clock cycle. Timers: T11, T12; clock cycle: T.



# 16-5 Various PLC device functions

Item	Specifications	Notes
Algorithmic control	Program stored internally, alternating	
method	back-and-forth scanning method	
Input/output control method	When it starts again after ending (after execution to the END command), the input/output has an immediate refresh command	
Algorithmic processing speed	Basic commands (several us);	Applications command (1-several tens of us)
Programming language	Command + ladder diagram	
Program capacity	10000 steps	
Input/output terminal	Input (X): 10, output (Y): 4	This number of contacts constitutes C2000 input/output contacts; other devices have different correspondences

Туре	Device	Ite	m	Range		Function
	Х	External inpu	ut relay	X0~X17, 16 points, octal number	Total 32	Corresponds to external input point
	Y	External outp		Y0~Y17, 16 points, octa number	points	Corresponds to external output point
	М	1	General Use	M0~M799, 800 points	Total 880	Contact can switch On/Off within the
Rel			Special ourpose	M1000~M1079, 80 points		program
Relay bit form	т	l limor	100ms timer	T0~T159, 160 points	Total 160 points	Timers referred to by the TMR command; contact of the T with the same number will go On when the time is reached
	С	Counter	16-bit counter, general use	C0~C79, 80 points	Total 80 points	Counter referred to by the CNT command; contact of the C with the same number will go On when the count is reached
	Т	Current timer value		T0~T159, 160 points		The contact will be On when the time is reached
Registe	С	Current cour	nter value	C0~C79, 16-bit count points	er 80	The counter contact will come On when the count is reached
Register word data	D	Data	Used maintain power Off	to D0~D399, 400 points	Total	Used as data storage
data		D Register	Special purpose	D1000~D1199, 200 points D2000~D2799, 800 points	points	memory area
	К	Decimal	Single-byt			
Constant	r.	Decimal		Double-byte Setting Range: K-2,147,483,64		8~K2,147,483,647
Constant	Н	Hexadecima		-byte Setting Range:H0000 ~ HFFFF		
			"Double-by	te Setting Range: H00000	000 ~ H	IFFFFFFF

Serial communications port (program write/read)		RS-485/keypad port
Input/output		Built-in three analog inputs and two analog outputs
Function expansion module	Optional Accessories	EMC-D42A; EMC-R6AA; EMCD611A
Communication Expansion Optional Module Accessories		EMC-COP01,(CANopen)

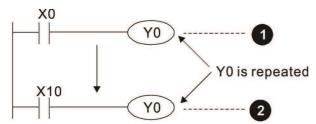
## 16-5-1 Introduction to device functions

## Input/output contact functions

Input contact X functions: Input contact X is connected with an input device, and reads input signals entering the PLC. The number of times that contact a or b of input contact X is used in the program is not subject to restrictions. The On/Off state of input contact X will change as the input device switches On and Off; a peripheral device (WPLSoft) cannot be used to force contact X On or Off.

### Output contact Y functions

The job of output contact Y is to send an On/Off signal to drive the load connected with output contact Y. Output contacts consist of two types: relays and transistors. While number of times that contact a or b of each output contact Y is used in the program is not subject to restrictions, it is recommended that the number of output coil Y be used only once in a program, otherwise the right to determine the output state when the PLC performs program scanning will be assigned to the program's final output Y circuit.



The output of Y0 will be decided by circuit **2**, i.e. decided by On/Off of X10.

#### Numerical value, constant [K]/[H]

ĸ	L)ecimal	K-32,768 ~ K32,767
		K-2,147,483,648~K2,147,483,647
Ц	Hexadecimal	H0000 ~ HFFFF
		H00000000 ~ HFFFFFFF
	K H	H Hexadecimal

The PLC can use five types of numerical values to implement calculations based on its control tasks; the following is an explanation of the missions and functions of different numerical values.

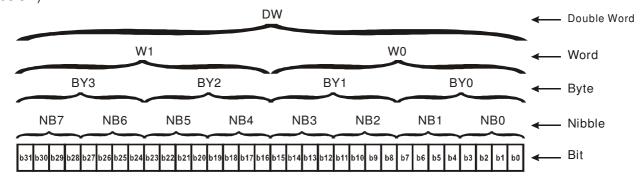
#### Binary Number, BIN

The PLC's numerical operations and memory employ binary numbers. Binary nibbles and relevant terms are explained as follows:

Bit	Bits are the fundamental units of binary values, and have a state of either 1 or 0
Nibble	Comprised of a series of 4 bits (such as b3-b0); can be used to express a
	one-nibble decimal number 0-9 or hexadecimal number: 0-F.
Byte	Comprised of a series of two nibbles (i.e. 8 bits, b7-b0); can express a
Dyte	hexadecimal number: 00-FF.
Word	Comprised of a series of two bytes (i.e. 16 bits, b15-b0); can express a
vvoru	hexadecimal number with four nibbles: 0000-FFFF.

# Double Word Comprised of a series of two words (i.e. 32 bits, b31-b0); can express a hexadecimal number with eight nibbles: 00000000-FFFFFFFF

Relationship between bits, digits, nibbles, words, and double words in a binary system (see figure below):



#### Octal Number, OCT

The external input and output terminals of a DVP-PLC are numbered using octal numbers Example: External input: X0~X7, X10~X17...(Device number table); External output: Y0~Y7, Y10~Y17...(Device number table)

#### Decimal Number, DEC

Decimal numbers are used for the following purposes in a PLC system:

The setting values of timer T or counter C, such as TMR C0 K50. (K constant)

The numbers of devices including M, T, C, or D, such as M10 or T30. (device number)

Used as a operand in an application command, such as MOV K123 D0. (K constant)

#### Binary Code Decimal, BCD

Uses one nibble or 4 bits to express the data in a decimal number; a series of 16 bits can therefore express a decimal number with 4 nibbles. Chiefly used to read the input value of a fingerwheel numerical switch input or output a numerical value to a seven-segment display driver.

#### Hexadecimal Number, HEX

Applications of hexadecimal numbers in a PLC system: Used as operands in application commands, such as MOV H1A2B D0. (H constant)

#### Constant K

Decimal numbers are usually prefixed with a "K" in a PLC system, such as K100. This indicates that it is a decimal number with a numerical value of 100.

Exceptions: K can be combined with bit device X, Y, M, or S to produce data in the form of a nibble, byte, word, or double word, such as in the case of K2Y10 or K4M100. Here K1 represents a 4-bit combination, and K2-K4 variously represent 8-, 12-, and 16-bit combinations.

#### Constant H

Hexadecimal numbers are usually prefixed with the letter "H" in a PLC system, such as in the case of H100, which indicates a hexadecimal number with a numerical value of 100.

#### Functions of auxiliary relays

Like an output relay Y, an auxiliary relay M has an output coil and contacts a and b, and the number

of times they can be used in a program is unrestricted. Users can use an auxiliary relay M to configure the control circuit, but cannot use it to directly drive an external load. Auxiliary relays have the following two types of characteristics:

Ordinary auxiliary relays: Ordinary auxiliary relays will all revert to the Off state if a power outage occurs while the PLC is running, and will remain in the Off state if power is again turned down.

Special purpose auxiliary relays: Each special purpose auxiliary relay has its own specific use. Do not use any undefined special purpose auxiliary relays.

#### **Timer functions**

Timers take 100 ms as their timing units. When the timing method is an upper time limit, when the current timer value = set value, power will be sent to the output coil. Timer setting values consist of decimal K values, and the data register D can also serve as a setting value.

Actual timer setting time = timing units \* set value

#### Counter features

Item	16-bit counter
Туре	General Type
CT Direction:	Score:
Setting	0~32,767
Designation of	Constant K or data register D
set value	_
Change in current	When the count reaches the set value, there is no
value	longer a count
Output contact	When the count reaches the set value, the contact
	comes On and stays On
Reset	The current value reverts to 0 when an RST
	command is executed, and the contact reverts to Off
Contact actuation	All are actuated after the end of scanning

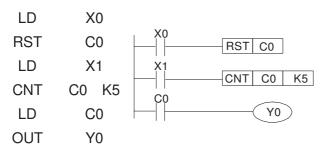
#### Counter functions

When a counter's counting pulse input signal goes  $Off \rightarrow On$ , if the counter's current value is equal to the set value, the output coil will come On. The setting value will be a decimal K values, and the data register D can also serve as a setting value.

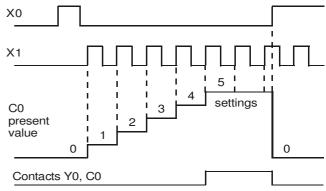
16-bit counter C0-C79:

- ☑ 16-bit counter setting range: K0-K32,767. (when K0 and K1 are identical, the output contact will immediately be On during the first count.)
- ☑ The current counter value will be cleared from an ordinary counter when power is shut off to the PLC.
- ☑ If the MOV command or WPLSoft is used to transmit a value greater than the set value to the C0 current value register, when the next X1 goes from Off→On, the C0 counter contact will change to On, and the current value will change to the set value.
- ☑ A counter's setting value may be directly set using a constant K or indirectly set using the value in register D (not including special data registers D1000- D1199 或 D2000 ~ D2799).
- ☑ If the set value employs a constant K, it may only be a positive number; the set value may be either a positive or negative number if the value in data register D is used. The current counter value will change from 32,767 to -32,768 as the count continues to accumulate.

#### Example



- When X0=On and the RST command is executed, the current value of C0 will revert to 0, and the output contact will revert to Off.
- When X1 changes from Off→On, the current value of the counter will execute an increase (add one).
- When the count of counter C0 reaches the set value K5, the contact C0 will come On, and the current value of C0= set value =K5. Afterwards, signal C0 triggered by X1 cannot be received, and the current value of C0 will remain K5.



## 16-5-2 Introduction to special relay functions (special M)

Special M	Description of Function	R/W *
M1000	Operates monitor NO contact (contact a). NO while RUN, contact a. This contact is On while in the RUN state.	RO
M1001	Operates monitor NC contact (contact b). NC while RUN, contact b. This contact is Off while in the RUN state.	RO
M1002	Initiates a forward (the instant RUN is On) pulse. Initial pulse, contact a. Produces a forward pulse the moment RUN begins; its width = scan cycle	RO
M1003	Initiates a reverse (the instant RUN is Off) pulse. Initial pulse, contact a. Produces a reverse pulse the moment RUN ends; the pulse width = scan cycle	RO
M1004	Reserved	RO
M1005	Driver malfunction instructions	RO
M1006	Converter has no output	RO
M1007	Driver direction FWD(0)/REV(1)	RO
M1008		
M1010		
M1011	10 ms clock pulse , 5ms On/5ms Off	RO
M1012	100 ms clock pulse 3 50ms On / 50ms Off	RO
M1013	1 sec. clock pulse -, 0.5s On / 0.5s Off	RO
M1014	1 min. clock pulse 30s On / 30s Off	RO
M1015	Frequency attained (when used together with M1025)	RO

#### R/W items: RO: read only function; RW: read and write function

Special M	Description of Function	R/W *
M1016	Parameter read/write error	RO
M1017	Parameter write successful	RO
M1018		
M1019		
M1020	Zero flag	RO
M1021	Borrow flag	RO
M1022	Carry flag	RO
M1022	Divisor is 0	RO
M1020		
M1021	Driver frequency = set frequency (ON) Driver frequency =0(OFF)	RW
M1026	Driver operating direction FWD(OFF)/REV(ON)	RW
M1027	Driver Reset	RW
M1028		
M1029		
M1020		
M1030	Compulsory setting of the current PID integral value equal to D1019 (0 change, 1 valid)	RW
M1032	Compulsory definition of FREQ command after PID control	RW
M1033		
M1034	Initiates CANopen real-time control	RW
M1035	Initiates internal communications control	RW
M1036	Ignore calendar error	RW
M1037		
M1038	MI8 count begins	RW
M1039	Reset MI8 count value	RW
M1000	Hardware power (Servo On)	RW
M1040		
M1041	Quick stop	RW
M1042		
M1043	Pause	RW
M1044		1100
M1043		
M1048	Move to new position	RW
M1049		
M1050	Absolute position/relative position (0: relative/1: absolute)	RW
M1051		
M1052	Lock frequency (lock, frequency locked at the current operating frequency)	RW
M1053		
M1054	Compulsory reset of absolute position	RW
M1055	Search Origin	RW
M1055	Hardware already has power (Servo On Ready)	RO
M1057		
M1057	On Quick Stopping	RO
M1058	CANopen Master setting complete	RO
M1059	CANopen Currently initializing slave station	RO
M1060	CANopen Slave station initialization failure	RO
M1061	Univopen Slave Slation Initialization Tallure	
	Torque attained	
M1063	Torque attained	RO
M1064	Target reached	RO
M1065	Read/write CANOpen data time out	RO
M1066	Read/write CANopen data complete	RO
M1067	Read/write CANopen data successful	RO
M1068	Calendar calculation error	RO

Special M	Description of Function	R/W *
M1069		
M1070	Return home complete	RO
M1071	Homing error	RO
M1072		
~		
M1075		
M1076	Calendar time error or refresh time out	RO
M1077	485 Read/write complete	RO
M1078	485 Read-write error	RO
M1079	485 Communications time out	RO

## 16-5-3 Introduction to special register functions (special D)

Special	Description of Function	R/W *
D D1000		
D1000	Device system program version	RO
D1001	Program capacity	RO
D1002	Total program memory content	RO
D1000		
~		
D1009		
D1010	Current scan time (units: 0.1 ms)	RO
D1011	Minimum scan time (units: 0.1 ms)	RO
D1012	Maximum scan time (units: 0.1 ms)	RO
D1013		
~		
D1017		
	Current integral value	RO
D1019	Compulsory setting of PID I integral	RW
D1020	Output frequency (0.000~600.00Hz)	RO
D1021	Output current (####.#A)	RO
	AI AO DI DO Expansion card number	
	0 : No expansion card	
D1022	4 : AC input card (6 in) (EMC-D611A)	RO
	5 : I/O Card ( 4 in 2 out ) (EMC-D42A)	
	6 : Relay card( 6 out ) (EMC-R6AA)	
	Communication expansion card number	
	0 : No expansion card	
	1 : DeviceNet Slave	
D1023	2 : Profibus-DP Slave	RO
	3 : CANopen Slave	
	4 : Modbus-TCP Slave	
	5 : EtherNet/IP Slave	
D1024		
~		
D1026		
D1027	PID calculation frequency command (frequency command after PID calculation)	RO
D1028	AVI value (0.00~100.00%)	RO
D1029	ACI value (0.0~100.00%)	RO
D1030	AUI value (-100.0~100.00%)	RO
D1031		

Special D	Description of Function	R/W *
~		
D1035 D1036	Servo error bit	RO
D1036		RO
	Driver output frequency	RO
D1038	DC BUS voltage	
D1039	Output voltage	RO
D1040	Analog output value AFM1(-100.00~100.00%)	RW
D1041 ~		
D1042		
D1043	Can be user-defined (will be displayed on panel when parameter 00-04 is set as 28; display method is C xxx)	RW
D1044		-
D1045	Analog output value AFM2(-100.00~100.00%)	RW
D1046		
D1049		
	Actual Operation Mode	
	0 : Speed	
D1050	1 : Position	RO
	2 : Torque	
	3 : Homing Origin	
D1051	Actual position (Low word)	RO
	Actual position (High word)	RO
	Actual torque	RO
D1054	MI8 current calculated count value (L Word)	RO
D1055	MI8 current calculated count value (H Word)	RO
D1056	Rotational speed corresponding to MI8	RO
	MI8's rotational speed ratio	RW
	MI8 refresh rate (ms) corresponding to rotational speed	RW
D1059	Number of nibbles of rotational speed corresponding to MI8 (0-3)	RW
01000	Operation Mode setting	1100
	0 : Speed	
D1060	1 : Position	RW
D1060	2 : Torque	ΠVV
	•	
- Diagi	3 : Homing Origin	
D1061	485 COM1 communications time out time (ms)	RW
D1062	Torque command (torque limit in speed mode)	RW
D1063	Year (Western calendar) (display range 2000-2099) (must use KPC-CC01)	RO
D1064	Week (display range 1-7) (must use KPC-CC01)	RO
D1065	Month (display range 1-12) (must use KPC-CC01)	RO
D1066	Day (display range 1-31) (must use KPC-CC01)	RO
D1067	Hour (display range 0-23) (must use KPC-CC01)	RO
D1068	Minute (display range 0-59) (must use KPC-CC01)	RO
D1069	Second (display range 0-59) (must use KPC-CC01)	RO
D1100	Target frequency	RO
D1101	Target frequency (must be operating)	RO
D1102	Reference frequency	RO
D1103	Target L	RO
D1104	Target H	RO
D1105	Target torque	RO
D1106		
D1107	π(Pi) Low word	RO
D1108	π(Pi) High word	RO

Special D	Description of Function	R/W *
D1109	Random number	RO
D1110	Internal node communications number (set number of slave stations to be controlled)	RW
D1111	Encoder Pulses L	RO
D1112	Encoder Pulses H	RO
D1113		RO
D1114		
	Internal node synchronizing cycle (ms)	RO
D1116	Internal node error (bit0 = Node 0, bit1 = Node 1,bit7 = Node 7)	RO
D1117	Internal node online correspondence (bit0 = Node 0, bit1 = Node 1,bit7 = Node 7)	RO
D1118		
D1119		
D1120	Internal node 0 control command	RW
D1121	Internal node 0 mode	RW
D1122	Internal node 0 reference command L	RW
D1123	Internal node 0 reference command H	RW
D1124		
D1125		
D1126	Internal node 0 status	RO
D1127	Internal node 0 reference status L	RO
D1128	Internal node 0 reference status H	RO
D1129		
D1130	Internal node 1 control command	RW
D1131	Internal node 1 mode	RW
D1132	Internal node 1 reference command L	RW
D1133	Internal node 1 reference command H	RW
D1134		
D1135		
	Internal node 1 status	RO
D1137	Internal node 1 reference status L	RO
D1138	Internal node 1 reference status H	RO
D1139		
D1140	Internal node 2 control command	RW
D1141	Internal node 2 mode	RW
D1142	Internal node 2 reference command L	RW RW
D1143 D1144	Internal node 2 reference command H	L M M
D1145	 Internel node 2 statue	
D1146	Internal node 2 status	RO
D1147 D1148	Internal node 2 reference status L Internal node 2 reference status H	RO RO
D1148		nU
D1149 D1150	Internal node 3 control command	 RW
D1150 D1151	Internal node 3 control command Internal node 3 mode	RW
D1151	Internal node 3 reference command L	RW
D1152	Internal node 3 reference command H	RW
D1154		
D1155	 	
D1155	Internal node 3 status	RO
D1150	Internal node 3 reference status L	RO
D1158	Internal node 3 reference status E	RO
D1159		
D1160	Internal node 4 control command	RW
	Internatione i control commune	

Special D	Description of Function	R/W *
D1161	Internal node 4 mode	RW
D1162	Internal node 4 reference command L	RW
D1163	Internal node 4 reference command H	RW
D1164		
D1165		
D1166	Internal node 4 status	RO
D1167	Internal node 4 reference status L	RO
D1168	Internal node 4 reference status H	RO
D1169		
D1170	Internal node 5 control command	RW
D1171	Internal node 5 mode	RW
D1172	Internal node 5 reference command L	RW
D1173	Internal node 5 reference command H	RW
D1174		RW
D1175		
D1176	Internal node 5 status	
D1177	Internal node 5 reference status L	RO
D1178	Internal node 5 reference status H	RO
D1179		
D1180	Internal node 6 control command	RW
D1181	Internal node 6 mode	RW
D1182	Internal node 6 reference command L	RW
D1183	Internal node 6 reference command H	RW
D1184		
D1185		
D1186	Internal node 6 status	RO
D1187	Internal node 6 reference status L	RO
D1188	Internal node 6 reference status H	RO
D1189		
D1190	Internal node 7 control command	RW
D1191	Internal node 7 mode	RW
	Internal node 7 reference command L	RW
D1193	Internal node 7 reference command H	RW
D1194		
D1195		
D1196	Internal node 7 status	RO
D1197	Internal node 7 reference status L	RO
D1198	Internal node 7 reference status H	RO
D1199		

## The following is CANopen Master's special D (can be written in only

## with PLC in Stop state)

#### n = 0 ~ 7

Special D	Description of Function	PDO Map	Power off Memory	Default:	R/W
D1070	Channel opened by CANopen initialization (bit0=Machine code0)	NO	NO	0	R
1 171071	Error channel occurring in CANopen initialization process (bit0=Machine code0)	NO	NO	0	R
D1072	Reserved	-	-		-
D1073	CANopen break channel (bit0=Machine code0)	NO	NO		R

Special D	Description of Function	PDO Map	Power off Memory	Default:	R/W
D1074	Error code of master error 0: No error 1: Slave station setting error 2: Synchronizing cycle setting error (too small)	NO	NO	0	R
D1075	Reserved	-	-		-
D1076	SDO error message (main index value)	NO	NO		R
D1077	SDO error message (secondary index value)	NO	NO		R
D1078	SDO error message (error code)	NO	NO		R
D1079	SDO error message (error code)	NO	NO		R
D1080	Reserved	-	-		-
D1081					-
~	Reserved	-	-		
D1086					
D1087					
~	Reserved	-	-		-
D1089					
D1090	Synchronizing cycle setting	NO	YES	4	RW
D1091	Sets slave station On or Off (bit 0-bit 7 correspond to slave stations number 0-7)	NO	YES	FFFFH	RW
D1092	Delay before start of initialization	NO	YES	0	RW
D1093	Break time detection	NO	YES	1000ms	RW
D1094	Break number detection	NO	YES	3	RW
D1095 ~ D1096	Reserved	-	-		-
D1097	Corresponding real-time transmission type (PDO) Setting range: 1~240	NO	YES	1	RW
D1098	Corresponding real-time receiving type (PDO) Setting range: 1~240	NO	YES	1	RW
D1099	Initialization completion delay time Setting range: 1 to 60000 sec	NO	YES	15 sec.	RW
D2000+100*n	Station number n of slave station Setting range: 0~127 0: No CANopen function	NO	YES	0	RW

The C2000 supports 8 slave stations under the CANopen protocol; each slave station

occupies 100 spec	al D locations;	stations are n	numbered 1-8, total of 8 stations.
Explanation of	Slave station no.	D2000	Node ID
slave station	1	D2001	Slave station no. 1 torque restrictions
number and		~	~
		D2099	Address 4(H) corresponding to receiving channel 4
	Slave station no.	D2100	Node ID
	2	D2101 ~	Slave station no. 2 torque restrictions
		D2199	Address 4(H) corresponding to receiving channel 4
	Slave station no.	D2200	Node ID
	3	D2201	Slave station no. 3 torque restrictions
		~	~
		D2299	Address 4(H) corresponding to receiving
			channel 4
		Û	
	Slave station no.	D2700	Node ID
	8	D2701	Slave station no. 8 torque restrictions
		~	~
		D2799	Address 4(H) corresponding to receiving channel 4
			-

#### 1. The range of n is 0-7

# 2. ●Indicates PDOTX, ▲Indicates PDORX; unmarked special D can be refreshed using the CANFLS command

Special D Description of Function		Default:	R/W
	Station number n of slave station Setting range: 0~127 0: No CANopen function	0	RW
D2002+100*n	Manufacturer code of slave station number n (L)	0	R
D2003+100*n	Manufacturer code of slave station number n (H)	0	R
D2004+100*n	Manufacturer's product code of slave station number n (L)	0	R
D2005+100*n	Manufacturer's product code of slave station number n (H)	0	R

#### **Basic definitions**

Special D	Description of Function	Default:	CAN Index	PD 1	2	Def 3	ault: 4	R/W
D2006+100*n	Communications break handling method of slave station number n	0	6007H-0010H					RW
D2007+100*n	Error code of slave station number n error	0	603FH-0010H					R
D2008+100*n	Control word of slave station number n	0	6040H-0010H	•		•	٠	RW
D2009+100*n	Status word of slave station number n	0	6041H-0010H					R
D2010+100*n	Control mode of slave station number n	2	6060H-0008H					RW
D2011+100*n	Actual mode of slave station number n	2	6061H-0008H					R

#### Velocity Control

#### Slave station number n=0-7

Special D	Description of Function	Default:	CAN	PE	00	R/W		
Special D	Description of Function Default.		Index	1	2	3	4	
D2001+100*n	Torque restriction on slave station number n	0	6072H-0010H					RW
D2012+100*n	Target speed of slave station number n	0	6042H-0010H	•				RW
D2013+100*n	Actual speed of slave station number n	0	6043H-0010H					R
D2014+100*n	Error speed of slave station number n	0	6044H-0010H					R
D2015+100*n	Acceleration time of slave station number n	1000	604FH-0020H					R
D2016+100*n	Deceleration time of slave station number n	1000	6050H-0020H					RW

#### Torque control

Slave station number n=0-7

Special D	Description of Function	Default:	CAN		PDO Default:			R/W
Special D		Delault.	Index	1	2	3	4	
D2017+100*n	Target torque of slave station number n	0	6071H-0010H					RW
D2018+100*n	Actual torque of slave station number n	0	6077H-0010H					R
D2019+100*n	Actual current of slave station number n	0	6078H-0010H					R

#### Position control

Slave station number n=0-7

Special D	Description of Function	Default:	CAN	PDO Default:		R/W			
Special D	Description of Function	Delault.	Index	1	2	3	4		
D2020+100*n	Target of slave station number n (L)	0	607AH-0020H					RW	
D2021+100*n	Target of slave station number n (H)	0	007AH-0020H					RW	
D2022+100*n	Actual position of slave station number n (L)	0	6064H-0020H					R	
D2023+100*n	Actual position of slave station number n (H)	0	000411-002011						R
D2024+100*n	Speed chart of slave station number n (L)	10000	6081H-0020H					RW	
D2025+100*n	Speed chart of slave station number n (H)	0	000111-002011					RW	

#### 20XXH correspondences: MI MO AI AO

#### Slave station number n=0-7

Special D	Description of Function	Default:	CAN	P	00	Def	ault:	R/W
Special D	Description of Function	Delault.	Index	1	2	3	4	
D2026+100*n	MI status of slave station number n	0	2026H-0110H					RW
D2027+100*n	MO setting of slave station number n	0	2026H-4110H		•			RW
D2028+100*n	Al1 status of slave station number n	0	2026H-6110H					RW
D2029+100*n	AI2 status of slave station number n	0	2026H-6210H					RW
D2030+100*n	AI3 status of slave station number n	0	2026H-6310H					RW
D2031+100*n	AO1 status of slave station number n	0	2026H-A110H		•			RW
D2032+100*n	AO2 status of slave station number n	0	2026H-A210H		•			RW
D2033+100*n	AO3 status of slave station number n	0	2026H-A310H		•			RW

PDO reflection length setting:

Special D	Description of Function	Default:	R/W
D2034+100*n	Real-time transmission setting of slave station number n	000AH	RW
D2067+100*n	Real-time reception setting of slave station number n	0000H	RW

## 16-5-4 PLC Communication address

Device	Range	Туре	Address (Hex)
Х	00~37 (Octal)	bit	0400~041F
Y	00~37 (Octal)	bit	0500~051F
Т	00~159	bit/word	0600~069F
M	000~799	bit	0800~0B1F
M	1000~1079	bit	0BE8~0C37
С	0~79	bit/word	0E00~0E47
D	00~399	word	1000~118F
D	1000~1099	word	13E8~144B
D	2000~2799	word	17D0~1AEF

#### Command code that can be used

Function Code	Description of Function	Function target
01	Coil status read	Y,M,T,C
02	Input status read	X,Y,M,T,C
03	Read single unit of data	T,C,D
05	Compulsory single coil status change	Y,M,T,C
06	Write single unit of data	T,C,D
0F	Compulsory multiple coil status change	Y,M,T,C
10	Write multiple units of data	T,C,D

#### 

When PLC functions have been activated, the C2000 can match PLC and driver parameters; this method employs different addresses, drivers (default station number is 1, PLC sets station number as 2)

# 16-6 Introduction to the Command Window

## 16-6-1 Overview of basic commands

#### Ordinary commands

Command	Function	OPERAND	Execution
code			speed (us)
LD	Load contact a	$X \cdot Y \cdot M \cdot T \cdot C$	0.8
LDI	Load contact b	Χ、Υ、Μ、Τ、Ο	0.8
AND	Connect contact a in series	Χ、Υ、Μ、Τ、Ο	0.8
ANI	Connect contact b in series	Χ、Υ、Μ、Τ、Ο	0.8
OR	Connect contact a in parallel	Χ、Υ、Μ、Τ、Ο	0.8
ORI	Connect contact b in parallel	$X \mathrel{\scriptstyle{\vee}} Y \mathrel{\scriptstyle{\vee}} M \mathrel{\scriptstyle{\vee}} T \mathrel{\scriptstyle{\vee}} C$	0.8
ANB	Series circuit block	N/A	0.3
ORB	Parallel circuit block	N/A	0.3
MPS	Save to stack	N/A	0.3
MRD	Stack read (pointer does not change)	N/A	0.3
MPP	Read stack	N/A	0.3

#### Output command

Command	Function	OPERAND	Execution
code			speed (us)
OUT	Drive coil	Y、M	1
SET	Action continues (ON)	Y v M	1
RST	Clear contact or register	Y、M、T、C、D	1.2

#### Timer, counter

Command code	Function	OPERAND	Execution speed (us)
TMR	16-bit timer	T-K or T-D commands	1.1
CNT	16-bit counter	C-K or C-D (16-bit)	0.5

#### Main control command

Command code	Function	OPERAND	Execution speed (us)
MC	Common series contact connection	N0~N7	0.4
MCR	Common series contact release	N0~N7	0.4

#### Contact rising edge/falling edge detection command

			<b>—</b>
Command	Function	OPERAND	Execution
code			speed (us)
LDP	Start of forward edge detection action	$X \mathrel{\scriptstyle{\vee}} Y \mathrel{\scriptstyle{\vee}} M \mathrel{\scriptstyle{\vee}} T \mathrel{\scriptstyle{\vee}} C$	1.1
LDF	Start of reverse edge detection action	Χ、Υ、Μ、Τ、Ο	1.1
ANDP	Forward edge detection series connection	$X \cdot Y \cdot M \cdot T \cdot C$	1.1
ANDF	Reverse edge detection series connection	$X \mathrel{\scriptstyle{\vee}} Y \mathrel{\scriptstyle{\vee}} M \mathrel{\scriptstyle{\vee}} T \mathrel{\scriptstyle{\vee}} C$	1.1
ORP	Forward edge detection parallel connection	Χ、Υ、Μ、Τ、Ο	1.1
ORF	Reverse edge detection parallel connection	Χ、Υ、Μ、Τ、Ο	1.1

## Upper/lower differential output commands

Command code	Function	OPERAND	Execution speed (us)
PLS	Upper differential output	Y ∘ M	1.2
PLF	Lower differential output	Y ∘ M	1.2

#### Stop command

Command	Function	OPERAND	Execution
code			speed (us)
END	Program conclusion	N/A	0.2

#### Other commands

Command	Function	OPERAND	Execution
code			speed (us)
NOP	No action	N/A	0.2
INV	Inverse of operation results	N/A	0.2
Р	Index	Р	0.3

## 16-6-2 Detailed explanation of basic commands

Command	Function						
LD	Load contact a	a					
Ora a waxa d	X0~X17	Y0~Y17	M0~M799	T0~159	(	C0~C79	D0~D399
Operand	✓	$\checkmark$	✓	$\checkmark$		$\checkmark$	_
Explanation	at a contact ci contact status Ladder diagram	rcuit block; its in the cumulat m:			conte	nt and save	
		.1	Y1	LD	X0	Load Cor	ntact a of X0
				AND	X1	Create connectic of X1	series on to contact a
				OUT	Y1	Drive Y1	coil

Command	Function						
LDI	Load contact b	)					
Operand	X0~X17	Y0~Y17	M0~M799	T0~15	9	C0~C79	D0~D399
Operand	✓	$\checkmark$	✓	$\checkmark$		$\checkmark$	—
Explanation       The LDI command is used for contact b starting at the left busbar or contact b starting at a contact circuit block; its function is to save current content and save the acquired contact status in the cumulative register.         Example       Ladder diagram:       Command code:       Description:							
	X0 X	1	Y1 )	LDI	<b>X0</b>	Load Cor	ntact b of X0
				AND	X1	Create connectic of X1	series on to contact a
				OUT	Y1	Drive Y1	coil

Command			Fun	ction			
AND	Connect conta						
Operand	X0~X17	Y0~Y17	M0~M799	T0~159		C0~C79	D0~D399
Operand	✓	$\checkmark$	$\checkmark$	✓		$\checkmark$	—
Explanation The AND command is used to create a series connection to contact a; first reads current status of the designated series contact and logical operation results before contact in order to perform "AND" operation; saves results in cumulative register.							
Example	Ladder diagrau			Command LDI	d code X1		scription: ntact b of X1
		(	Y1)	AND	X0	Create connectic of X0	series on to contact a
				OUT	Y1	Drive Y1	coil
Command	Function						
ANI	Connect conta	ct b in series					
Onerend	X0~X17	Y0~Y17	M0~M799	T0~159		C0~C79	D0~D399
Operand	✓	$\checkmark$	$\checkmark$	✓		$\checkmark$	—
Explanation	first read curre before contac register. Ladder diagrad	t in order to m:			n; sav	ves results	
		0	Ŷ1	LD	X1	Load Cor	tact a of X1
				ΑΝΙ	X0	Create connectio of X0	series on to contact b
				OUT	Y1	Drive Y1	coil
Command			Fun	ction			
OR	Connect conta	ct a in parallel					
		Y0~Y17	M0~M799	T0~159		C0~C79	D0~D399
Operand	✓	~	$\checkmark$	✓		$\checkmark$	
Explanation	The OR comm to first read c results before register.	urrent status	of the design	ated series	cont	act and log	ical operation
Example	Ladder diagram	m:		Command	d code	: Des	scription:
		(	Y1)	LD	X0	Load Cor	tact a of X0

<u> </u>	results before contact in eregister.	order to perform "	OR" opera	tion; sa	ves results	in cumulative
Example	Ladder diagram:		Comman	d code:	Desc	cription:
	X0	- <u>Y1</u>	LD	X0	Load Cont	tact a of X0
	X1		OR	X1	Create connection of X1	series n to contact a
			OUT	Y1	Drive Y1 c	oil
Command ORI	Connect contact b in para	-	ction			
Operand	X0~X17 Y0~Y17 ✓ ✓		T0~159 ✓	) (	C0~C79 ✓	D0~D399 
Explanation	The ORI command is use is to first read current st results before contact in o register.	atus of the desig	nated serie	es conta	act and logi	ical operation
Example	Ladder diagram:		Comman	d code:	Dese	cription:
			LD	X0	Load Cont	tact a of X0

X0 Y1 X1	ORI	X1	Create serie connection to contact of X1	
	OUT	Y1	Drive Y1 coil	

Command				Func	tion		
ANB	Series circuit blo	ock					
Operand				N//	A		
Explanation	ANB performs current cumulat			on the	e previous	sly save	ed logic results and the
Example	Ladder diagram	:			Command	d code:	Description:
Example	X0 ANB	X1	-(Y1)		LD	X0	Load Contact a of X0 Establish parallel
	X2	X3			ORI	X2	connection to contact b of X2
	Block A	Block B			LDI	X1	Load Contact b of X1 Establish parallel
					OR	Х3	connection to contact a of X3
					ANB		Series circuit block
					OUT	Y1	Drive Y1 coil

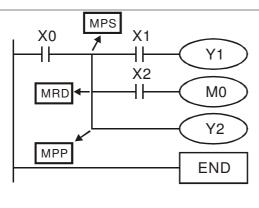
			Function		Function				
ORB	Parallel circuit blo	ck							
Operand			N/A						
Explanation	ORB performs an cumulative registe		the previously sav	ved logi	ic results and the current				
Example	Ladder diagram:		Command	code:	Description:				
Example	X0	X1 Block A	LD	X0	Load Contact a of X0				
	X2	Y1 X3 OBB	ANI	X1	Establish parallel connection to contact b of X1				
		Block B	LDI	X2	Load Contact b of X2 Establish parallel				
			AND	Х3	connection to contact a of X3				
			ORB		Parallel circuit block				
			OUT	Y1	Drive Y1 coil				

Command	Function
MPS	Save to stack
Operand	N/A

(Explanation) Save current content of cumulative register to the stack. (Add one to stack pointer)

Command	Function
MRD	Read stack (pointer does not change)
Operand	N/A
Explanation	Reads stack content and saves to cumulative register. (Stack pointer does not change)

Command	Function
MPP	Read stack
Operand	N/A
	Retrieves result of previously-save logical operation from the stack, and saves to cumulative register. (Subtract one from stack pointer)
	Ladder diagram: Command code: Description:



LD	X0	Load Contact a of X0
MPS		Save to stack
AND	X1	Create series connection to contact a of X1
OUT	Y1	Drive Y1 coil
MRD		Read stack (pointer does not change)
AND	X2	Create series connection to contact a of X2
OUT	MO	Drive M0 coil
MPP		Read stack
OUT END	Y2	Drive Y2 coil Program conclusion

Command			Func	tion			
OUT	Drive coil						
Onerend	X0~X17	Y0~Y17	M0~M799	T0~159		C0~C79	D0~D399
Operand	—	$\checkmark$	✓	_		_	—
Explanation	Outputs result o Coil contact acti		ration before OUT of	command to	the des	ignated eler	nent.
	Out command						
	Result:	Coil	Access	Point:			
			Contact a (NO)	Contact b (NC)			
	FALSE	Off	Not conducting	Conduct	ting		
	TRUE	On	Conducting	Not condu	ot conducting		
Example	Ladder diagra			Command	code:	Des	cription:
		1	-(Y1)	LD	X0	Load Con Establish	tact b of X0 parallel
		I		AND	X1		n to contact a
				OUT	Y1	Drive Y1 of	coil
				OUT	Y1	Drive Y1 of	coil

Command	Function						
SET	Action continu	es (ON)					
Onerend	X0~X17	Y0~Y17	M0~M799	T0~159	(	C0~C79	D0~D399
Operand	_	$\checkmark$	✓	_		—	_
When the SET command is driven, the designated element will be set as On, and will be maintained in an On state, regardless of whether the SET command is still driven. The RST command can be used to set the element as Off.							
<b>Evample</b>	Ladder diagra	m:		Command	d code:	Des	scription:
Example		SET	Y1	LD	X0	Establish	
				AN	Y0	connection of Y0	on to contact b
				SET	Y1	Action co	ntinues (ON)

Command	Function					
RST	Clear con	tact or register				
Operand	X0~X1	7 Y0~Y17	M0~M799	T0~159	C0~C79	D0~D399
Operand	_	✓	✓	✓	✓	✓
	When the follows:	Vhen the RST command is driven, the action of the designated element will b blows:				
	Element	Element Mode				
	Υ, Μ	Y, M Both coil and contact will be set as Off.				
	T, C	T, C The current timing or count value will be set as 0, and both the coil and contact ill be set as Off.				
	D	The content value	will be set as (	).		

If the RST command has not been executed, the status of the designated element will remain unchanged.

Ladder diagra	am:		
	RST	Y5	

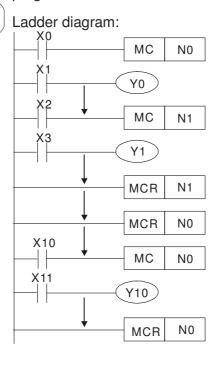
Commar	nd code:	De	scription:	
LD	X0	Load Co	ntact a of X	0
RST	¥5	Clear register	contact	or

Command			Fun	ction				
TMR	16-bit timer							
Operand	T-K	T0~T159,K0~K	32,767					
Operand	T-D	T0~T159 , D0~D	399					
Explanation						oil will be electrified, and		
		s the designated s				follows when the timing		
		ally Open) contact	Closed		10 > = 001 V			
		ally Close) contact	Open					
			en execute	ed, the st	atus of the	designated element will		
	remain uncha Ladder diagra	•		Comma	and code:	Description:		
Example		[ [		LD	X0	Load Contact a of X0		
		TMR T5 K1	000	TMR	T5 K1000	T5 timer Set value as K1000		
Command			Fund	ction				
CNT	16-bit counter							
	C-K	C0~C79,K0~K	32,767					
Operand	C-D	C0~C79 , D0~D	399					
	When the CN	T command is exe	cuted from	Off→Or	n, this indic	ates that the designated		
Explanation	counter coil g	joes from no powe	$er \rightarrow electr$	ified, an	d 1 will be	added to the counter's		
	count value; when the count reaches the designated value (count value = set value),							
		ill have the followir		5		,,,		
		ally Open) contact	Closed	ł				
		Illy Close) contact	Open					
		• •	· ·	e contac	t and cour	nt value will both remain		
	unchanged ev	ven if there is cont	inued coun	t pulse ir	nput. Pleas	e use the RST		
	C	ou wish to restart o		•				
	Ladder diagra				and code:	Description:		
Example				LD	X0	Load Contact a of X0		
		CNT C2 K1	00	CNT	C2 K100	C2counter		
				ONT	02 1(100	Set value as K100		
Command			Fun	ction				
MC/MCR	Connect/relea	ase a common ser	ies contact					
Operand	N0~N7							
Explanation	MCR will be		ly. When t			ands between MC and is Off, any commands		
		on of commands			Descripti	on		
	Ordi	nary timer	The timing value will revert to 0, the coil will lose					
	С	ounter	· ·	ill lose p	ower, and	the count value and		
	Coil driven b	y OUT command	None rece					

	Elements driven by SET, RST commands	Will remain in their current state
--	--------------------------------------	------------------------------------

Applications commands None are actuated MCR is the main control stop command, and is placed at the end of the main control program. There may not be any contact commands before the MCR command. The MC-MCR main control program commands support a nested program structure with a maximum only 8 levels; use in the order N0-N7, please refer to the following program:

#### Example



	mand de:	Description:				
LD	X0	Load Contact a of X0				
МС	N0	Connection of N0 common series contact				
LD OUT :	X1 Y0	Load Contact a of X1 Drive Y0 coil				
LD	X2	Load Contact a of X2				
МС	N1	Connection of N1 common series contact				
LD OUT :	X3 Y1	Load Contact a of X3 Drive Y1 coil				
MCR	N1	Release N1 common series contact				
:						
MCR	NO	Release N0 common series contact				
: LD	X10	Load Contact a of X10				
MC	N0	Connection of N0 common series contact				
LD	X11	Load Contact a of X11				
OUT :	Y10	Drive Y10 coil				
MCR	N0	Release N0 common series contact				

Command	Function							
LDP	Start of forwar	rt of forward edge detection action						
Operand	X0~X17	Y0~Y17	M0~M799	T0~159	C0~C79	D0~D399		
Operand	✓	$\checkmark$	$\checkmark$	~	~	_		
Explanation The LDP command has the same usage as LD, but its action is different; its function is to save current content, while also saving the detected state of the rising edge of the								
Example	contact to the Ladder diagra		gister. Comn		Descriptio	on:		

Ladder diagram:	code	e:			
	LDP	X0	Start of X0 forwa action	rd edge detec	tion
	AND	X1	Create series contact a of X1	connection	to
	OUT	Y1	Drive Y1 coil		

Remark

Please refer to the function specifications table for each device in series for the scope of usage of each operand.

A rising edge contact will be TRUE after power is turned on if the rising edge contact is On before power is turned on to the PLC.

Command		Function				
LDF	Start of revers	tart of reverse edge detection action				
Operand	X0~X17	Y0~Y17	M0~M799	T0~159	C0~C79	D0~D399
Operand	✓	$\checkmark$	✓	$\checkmark$	$\checkmark$	_

The LDF command has the same usage as LD, but its action is different; its function is to save current content while also saving the detected state of the falling edge of the Explanation contact to the cumulative register. ~ -1 \_ . ..

Example

Ladder diagram:	
X0 X1	- <u>Y1</u>

Command code:		Description:
LDF	X0	Start of X0 reverse edge detection action
AND	X1	Create series connection to contact a of X1
OUT	Y1	Drive Y1 coil

Command		Function				
ANDP	Forward edge	orward edge detection series connection				
Operand	X0~X17	Y0~Y17	M0~M799	T0~159	C0~C79	D0~D399
Operand	✓	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	_

(Explanation) The ANDP command used for a contact rising edge detection series connection.

Example	Ladder diagram:	
		-(Y1

XQ

Y1

Cor Ll	nmand D	code: X0	Description: Load Contact a of X0
AN	DP	X1	X1 Forward edge detection series connection
OL	JT	Y1	Drive Y1 coil

Command	Function					
ANDF	Reverse edge	Reverse edge detection series connection				
Operand	X0~X17	Y0~Y17	M0~M799	T0~159	C0~C79	D0~D399
Operand	✓	$\checkmark$	✓	$\checkmark$	~	_
Explanation The ANDF command is used for a contact falling edge detection series connection.						
Example	Ladder diagram	m:		Command co		scription:

Comma	nd code:	Description:
LD	X0	Load Contact a of X0
ANDF	X1	X1 Reverse edge detection series connection
OUT	Y1	Drive Y1 coil

Command		Function						
ORP	Forward edge	orward edge detection parallel connection						
Operand	X0~X17	Y0~Y17	M0~M799	T0~159	C0~C79	D0~D399		
Operand	✓	$\begin{tabular}{ c c c c c } \hline $$ $$ $$ $$ $$ $$ $$ $$ $$ $$ $$ $$ $$						
Explanation The ORP command is used for a contact rising edge detection parallel connection.								

Y1

Ladder diagram: X0 Example ┥╽ X1

Commai	nd code:	Description:
LD	X0	Load Contact a of X0
ORP	X1	X1 Forward edge detection parallel connection
OUT	Y1	Drive Y1 coil

Command				ction			
ORF		· · · · ·	allel connectior				1
Operand	X0~X17	Y0~Y17	M0~M799	T0~159		C0~C79	D0~D399
	✓	$\checkmark$	✓	✓		$\checkmark$	_
Explanation	The ORF com	mand is used	for contact fall	ing edge de	etectio	n parallel co	onnection.
	Ladder diagra	m:		Comman	d code	: Des	scription:
Example	X0	(	Y1	LD	X0	Load Co	ntact a of X0
						X1 Reve	rse edge
				ORF	X1	detection connection	parallel
				OUT	Y1	Drive Y1	coil
Command			Fun	ction			
PLS	Upper differen	· ·					
Operand	X0~X17	Y0~Y17	M0~M799	T0~159		C0~C79	D0~D399
Operand	_	$\checkmark$	$\checkmark$	_		—	_
Explanation		d will be exec	uted, and M0				triggered), the a pulse length
Example	Ladder diagra			Command	d code	: Des	scription:
		PLS M0		LD	X0	Load Co	ntact a of X0
	M0	SET Y0		PLS	MO	M0 Uppe output	r differential
	Time sequenc	e diagram:		LD	M0		ntact a of M0
	X0			SET	Y0	Y0 Actior (ON)	n continues
	M0Time	for one scan cy	/cle			()	
	Y0						
Command			Fun	ction			
PLF	Lower differen	tial output					
Operand	X0~X17	Y0~Y17	M0~M799	T0~159		C0~C79	D0~D399
Operand	_	$\checkmark$	$\checkmark$	_		—	_
Explanation		d will be exe	nmand. When 2 cuted, and Mo period.				
	Ladder diagra	01		Comman	d code	e: De:	scription:
Example		PLF M0		LD	X0		ntact a of X0
	M0	SET Y0		PLF	MO	M0 Lowe	er differential
	Time sequenc	e diagram:		LD	M0	Load Co	ntact a of M0
	X0	3		SET	Y0		n continues
	M0Time	for one scan cy	cle			(ON)	
	Y0						

Command	Function
END	Program conclusion
Operand	N/A
	An END command must be added to the end of a ladder diagram program or

Explanation An END command must be added to the end of a ladder diagram program or command program. The PLC will scan from address 0 to the END command, and will return to address 0 and begins scanning again after execution.

Command	Function						
NOP	No action						
Operand	N/A						
Explanation The command NOP does not perform any operation in the program. Because execution of this command will retain the original logical operation results, it can be used in the following situation: the NOP command can be used instead of a command that is deleted without changing the program length.							
Example	Ladder diagram:	Command code:		Description:			
	NOP command will be simplified and not displayed when the ladder diagram is	LD	X0	Load Contact b of X0			
	displayed.	NOP		No action			
		OUT	Y1	Drive Y1 coil			

Command	Function						
INV	Inverse of operation results						
Operand	N/A						
Explanation	tion Saves the result of the logic inversion operation prior to the INV command in the cumulative register.						
Example	Ladder diagram:		Comma	and code:	Description:		
	×0	— Y1	LD	X0	Load Contact a of X0		
			INV		Inverse of operation results		
			OUT	Y1	Drive Y1 coil		

Command	Function
P	Index
Operand	P0~P255
Explanation	Pointer P is used to subprogram call command API 01 CALL. Use does not require starting from zero, but the number cannot be used repeatedly, otherwise an unpredictable error will occur.

Ladder diagram:			Comman	d code:	Description:
Example X0 X0 P10	- CALL	P10	LD CALL :	X0 P10	Load Contact a of X0 Call command CALL to P10
I			P10		Pointer P10
			LD	X1	Load Contact a of X1
			OUT	Y1	Drive Y1 coil

# 16-6-3 Overview of application commands

Classification	API	Command code		P	Function	STE	
Olassification		16 bit	32 bit	command		16bit	32bit
	01	CALL	-	✓	Call subprogram	3	-
Circuit control	2	SRET	-	-	Conclusion of subprogram	1	-
	06	FEND	-	-	Conclusion a main program	1	-
	10	CMP	DCMP	✓	Compares set output	7	13
Send	11	ZCP	DZCP	✓	Range comparison	9	17
comparison	12	MOV	DMOV	✓	Data movement	5	9
	15	BMOV		✓	Send all	7	
	20	ADD	DADD	✓	BIN addition	7	13
	21	SUB	DSUB	✓	BIN subtraction	7	13
Four logical	22	MUL	DMUL	✓	BIN multiplication	7	13
operations	23	DIV	DDIV	✓	BIN division	7	13
	24	INC	DINC	✓	BIN add one	3	5
	25	DEC	DDEC	✓	BIN subtract one	3	5
Rotational	30	ROR	DROR	✓	Right rotation	5	_
displacement	31	ROL	DROL	✓	Left rotation	5	_
Data Process	40	ZRST	_	✓	Clear range	5	_
-	10	2.1.01			BIN whole number $\rightarrow$ binary	0	
	49		DFLT	· ·	floating point number $\rightarrow$ binary		9
	49	_	DFLI		transformation	-	9
communication							
communication							
	150	MODRW	_		MODBUS read/write	7	_
	150				WODDOG read/ write		
				✓	Comparison of binary floating		
	110		DECMP		point numbers	-	13
-		_		✓	Comparison of binary floating		
	111		DEZCP		point number range	-	17
-	116	_	DRAD	✓	Angle $\rightarrow$ Diameter		9
	117		DDEG	· · · · · · · · · · · · · · · · · · ·	Diameter $\rightarrow$ angle		9
-				· ·	Binary floating point number		
	120	_	DEADD		addition	-	13
-				✓	Binary floating point number		
	121		DESUB		subtraction	-	13
-				✓	Binary floating point number		
	122		DEMUL	DEMUL	multiplication	-	13
<sup> </sup>				✓	Binary floating point number		
loa	123	_	DEDIV DEDIV			-	13
tin				✓	Binary floating point number		
4 D	124	_	DEXP		obtain exponent	-	9
ĕ		Pipary floating point number					
nt o	125	_	DLN	•	obtain logarithm	-	9
- pe				✓	Binary floating point number		
Floating point operation	127	_	DESQR		find square root	-	9
				✓	Binary floating point number $\rightarrow$		
⊐ 129		_	DINT	•	Binary loating point number $\rightarrow$ BIN whole number		9
-	123		DINT		transformation	_	9
				✓	Binary floating point number		
	130		DSIN	· ·	SIN operation	-	9
					Binary floating point number		
	131	_	DCOS	· ·	COS operation	-	9
					Binary floating point number		
	132		DTAN	· ·		-	9
-					TAN operation		
	133		DASIN	<b>`</b>	Binary floating point number	-	9
				✓	ASIN operation		
	134		DACOS	<b>v</b>	Binary floating point number	_	9
					ACOS operation		

Classification	API	Comma	ind code	Р	Function	STE	EPS
Classification	AFI	16 bit	32 bit	command		16bit	32bit
	135	-	DATAN	~	Binary floating point number ATAN operation	_	9
р П	136	_	DSINH	~	Binary floating point number SINH operation	_	9
Floating point operation	137	-	DCOSH	~	Binary floating point number COSH operation	_	9
D UC	138	_	DTANH	~	Binary floating point number TANH operation	_	9
	160	TCMP	-	✓	Compare calendar data	11	-
	161	TZCP	_	✓	Compare calendar data range	9	-
Calendar	162	TADD	-	<ul> <li>✓</li> </ul>	Calendar data addition	7	-
_	163	TSUB	-	<ul> <li>✓</li> </ul>	Calendar data subtraction	7	-
	166	TRD	-	✓	Calendar data read	3	-
	170	GRY	DGRY	✓	BIN→GRY code transformation	5	9
GRAY code	171	GBIN	DGBIN	<b>√</b>	GRY code →BIN transformation	5	9
_	215	LD&	DLD&	-	Contact form logical operation	5	9
Q	216	LD	DLDJ	-	Contact form logical operation LD#	5	9
ontac	217	LD^	DLD^	-	Contact form logical operation LD#	5	9
t form	218	AND&	DAND&	-	Contact form logical operation AND#	5	9
n logi	219	ANDI	DANDI	-	Contact form logical operation AND#	5	9
cal op	220	AND^	DAND^	-	Contact form logical operation AND#	5	9
Contact form logical operation	221	OR&	DOR&	-	Contact form logical operation OR#	5	9
n	222	OR	DOR	-	Contact form logical operation OR#	5	9
_	223	OR^	DOR^	-	Contact form logical operation OR#	5	9
	224	LD=	DLD=	-	Contact form compare LD*	5	9
	225	LD>	DLD>	-	Contact form compare LD*	5	9
	226	LD<	DLD<	-	Contact form compare LD*	5	9
	228	LD<>	DLD<>	-	Contact form compare LD*	5	9
or i	229	LD<=	DLD <=	-	Contact form compare LD*	5	9
Itac	230	LD>=	DLD>=	-	Contact form compare LD*	5	9
t f	232	AND	DAND	-	Contact form compare AND*	5	9
orm	233	AND>	DAND>	-	Contact form compare AND*	5	9
2	234	AND <	DAND<	-	Contact form compare AND*	5	9
) mp	234	AND<>	DAND<>		Contact form compare AND*	5	9
oar -	230	AND<>	DAND<	_	Contact form compare AND*	5	9
e c			$ DAND\rangle =$	-	Contact form compare AND*	5	9
ĝ -	238			-			
Contact form compare command	240	OR=	DOR=	-	Contact form compare OR*	5	9
but	241	OR>	DOR>	-	Contact form compare OR*	5	9
	242	OR<	DOR<	-	Contact form compare OR*	5	9
-	244		DOR<>	-	Contact form compare OR*	5	9
	245		DOR<=	-	Contact form compare OR*	5	9
	246	OR>=	DOR>=	-	Contact form compare OR*	5	9

Oleccification		Comma	ind code	Р	Function	STE	EPS
Classification	API	16 bit	32 bit	command	Function	16bit	32bit
po: F	275	-	FLD=	-	Floating point number contact form compare LD*	-	9
Floating point contact form	276	-	FLD>	-	Floating point number contact form compare LD*	-	9
ig	277	-	FLD <	-	Floating point number contact form compare LD*	-	9
	278	-	FLD<>	-	Floating point number contact form compare LD*	-	9
	279	-	FLD<=	-	Floating point number contact form compare LD*	-	9
	280	-	FLD>=	-	Floating point number contact form compare LD*	-	9
_	281	-	FAND	-	Floating point number contact form compare AND*	-	9
	282	-	FAND>	-	Floating point number contact form compare AND*	-	9
Q	283	-	FAND<	-	Floating point number contact form compare AND*	-	9
Compare command	284	-	FAND<>	-	Floating point number contact form compare AND*	-	9
re cor	285	-	FAND<=	-	Floating point number contact form compare AND*	-	9
nmar	286	-	FAND>=	-	Floating point number contact form compare AND*	-	9
d	287	-	FOR=	-	Floating point number contact form compare OR*	-	9
	288	-	FOR>	-	Floating point number contact form compare OR*	-	9
	289	-	FOR<	-	Floating point number contact form compare OR*	-	9
	290	-	FOR<>	-	Floating point number contact form compare OR*	-	9
	291	-	FOR<=	-	Floating point number contact form compare OR*	-	9
	292	-	FOR>=	-	Floating point number contact form compare OR*	-	9
	139	RPR	_	✓	Read servo parameter	5	_
	140	WPR	_	✓	Write servo parameter	5	_
	141	FPID	_	✓	Driver PID control mode	9	_
	142	FREQ	_	✓	Driver torque control mode	7	_
Y S	262	_	DPOS	✓	Set target	-	5
j pe	263	TORQ	-	✓	Set target torque	5	-
cial c	261	CANRX	-	✓ ✓	Read CANopen slave station data	9	-
Driver special command	264	CANTX	-	✓	Write CANopen slave station data	9	-
	265	CANFLS	-	✓ 	Refresh special D corresponding to CANopen	3	-
	320	ICOMR	DICOMR	✓	Internal communications read	9	17
	321	ICOMW	DICOMW	✓	Internal communications write	9	17

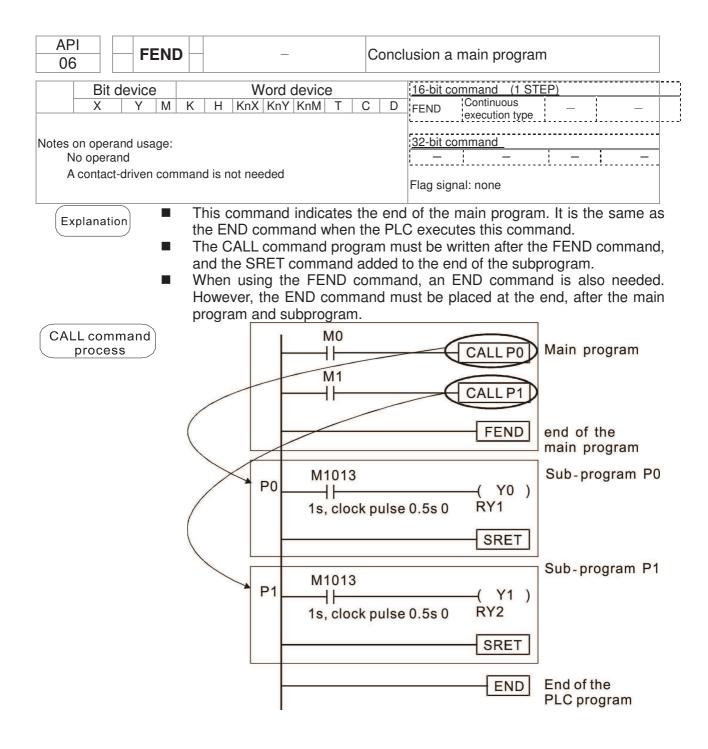
## 16-6-4 Detailed explanation of applications commands

API 01 CALL	P	Call subprogram
Bit device X Y M	Word device           K         H         KnX         KnY         KnM         T         0	16-bit command         (3 STEP)           C         D         CALL         Continuous         CALLP         Pulse           execution type         execution type         execution type
Notes on operand usag The S operand ca C2000 series devi		P63 Flag signal: none
Explanation	<b>S</b> : Call subprogram pointer Write the subprogram after t	
	The subprogram must end a	fter the SRET command.

Refer to the FEND command explanation and sample content for detailed command functions.

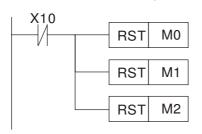
API 02 SRET	P – Conclu	usion of subprogram
Bit device       X     Y	Word device           K         H         KnX         KnY         KnM         T         C         D	16-bit command       (1 STEP)         FEND       Continuous         execution type
Notes on operand usage: No operand A contact-driven cor	mmand is not needed	<u>32-bit command</u> Flag signal: none
Explanation	A contact-driven command is command after CALL command	not needed. Automatically returns next

- command after CALL command
   Indicates end of subprogram. After end of subprogram, SRET returns to main
- program, and executes next command after the original call subprogram CALL command.
   Refer to the FEND command explanation and sample content for detailed
- Refer to the FEND command explanation and sample content for detailed command functions.



AF 1(		D	CMP	Ρ		(S1)	(S2		$\mathbf{D}$	Co	ompa	ares set output				
	Bit	t dev	ice			V	Vord	devic	e			16-bit command (7 STEP)				
	Х	Y	M	K	Н	KnX	1		Т	С	D	CMP Continuous CMPP Pulse				
S1				*	*	*	*	*	*	*	*	execution type execution type				
S2				*	*	*	*	*	*	*	*	32-bit command (13 STEP)				
D		*	*									DCMP Continuous DCMPP Pulse				
	es on operand usage: operand D occupies three consecutive points										Flag signal: none					
(E)	plan	ation			(S1): Compare value 1. $(S2)$ : Compare value 2. $(D)$ : Results of comparison.											
$\subseteq$				Con	Compares the size of the content of operand S1 and S2; the results of											
			•	comparison are expressed in D. Size comparison is performed algebraically. All data is compared in the form of numerical binary values. Because this is a 16-bit command, when b15 is 1, this indicates a negative number.												
E	Exam	nple		When the designated device is Y0, it automatically occupies Y0, Y1 and Y2. When X10=On, the CMP command executes, and Y0, Y1 or Y2 will be On. When X10=Off, the CMP command will not execute, and the state of Y0, Y1 and Y2 will remain in the state prior to X10=Off. If $\geq$ , $\leq$ , or $\neq$ results are needed, they can be obtained via series/parallel connections of Y0-Y2.												
			$\begin{array}{c c c c c c c c c c c c c c c c c c c $													
				Y1 If K10=D10, Y1 = On												

- To clear results of comparison, use the RST or ZRST command.



X10	ZRST	M0	M2
	I		

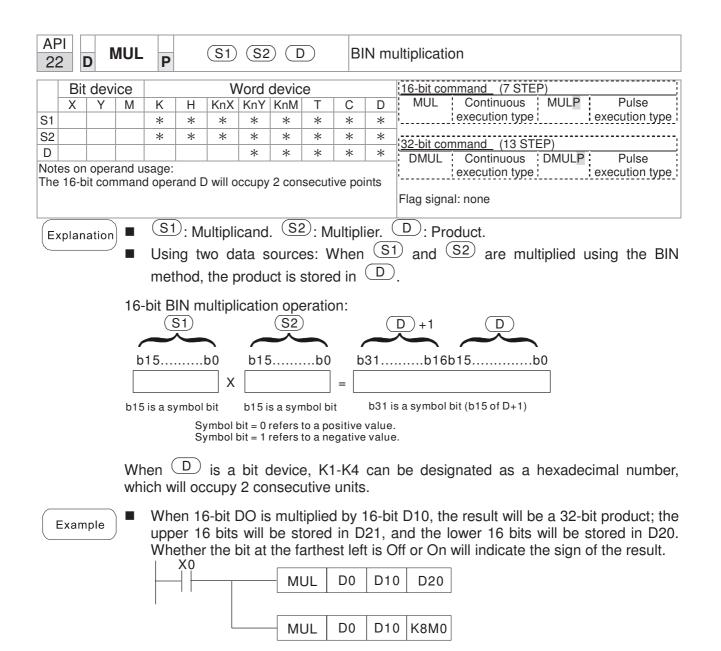
AF 11			ZCP	Ρ	(S	1) (5	32) (	S	D	) <b>F</b>	Ranę	ge	comparison		
	Bit	dev	ice			V	Vord	devic	e				16-bit command (9 STEP)		
S1	Х	Y	М	K *	H *	KnX *		KnM *	T *	C *	_	) *	ZCP Continuous ZCPP Pulse execution type execution type		
S2				*	*	*	*	*	*	*	_	*	32-bit command (17 STEP)		
S D		*	*	*	*	*	*	*	*	*	*	*	DZCP Continuous DZCPP Pulse		
Note		oper	and u										execution type execution type		
	cont opera		alue c	of oper	rand S	S1 is l	ess th	ian the	e conte	ent v	value	e of	Flag signal: none		
			Ο οςςι	ipies t	hree	conse	cutive	points	;						
Ex	plan	ation							-		<u> </u>		on. S2: Upper limit of range comparison. sults of comparison.		
				Whe	en th	ie co	mpai	rative	valu	ie (	S	) is	s compared with the lower limit $(S1)$ and		
												•	arison are expressed in $\bigcirc$ .		
										•			(S2), the command will use the lower limit		
			_	(S1)									upper and lower limit.		
				Size comparison is performed algebraically. All data is compared in the form on numerical binary values. Because this is a 16-bit command, when b15 is 1, this											
				indio	cates	s a ne	egativ	/e nu	mber						
E	Exam	<ul> <li>When the designated device is M0, it automatically occupies M0, M1 and M2.</li> <li>When X0=On, the ZCP command executes, and M0, M1 or M2 will be On. WI X0=Off, the ZCP command will not execute, and the state of M0, M1 or M2 remain in the state prior to X0=Off.</li> </ul>											ecutes, and M0, M1 or M2 will be On. When		
			•	lf ≥	, ≤,		≠ res of M0	sults				d,	they can be obtained via series/parallel		
							x₀ ⊣⊢		—	ZC	CP	k	<10 K100 C10 M0		
									MO						
									-11	_	If C1	10	< K10, M0 = On		
									M1		lf K1	10.	≤ C10 ≤ K100, M1 = On		
									M2				= = = = ;		
											If C1	10	> K100, M2 = On		
						resul	ts of	comp	oariso	on,			e RST or ZRST command.		
					×o ⊣∕I—	1	- F	ST	M0		X	0	ZRST M0 M2		
					VI				]		V	/			
							- F	ST	M1						
							- F	ST	M2						
				Ι					,						

AF 12		D N	IOV	V P S D I								ovement	
	Bit	dev	ice			V	Vord	devic	e			16-bit command (5 STEP)	
	X	Y	M	K	Н	KnX		KnM	T	С	D	MOV Continuous MOVP Pulse	
S				*	*	*	*	*	*	*	*	execution type execution type	
D							*	*	*	*	*	32-bit command (9 STEP)	
Not	es on	oper	and u	sage:						DMOV Continuous DMOVP Pulse execution type execution type Flag signal:			
E	Explanation S: Data source. D: Destination of data movement.												
		/		mov								e content of $\bigcirc$ content will be directly s not executed, the content of $\bigcirc$ will not	
	Exam	ple		sen Whe	t to d en X	lata r 1=Of	egiste f, the	er D1 cont	0.	f D1	0 wil	not change; if X0=On, the value K10 will be not change; if X1=On, the current value of <u>MOV K10 D0</u> MOV T0 D10	

API 15 BMO	Image: Market Signal     Image: Signal     Send all
Bit device	Word device 16-bit command (7 STEP)
X Y M	K H KnX KnY KnM T C D BMOV Continuous BMOVP Pulse
S	*     *     *     *     execution type     execution type
D n	*         *         *         *         *           *         *         *         *         *         *
Notes on operand u	Isage:
n operand scope n	= 1 to 512 Flag signal: none
	S: Initiate source device. D: Initiate destination device. C: Send block
Explanation	length.
	The content of n registers starting from the initial number of the device designated
	by S will be sent to the n registers starting from the initial number of the
	device designated by (n); if the number of points referred to by n exceeds the
	range used by that device, only points within the valid range will be sent.
	When X10=On, the content of registers D0-D3 will be sent to the four registers
Example 1	D20 to D23.
	$X10 \qquad \qquad$
	$D1 \rightarrow D21$ ( $p=4$
	$D2 \longrightarrow D22$
	$D3 \longrightarrow D23$ J If the designated bit devices KnX, KnY, and KnM are sent, $\bigcirc$ and $\bigcirc$ must
Example 2	If the designated bit devices KnX, KnY, and KnM are sent, (S) and (D) must have the same number of nibbles, which implies that n must be identical.
	M1000
	$ \begin{array}{c c c c c c c c c c c c c c c c c c c $
	$\begin{array}{c c} M1 \longrightarrow Y1 \\ M2 \longrightarrow Y2 \end{array}$
	$M3 \longrightarrow Y3$
	M4 → Y4
	M5 X5
	$M6 \rightarrow Y6$ $n=3$
	M7
	M8
	$\frac{M9}{M10} \rightarrow \frac{Y11}{Y10}$
	$\begin{array}{c} M10 \longrightarrow Y12 \\ M11 \longrightarrow Y13 \end{array}$
Example 3	In order to prevent overlap between the transmission addresses of two operands,
	which would cause confusion, make sure that the addresses designated by the two operands have different sizes, as shown below:
	When $(S) > (D)$ , send in the order $(1 \rightarrow 2) \rightarrow (3)$ .
	$\chi$ X10
	BMOV D20 D19 K3 D20  19 BMOV D20 D19 K3 D20 (1) D19
	$\begin{array}{c c c c c c c c c c c c c c c c c c c $
	When $(\underline{S}) < (\underline{D})$ , send in the order $(\underline{3} \rightarrow \underline{2}) \rightarrow (\underline{1})$ .
	$  - BMOV D10 D11 K3 D10 \xrightarrow{(3)} D11$
	$D11 \longrightarrow D12$
	$D12 \longrightarrow D13$

API 20		DD	Ρ		<u>(S1</u> )	(S2		$\mathbf{\Sigma}$	BI	N ad	dition
D:+	devi				14	lord	dovia				16 bit command (7 STED)
	dev		17		1		devic		<u> </u>	<b>D</b>	16-bit command (7 STEP) ADD Continuous ADDP Pulse
X	Y	М	K	H	KnX				C	D	execution type execution type
S1			*	*	*	*	*	*	*	*	
S2			*	*	*	*	*	*	*	*	32-bit command (13 STEP)
D Notes on	oper	and u	sage:	none		*	*	*	*	*	DADD Continuous DADDP Pulse execution type execution type
											Flag signal: M1020 Zero flag M1021 Borrow flag M1022 Carry flag Please refer to the following supplementary explanation
Explan	ation		(S1	): AI	iaena	$\frac{1}{3}$	2). A	dden	nd. 🤇	D).	Sum.
Explan			Usir met The	ng tv hod v high	vo da will b nest b	ata s e sto pit of	ourco red in any o	es: T n D data i	"he r ⊡. s syn	esult nboli	of adding S1 and S2 using the BIN zed as bit 0 indicating (positive) 1 indicating
		_	3+(·	9)=-(	6)		Ū.				gebraic addition operations. (for instance:
			Flag	g cha	inges	con	necte	ed wit	n the	add	ition.
			2. 3.	Whe Dn.	en cal	culat	ion r	esults	s are	less	e zero flag M1020 will be On. than –32,768, the borrow flag M1021 will be ter than 32,767, the carry flag M1022 will be
Exam	ple		16-l	oit Bl							e result of the content of addend D0 plus the
		J	con	tent o X0 	of aug	gend	[	will e	D0	n the	e content of D20.
Rem	ark	)						lag a			d negative/positive numbers: Zero flag
			-2, ▼	-1,0	-3	2,768	3 ◀		1,		32,767 0 1 2
				Borro	ow fla	ıg	of th	high ne dat (nega	ta	C	The highest bit of the data Carry flag = 0 (positive)
				¢	Zero -2,14	-	648	•	Ze	oro fla	ag Zero flag $1 \rightarrow 2,147,483,647 \qquad 0 \qquad 1 \qquad 2$
			B	orrow	/ flag		of th	highe ne dat (nega	a		The highest bit Carry flag of the data = 0 (positive)

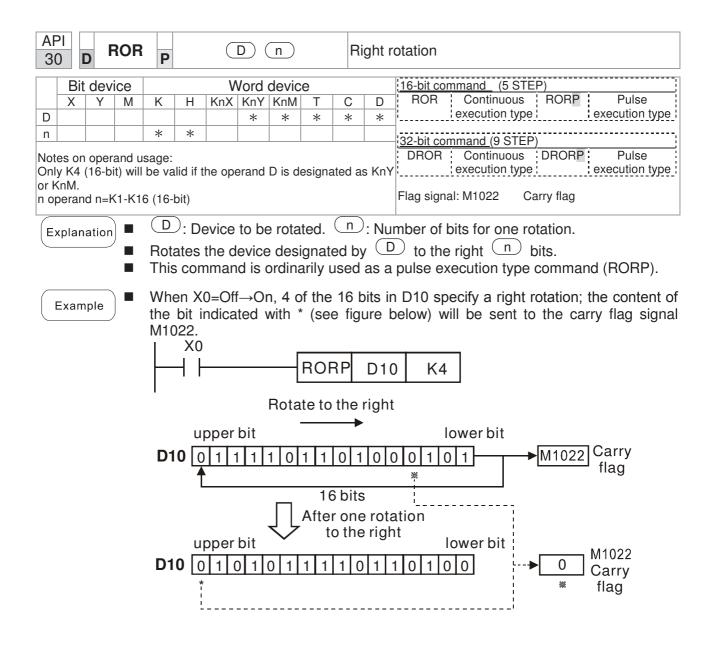
AF 2		5	SUB	B P S1 S2 D							N su	btraction		
	Bit	dev	ice			V	Vord	devic	e			16-bit command (7 STEP)		
	X	Y	M	Κ	Н	KnX	1		T	С	D	SUB Continuous SUBP Pulse		
S1				*	*	*	*	*	*	*	*	execution type execution type		
S2				*	*	*	*	*	*	*	*	32-bit command (13 STEP)		
D							*	*	*	*	*	Continuouo Duloo		
	kplan			usage: none       DSUB       Continuous       DSUBP       Puise         Image: none       DSUB       execution type       DSUBP       execution type         Flag signal: M1020       Zero flag       M1021       Borrow flag         M1022       Carry flag       Please refer to the following supplementary explanation         S1       Minuend.       S2       Subtrahend.       D       D       Difference.         Using two data sources: The result of subtraction of       S1       and       S2       using the BIN method is stored in       D.         The highest bit of any data is symbolized as bit 0 indicating (positive) 1 indicating (negative), enabling the use of algebraic subtraction operations.       The application operations.       Flag changes connected with subtraction.										
	Exam	ple		2. 3. 16-k	Whe Dn. Whe Dn. Dit Bl	en cal en cal N su	lculat Iculat btrac	ion re ion re tion:	esults esults Whei differe	are are n X0	less grea )=On	e zero flag M1020 will be On. than $-32,768$ , the borrow flag M1021 will be ter than 32,767, the carry flag M1022 will be , the content of D10 is subtracted from the ored in D20.		

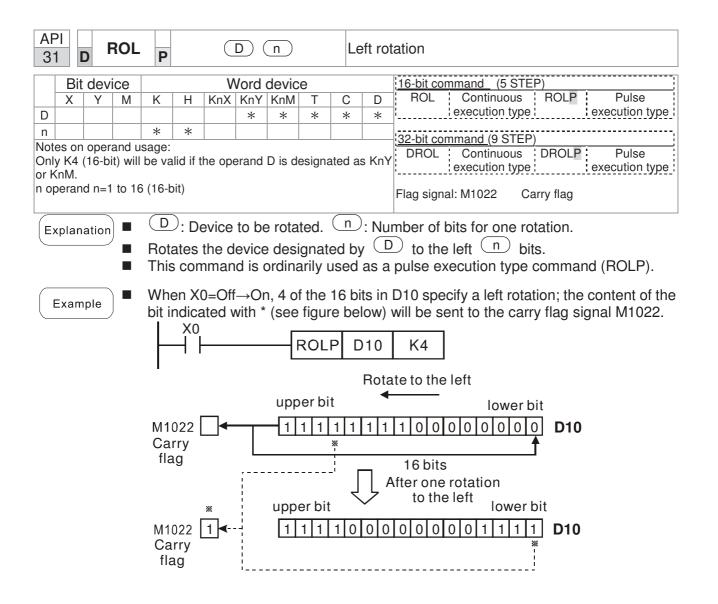


AF 23		)	DIV	Ρ		(S1)	<u>S1) (S2) (D</u>					vision
	Bit	dev	ice			V	Vord	devic	е			16-bit command (7 STEP)
	Х	Y	M	K	Н	KnX		KnM	Т	С	D	DIV Continuous DIVP Pulse execution type execution type
S1				*	*	*	*	*	*	*	*	execution type : : : execution type :
S2 D				*	<u>^</u>	*	*	*	*	*	*	32-bit command_ (13 STEP)
	Notes on operand usage:       image:       image:											
	<ul> <li>Using two data sources: The quotient and remainder will be stored in </li> <li>D when</li> <li>S1 and </li> <li>S2 are subjected to division using the BIN method. The sign bit for</li> <li>S1, </li> <li>S2 and </li> <li>D must be kept in mind when performing a 16-bit operation.</li> </ul>											
			16-	bit B	IN div	visior	1:					Quotient Remainder
				C	<b>S</b> 1				<b>S</b> <sub>2</sub>	)		$\bigcirc$ $\bigcirc$ $\bigcirc$ $+1$
			b1	5		b00	/[	o15		b	\ 00 ]=	b15b00 b15b00
E	<ul> <li>If D is a bit device, K1-K4 can be designated 16 bits, which will occupy 2 consecutive units and yield the quotient and remainder.</li> <li>When X0=On, the quotient resulting from division of dividend D0 by divisor D10 will be placed in D20, and the remainder will be placed in D21. Whether the highest bit is Off or On will indicate the sign of the result.</li> <li>X0</li> <li>DIV</li> <li>D0</li> <li>D10</li> <li>D20</li> </ul>											

AF 24		D	INC	Ρ			D	)		В	BIN ad	dd one				
	Bit device Word device											16-bit command (3 STEP)				
	Х	Y	М	K	Н	KnX	KnY	KnM	Т	С	D	INC Continuous INCP Pulse				
D							*	*	*	*	*	execution type : execution type :				
Not	es or	n oper	and u	sage:	none							<u>32-bit command</u> (5 STEP)				
												DINC Continuous DINCP Pulse execution type execution type				
												Flag signal: none				
F	olar	nation		D	): De	estina	tion o	device	Э.							
( -				lf a	comr	nand	is no	t the	pulse	exe	cutio	n type, when the command is executed, the				
				prog	gram	will a	dd 1	to the	e cont	ent	of de	vice $\bigcirc$ for each scanning cycle.				
				This	com	imano	d is o	rdina	rily us	ed a	as a l	oulse execution type command (INCP).				
			•									change the value to -32,768. During 32 bit ge the value to -2,147,483,648.				
	Exam	nple		When X0=Off $\rightarrow$ On, 1 is automatically added to the content of D0.												
			)	X0 INCP D0												

AF 25		)	DEC	Ρ			D	)		BIN subtract one						
	Bit	devi	ice			V	Vord	devic	е			16-bit command_ (3 STEP)				
	Х	Y	М	K	Н	KnX	KnY	KnM	Т	С	D	DEC Continuous DECP Pulse				
D				*	*	*	*	*				execution type execution type				
Note	es on	opera	and u	sage:	none							32-bit command (5 STEP)				
												DDEC Continuous DDECP Pulse execution type execution type				
										Flag signal: none						
Ex	plan	ation		D	): De	estina	ation	devic	e.							
$\subseteq$				lf a (	comr	nand	is no	ot the	puls	e exe	ecutio	ion type, when the command is executed, the				
				proc	Iram	will a	add 1	to th	e coi	ntent	of d	device $\bigcirc$ for each scanning cycle.				
					·							a pulse execution type command (DECP).				
	<ul> <li>During 16-bit operation, -32,768 -1 will change the value to 32,767. During 32 bit operation, -2,147,483,648 -1 will change the value to -2,147,483,647.</li> </ul>															
E	Example When X0=Off $\rightarrow$ On, 1 is automatically subtracted from the content of D0.															
							DEC	P	D0							





AF 4(			ZRST	P			D1)(	D2)		С	Clear r	ange	)					
	Bit	de	vice			V	Vord	devic	е			16-b	it comman	d_ (5 STEP	·			
	Х	Y	М	Κ	Н	KnX	KnY	KnM	Т	С	D	ZR	ST Co	ntinuous	ZRSTP Pulse			
D1		*	*						*	*	*	¦	exec	ution type	execution type			
D2	26 ON	*	rand u	eauo.					*	*	*	32-b	it comman	d				
			perand		erand	≤ nun	nber o	f opera	and D2	2		-	-					
Ope	erands	$SD_1$	, D <sub>2</sub> mu	ist de	signat	e the s	same	type o	f devic	e		Floo	aignal: nor					
Plea	ase re	eter the	to the scope	function of deviation	on spe vice us	ecifica sage	tions 1	able to	or eac	h de	evice in	гад	signal: nor	le				
	plana						ige's	initia	l devi	ce.	<b>D</b> <sub>2</sub> : C	lear i	range's fi	nal device	).			
$\subseteq$				Wł	nen t	he n	umbe	er of	opera	and	D1 >	nun	nber of d	perand E	$D_2$ , only the operand			
								will b										
E	Exam	ple													and changed to Off. (Writes 0, and clears			
_			_					act ar			,							
											ill all	be clear	ed. (Write	es 0, and clears and				
			_		0			nd co						o				
				Wh	en Xa	3 is C	n, th		a in c	lata	regis	ters	D0 - D10	0 will be c	leared and set as 0.			
								X0			70	RST	M300	M399	7			
								11			21	101	101300	101333				
								X1 ┨┠───			ZF	RST	CO	C127	]			
								X10							_			
							-	┨┣──			- ZF	RST	ТО	T127				
								X3					ı	1	-			
								┨┣──			ZF	RST	D0	D100				
	Rema	ark					•		-	ise	the cle	ear c	ommand	(RST), sı	uch as bit device Y, M			
$\subseteq$				and	word	a aev		; C, E X0	).			_						
							-	́Н⊢				_	RST	MO				
												L						
													RST	то				
													RST	Y0				
							I											

AF 49													number	$\rightarrow$	binary	decimal
	Bit	devi	ce			V	/ord	devic	e			16-bit co	mmand			
	X Y M K H KnX KnY KnM T C D											<u> </u>				
S		* * * * * *									*					
D		*	*						*	*	*	<u>32-bit cou</u> DFLT	<u>mmand (9ste</u> Continuou	<del></del>	FLTP	Pulse
tabl The	e for e operations	and D	device will d	e in se occupy <b>S</b> : <sup>-</sup> Tra	ries fo 2 co Trans nsfo	or the nsecu sform rms I	scope tive po atior BIN v	n sou vhole	rce d	sage evice ber i	e. <b>D</b> : nto a	Flag signa Device s binary c	execution ty al: none storing tran decimal val of values	sform ue.	ation resu	
	Exam	ple				loatir		int nu		rs, w I			ed in D20 a			

AP 15		MC	DDR	WP	S	5	2 (	<u>S</u> 3 (	S	n	M	ODBUS data read/write
	Bit	dev	ice			V	Vord	16-bit command (5 STEP)				
	Х	Y	М	Κ	Н	KnX	KnY	KnM	Т	С	D	MODRW Continuous MODRW Pulse
S1				*	*						*	execution type execution type
S2				*	*						*	
S3				*	*						*	<u>32-bit command</u>
S											*	·····
n				*	*						*	

Explanation

- S1: online device address. S2: communications function code. S3: address of data to read/write. S: register for data to be read/written is stored. N: length of data to be read/written.
- COM1 must be defined as controlled by the PLC (set P9-31 = -12) before using this command, and the corresponding communications speed and format must also be set (set P09-01 and P09-04). S2: communications function code. Currently only supports the following function code; the remaining function code cannot be executed.

Function	Description
H 02	Input read
H 03	Read word
H 06	Write single word
H 0F	Write multiple coils
H10	Write single word

- After executing this command, M1077, M1078 and M1079 will be immediately changed to 0.
- As an example, when C2000 must control another converter and PLC, if the converter has a station number of 10 and the PLC has a station number of 20, see the following example:

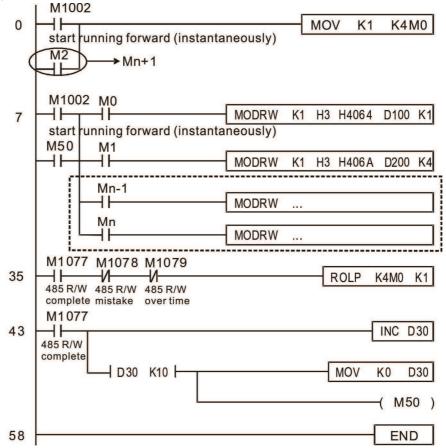
			MODF	RW comr	mand	
Seria	Example	S1	S2	S3	S4	n
l No.		Node ID	Function code	Addres s	Register	Leng th:
1	Reads 4 sets of data comprising the converter slave device parameters P01-00 to P01-03, and saves the read data in D0 to D3	K10	H3	H100	D0	K4
2	Reads 3 sets of data comprising the converter slave device addresses H2100 to H2102, and saves the read data in D5 to D7	K10	H3	H2100	D5	K3
3	Reads 3 sets of data comprising the converter slave device parameters P05-00 to P05-03, and writes the values as D10 to D12	K10	H10	H500	D10	K3
4	Writes 2 sets of data comprising the converter slave device addresses H2000 to H2001, and writes the values as D15 to D16	K10	H10	H2000	D15	K2

## PLC controlling slave device

	controlling slave device		MOD	RW com	mand	
Serial	Example	S1	S2	S3	S4	n
No.	Example	Node	Functio			11
INO.		ID	n code	Addres	Ŭ	Length:
	Poodo 4 poto of data comprising the	U	n coue	S	r	
4	Reads 4 sets of data comprising the	1/00	110	11400	DO	K4
1	PLC slave device's X0 to X3 state, and	K20	H2	H400	D0	N4
	saves the read data in bits 0 to 3 of D0					
0	Reads 4 sets of data comprising the	KOO	110		D1	144
2	PLC slave device's Y0 to Y3 state, and	K20	H2	H500	D1	K4
	saves the read data in bits 0 to 3 of D1					
_	Reads 4 sets of data comprising the	Koo		11000	Do	14
3	PLC slave device's M0 to M3 state, and	K20	H2	H800	D2	K4
	saves the read data in bits 0 to 3 of D2					
	Reads 4 sets of data comprising the	1/00		11000	Do	
4	PLC slave device's T0 to T3 state, and	K20	H2	H600	D3	K4
	saves the read data in bits 0 to 3 of D3					
_	Reads 4 sets of data comprising the	1/00	110	11500	54	144
5	PLC slave device's C0 to C3 state, and	K20	H2	HE00	D4	K4
	saves the read data in bits 0 to 3 of D4					
	Reads 4 sets of data comprising the					
6	PLC slave device's T0 to T3 count	K20	H3	H600	D10	K4
	value, and saves the read data of D10					
	to D13					
	Reads 4 sets of data comprising the					
7	PLC slave device's C0 to C3 count	K20	H3	HE00	D20	K4
	value, and saves the read data of D20					
	to D23					
	Reads 4 sets of data comprising the PLC slave device's D0 to D3 count					
8	value, and saves the read data of D30	K20	H3	H1000	D30	K4
	to D33					
	Writes 4 sets of the PLC slave device's					
9	Y0 to Y3 state, and writes the values as	K20	HF	H500	D1	K4
J	bits 0 to 3 of D1	IX20		11000		114
	Writes 4 sets of the PLC slave device's					
10	M0 to M3 state, and writes the values	K20	HF	H800	D2	K4
10	as bits 0 to 3 of D2	1120		11000	02	114
	Writes 4 sets of the PLC slave device's					
11	T0 to T3 state, and writes the values as	K20	HF	H600	D3	K4
	bits 0 to 3 of D3	1.20			20	
	Writes 4 sets of the PLC slave device's					
12	C0 to C3 state, and writes the values	K20	HF	HE00	D4	K4
	as bits 0 to 3 of D4					
	Writes 4 sets of the PLC slave device's					
13	T0 to T3 state, and writes the values of	K20	H10	H600	D10	K4
	D10 to D13					
	Writes 4 sets of the PLC slave device's					
14	C0 to C3 state, and writes the values of	K20	H10	HE00	D20	K4
	D20 to D23					
	Writes 4 sets of the PLC slave device's					
15	D0 to D3 state, and writes the values of	K20	H10	H1000	D30	K4
	D30 to D33					

## Example

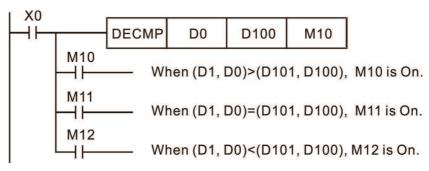
- Will trigger M0 On when the PLC begins to operate, and sends instruction to execute one MODRW command.
- After receiving the slave device's response, if the command is correct, it will execute one ROL command, which will cause M1 to be On.
- After receiving the slave device's response, will trigger M50 = 1 after a delay of 10 PLC scanning cycles, and then execute one MODRW command.
- After again receiving the slave device's response, if the command is correct, it will execute one ROL command, and M2 will change to On at this time (and M2 can be defined as a repeat of M); K4M0 will change to K1, and only M0 will remain 1. Transmission can proceed in a continuous cycle. If you wish to add a command, merely add the desired command in the empty frame, and change repeat M to Mn+1.



AF 11		D E	CMF	•		<b>S</b> 1	<u>(S2</u>		D	Co	ompa	arison of binary floating point numbers				
	Bit device         Word device           X         Y         M         K         H         KnX         KnY         KnM         T         C         D											16-bit command				
	Х	Y	Μ	Κ	Н	KnX	KnY	KnM	Т	С	D					
S1				*	*						*	[''				
S2				*	*						*	32-bit command (13 STEP)				
D				*	*						*	DECMP Continuous DECMPP Pulse				
Not	es on	oper	and u	sage:								execution type execution type				
The	operand D occupies three consecutive points															
Plea	lease refer to the function specifications table for each device in Flag signal: none															
seri	series for the scope of device usage															
(E)	<ul> <li>Explanation</li> <li>S<sub>1</sub>: Comparison of binary floating point numbers value 1. S<sub>2</sub>: Comparison of binary floating point numbers value 2. D: Results of comparison, occupies consecutive points.</li> </ul>															
			•									r 1 is compared with comparative binary comparison (>, =, <) will be expressed in $\mathbf{D}$ .				
	<ul> <li>If the source operand S<sub>1</sub> or S<sub>2</sub> designates a constant K or H, the command will transform the constant to a binary floating-point number for the purpose of comparison.</li> </ul>															
E	xam	ple		Wh	nen tl	ne de	signa	ated o	device	e is l	M10,	it will automatically occupy M10-M12.				
<ul> <li>Example</li> <li>When X0=On, the DECMP command executes, and one of M10-M12 will be C When X0=Off, the DECMP command will not execute, and M10-M12 will remain the command will not execute.</li> </ul>																

- If results in the form of  $\geq$ ,  $\leq$ , or  $\neq$  are needed, they can be obtained by series and parallel connection of M10-M12.
- Please use the RST or ZRST command to clear the result.

in the X0=Off state.



AF 11		) E	ZCP	P	3	10	52) (	S	▣	C	ompa	rison of binary floating point number range	
	Bit	dev	ce			V	/ord	devic	e				
ľ	Х	Υ	М	Κ	Н	KnX	KnY	KnM	Т	С	D	16-bit command	
S1				*	*						*		
32				*	*						*		
S				*	*						*	32-bit command (17 STEP) DEZCP Continuous DEZCPP Pulse	
D		*	*									execution type execution type	
he lea	oper ase re	and E efer to	) occu	functio					or eac	h dev	vice in	Flag signal: none	
<ul> <li>Explanation</li> <li>S<sub>1</sub>: Lower limit of binary floating point number in range comparison. S: Comparison of binary floating point numerical values. D: Results of comparison consecutive points.</li> <li>Comparison of binary floating point numerical value S with binary</li> </ul>													
			•	nui	nber	lowe	r limi	it valu	ue <b>S</b> ₁	and	bina	numerical value <b>S</b> with binary floating pointry floating point number upper limit value $S_2$ sed in <b>D</b> .	
			•	tra cor Wh	nsfor npar nen t	gnates a constant K or H, the command wi floating-point number for the purpose of point number $S_1$ is greater than the upper							
					<b>S</b> <sub>2</sub> , a command will be issued to perform limits using the binary floating point number								
E	xam	ble		When the designated device is M0, it will automatically occupy M0- M2.									
			•	On	. Wh		)=Of	f, the				will be executed, and one of M0-M2 will be nd will not execute, and M0-M2 will continue	
				Ple	ase	use t	he R	ST oi	r ZRS	т сс	omma	and to clear the result.	
						M0   - M1   - M2   -		– v	Vhen Vhen	(D1,	D0) : D0) :	D10 D20 M0 > (D21, D20), M0 is On. ≤ (D21, D20) ≤ (D11, D10), M1 is On. D) > (D11, D10), M2 is On.	

	API 116 D RAD P S D Bit device Word device										Angle	$Ie \rightarrow Diameter$			
	Bit	dev	ice			V	Vord	devic	16-bit command						
	Х	Υ	М	K	Н	KnX	KnY	KnM	Т	С	D				
S				*	*						*	200 bit command (0 CTER)			
Plea	ase re	efer to	and us o the t scope	functio			tions t	able f	or eac	h de	evice	<u>32-bit command (9 STEP)</u> DRAD Continuous DRADP 脈波執行型 execution type Flag signal: none			
<ul> <li>Explanation</li> <li>S: data source (angle). D: result of transformation (diameter).</li> <li>Uses the following formula to convert angles to radians.</li> <li>Diameter = Angle × (π/180)</li> </ul>															
E	Examı	ole	•	will	be c	onve	erted	to ra		an	d sto	signated binary floating point number (D1, D0) tored in (D11, D10), with the content consisting			
					<0 	-[[	DRAD		D0		D1(	0			
D 1 D 0 angle value     two decimal places															
$\square D 11 D 10 RAD value (angle value x\pi/2) two decimal places$															

AF 11		) [	DEG	Ρ		C	<u>s</u> (	D		Diameter $\rightarrow$ angle							
	Bit	dev	ice			V	Vord	devic	e		16-bit command						
	Х	Υ	М	Κ	Н	KnX	KnY	KnM	Т	С	D						
S				*	*						*	32-bit command (9 STEP)					
D											*	DDEG Continuous DDEGP Pulse					
				sage:		acifica	tione 1	ahla f	or eac	h da	vice in						
				of dev			10115	able i	UI Eac	n ue							
						0				Flag signal: none							
$\square$			)	<b>S</b> :	data	sour	ce (d	iame	ter). <b>C</b>	sults	of transformation (angle).						
E×	plan	ation	J														
				Us	es th	e foll	owinę	g forr	nula t	onvert	radians to an angle.						
				Ang	gle	=Dia	mete	r × (1									
E	Exam	ole	•	rad	lians	will k	be co	nver	ted to	an	angle	ed binary floating point number (D1, D0) in and stored in (D11, D10), with the content umber.					
	X0 DDEG D0 D10										]						
S D1 D0 徑度值 2進小數點											Ę						
						D 11	Ť	D 1	0		值 <b>(</b> 徑 小數黑	度值 x 180/π) 结					

AF 12		D	EAD	D P		<u>S1</u>	<u>(S2</u>		D	Ac	dding	binary floating point numbers
	Bi	t de	evice			V	Vord	devic	e			16-bit command
	Х	Y		K	Н	KnX	KnY	KnM	Т	С	D	
S1				*	*						*	·
S2				*	*						*	<u>32-bit command</u> (9 STEP)
D											*	DEADD Continuous DEADDP Pulse execution type execution type
Plea	ise r	refer	erand to the scope	function of de	vice u	sage						Flag signal: none
E	plar	natio		<b>S</b> <sub>1</sub> :	add	end.	<b>S₂</b> : a	ugen	d. <b>D</b> :	sum		
				reg Ad	ister ditior	desi 1 is p	gnate erfori	ed by ned	<b>S</b> ₁, a entire	ind th ely us	ie res ing b	ignated by $S_2$ is added to the content of the sult is stored in the register designated by <b>D</b> . inary floating-point numbers. gnates a constant K or H, the command will
			-									loating point number for use in addition.
			•	"cc the	ntinu regi	ious ster	exec will p	ution erfor	" con m ac	nmar dditio	nd is n on	designate identical register numbers, if a employed, when conditional contact is On, ce during each scan. Pulse execution type used under ordinary circumstances.
E	xam	nple										number (D1, D0) will be added to a binary ne results stored in (D11, D10).
					×0 	D	EADI	D	D0		D2	D10
			•	(wł	nich I	nas b	been	autor	matic		onve	number (D11, D10) will be added to K1234 rted to a binary floating-point number), and

DEADD D10 K1234 D20
---------------------

	API 121 D ESUB P (S1 (S2) (D)											Subtraction of binary floating point numbers						
	Bit	dev	ice			V	Vord	devic	e			16-bit command						
	Х	Υ	Μ	Κ	Н	KnX	KnY	KnM	Т	С	D							
S1				*	*						*	100 bit command (10 CTED)						
S2				*	*						*	32-bit command (13 STEP) DESUB Continuous DESUBP Pulse						
D											*	execution type execution type						
Plea	es on ase re es for	Flag signal: none																
E	plan	ation		<b>S</b> 1:	minu	uend.	. <b>S</b> ₂∷ s	rence.										
<ul> <li>When the content of the register designated by S<sub>2</sub> is subtracted from the cor of the register designated by S<sub>1</sub>, the difference will be stored in the reg designated by D; subtraction is performed entirely using binary floating-p numbers.</li> <li>If the source operand S<sub>1</sub> or S<sub>2</sub> designates a constant K or H, the command transform that constant into a binary floating point number for use in subtract</li> </ul>																		
	Exam	ple		"cc the cor Wł	ntinu regi mma nen λ	ious ster nds ( (0=O	exec will p DESI n, a	ution berfor UBP) binai	" com m ade are g ry floa	imar ditio jene ating	nd is n one rally poir	designate identical register numbers, if a employed, when conditional contact is On, ce during each scan. Pulse execution type used under ordinary circumstances. It number (D1, D0) will be subtracted to a , and the results stored in (D11, D10).						
					×0 	D	ESUI	3	D0		D2	D10						
			•	K1	234	(whio	ch h	as b	een	auto	matio	int number (D1, D0) will be subtracted from cally converted to a binary floating-point 11, D10).						



AP		D	EM	UL	P		<b>S</b> 1	<u>(S2</u>		D	M	ultipli	cation of binary floating point numbers
	B	it d	evice	ڊ ا			V	Vord	devic	e			16-bit command
	X			Λ	K	Н		KnY			С	D	
S1					*	*						*	
S2					*	*						*	<u>32-bit command (</u> 13 STEP)
D												*	DEMUL Continuous DEMULP Pulse execution type execution type
Please refer to the function specifications table for each device in series for the scope of device usage													
Fx	pla	nat	ion		<b>S</b> <sub>1</sub> :	mult	iplica	and. S	<b>S₂</b> : m	ultipli	er.	D:	product.
			-		the des nur	reg signa nber	ister ited k s.	des by <b>D</b> ;	ignat muli	ed b tiplica	y <b>S</b> 2 Ition	2, th is pe	ignated by $S_1$ is multiplied by the content of e product will be stored in the register erformed entirely using binary floating-point
If the source operand S <sub>1</sub> or S <sub>2</sub> designates a constant K or H, the comman transform that constant into a binary floating point number for us multiplication.													
			I	•	"co the	ntinu regi	ious ster	exec will p	ution erfor	" con m mi	nmar ultipli	nd is catio	designate identical register numbers, if a employed, when conditional contact is On, n once during each scan. Pulse execution rally used under ordinary circumstances.
E	Exa	mp	le	•	bin	ary f	loatir	ng po	oint n		er (D	11, [	nt number (D1, D0) will be multiplied by the D10), and the product will be stored in the
						≺1 ┣──	D	EMU	L	D0	C	010	D20
			I	•	K12	234	(whio	ch h	as b	een	auto	matio	bint number (D1, D0) will be multiplied from cally converted to a binary floating-point 11, D10).

I X2			,	. ,
	DEMUL	K1234	D0	D10

APIEDIVS1S2DDivision123DPS1S2DD											ivisio	n of binary floating point numbers
	Bit device Word device								16-bit command			
	Х	Y	М	Κ	Н	KnX	KnY	KnM	Т	С	D	
S1				*	*						*	
S2				*	*						*	32-bit command (13 STEP)
D											*	DEDIV Continuous DEDIVP Pulse
Note	Notes on operand usage:											execution type execution type
Plea	Please refer to the function specifications table for each device in series for the scope of device usage											
F	Explanation S <sub>1</sub> : dividend. S <sub>2</sub> : divisor. D: quotient and remainder.											
			•	reg	gister	desi	gnat	ed by	/ <b>S</b> <sub>2</sub> , 1	the c	quotie	gnated by $S_1$ is divided by the content of the ent will be stored in the register designated sing binary floating-point numbers.
If the source operand S₁ or S₂ designates a constant K or H, the command with transform that constant into a binary floating point number for use in division.												
	Example When X1=On, the binary floating point number (D1, D0) will be divided by the binary floating point number (D11, D10),											

X1 DEDIV D0 D10 D20

D20).

When X2 =On, the binary floating point number (D1, D0) will be divided by K1,234 (which has been automatically converted to a binary floating-point number), and the results stored in (D11, D10).

and the quotient stored in the register designated by (D21,

I X2				
	DEDIV	D0	K1234	D10

AF		) E	ΞΧΡ	Ρ		C	<u>s</u> (	D		Bi	nary	floating point number obtain exponent		
	Bit	dev	ice			V	Vord	devic	e			16-bit command		
	X	Y	M	K	Н			וY KnM T C		С	D			
S				*	*						*			
D											*	<u>32-bit command (9 STEP)</u>		
			and us			adifiaa	tional	DEXP Continuous DEXPP Pulse execution type execution type						
			scope				lions i	able I	or eac	n dev	nce in			
												Flag signal: none		
Ex	plana	ation			<b>S</b> :	oper	ation	sour	ce de	evice	. <b>D</b> : c	operation results device.		
$\subseteq$			/		Та	king	ə =2.	7182	8 as	a ba	se, <b>S</b>	is the exponent in the EXP operation.		
					[ D	)+1,	<b>D</b> ]=	EXP	<sup>[</sup> S +1	۱ ، S	]			
	<ul> <li>Valid regardless of whether the overlap value. The designated register D</li> </ul>											e content of <b>S</b> has a positive or negative D must have a 32-bit data format. This ating-point numbers, and <b>S</b> must therefore number.		
				•	Сс	onten	t of o	perai	nd D	=e <sup>s</sup>	; e=2	.71828, <b>S</b> is the designated source data		
	Exam	ple	)	•								1, D0) will be converted to a binary floating ed in register (D11, D10).		
				•		0); its						ation is performed on the exponent of (D11, ting point number stored in register (D21,		
						Í	Μ	0						
												DFLT D0 D10		
M1														
								•				DEXP D10 D20		

		DEXP	D10	D20
11	I	DEXI	DIU	DLU
				FND

AF 12		)	LN	Ρ		C	S) (	Ð		Bi	inary	floating point number obtain logarithm
	Bit	dev	ice			V	Vord	devic	e			16-bit command
	X	Y	M	Κ	Н			KnM		С	D	
S				*	*						*	
D											*	<u>32-bit command (9 STEP)</u>
Plea	ase re	fer to	o the	sage: functio of dev	vice u							Flag signal: none
Ex	plana	ation			S:	oper	ation	sour	ce de	evice	. <b>D</b> : c	peration results device.
	•		)		Та	king	ə =2.	7182	8 as	a ba	se, <b>S</b>	is the exponent in the EXP operation.
					[ [	<b>)</b> +1,	<b>D</b> ]=	EXP	<sup>[</sup> S +	1 <sup>,</sup> S	1	
				•	val ope	ue. 1 eratio	he o n is	desig perfo	nateo rmec	d reg Lusir	gister ng flo	e content of <b>S</b> has a positive or negative D must have a 32-bit data format. This ating-point numbers, and <b>S</b> must therefore number.
					Сс	onten	t of o	pera	nd D	=e <sup>s</sup>	; e=2	.71828 , <b>S</b> is the designated source data
	Exam	ple	)	•								1, D0) will be converted to a binary floating d in register (D11, D10).
				•	D1 D2	0); its						tion is performed on the exponent of (D11, ting point number stored in register (D21,
				_							[	DFLT D0 D10
					1	//1   ├──					[	DLN D10 D20
												END

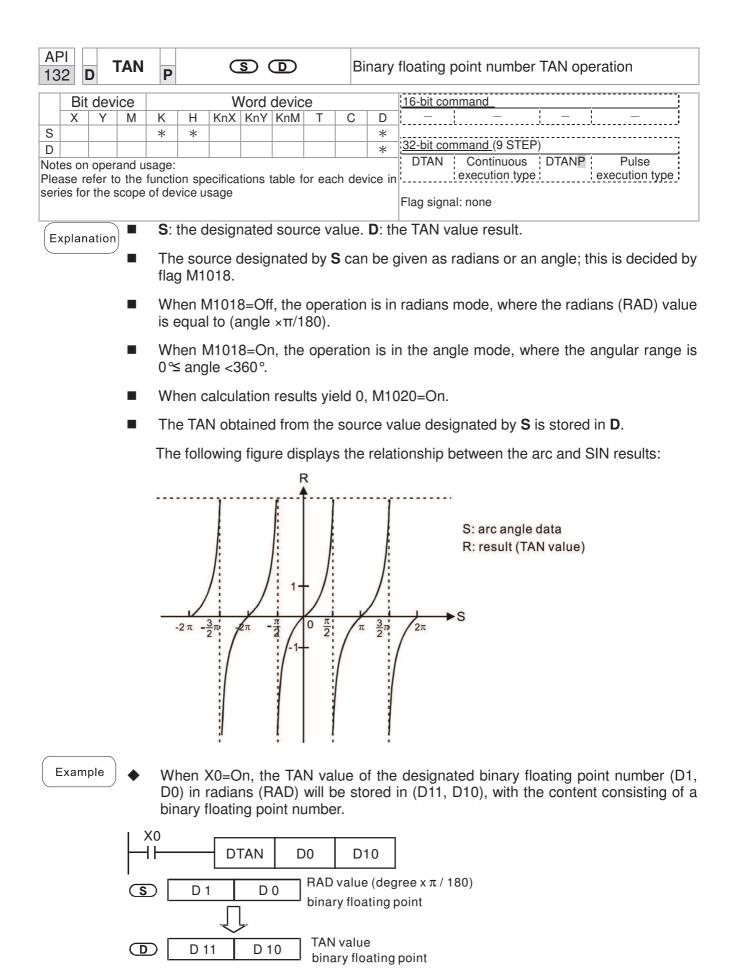
AF 12											Binary floating point number find square root					
	Bi	t dev	ice M	K	Н			devic KnM	e T	С	D	16-bit command				
S			101	*	*			T CI IIVI		<u> </u>	*	1				
Plea	ase re	efer to	and us the f cope o	unctio	ice us	age						DESQR Continuous DESQR Pulse in execution type P execution type Flag signal: none				
E	xplan	ation	)		S: ro		ce de	evice	for wł	hich	squa	re root is desired <b>D</b> : result of finding square				
				•	S,	the i	result	t is te	mpor	arily	v stoi	of the content of the register designated by red in the register designated by <b>D</b> . Taking aly using binary floating-point numbers.				
				•	tra		rm th					s to a constant K or H, the command will binary floating point number for use in the				
E	xam	ole	•									en of the binary floating point number (D1, gister designated by (D11, D10).				
						X0 ⊣		DE	SQR	[	D0	D10				
						<b>(D1,</b> Binary fl Point	'	E	( <b>D11,</b> Binary fl point		,					
			•		nvert							en of K1,234 (which has been automatically number), and the results stored in (D11,				

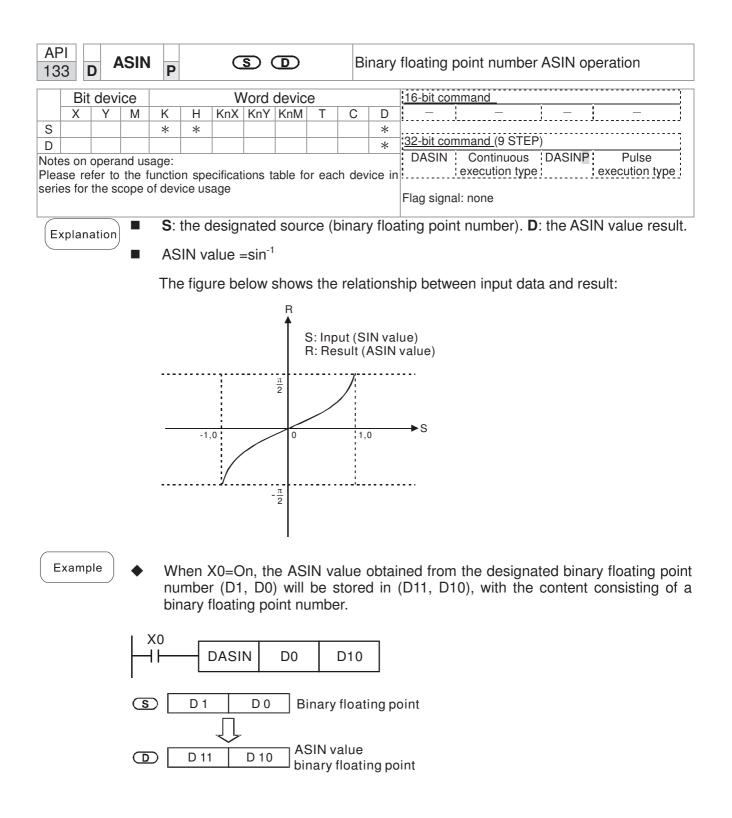


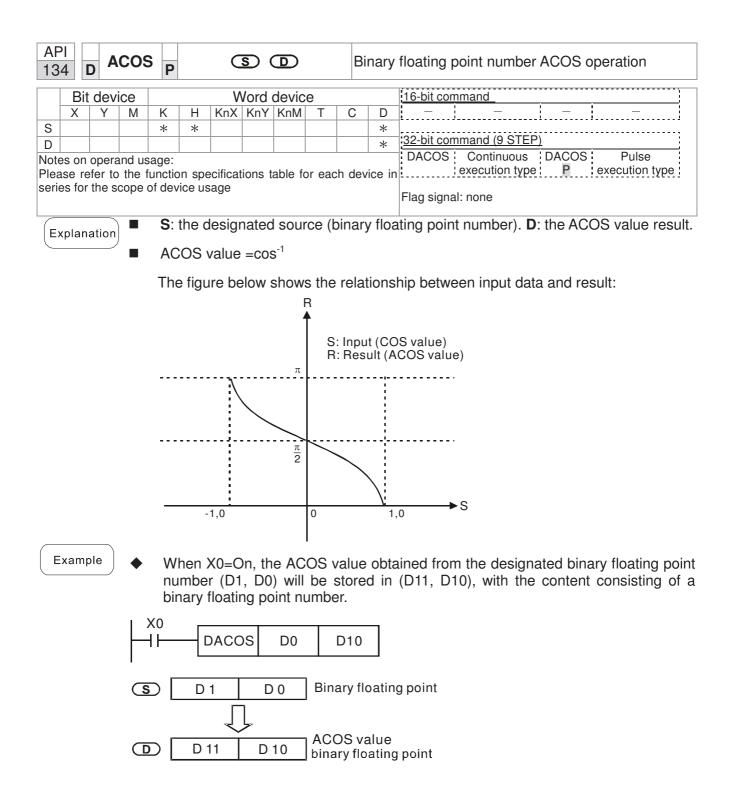
AP		D	INT	Ρ		C	S (	Ð				floating point number $\rightarrow$ BIN whole r transformation
	Bit	dev	rice			V	/ord	devic	e			16-bit command
	Х	Y	М	K	Н	KnX	KnY	KnM	Т	С	D	
S											*	
D											*	32-bit command (9 STEP)
			nd usa									DINT Continuous DINTP Pulse
			the fu				ons ta	able fo	or eac	h dev	ice in	execution type: execution type
serie	s for t	he so	ope of	devic	e usa	ge						Flag signal: none
F	plana	ation			<b>S</b> : 1	the so	ource	e dev	ice to	be t	rans	ormed. <b>D</b> : results of transformation.
	plane			_	<b>T</b> 1-			- 6 41-				and the distance of the second former of the second s
												gnated by <b>S</b> is transformed from a binary
						<u> </u>						o a BIN whole number, and is temporarily
					sto	red ir	ז <b>D</b> . 1	The E	BIN w	hole	num	ber floating point number will be discarded.
				_	ть	+		f +b;			ad ia	the ennecite of thet of economic ADL 40
							ion c	or true	s con	nmar	ia is	the opposite of that of command API 49
					(FL	.1).						
E	kamp	e		Wh	en X	0=Or	n, the	e bina	ary fl	oatin	g po	int number (D1, D0) is transformed into a
									-		• •	s stored in (D10); the BIN whole number
						point						
				nou	mg	point						
						1	X0	)				
						<u> </u>	—   -					DINT D0 D10
												END
						I						

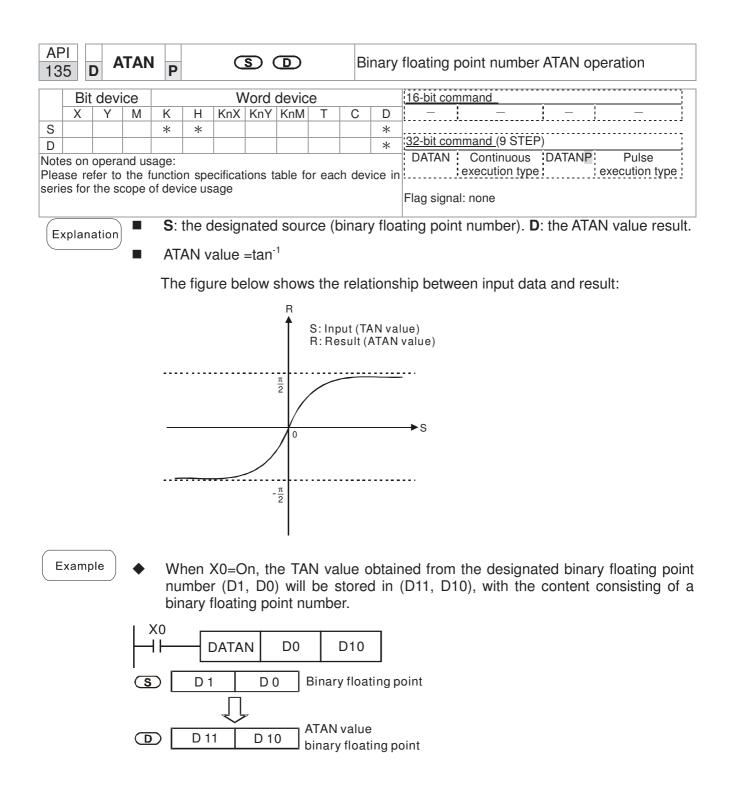
AP 130		D	SIN	Ρ		G	5) (	D		Bi	nary	floating point number SIN operation
	Bit device			Word device								16-bit command
	Х	Y	M	Κ	Н			KnM	Т	С	D	
S				*	*						*	: <u>32-bit command (</u> 9 STEP)
D	00 000	erand u	6300.								*	DSIN Continuous DSINP Pulse
		to the fi		n spec	ificati	ons ta	ble fo	r each	devid	ce in s	series	
for the scope of device usage Flag signal: none												Flag signal: none
Expla	Explanation S: the designated source value. D: the SIN value result.											
<ul> <li>S is the designated source in radians.</li> </ul>												
• The value in radians (RAD) is equal to (angle $\times \pi/180$ ).												
	• The SIN obtained from the source value designated by <b>S</b> is stored in <b>D</b> .											
	The following figure displays the relationship between the arc and SIN results:										hip between the arc and SIN results:	
							F	3		S: F	Radia	เท
							1			R: F	lesul	t (SIN value)
$\frac{1}{\frac{1}{2}\pi - \frac{3}{2}\pi - 2\pi} - \frac{\pi}{2} = 0 = \frac{\pi}{2} - \frac{\pi}{2} = \pi - \frac{3}{2}\pi - \frac{3}$											$s \rightarrow s$	
Example When X0=On, the SIN value of the designated binary floating point number (D1, D0) in radians (RAD) will be stored in (D11, D10), with the content consisting of a binary floating point number.												
		×  ⊣	(0 		DS	SIN	D	0	D1	0		
S D 1 D 0 RAD value ( $x/\pi$ 180) binary floating point												
				D 11	Ť	D 1(		SIN binar			poin	t

API 131 D COS	PSD	Binary floating point number COS operation								
Bit device         X       Y         S       Image: Second sec	*     *       age:       unction specifications table for each	16-bit command         C       D         *       32-bit command (9 STEP)         *       32-bit command (9 STEP)         DCOS       Continuous       DCOSP         device in       execution type         Flag signal: none       Flag signal: none								
Explanation	decided by flag M1018.	<b>y S can be given as radians or an angle; this is</b> ation is in radians mode, where the radians (RAD)								
:	<ul> <li>When M1018=On, the operation is in the angle mode, where the angular range 0°≤ angle &lt;360°.</li> <li>When calculation results yield 0, M1020=On.</li> </ul>									
	The following figure displays	re displays the relationship between the arc and SIN results: R S: Radian R: Result (COS value)								
	$-2\pi$ $-\frac{3}{2}\pi$ $-2\pi$ $\frac{\pi}{2}$ 0	$\frac{\pi}{2} \qquad \pi \qquad \frac{3}{2}\pi \qquad 2\pi$								
Example		On, the COS value of the designated binary floating point number (D1, ians will be stored in (D11, D10), with the content consisting of a binary int number.								
(S	D1 $D0$ binary	D10 alue ( x π/180) v floating point value v floating point								









AP 13		5	SINH	Ρ		C	s) (	D		Bir	nary	floating point number SINH operation		
	Bit	devi	ce			V	lord	devic	e			16-bit command		
	Х	Y	Μ	Κ	Н	KnX	KnY	KnM	Т	С	D			
S				*	*						*	32-bit command (9 STEP)		
D	00	opora	nd us	200.							*	DSINH Continuous DSINHP Pulse		
					n spe	cificat	ions t	able fo	or eac	h devi	ice in			
			cope c											
	Flag signal: none													
E	<b>S</b> : the designated source (binary floating point number). <b>D</b> : the SINH value result.													
	SINH value = $(e^{s}-e^{-s})/2$													
_														
E	xamp	le		Wł	ien )	(0=0	n th	e SIN	JH va	alue d	obtai	ned from the designated binary floating point		
$\subseteq$			_									(D11, D10), with the content consisting of a		
								int nu				(= · · , = · · ),		
					,		01							
				<0	Γ.			<b>D</b> 0			Γ			
						DSIN	н	D0		D10				
			I											
			S	ЪΓ	D	1	D	0	bina	ry floa	ting	point		
							1							
						Ł	Ļ							

SINH value

binary floating point

D 11

D 10

AF 13		c	OSH	I P		C	S) (	Ð		Bi	nary	floating point number COSH operation		
	Bit	dev	ice			V	/ord	devic	е			16-bit command		
	Х	Y	M	K	Н		KnY		Т	С	D			
S				*	*						*			
D											*	32-bit command (9 STEP)		
			and us									DCOSH Continuous DCOSHP Pulse execution type execution type		
			o the 1 scope				tions 1	table f	or ead	ch dev	ice in			
5011	55 101	ine a	scope	orue		saye						Flag signal: none		
	<b>S</b> : the designated source (binary floating point number). <b>D</b> : the COSH value result.													
E×	<b>S</b> : the designated source (binary floating point number). <b>D</b> : the COSH value result.													
$\subseteq$	Explanation COSH value = $(e^{s}+e^{-s})/2$													
	• COSH value = $(e^s + e^{-s})/2$													
E	<ul> <li>Example</li> <li>When X0=On, the COSH value obtained from the designated binary floating point number (D1, D0) will be stored in (D11, D10), with the content consisting of a binary floating point number.</li> </ul>													
			S		D		D	0	bina	ry floa	iting p	point		
					D 1	1	D	10		SH valı ry floa		point		

AF 13		D T	ANH	Ρ		C	<u>s</u> (	Ð		Bi	nary	floating point number TANH operation		
	Bit	dev	ice			V	Vord	devic	e			16-bit command		
	Х	Y	М	K	Н		KnY		Т	С	D			
S				*	*						*			
D											*	32-bit command (9 STEP)		
			and us									DTANH Continuous DTANHP Pulse execution type execution type		
Plea	ase re	eter to	o the 1 scope	of dov	on spe	ecifica	tions 1	table f	or eac	n dev	ice in			
Sen	25 101		scope	orue	nce u:	saye						Flag signal: none		
	<b>S</b> : the designated source (binary floating point number). <b>D</b> : the TANH value result.													
E>														
$\subseteq$	$\blacksquare  \tanh \text{ value } = (e^{s} - e^{-s})/(e^{s} + e^{-s})$													
_	$\blacksquare  \tanh value = (e^{\circ} - e^{-\circ})/(e^{\circ} + e^{-\circ})$													
E	Example When X0=On, the TANH value obtained from the designated binary floating point number (D1, D0) will be stored in (D11, D10), with the content consisting of a binary floating point number.													
	X0 DTANH D0 D10													
	S D1 D0 binary floating point													
					D 1	1	D	10		H valu ry floa	-	oint		

AF 16		Т	CMF	P	S	03	2	<u>S</u> 3 (	S	Ð		omparison of calendar data	
	Bit	dev	ice			V	Vord	devic	е				
	Х	Y	M	Κ	Н	KnX			Т	С	D	16-bit command (11 STEP)	
S1				*	*	*	*	*	*	*	*	TCMP Continuous TCMPP Pulse	
S2				*	*	*	*	*	*	*	*	execution type execution type	
S3				*	*	*	*	*	*	*	*	32-bit command	
S									*	*	*		
D		*	*									·'	
Plea seri	ase re es foi	efer to		function of device <b>S</b> <sub>1</sub> : mir the Re Co cal	vice u Sets nutes cor sults mpai enda	sage s the of th npari of co res th ar tim	hour le co son ompa ne tin le in	mpari time, trison, ne in	he co ison sett hour	ompa time, ing r s, mi	risor sett ange nute	Flag signal: none in time, setting range is "K0-K23." $S_2$ : Sets the ing range is "K0-K59." $S_3$ : Sets the seconds of e is "K0-K59." <b>S</b> : current calendar time. <b>D</b> : s, and seconds set in $S_1 - S_3$ with the current and seconds, with the results of comparison	
	<ul> <li>expressed in D.</li> <li>S The hour content of the current calendar time is "K0-K23." S +1 comprises the minutes of the current calendar time, and consists of "K0-K59." S +2 comprises the seconds of the current calendar time, and consists of "K0-K59."</li> </ul>												
			•									ed by <b>S</b> is usually compared using the TCMP mand to read the current calendar time. If the	

- The current calendar time designated by S is usually compared using the TCMP command after using the TRD command to read the current calendar time. If the content value of S exceeds the range, this is considered an operating error, the command will not execute, and M1068=On.
- When X10=On, the command will execute, and the current calendar time in D20-D22 will be compared with the preset value of 12:20:45; the results will be displayed in M10-M12. When X10 On→Off, the command will not be executed, but the On/Off status prior to M10-M12 will be maintained.

Example

If results in the form of ≥, ≤, or ≠ are needed, they can be obtained by series and parallel connection of M10-M12.

		TCMP	K12	K20	K45	D20	M10
I	M <sup>.</sup>		when12: 2(	): 45 >	D20 (hr) D21(min) D22(sec)		
	M <sup>.</sup>	1	when 12: 20	): 45 😑	D20 (hr) D21(min) D22 (sec)		
	M <sup>-</sup>	-	when12: 20	: 45 <	D20 (hr) D21 (min) D22(sec)		

AF 16		- T	ZCF	<b>P</b>		<u>S1</u>	<u>S2</u>	) (5	D			omparison of calendar data		
Bit device     Word device     16-bit command (9 STEP)       X     Y     M     K     H     KnY     KnM     T     C     D     TZCP     Continuous     TZCP     Pulse														
	Х	Y	M	K	Н	KnX	KnY	KnM	Т	С	D	TZCP Continuous TZCPP Pulse		
S1									*	*	*	execution type execution type		
S2									*	*	*			
S									*	*	*	<u>32-bit command</u>		
D * *														
Note	lotes on operand usage:													
Plea	ease refer to the function specifications table for each device in Flag signal: none													

series for the scope of device usage

Explanation

 $S_1$ : Sets the lower limit of the comparison time.  $S_2$ : Sets the upper limit of the comparison time. **S**: current calendar time. **D**: Results of comparison.

- Performs range comparison by comparing the hours, minutes, and seconds of the current calendar time designated by S with the lower limit of the comparison time set as S<sub>1</sub> and the upper limit of the comparison time set as S<sub>2</sub>, and expresses the results of comparison in D.
- **S**<sub>1</sub> × **S**<sub>1</sub> +1 × **S**<sub>1</sub> +2: Sets the hours, minutes, and seconds of the lower limit of the comparison time.
- **S**<sub>2</sub>  $\cdot$  **S**<sub>2</sub> +1  $\cdot$  **S**<sub>2</sub> +2: Sets the hours, minutes, and seconds of the upper limit of the comparison time.
- S \ S +1 \ S +2: The hours, minutes, and seconds of the current calendar time
- The D0 designated by the **S** listed in this program is usually obtained by comparison using the TZCP command after using the TRD command in advance to read the current calendar time. If the value of  $S_1$ ,  $S_2$ , or **S** exceeds the range, this is considered an operating error, the command will not execute, and M1068=On.
- When the current time **S** is less than the lower limit value  $S_1$  and **S** is less than the upper limit value  $S_2$ , **D** will be On. When the current time **S** is greater than the lower limit value  $S_1$  and **S** is greater than the upper limit value  $S_2$ , **D** +2 will be On; **D** +1 will be On under other conditions.

#### Example

When X10=On, the TZCP command executes, and one of M10-M12 will be On. When X10=Off, the TZCP command will not execute, and M10-M12 will remain in the X10=Off state.

X10								
$\dashv \vdash$		TZCP	D0	D2(	0	D10	ľ	VI10
I	M 	10   N when	D0 (hr) D1 (min D2 (sec	4 -	D	D10 (hr) D11 (min) D12 (sec)		
		11   N when	D0 (hr)           D1 (min)           when         D2 (sec)			10 (hr) 11 (min) 12 (sec)	<=	D20 (hr) D21 (min) D22 (sec)
		12   Nwhen			D	10 (hr) 11 (min) 12 (sec)	>	D20 (hr) D21(min) D22 (sec)

API 162	- T		Ρ		3	51 (	<u>S2</u> )	D		(	Calendar data addition					
Bit	dev	vice			٧	Vord	devic	e			16-bit command (7 STEP)					
X	Y	M	K	Н			KnM		С	D	TADD Continuous TADDP Pulse					
S1								*	*	*	execution type execution type					
S2								*	*	*	32-bit command					
D								*	*	*						
Notes on Please re series for	efer t	o the	function of dev	vice us	sage						<ul> <li>Flag signal: M1020 Zero flag M1022 Carry flag M1068 Calendar error</li> </ul>					
Explana	ation		<b>S</b> ₁:	time	add	end.	S₂: tiı	me a	ugei	nd. <b>C</b>	<b>)</b> : time sum.					
<u> </u>			command will not execute, M1067, M1068=On, and D1067 will record the error code 0E1A(HEX).													
		•									eater than or equal to 24 hours, carry flag esults of addition minus 24 hours.					
		•				of a	dditic	on are	e eq	ual t	to 0 (0 hours, 0 minutes, 0 seconds), zero flag					
Exam	ple	<ul> <li>M1020=On.</li> <li>When X10=On, the TADD command will be executed, and the calendar data in hours, minutes, and seconds designated by D0 to D2 will be added to the calendar data in hours, minutes, and seconds designated by D10 to D12, and the results are stored as a total number of hours, minutes, and seconds in the registers designated by D20 to D22.</li> </ul>														
				10	[	TAD	D	D0		D1	0 D20					

	11	TADD	00				0	
I			r					
	D0 8	B(hr)		D10	6(h	r)		D20 14(hr)
	D1 10	(min)	+ [	D11	40(m	in)	$\rightarrow$	D2150(min)
	D2 20	(sec)		D12	6(se	<b>C</b> )		D22 26(sec)
	8:10	:20		6:4	40:6			14:50:26

AF 16		T	SUB	P		3	D (	<u>S</u> 2	D		С	alendar data subtraction		
	Bit	t dev	vice			V	/ord	devic	e			16-bit command (7 STEP)		
	X	Y	M	Κ	Н			KnM	Т	С	D	TSUB Continuous TSUBP Pulse		
S1									*	*	*	execution type execution type		
S2									*	*	*	32-bit command		
D									*	*	*			
			rand u									··		
			o the scope				tions 1	able f	or ead	ch dev	vice in	<ul> <li>Flag signal: M1020 Zero flag M1022 Carry flag M1068 Calendar error</li> </ul>		
E	nlan	atior		<b>S</b> 1:	time	minu	lend	. <b>S</b> 2: t	ime	auge	nd. 🛙	D: time sum.		
		<ul> <li>Subtracts the calendar data in hours, minutes, and seconds designated by S<sub>2</sub> from the calendar data in hours, minutes, and seconds designated by S<sub>1</sub>, and the result is temporarily stored as hours, minutes, and seconds in the register designated by D.</li> <li>If the value of S<sub>1</sub> or S<sub>2</sub> exceeds the range, this is considered an operating error, the command will not execute, M1067, M1068=On, and D1067 will record the error code 0E1A(HEX).</li> <li>If subtraction results in a negative number, borrow flag M1021=On, and the result of</li> </ul>												
			•									mber, borrow flag M1021=On, and the result of will be displayed in the register designated by		
			•		ne re: 020=		of su	ıbtrac	ction	are e	qual	to 0 (0 hours, 0 minutes, 0 seconds), zero flag		
E	Exam	<ul> <li>When X10=On, the TADD command will be executed, and the calendar data in hours, minutes, and seconds designated by D10 to D12 will be subtracted from the calendar data in hours, minutes, and seconds designated by D0 to D2, and the results are stored as a total number of hours, minutes, and seconds in the registers designated by D20 to D22.</li> </ul>												
						10 		TSUE	3	D0		D10 D20		

••		- •						
			-					
D0 2	0(hr)	ĺ	D10 14	(hr)		D20	5(hr)	
D1 2	0(min)	_ [	D11 30	(min)	$\rightarrow$	D21	49(min	)
D2 5	5(sec)		D12 8	(sec)		D22	<u>57(sec</u>	)
20:	20: 5		14: 30	D: 8		5:	49: 57	,

	API 166 TRD P D											alendar data read			
	Bit device         Word device         16-bit command_(3 STEP)           X         Y         M         K         H         KnX         KnM         T         C         D         TRD         Continuous         120         Pulse														
	Х	Y	Μ	Κ	Н	KnX	KnY	KnM	Т	С	D	TRD Continuous 120 Pulse			
D									*	*	*	execution type execution type			
Not Ple	es on ase re	oper efer to	and u o the	sage: functio	on spe	ecifica	tions t	able fo	or eac	h devi	ice ir	32-bit command			
seri	lease refer to the function specifications table for each device in <u>32-bit command</u>														
												Flag signal: none			

- **S**<sub>1</sub>: time minuend. **S**<sub>2</sub>: time augend. **D**: time sum.
  - D: device used to store the current calendar time after reading.
- The EH/EH2/SV/EH3/SV2/SA/SX/SC main units have a built-in calendar clock, and the clock provides seven sets of data comprising year, week, month, day, hour, minute, and second stored in D1063 to D1069. The TRD command function allows program designers to directly read the current calendar time into the designated seven registers.
- D1063 only reads the two right digits of the Western calendar year.
  - When X0=On, the current calendar time is read into the designated registers D0 to D6.
  - In D1064, 1 indicates Monday, 2 indicates Tuesday, and so on, with and 7 indicating Sunday.



Special D	Item	Content		General D	Item
D1063	Year (Western)	00~99	->	D0	Year (Western)
D1064	Weeks	1~7	+	D1	Weeks
D1065	Month	1~12	+	D2	Month
D1066	Day	1~31	+	D3	Day
D1067	Hour	0~23	+	D4	Hour
D1068	Minute	0~59	+	D5	Minute
D1069	Second	0~59	$\rightarrow$	D6	Second

Example

Explanation

AF 17		C	GRY	Ρ			S		C		E	BIN→GRAY code transformation
	Bit	devi	ce			V	/ord	devic	е			16-bit command (5 STEP)
	Х	Υ	М	K	Н	KnX			Т	С	D	GRY Continuous GRYP Pulse
S D				*	*	*	*	*	*	*	*	execution type execution type
Note Plea		fer to	the					able f				execution type execution type
				<b>C</b> · .	2011		vico	D: d	ovice	otor	ina	• Flag signal: none
Ex	plana	tion		Э.:	sour	e de	vice.	<b>D</b> . a	evice	stor	ng	GRAY code.
												value) of the device designated by <b>S</b> to GRAY designated by <b>D</b> .
			•				<u> </u>					n below; if this range is exceeded, it will be and will not execute.
				16-	bit co	omma	and:	0~32,	767			
				32-	bit c	omm	and:	0~2,	147,4	183,6	47	
E	Examp	ole		•		hen ) bred i		,	ie co	onsta	nt K	(6513 will be transformed to GRAY code and
					$\vdash$	(0 		GRY	k	6513	3	DO
						K65	13=H	1971	b15 00	0 1	1 0	b0 1 0 1 1 1 0 0 0 1
						11/0		CE 1 0	b15			
					GR,	AY CI	JDE	6513	00	0 1	0 1	

DO

AF 17		<b>b</b>	BIN	Ρ			S		D		G	GRAY code $\rightarrow$ BIN transformation
	Bit	dev	ice			V	Vord	devic	e			16-bit command (5 STEP)
	Х	Y	M	Κ	Н	KnX	KnY	KnM	Т	С	D	GBIN Continuous GBINP Pulse
S				*	*	*	*	*	*	*	*	execution type execution type
D	00.00	opor	and us	200.			*	*	*	*	*	<u>32-bit command (</u> 9 STEP)
Plea	ase re	efer to	the fi cope of	unctio	on spe vice u	ecifica sage	tions	table f	or ea	ch dev	rice ir	execution type execution type
			_									• Flag signal: none
E)	kplan	ation				ce de matio		usea	to si	ore C	aRA	Y code. <b>D</b> : device used to store BIN value after
			•									the value of the device designated by ${\bf S}$ is is stored in the device designated by ${\bf D}.$
			•	wit	h the	PLC	C's in	put a	ind (	this e	nco	ue of the absolute position encoder connected der usually has an output value in the form of is stored in the designated register.
			•				•					below; if this range is exceeded, it will be and will not execute.
				16-	bit co	omma	and:	0~32	,767			
				32-	bit c	omm	and:	0~2,	147,4	483,6	47	
E	Exam	ple	)	•		th inp						le of the absolute position encoder connected I be transformed into BIN value and stored in
						(20 		GBIN	1	K4X0		D10
									X17			K4X0 <sub>X0</sub>
					GR	AY C	ODE	6513		01	0 1	
												$\prod$

215 21	j~	C	LD#			3	S1) (	<u>S2</u> )		С	onta	act form logical operation LD#	
	Bit	dev	rice			V	Vord	devic	e			16-bit command (5 STEP)	Ţ
	Х	Y	Μ	Κ	Н	KnX	KnY	KnM	Т	С	D	LD# Continuous – –	į
S1				*	*	*	*	*	*	*	*	execution type	j
S2				*	*	*	*	*	*	*	*	20 hit command (0 STED)	-1
Plea	ase re	efer t	o the	functio	on spe			table f	or eac	h de	vice in	- <u>32-bit command</u> (9 STEP) DLD# Continuous n execution type	
seri	es for	r the i	range	of dev	/ice u	sage						Flag signal: none	•

Explanation

**S**<sub>1</sub>: data source device 1. **S**<sub>2</sub>: data source device 2.

- This command performs comparison of the content of  $S_1$  and  $S_2$ ; when the result of comparison is not 0, this command will be activated, but this command will not be activated when the result of comparison is 0.
- The LD#This command can be used while directly connected with the busbar

API No.	16-bit commands	32-bit commands			tions fo vation	or	Conditio	ons f	or inacti	vation
215	LD&	DLD&	S <sub>1</sub>	&	S <sub>2</sub>	≠0	<b>S</b> <sub>1</sub>	&	S <sub>2</sub>	=0
216	LD	<b>D</b> LD	S <sub>1</sub>		S <sub>2</sub>	≠0	S <sub>1</sub>		S <sub>2</sub>	=0
217	LD^	DLD^	S <sub>1</sub>	٨	S <sub>2</sub>	≠0	S <sub>1</sub>	^	S <sub>2</sub>	=0

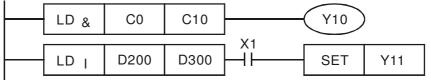
&: logical AND operation.

: logical OR operation.

^: logical XOR operation.

Example

- When the content of C0 and C10 is subjected to the logical AND operation, and the result is not equal to 0, Y10=On.
  - When the content of D200 and D300 is subjected to the logical OR operation, and the result is not equal to 0, and X1=On, Y11=On and remains in that state.



218 22	3~	A	ND#	ŧ —			61) (	<u>S2</u> )		C	ontac	t form logical operation AND#	
	Bit	dev	ice			٧	Vord	devic	e			16-bit command (5 STEP)	J
	Х	Y	Μ	Κ	Н	KnX	KnY	KnM	Т	С	D	AND# Continuous – –	
S1				*	*	*	*	*	*	*	*	execution type	1
S2				*	*	*	*	*	*	*	*	32-bit command (9 STEP)	-1
Plea	ase re	efer to	the		on sp	÷ & 、 ecifica		table f	or ead	ch dev	/ice in	DAND# Continuous – –	
seri	es toi	r the s	scope	of de	vice u	sage						Flag signal: none	

Explanation

**S**<sub>1</sub>: data source device 1. **S**<sub>2</sub>: data source device 2.

- This command performs comparison of the content of  $S_1$  and  $S_2$ ; when the result of comparison is not 0, this command will be activated, but this command will not be activated when the result of comparison is 0.
- The AND# command is an operation command in series with the contact.

API N	o. 16-bit commands	32-bit commands			tions fo vation	or	Conditio	ons f	or inacti	vation
218	AND&	DAND&	S <sub>1</sub>	&	S <sub>2</sub>	≠0	S <sub>1</sub>	&	S <sub>2</sub>	=0
219	AND	DAND	S <sub>1</sub>		S <sub>2</sub>	≠0	S <sub>1</sub>		S <sub>2</sub>	=0
220	AND^	DAND^	<b>S</b> <sub>1</sub>	^	S <sub>2</sub>	≠0	S <sub>1</sub>	^	S <sub>2</sub>	=0

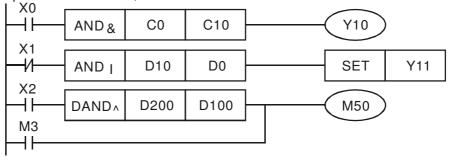
&: logical AND operation.

: logical OR operation.

^: logical XOR operation.

Example

- When X0=On and the content of C0 and C10 is subjected to the logical AND operation, and the result is not equal to 0, Y10=On.
- When X1=Off and D10 and D0 is subjected to the logical OR operation, and the result is not equal to 0, Y11=On and remains in that state.
- When X2 =On and the content of the 32-bit register D200(D201) and 32-bit register D100(D101) is subjected to the logical XOR operation, and the result is not equal to 0 or M3=On, M50=On.



Bit device Word device <u>16-bit command (5 STEP)</u>	
X Y M K H KnX KnY KnM T C D OR# Continuous	
S1 * * * * * * * * execution type	!
S2 * * * * * * * * * 32-bit command (9 STEP)	······
Notes on operand usage:       # : & \ \ ^         Please refer to the function specifications table for each device in series for the scope of device usage       DOR#         Continuous       -         Please refer to the function specifications table for each device in series for the scope of device usage       -         Flag signal: none       -	

Explanation

**S**<sub>1</sub>: data source device 1. **S**<sub>2</sub>: data source device 2.

- This command performs comparison of the content of  $S_1$  and  $S_2$ ; when the result of comparison is not 0, this command will be activated, but this command will not be activated when the result of comparison is 0.
- The OR# command is an operation command in series with the contact.

API No.	16-bit commands	32-bit commands			tions fo vation	or	Conditio	ons f	or inacti	vation
221	OR&	DOR&	S <sub>1</sub>	&	S <sub>2</sub>	≠0	S <sub>1</sub>	&	S <sub>2</sub>	=0
222	OR	<b>D</b> OR	S <sub>1</sub>		S <sub>2</sub>	≠0	S <sub>1</sub>		S <sub>2</sub>	=0
223	OR^	DOR^	S <sub>1</sub>	^	S <sub>2</sub>	≠0	S <sub>1</sub>	۸	S <sub>2</sub>	=0

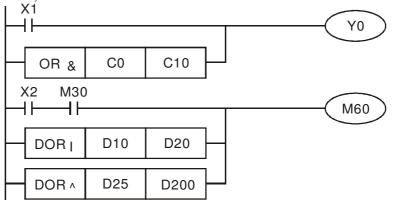
&: logical AND operation.

|: logical OR operation.

^: logical XOR operation.

Example

- When X1=On or the content of C0 and C10 is subjected to the logical AND operation, and the result is not equal to 0, Y0=On.
- When X2 and M30 are both equal to On, or the content of 32-bit register D10 (D11) and 32-bit register D20 (D21) is subjected to the logical OR operation, and the result is not equal to 0, or the content of the 32-bit counter C235 and the 32-bit register D200 (D201) is subjected to the logical XOR operation, and the result is not equal to 0, M60=On.



AF 224 23	4~		.D%			(	61) (	<u>S2</u> )		C	ontac	t form compare LD*	
	Bit	dev	ice			٧	Vord	devic	e			16-bit command (5 STEP)	3
	Х	Y	Μ	Κ	Н	KnX	KnY	KnM	Т	С	D	LD X Continuous – –	ł
S1				*	*	*	*	*	*	*	*	execution type	_!
S2				*	*	*	*	*	*	*	*	32-bit command (9 STEP)	-!
Plea	ase re	efer to	o the	functio	on spe	ecifica		x <> x able f			vice in	DLD X Continuous – –	
sen	es ioi	rines	scope	orde	vice u	sage						Flag signal: none	

Explanation

**S**<sub>1</sub>: data source device 1. **S**<sub>2</sub>: data source device 2.

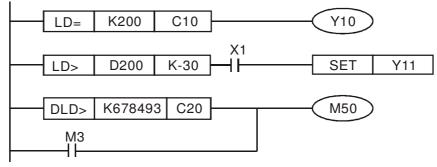
- This command compares the content of S<sub>1</sub> and S<sub>2</sub>. Taking API 224 (LD=) as an example, this command will be activated when the result of comparison is "equal," and will not be activated when the result is "unequal."
- The LD\* can be used while directly connected with the busbar

API No.	16-bit commands	32-bit commands	Conditions for activation	Conditions for inactivation
224	LD=	<b>D</b> LD=	$S_1 = S_2$	$S_1 \neq S_2$
225	LD>	<b>D</b> LD>	$\mathbf{S_1} > \ \mathbf{S_2}$	$S_1 \leq S_2$
226	LD<	DLD<	$S_1 < S_2$	$S_1 \ge S_2$
228	LD<>	DLD<>	$S_1 \neq S_2$	$S_1 = S_2$
229	LD < =	DLD < =	$S_1 \leq S_2$	$S_1 > S_2$
230	LD>=	<b>D</b> LD>=	$S_1 \ge S_2$	$S_1 < S_2$

Example

When the content of C10 is equal to K200, Y10=On.

When the content of D200 is greater than K-30, and X1=On, Y11=On and remains in that state.



AF 232 233	~	AI	NDX	× –		(3	61) (	<u>S2</u> )		С	ontac	t form compare AND*
	Bit	devi	ice			V	Vord	devic	е			16-bit command (5 STEP)
	Х	Υ	М	Κ	Н	KnX	KnY	KnM	Т	С	D	AND※ Continuous – – –
S1				*	*	*	*	*	*	*	*	execution type
S2				*	*	*	*	*	*	*	*	32-bit command (9 STEP)
Note	es on	opera	and u	sage:	×	≪ : = `	> ` <	· <> ·	$\leq$ $\cdot$	≧		DAND % Continuous – – –
				function of dev			tions t	able f	or eac	h de	vice in	execution type
Sen	25 101	the s	cope	ordev	vice u	saye						Flag signal: none

```
Explanation
```

 $S_1$ : data source device 1.  $S_2$ : data source device 2.

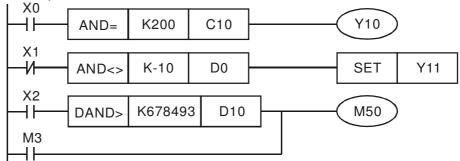
- This command compares the content of  $S_1$  and  $S_2$ . Taking API 232 (AND=) as an example, when the result of comparison is equal, this command will be activated; when the result of comparison is unequal, this command will not be activated.
- The AND\* command is a comparison command in series with a contact.

API No.	16-bit commands	32-bit commands	Conditions for activation	Conditions for inactivation
232	AND=	<b>D</b> AND =	$S_1 = S_2$	$S_1 \neq S_2$
233	AND>	<b>D</b> AND>	$\mathbf{S_1} > \ \mathbf{S_2}$	$S_1 \leq S_2$
234	AND<	DAND<	$S_1 < S_2$	$S_1 \ge S_2$
236	AND <>	DAND <>	$S_1 \neq S_2$	$S_1 = S_2$
237	AND < =	DAND < =	$S_1 \leq S_2$	$S_1 > S_2$
238	AND > =	DAND>=	$S_1 \ge S_2$	$S_1 < S_2$

Example

When X0=On and the current value of C10 is also equal to K200, Y10=On.

- When X1=Off and the content of register D0 is not equal to K-10, Y11=On and remains in that state.
- When X2 =On and the content of the 32-bit register D0(D11) is less than 678,493, or M3=On, M50=On.



AF 240 24	)~		)R×				61) (	<u>S2</u> )		C	Contact form compare OR*								
	Bit	dev	ice			٧	Vord	devic	е			16-bit command (5 STEP)	Ţ						
	Х	Y	Μ	Κ	Н	KnX	KnY	KnM	Т	С	D	OR X Continuous – –	ł						
S1				*	*	*	*	*	*	*	*	execution type	j						
S2			* * * * * * *																
Notes on operand usage: $3 = 2 > 2 < 2 > 2 \le 2 \le 2$ Please refer to the function specifications table for each device in series for the scope of device usage											32-bit command (9 STEP)  ORX Continuous execution type  Flag signal: none								

```
Explanation
```

**S**<sub>1</sub>: data source device 1. **S**<sub>2</sub>: data source device 2.

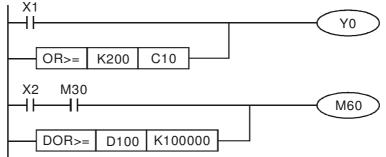
- This command compares the content of  $S_1$  and  $S_2$ . Taking API 240 (OR=) as an example, when the result of comparison is equal, this command will be activated; when the result of comparison is unequal, this command will not be activated.
- The OR\* command is a compare command in parallel with a contact.

API No.	16-bit commands	32-bit commands	Conditions for activation	Conditions for inactivation
240	OR=	DOR=	$S_1 = S_2$	$S_1 \neq S_2$
241	OR>	DOR>	$S_1 > S_2$	$S_1 \leq S_2$
242	OR<	DOR<	$S_1 < S_2$	$S_1 \ge S_2$
244	OR<>	DOR<>	$S_1 \neq S_2$	$S_1 = S_2$
245	OR<=	DOR < =	$S_1 \leq S_2$	$S_1 > S_2$
246	OR>=	DOR>=	$S_1 \ge S_2$	$S_1 < S_2$

Example

When X0=On and the current value of C10 is also equal to K200, Y10=On. When X1=Off and the content of register D0 is not equal to K-10, Y11=On and remains in that state.

When X2 =On and the content of the 32-bit register D0(D11) is less than 678,493, or M3=On, M50=On.



275 28	5~	F	LD >	*	_	(	<u>S1</u> )	(S2)		FI	loating point number contact form compare LD*						
	Bit	t dev	ice			V	Vord	devic	e			16-bit command					
	Х	Y	Μ	K	Н	KnX	KnY	KnM	Т	С	D						
S1									*	*	*						
S2									*	*	*	32-bit command (9 STEP)					
		•		•			•					FLD Continuous – – – execution type					
	lotes on operand usage: $\# : \& \times   \times \land$ Please refer to the function specifications table for each de eries for the scope of device usage										vice in	Flag signal: none					
L			•	-					4 0								

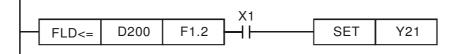
- $S_1$ : data source device 1.  $S_2$ : data source device 2.
- This command compares the content of S<sub>1</sub> and S<sub>2</sub>. Taking "FLD=" as an example, if the result of comparison is "equal," this command will be activated; but it will not be activated when the result is "unequal."
- The FLD\* command can directly input floating point numerical values (for instance: F1.2) to the S<sub>1</sub>, S<sub>2</sub> operands, or store floating-point numbers in register D for use in operations.
- This command can be used while directly connected with the busbar

API No.	32-bit commands	Conditions for activation	Conditions for inactivation
275	FLD=	$S_1 = S_2$	$S_1 \neq S_2$
276	FLD>	$S_1 > S_2$	$S_1 \leq S_2$
277	FLD<	$S_1 < S_2$	$S_1 \ge S_2$
278	FLD<>	$S_1 \neq S_2$	$S_1 = S_2$
279	FLD < =	$S_1 \leq S_2$	$S_1 > S_2$
280	FLD> =	$S_1 \ge S_2$	$S_1 < S_2$

Example

Explanation

When the floating point number of register D200 (D201) is less than or equal to F1.2, and X1 activated, contact Y21 will be activated and remain in that state.



281 28	~	F	AND	*	_	S1 S2 Floating point number contact form compare AND										
	Bit device Word device <u>16-bit command</u>															
	Х	Y	Μ	K	Н	KnX	X KnY KnM T C D									
S1									*	*	*					
S2									*	*	*	32-bit command (9 STEP)				
Plea	ase r	efer to	o the		on sp			table f	or eac	h de	vice in	FAND Continuous – – execution type Flag signal: none				

S<sub>1</sub>: data source device 1. S<sub>2</sub>: data source device 2.

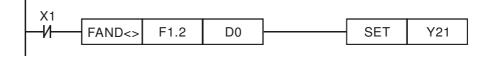
- This command compares the content of S<sub>1</sub> and S<sub>2</sub>. Taking "FAND=" as an example, if the result of comparison is "equal," this command will be activated; but it will not be activated when the result is "unequal."
- The FAND\* command can directly input floating point numerical values (for instance: F1.2) to the S<sub>1</sub>, S<sub>2</sub> operands, or store floating-point numbers in register D for use in operations.
- This command can be used while directly connected with the busbar

API No.	32-bit commands	Conditions for activation	Conditions for inactivation
281	FAND	$S_1 = S_2$	$S_1 \neq S_2$
282	FAND>	$S_1 > S_2$	$S_1 \leq S_2$
283	FAND <	$S_1 < S_2$	$S_1 \ge S_2$
284	FAND<>	$S_1 \neq S_2$	$S_1 = S_2$
285	FAND <=	$S_1 \leq S_2$	$S_1 > S_2$
286	FAND>=	$S_1 \ge S_2$	$S_1 < S_2$

Example

Explanation

When X1=Off, and the floating point number in register D100 (D101) is not equal to F1.2, Y21=On and remains in that state.



287 29	7~	F	OR	*		(	<u>S1</u> )	(S2)		FI	Floating point number contact form compare OR							
	Bit device Word device <u>16-bit command</u>																	
	Х	Y	Μ	K	Н	KnX	KnY	KnM	Т	С	D							
S1									*	*	*							
S2									*	*	*	<u>32-bit command</u> (9 STEP)						
		•		•		‡:&`	•					FOR Continuous – – –						
				function of dev			tions 1	able f	or eac	h dev	vice in	Flag signal: none						

- $S_1$ : data source device 1.  $S_2$ : data source device 2.
- This command compares the content of S<sub>1</sub> and S<sub>2</sub>. Taking "FOR=" as an example, if the result of comparison is "equal," this command will be activated; but it will not be activated when the result is "unequal."
- The FOR\* command can directly input floating point numerical values (for instance: F1.2) to the S<sub>1</sub>, S<sub>2</sub> operands, or store floating-point numbers in register D for use in operations.
- This command can be used while directly connected with the busbar

API No.	32-bit commands	Conditions for activation	Conditions for inactivation
287	FOR=	$S_1 = S_2$	$S_1 \neq S_2$
288	FOR>	$S_1 > S_2$	$S_1 \leq S_2$
289	FOR<	$S_1 < S_2$	$S_1 \ge S_2$
290	FOR<>	$S_1 \neq S_2$	$S_1 = S_2$
291	FOR<=	$S_1 \leq S_2$	$S_1 > S_2$
292	FOR>=	$S_1 \ge S_2$	$S_1 < S_2$

Example

Explanation

When X2 and M30 are both equal to "On," or the floating point number in register D100 (D101) is greater than or equal to F1.234, M60=On.

2	X2 M30							M60	$\overline{}$
				_					
-	FOR>=	D100	F1.234	┢	1				

### 16-6-5 Detailed explanation of driver special applications commands

API 139	- R	PR	Ρ			S1) (	<u>S2</u> )		R	ead	serv	o parameter
Bi	it devi	ce			V	Vord	devid	e			16	bit command (5 STEP)
X	Y	M	K	Н		KnY			С	D		RPR Continuous RPRP Pulse
S1			*	*						*		execution type execution type
S2										*		
Notes or	n opera	ind us	sage:	none							<u>32</u>	bit command
												g signal: none
Explar	nation	•		): Pa d is s			addro	ess c	of da	ta to	o be	read. (S2): Register where data to be
API 140		W	PR	Ρ		(5	61) (	S2)		W	/rite :	servo parameter
	Bit d	ovica	2			١٨	lord	devic	0			110 hit command (FOTED)
	X	Y	M	K	Н		KnY		с Т	С	D	16-bit command (5 STEP) WPR Continuous WPRP Pulse
S1	~	-	111	*	*			TXIIIVI	-	0	*	execution type execution type
S2				*	*						*	
Notes or	n opera	ind us	sade:	none							<u> </u>	<u>32-bit command</u>
												Flag signal: none
Exp	planatio	on			D: D ten.	ata to	o writ	e to :	spec	ified	l pag	e. (S2): Parameter address of data to be
E	xample	•										s parameter H01.00 is read and written to nd written to D1.
												Il be written to the C2000 driver parameter
												levels).
			-									en successfully, M1017=On.
												not support writing to the 20XX address,
												ding of 21XX, 22XX.
				but	line i		1000	nanu	sup	ροπ	Siea	
						Ц						RPR H100 D0
								open c				
						ope	ration	monit	oring	(a)		RPR H101 D1
						M	)					
						Hi	8					WPR D10 H400
												END
Decer		- المما	- T-'	/		l ub c ir		- مالم -				
Recom	imenc	atioi										nand. When writing parameters, because are written, these parameters may only be

mendation take care when using the WPR command. When writing parameters, because most parameters are recorded as they are written, these parameters may only be revised 109 times; a memory write error may occur if parameters are written more than 10<sup>9</sup> times.

Because the following commonly-used parameters have special processing, there are **no** restrictions on the number of times they may be written.

- P00-10: Control method
- P00-11: Speed mode selection
- P00-12: P2P position mode
- P00-13: Torque mode select
- P00-27: User-defined value

- P01-12: Acceleration time 1
- P01-13: Deceleration time 1
- P01-14: Acceleration time 2
- P01-15: Deceleration time 2
- P01-16: Acceleration time 3
- P01-17: Deceleration time 3
- P01-18: Acceleration time 4
- P01-19: Deceleration time 4

P02-12: Select MI Conversion Time mode:

P02-18: Select MO Conversion Time mode:

P04-50 ~ P04-69: PLC register parameter 0 - 19

P08-04: Upper limit of integral

- P08-05: PID output upper limit
- P10-17: Electronic gear A
- P10-18: Electronic gear B
- P11-34: Torque command
- P11-43: P2P highest frequency
- P11-44: Position control acceleration time
- P11-45: Position control deceleration time

Calculation of the number of times written is based on whether the written value is modified. For instance, writing the same value 100 times at the same time counts as writing only once.

When writing a PLC program, if unsure of usage of the WPR command, we recommend that you use the WPRP command.

AF 14		F	PID	P	S	1) (3	32) (	<b>S</b> 3	<u>(S4</u> )	Dri	iver	PID co	ntrol mode	Э						
		devi				V	lord	devic	0			16 bit o	ommand (							
	X	Y	M	K	Н		KnY		е Т	С	D	FPID		Jous   Fl	PIDP :	Ρι	ulse			
S1	~	· ·		*	*	10170					*	¦	executio	n type		execut	ion type			
S2				*	*						*	32-bit c	ommand							
S3				*	*						*	<u>-02-bit c</u>		:	_ :					
S4				*	*						*						'			
Note	es on	opera	and us	usage: none Flag signal: none																
<ul> <li>Explanation</li> <li>S1: PID reference target value input terminal select. S2: PID function proportional gain P. S3: PID function integral time I. S4: PID function differential time D.</li> <li>The FPID command can directly control the driver's feedback control on PID parameter 08-00 PID reference target value input terminal selection, 08-07 proposal gain P, 08-02 integral time I, and 08-03 differential time D.</li> <li>When M0=On, the set PID reference target value input terminal selection is 0 (not PID function), the PID function proportional gain P is 0, the PID function integrat time I is 1 (units: 0.01 sec.), and the PID function differential time D is 1 (units: 0.01 sec.).</li> <li>When M1=On, the set PID reference target value input terminal selection is 0 (not PID function), the PID function proportional gain P is 1 (units: 0.01), the PID function proportional gain P is 1 (units: 0.01), the PID function integral time I is 0, and the PID function differential time D is 0.</li> <li>When M2=On, the set PID reference target value input terminal selection is 0.</li> <li>When M2=On, the set PID reference target value input terminal selection is 0.</li> <li>When M2=On, the set PID reference target value input terminal selection is 1 (target frequency input is controlled from the digital keypad), the PID function proportional gain P is 1 (units: 0.01), the PID function integral time I is 0, and the PID function integral time I is 0, and the PID function integral time I is 0, and the PID function integral time I is 0, and the PID function integral time I is 0, and the PID function integral time I is 0, and the PID function integral time I is 0, and the PID function integral time I is 0, and the PID function integral time I is 0, and the PID function integral time I is 0, and the PID function integral time I is 0, and the PID function integral time I is 0, and the PID function integral time I is 0, and the PID function integral time I is 0, and the PID function integral ti</li></ul>														function ntrol of n, 08-01 is 0 (no integral I (units: is 0 (no 01), the 0. ion is 1 function						
				_		Frequ	iency	com	mano	d afte	r Pll	D opera	ation.							
					/10				- F	PID		H0	H0	H1		H1				
					/11   ├───				- F	PID		H0	H1	H0	H	-10				
				N	//2   ├──				- F	PID		H1	H1	H0	ŀ	-10				
					1000 				N	NOV		1027	D1							
				END																

l

AP 14		F	REQ	Ρ		(S1)	(S2	) (S	3)	D	river	speed control mode
	Bit	devi	се			V	Vord	devic	e			16-bit command (7 STEP)
S1	X	Y	M	K *	H *		KnY			С	D *	FREQ Continuous FREQP Pulse execution type execution type
S2				*	*						*	<u>32-bit command</u>
S3				*	*						*	
Note	es on	opera	and us	sage:	none							Flag signal: M1015
	plana		Whe The and	S2,5 dete mple en 01 setti the 5 The dece M10 M10 M10 M10 M10 M10 M10	3: Ir rmine -45= ng of 33 (d FRE elerat 25: 0 26: 0 40: 0 40: 0 42: T 44: F 52: L 25:	n acc ed by 0: uni 50 fo eceler Q co ion tir Contro	ts of ( r S2 ( ration mma ne; it of drive l drive r quic (On)/ reque Driver	tion/d efinition (accel time) nd ca also u er RU er ope vo On k stop rrelea ncy (0	eceler ons of eec. eratio settir an cor uses s JN(Or erating /Serve o (ON) se par On)/re RUN	ratio Pr0 n tin ng of ntrol pec o of //doe use leas ((On)	n time 1-45. 60 im drive ial reg FOP(C ection f. es not (Off) e lock	leration time. (S3): Deceleration time e settings, the number of decimal places is the ladder diagram below implies 0.5 sec, plies 0.6 sec r frequency commands, and acceleration and ister control actions, such as: ff) (RUN requires Servo On (M1040 On) to be FWD(Off)/REV(On) trigger quick stop (Off). frequency (Off) P(Off), M1026: driver operating juency reached.
				Whe acce Whe acce Whe	en M elerat en M elerat en M1	110=0 ion/de 11=Or tion tir	Dn, seten n, seten ne of	sets ation s the 50 (0	the time o driver 0.5 sec	driv of 0. freq c.) a	er fre uency nd dec	equency command K300(3.00Hz), with an command K3000 (30.00Hz), with an celeration time of 60 (0.6 sec.). (When 01-45=0) mand will now change to 0
				M M	1000					025 026 040 042 044	>	
				N	114   110    	M11 — И- М1( — И-	)	areo	- FRI - FR - EI		<u>р ка</u> Кз	00 К0 К0 000 К50 К60 basis of whether reference commands have

been cleared before PLC operation

Bit 0 : Prior to PLC scanning procedures, whether the target frequency has been cleared is 0. (This will be written to the FREQ command when the PLC is On)

- Bit 1: Prior to PLC scanning procedures, whether the target torque has been cleared is 0. (This will be written to the TORQ command when the PLC is On)
- Bit 2: Prior to PLC scanning procedures, whether speed limits in the torque mode have been cleared is 0. (This will be written to the TORQ command when the PLC is On)

Example: When using r to write a program,

M0 	FREQ	K2000	K1000	K1000
				END

if we force M0 to be 1, the frequency command will be 20.00 Hz; but when M0 is set as 0, there will be a different situation.

Case 1: When the 09-33 bit 0 is 0, and M0 is set as 0, the frequency command will remain at 20.00Hz.

Case 2: When the 09-33 bit 0 is 1, and M0 is set as 0, the frequency command will change to 0.00Hz

The reason for this is that when the 09-33 bit 0 is 1 prior to PLC scanning procedures, the frequency will first revert to 0.

When the 09-33 bit 0 is 0, the frequency will not revert to 0.

AP 263		<b>–</b> T	ORQ	Ρ		(3	<u>81</u> (	<u>S2</u> )		D	river	torqu	ie co	ontrol	mode	e				
	Bit	dev	ice			V	Vord	devic	e			16-b	it com	nmand	(5 S	TEP	·)			
	Х	Y	M	K	Н			KnM	Т	С	D		RQ	Con	tinuou	IS -	TOR			ulse
S1				*	*						*	¦	l	execu	ition ty	/pe			execut	tion type
S2				*	*						*	32-h	it com	nmand						
Note	s on	oper	and us	age:	none							02.0		Innana			_			
												Flag	signa	I: M10	63					'
		ation		(S1	). To	raue a	omm	and (	numh	ered	no n			one di		(S2	). Sr	heed	limit.	
EX	Jian	ation		The	TOR		mmai	nd ca	n cor	ntrol	the di	iver	torau	ie con	nman					s; it also
			_								, such		10.94	0 001	innan	a a				<i>s</i> , it aloo
													n Se	ervo is	s ON	, if	a TC	ORQ	com	mand is
																			nand,	and the
_			_											the T						
É	xam	ple										1063	: set	torqu	e atta	aine	d. D	1060	) is th	ne mode
$\subseteq$									ual to			oomr	mand	K.F	00 (	50	00/ )	rot	otiona	al speed
						is is 3				1 10	que	COIIII	nanu	K+0	00 (-	+30.	0%),	TOL	aliona	li speed
									,	er to	orque	com	ımanı	d K-?	300 (	-30	0%)	rota	ationa	al speed
						is is 3				0. 0	9999	0011	initiality	u	, ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	00.	0,0),		ationia	. opeed
									,	utput	t torqu	ie coi	mmar	nd.						
				Whe	n se	t torq	ue is	attai	ned,	M10	63 wi	ll go	On;	this f	lag u	sual	lly ju	mps	conti	inuously,
				how	ever.															
				M	1000	1					-					-				
				H	$\vdash$		<u> </u>	511 KD				VC	K2	D1	060					
						y ope					0.00	CC	ontrol	mode	e setu	p (2:	torq	uem	node)	
				OT	opera	ation r	nonit	oring	(a)		-М	V	D10	)53	D0	1				
					10								1000	tual toro		Le (-1)	00.0%	~ +10	0%)	
					10						ТС	PO		00 K	A	-				
					10							nu	N-50	JU N.	3000	1				
					1						- ТС	RQ	K500	0 K	3000	1				
				M	110											-1				
				$\vdash$	$\vdash$									—(M	1040	))				
				M	1063									Se	ervo O	n				
					F									—(	Y0 )	)				
				rea	ach the	define	d torqu	e force								1				
															ND					
				Pa	rame	ter 09	-33 a	re det	fined	on th	e bas	is of v	wheth	her re	feren	ce c	omm	ands	s have	e been
									ration											

Bit 0 : Prior to PLC scanning procedures, whether the target frequency has been cleared

is 0. (This will be written to the FREQ command when the PLC is On)

Bit 1 : Prior to PLC scanning procedures, whether the target torque has been cleared is 0.

(This will be written to the TORQ command when the PLC is On)

Bit 2 : Prior to PLC scanning procedures, whether speed limits in the torque mode have

been cleared is 0. (This will be written to the TORQ command when the PLC is On) Example:

M1 	TORQ	K300	K400
		C	END

If we now force M1 to be 1, the torque command will be K+300 (+30%), and the speed limit will be 400 (40Hz). But when M1 is set as 0, there will be a different situation

Case 1: When bit 1 and bit 2 of 09-33 are both set as 0, and M1 is set as 0, the torque command will remain at +30%, and the speed limit will be set as 40Hz. Case 2: When bit 1 and bit 2 of 09-33 are both 1, and M1 is set as 0, the torque command will revert 0%, and the speed limit will be set as 0Hz.

AF 26		- 1	OPOS	S P			(S1	)		[	Driv	ver	point-to-point control
	Bit	t de	vice			V	Vord	devid	e				16-bit command
	Х	Y	Μ	K	Н	KnX	KnY	KnM	Т	С		D	
				*	*							*	32-bit command (5 STEP)
Not	00.00		erand u	0.000	. nono								DPOS Continuous DPOSP Pulse
	55 011	i ope		saye	. none								execution type execution type
													Flag signal: M1064, M1070
E>	(plan	atio		Th spo M ne is dri	e DP ecial r 1040: w pos in the ver w	OS co registo Cont sition. e Ser vill mo	omm er co trol S If th vo O ove to	and ntrol Servo e cor N sta	action On/S ntrol n ate (N	ont ns, Ser noc /110	trol suo vo le is 40	the ch a Off. s pc =	e driver's position commands, and employs as: M1055 search for origin. M1048 move to osition mode (D1060 = 1), and the converter 1), if the DPOS command is executed, the conjunction with activation of M1048 once
E	Exam	nple		M1 mc Wł Wł (m ha:	ide co nen X nen X ove to s cha	Control. 0=On 1=Or 0 new	rol S D10 , M1 n, set v pos at th	51(L 040 v ts DF ition) nis tir	) and will be POS µ after	D1 Oos a c fter	05 n (S itio dela the	2(H Serv on a ay c	M1064: set position attained. D1060 is the ) are the actual position points. vo On). Is +300000, and M1048 will change to On of 1 sec. Check whether the value of D1051 et position point has been reached, M1064
				0	M	A100	2						
				6	3	⊣	ntane						MOV K2 D1060 control mode setup (1: position mode)
				6	-		10						DMOV D1051 D0
									conta				actual position (Low word)
				1		X0	eratio	n mo	nitori	ng	(a)		
					-	́н́н́							(M1040)
						FWD							Servo On
				1	3	X1							DPOS K300000
					3	REV							
													TMR T0 K10
								1	ГО				
							<u> </u>						(M1048)
						M10	64						move to a new p
				3		⊣  - reach	n the	defin	ed po	siti	ion	(	————( Y0 ) RY1
				3	2								END

AF 26		CA	ANR	X P	S	1) (§	<u>52</u> ) (	<b>S</b> 3	D	F	Read	CANopen	slave	station	data		
	Bit	dev	се			V	Vord	devic	e			16-bit com	mand	(9 STEP	)		
	Х	Y	М	K	Н			KnM	Т	С	D	CANRX			CANRXP	Pulse	
S1				*	*							-	execut	ion type	i	execution typ	be i
S2 S3				*	*							32-bit com	mand				
D									*	*	*	i		<u> </u>	i		!
Note	es on	oper	and u	sage:	none							Flag signal					
	xplan Exam	ple		D The Whe M10 read press M10 D10 M10 K4M	): Pr CAI 266 a 366 a 367 v 367 v 79. 002: 002:	eset NRX is exand N If the egiste will b Whe $0 = K^{-1}$ rds, e M10	addro com cecuto A106 e slav er, ar e se en the 1 each t o2	ess. manc ed, it 7 will re sta nd se t as e PLC time I	d can will s both tion g t M10 0, ar C run M106	reasen be jive 067 nd a s, 1	ad the od the o at is the an en the co	e index of SDO mes that time, correct res . If the sla for messa	the ssage and spons ave s ge w vill be	correspo e format M1066 se, it will station ha ill be re e triggere	onding s to the s will be s write the as a res corded ed once messag	k+bit leng lave static lave static et as 1 aff value to t ponse err to D1076 and will s e.	on. on. ter the ror, to
				6		(ins M10 Teac CAN com	tantai 66 1 & wi lopei iplete	neous rite to		10				TMR	T10 K4M400	K5	
				17	i	M40	0					CANRXP	K1	H6041	H10	D120	
				27	•	M40	1				[	CANRXP		H6041		D121	
				37	)	M40					—[	CANTXP	K1	D120	H6040	H10	
				47	8	M40 					—[	CANTXP	K2	D120	H6040	H10	
				57	(									CA		D2025 diagram ation 1 (H)	
				61		M40 —  -	5							CA	NFLS speed	D2125 diagram ation 1 (H)	
				65											[	END	

AF 26		C	ANT	X P	S	1) (5	32) (	<u>S3</u>	<u>(S4</u> )	) W	rite (	CANopen slave station data
	Bit	dev	ice			W	/ord	devic	е			16-bit command (9 STEP)
	Х	Y	Μ	K	Н	KnX	KnY	KnM	Т	С	D	CANTX Continuous CANTXP Pulse
S1				*	*							execution type execution type
S2				*	*				*	*	*	32-bit command
S3				*	*							
S4				*	*							jiiiiii
Note	es on	opera	and us	age: r	none							Flag signal
E	olan	ation		(S1	): SI	ave :	static	n nu	mbe	r. (S	2):	Address to be written. S3: Main index.

(S4): Subindex+bit length.

The CANTX command can write a value to the index of the corresponding slave station. When it is executed, it will send the SDO message format to the slave station. M1066 and M1067 will both be 0 at that time, and M1066 will be set as 1 after reading. If the slave station gives the correct response, it will write the value to the preset register, and set M1067 as 1. If the slave station has a response error, M1067 will be set as 0, and an error message will be recorded to D1076 to D1079.

AF 26			NFL	SP			D	)		R	efres	h special D corresponding to CANopen
	Bit	dev	ice			N	/ord o	device	Э			16-bit command_ (3 STEP)
	Х	Y	Μ	K	Н	KnX	KnY	KnM	Т	С	D	CANFLS Continuous CANFLSP Pulse
D				*	*							lexecution type lexecution type
Note	es on	opera	and us	sage: r	none							32-bit command
												Flag signal

Explanation

■ (D): Special D to be refreshed.

- The CANFLS command can refresh special D commands. When is a read only attribute, executing this command will send a message equivalent to that of CANRX to the slave station, and the number of the slave station will be transmitted back and refreshed to this special D. When there is a read/write attribute, executing this command will send a message equivalent to that of CANTX to the slave station, and the value of this special D will be written to the corresponding slave station.
- When M1066 and M1067 are both 0, and M1066 is set as 1 after reading, if the slave station gives a correct response, the value will be written to the designated register, and M1067 will be set as 1. If the slave station's response contains an error, then M1067 will be set as 0, and an error message will be recorded to D1076-D1079.

AF 32			OMI	R P	(	<u>S1)(</u>	<u>52</u> )(	<u>S3</u> (	D)	In	terna	al communications read
	Bit	dev	ice			W	/ord	devic	е			16-bit command (9 STEP)
	Х	Y	Μ	Κ	Н	KnX	KnY	KnM	Т	С	D	ICOMR Continuous ICOMRP Pulse
S1				*	*						*	execution type execution type
S2				*	*						*	22 hit command (17 STED)
S3				*	*						*	32-bit command (17 STEP)
D				*	*						*	execution type execution
Note	es on	opera	and us	age: r	none							type
												Flag signal: M1077 M1078 M1079
E	kplan	ation	J	~						~		evice selection (0: converter, 1: internal
$\subseteq$				C). 🤅	<u>S3</u> ):	Read	d add	lress.	(D	): Sa	aving	g target.

The ICOMR command can obtain the slave station's converter and the internal PLC's register value.

	D:+	day	ioo			١.	lord	douic				16 6	toor	nmand (9 STEP)
		dev			11			devic KnM		0				Continuous ICOMWP Pulse
	X	Y	M	K *	H *	KIIX	KITY	KNIVI	T	С	D *			execution type: execution type
2				*	*						*	_ 	t con	nmand (17 STEP)
				*	*						*			Continuous DICOMWP Pulse
				*	*						*			execution execution
tes	s on	oper	and u	sage: I	none							¦		type type
												Flag s	signa	al: M1077 M1078 M1079
			$\overline{\mathbf{S}}$	1) 0						(52				ection (0: converter, 1: internal
Exp	olan	ation		C).( The	S3): ICO	Read	d ado com	lress. manc		): s	aving	g targe	ət.	slave station's converter and t
E:	xam	ple	Ple	ease i	refer	to the	e follo	owing	j exa	mple	:			
			,	1					ir	terna	al con	nmuni	catio	on
					online M100	node	error	mapp	ing	norm		man	oun	
			0			0							ī	MOV D1117 K2M700
						ally op	en co	ntact					L	internal node has online
					ofope	ration	moni	toring	(a)				_	mapping at node 0
													<u> </u>	MOV D1116 K2M720
														internal node has error mapping at node 0
														MOV K1 D1110
													-	communication control
														at internal node
				i i	read a	nd wri	te dat	а						( M1035 ) enable internal
			17	8	M100	2								communication control
				ŀ	ΗĻ	27								MOV K1 K4M0
						unning Intane								read the status of MI at node
					(moto	M4	ously							
					Repeat									
					M120	D M	50	M	0					
			24		$\neg \vdash$		<u> </u>	ΞÏ	Mlatr 1	ode 0				MR K0 K0 H2600 D0
					InnerCo Ready	OM Se	end quest	М	Miatr 1	iode U				
				ľ	Reauy	Te	quest		AVI at	node (	)			MR K0 K0 H2660 D1
								M	2				-	
								-1	Outpu	tstatu	s at no	de 0		MW K0 K0 H2640 D5
									3					
									AFM1	at nod	e 0			<u>MW K0 K0 H26A0 D6</u>
			70	6	M100	2				Service On	SI 81			
			10			runnin	g forw	ard ( i	nstant	aneo	usly)			MOV K0 D100 MI at node 0
						7 M1	078				.,			
			76	8 <b>-</b>		/	( <u> </u>	—//—	_					ROLP K4M0 K1
				4	comple	W 48	or	485Rð over ti						MI at node 0
					M107									INCF DIOU
			87	° F	$\neg \vdash$	_								<u>INC D30</u>
					485R& comple									Delay on reading & writing internal communication
				ľ	Joinpie		D20	K1						MOV K0 D30
						Dela		K1 ading		na				Delay on reading & writing
								mmuni		.9				internal communication
				- 1										( M50 )
														( 11100 )
			10											Send request

# 16-7 Error display and handling

Code	ID	Descript	Recommended handling approach
PLrA	47	RTC time check	Turn power on and off when resetting the keypad time
PLrt	49	(incorrect RTC mode)	Turn power on and off after making sure that the keypad is securely connected
PLod	50	Data writing memory error	Check whether the program has an error and download the program again
PLSv	51	Data write memory error during program execution	Restart power and download the program again
PLdA	52	Program transmission error	Try uploading again; if the error persists, sent to the manufacturer for service
PLFn	53	Command error while downloading program	Check whether the program has an error and download the program again
PLor	54	Program exceeds memory capacity or no program	
PLFF	55	Command error during program execution	Check whether the program has an error and download the program again
PLSn	56	Check code error	Check whether the program has an error and download the program again
PLEd	57	Program has no END stop command	Check whether the program has an error and download the program again
PLCr	58	MC command has been used continuously more than nine times	Check whether the program has an error and download the program again
PLdF	59	Download program error	Check whether the program has an error and download again
PLSF	60	PLC scan time excessively long	Check whether the program code has a writing error and download again

## 16-8 CANopen Master control applications

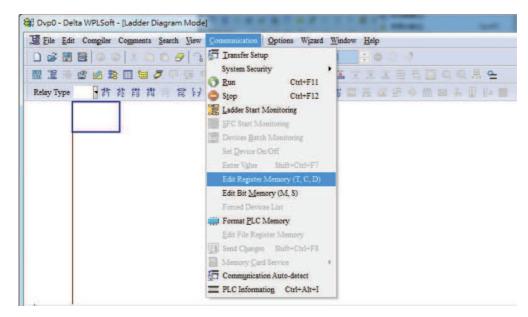
Control of a simple multi-axis application is required in certain situations. If the device supports the CANopen protocol, a C2000 can serve as the master in implementing simple control (position, speed, homing, and torque control). The setting method comprises the following seven steps:

### Step 1: Activating CANopen Master functions

- 1. Parameter 09-45=1 (initiates Master functions); restart power after completing setting, the status bar on the KPC-CC01 digital keypad will display "CAN Master".
- 2. Parameter 00-02=6 reset PLC (please note that this action will reset the program and PLC registers to the default values)
- 3. Turn power off and on again.
- 4. Use the KPC-CC01 digital keypad to set the PLC control mode as "PLC Stop" (if the KPC-CE01 digital keypad is used, set as "PLC 2"; if a newly-introduced driver is used, the blank internal PLC program will cause a PLFF warning code to be issued).

#### Step 2: Master memory settings

- 1. After connecting the 485 communications cable, use WPL Soft to set the PLC **status** as Stop (if the PLC mode has been switched to the **"PLC Stop"** mode, the PLC **status** should already be Stop)
- 2. Set the address and corresponding station number of the slave station to be controlled. For instance, if it is wished to control two slave stations (a maximum of 8 stations can be controlled simultaneously), and the station numbers are 21 and 22, it is only necessary to set D2000 and D2100 as 20 and 21, and then set D2200, D2300, D2400, D2500, D2600, and D2700 as 0. The setting method involves use of the PLC's WPL editing software WPL as follows:



Open WPL and implement communications > register edit (T C D) function

S Eile	Edit Cor	ngder Com	ments Searc	h View C	ommunication	<u>Options</u>	Wizard Wizard	ndow <u>H</u> elp			_ 8 ×
		000		9 3 0		0	0 1	* e	2.3		
	障會	🛆 13 🖽	939			009	15 5 3	e an ar	王君も		
D Regis Data Ty 16 b C 32 b	rpe 1 its	gister C Display Mo Cocimal Hexadeci Binary Float	de	bits) T Ro Transo Clear J	nit	Hint					
-	+0	+1.	+2	+3	+4	+5	+6	+7	+8	+9	1
D0	0	0	0	0	0	0	0	0	0	0	
D10	0	0	0	0	0	0	0	0	0	0	
D20	0	0	0	0	0	0	0	0	0	0	
D30	0	0	0	0	0	0	0	0	0	0	
D40	0	0	0	0	0	0	0	0	0	0	
D50	0	0	0	0	0	0	0	0	0	0	
D60	0	0	0	0	0	0	0	0	0	0	
D70	0	0	0	0	0	0	0	0	0	0	
D80	0	0	0	0	0	0	0	0	0	0	
D90	0	0	0	0	0	0	0	0	0	0	
D100	0	0	0	0	0	0	0	0	0	0	
D110	0	0	0	0	0	0	0	0	0	0	
D120	0	0	0	0	0	0	0	0	0	0	
D130	0	0	0	0	0	0	0	0	0	0	
D140	0	0	0	0	0	0	0	0	0	0	
D150	0	0	0	0	0	0	0	0	0	0	
D160	0	0	0	0	0	0	0	0	0	0	

After leaving the PLC register window, the register setting screen will appear, as shown below:

If there is a new PLC program and no settings have yet been made, you can read default data from the converter, and merely edit it to suit the current application. If settings have already been made, however, the special D in the CANopen area will display the saved status (the CANopen D area is located at D1090 to D1099 and D2000 to D2799). Assuming it is a new program, we will first read the default data from the converter; check the communications format if there is no communications link (the default PLC station number is 2, 9600, 7N2, ASCII). Perform the following steps: 1. Switch the PLC to Stop status; 2. Press the transmit button; 3. click on read memory after exiting the window; 4. Ignore D0-D399; and 5. click on the confirm button.)

File File	Edit Con	ngiler Com	ments Searc	h <u>V</u> iew <u>C</u>	ommunicat	ion Options	Wizard W				_
0 🖨		901	(00)	9 7 (		01	30	1 🗘 🔵	34		
	1 堂 🐳	1 2	80			300	5 5		E -	I (	Q 🖪 ᠲ
D Regis Data Ty © 16 b © 32 b	pe I	egister C Display Mo Decimal Hexadeci Binary Float		bits) T R 2 Trans Clear		Hint					
	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9	
D0	0	0	0	0	0	0	0	0	0	0	
D10	0	0	0	0	0	Transmission	Setup			5	×
D20	0	0	0	0	0		3				
D30	0	0	0	0	0			evice Register		OK	
D40	0	0	0	0	0	C Write t	o PLC Devi	ice Register		Cancel	1
D50	0	0	0	0	0	Bank Area S					
D60	0	0	0	0	0	4 V Bank	-	Stat	t 0	End	399
D70	0	0	0	0	0	4 M Bank	,		. 10	Linu	
D80	0	0	0	0	0			Range:D0 ~	D399		
D90	0	0	0	0	0				_	-	
D100	0	0	0	0	0	I Bank		Star	t 1000	End	1099
D110	0	0	0	0	0			Range:D100	0 ~ D1099		
D120	0	0	0	0	0						
D130	0	0	0	0	0	Bank	2	Star	t 2000	End	2799
D140	0	0	0	0	0			Range:D200	0 - D2700		
D150	0	0	0	0	0			Range 10200	0~ 02/99	21	
D160	0	0	0	0	0				-		

After reading the data, it is necessary to perform some special D settings. Before proceeding, we will first introduce the special D implications and setting range. The CANopen Master's special D range is currently D1070 to D1099 and D2000 to D2799; this range is divided into 3 blocks:

The first block is used to display CANopen's current status, and has a range of D1070 to D1089;

the second block is used for CANopen's basic settings, and has a range of D1090 to D1099; the third block is the slave station mapping and control area, and has a range of D2000 to D2799; These areas are therefore introduced as follows:

The first contains the current CANopen status display:

When the master initializes a slave station, we can from find out from D1070 whether configuration of the slave device has been completed; we can find out whether an error occurred in the configuration process from D1071 and whether the configuration is inappropriate from D1074.

After entering normal control, we can find out whether the slave device is offline from D1073. In addition, we can check the slave device's read/write information using the CANRX, CANTX, and CANFLS commands; error information can be obtained from D1076 to D1079 if there has been a read/write failure.

Special D	Description of Function					
D1070	D1070 Channel opened by CANopen initialization (bit0=Machine code0)					
D1071	Error channel occurring in CANopen initialization process (bit0=Machine code0)					
D1072	Reserved	-				
D1073	CANopen break channel (bit0=Machine code0)	R				

Special D	Description of Function	R/W
D1074	Error code of master error 0: No error 1: Slave station setting error 2: Synchronizing cycle setting error (too small)	R
D1075	Reserved	-
D1076	SDO error message (main index value)	R
D1077	SDO error message (secondary index value)	R
D1078	SDO error message (error code L)	R
D1079	SDO error message (error code H)	R

The second area is for basic CANopen settings: (the PLC must have **stopped** when this area is used to make settings)

We must set the information exchange time for the master and slave station,

Special D	Description of Function	Default:	R/W
D1090	Synchronizing cycle setting	4	RW

Use D1090 to perform settings; setting time relationships include:



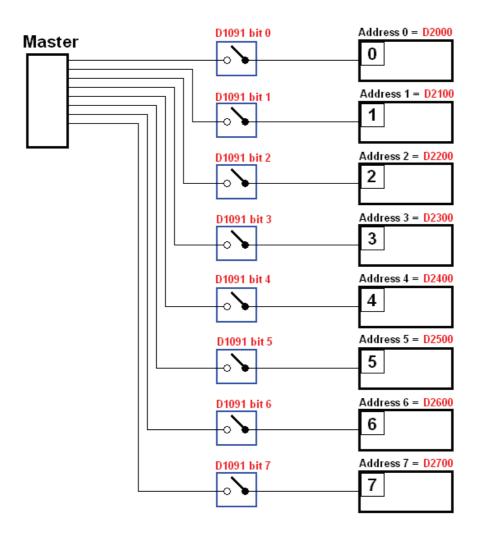
### N: TXPDO + RXPDO

For instance, when communications speed is 500K, TXPDO + RXPDO have 8 sets, and synchronizing time will require more than 4 ms

We must also define how many slave stations will be open. D1091 is the channel for defining station opening, and D2000+100\*n is the station number defining this channel. See the detailed explanation below.

Slave station number **n**=0-7

Special D	D Description of Function			
	Sets slave station On or Off (bit 0-bit 7 correspond to slave stations number 0-7)	RW		
D2000+100* <b>n</b>	Slave station number	RW		



If slave devices have a slow start-up, the master can delay for a short time before performing slave station configuration; this time delay can be set via D1092.

Special D	Description of Function	Default:	R/W
D1092	Delay before start of initialization	0	RW

With regard to slave device initialization, a delay time can be set to judge whether failure has occurred. If the communications speed is relatively slow, the delay time can be adjusted to judge whether initialization has been completed, which will ensure that there is time to perform slave device initialization.

Special D	Description of Function	Default:	R/W	
D1099	Initialization completion delay time	15 sec.	RW	
D1099	Setting range: 1 to 60000 sec	To sec.		

After communication is successful, the system must detect whether there is a break in communications with the slave station. D1093 is used to set detection time, and D1094 sets the number of consecutive errors that will trigger a break error.

Special D	Description of Function	Default:	R/W
D1093	Break time detection	1000ms	RW
D1094	Break number detection	3	RW

The packet type transmitted by PDO is set before establishing normal communications and generally does not require adjustment.

S	Special D	Description of Function	Default:	R/W
---	-----------	-------------------------	----------	-----

Special D	Description of Function	Default:	R/W
D1097	Corresponding real-time transmission type (PDO) Setting range: 1~240	1	RW
	Corresponding real-time receiving type (PDO) Setting range: 1~240	1	RW

The third block is the slave station mapping and control area.

CANopen provides a PDO method to perform mapping of the master and slave station memory, and enables the master to directly access read/write data in a certain memory area. The master will automatically perform data exchange with the corresponding slave device, and the read/write values can be seen directly from the special D area after real-time exchange (M1034 = 1 time) has been established. The C2000 currently supports real-time mapping of four PDOs, and there are two types of PDO RXPDO (reads slave device information) and TXPDO (writes to slave device). In addition, in order to facilitate control, the C2000 cannot perform mapping of commonly-used registers; the following is an overview of the current PDO mapping situation:

	TX PDO										
PDO4 (1	Forque)	PDO3 (P	osition)		PDO2 (Remote I/O)			PDO1 (Speed)			
Descriptio n	Special D	Descriptio n	Special D		Description	Special D	-	Descriptio n	Special D		
Controller Word Target torque	D2008+1 00*n D2017+1 00*n	Controller Word Target	D2008+1 00*n D2020+1 00*n D2021+1 00*n		Slave device DO Slave device AO1	D2027+1 00*n D2031+1 00*n		Controller Word Target speed	D2008+1 00*n D2012+1 00*n		
Control method	D2010+1 00*n	Control method	D2010+1 00*n		Slave device AO2 Slave device AO3	D2032+1 00*n D2033+100 *n					

	RXPDO												
PDO4 (	Torque)	PDO3 (F	Position)	PDO2 (Rer	note I/O)	PDO1 (S	Speed)						
Description	Special D	Description	Special D	Description	Special D	Description	Special D						
Mode word	D2009+100* n	Mode word	D2009+100* n	Slave device DI	D2026+100* n	Mode word	D2009+100* n						
Actual torque	D2018+100* n	Actual position	D2022+100* n D2023+100* n	Slave device Al1	D2028+100* n	Actual frequency	D2013+100* n						
Actual mode	D2011+100* n	Actual mode	D2011+100* n	Slave device Al2	D2029+100* n								
				Slave device Al3	D2030+100* n								

Because usage requires only simple to open the corresponding PDO, where TXPDO employs D2034+100\*n settings and RXPDO employs D2067+100\*n settings.

These two special D areas are defined as follows:

		PDO4		PDO3		PDO2		PDO1
Default definition		Torque		Position		Remote I/O		Speed
bit	15	14 ~ 12	11	10 ~ 8	7	6 ~ 4	3	2 ~ 0
Definition	En	Length:	En	Length:	En	Length:	En	Length:

En: indicates whether PDO is used

Length: indicates mapping of several variables

In a simple example, if we wish to control a C2000 slave device and cause it to operate in speed mode, we only have to make the following settings:

#### D2034+100\*n =000Ah

				ТХ	PD	0					
Lengt	P	DO4	P	PDO3		PDO2			PDO1		
h:	Descriptio	Special D	Descriptio	Special D		Descriptio	Special D		Descriptio	Special D	
	n		n	·		n			n		
1	Controller	D2008+100*	Controller	D2008+100*		Slave	D2027+10		Controller	D2008+100*	
	Word	n	Word	n		device DO	0*n		Word	n	
2	Target	D2017+100*	Target	D2020+100*		Slave	D2031+10		Target	D2012+100*	
	torque	n		n		device	0*n		speed	n	
				D2021+100*		AO1					
				n							
3	Control	D2010+100*	Control	D2010+100*		Slave	D2032+10				
	method	n	method	n		device	0*n				
						AO2					
4							D2033+100*				
						AO3	n				

	P	DO4		PDO3		PDO2	P	DO1
Definition	To	orque	F	Position	Re	mote I/O	S	peed
bit	15	14 ~ 12	11	10 ~ 8	7	6 ~ 4	3	2 ~ 0
Definition	0	0	0	0	0	0	1	2

D2067+100\*n =000Ah

Longt				ТХ	Ρ	DO				
Lengt h:	PD	D4	PD	O3		PDO2		PDO1		
	Description	Special D	Description	Special D		Description	Special D	Description	Special D	
1	Controller Word	D2009+100 *n	Controller Word	D2009+100 *n		Slave device DI	D2026+100 *n	Controller Word	D2009+100 *n	
2	Actual torque	D2018+100 *n	Actual position	D2022+100 *n D2023+100 *n		Slave device Al1	D2028+100 *n	Actual frequency	D2013+100 *n	
3	Actual mode	D2011+100 *n	Actual mode	D2011+100 *n		Slave device Al2	D2029+100 *n			
4						Slave device Al3	D2030+100*n			

	Р	DO4		PDO3		PDO2	PDO1		
Definition	To	orque	P	osition	Re	mote I/O	S	beed	
bit	15	14 ~ 12	11	10 ~ 8	7	7 6~4		2 ~ 0	
Definition	0	0	0	0	0	0 0		2	

Switch the PLC to Run after completing settings. Now wait for successful initialization of CANopen (M1059 = 1 and M1061 = 0), and then initiate CANopen memory mapping (M1034 = 1). The control word and frequency command will now automatically refresh to the corresponding slave device (D2008+n\*100 and D2012+n\*100), and the slave device's status word and currently frequency will also be automatically sent back to the master station (D2009+n\*100 and D2013+n\*100). This also illustrates how the master can handle these tasks through read/write operations in the special D area.

Furthermore, it should be noted that the remote I/O of PDO2 can obtain the slave device's current DI and AI status, and can also control the slave device's DO and AO status. Nevertheless, after introducing a fully automatic mapping special D, the C2000 CANopen master also provides additional information refreshes. For instance, while in speed mode, acceleration/deceleration settings may have been refreshed. The special D therefore also stores some seldom-used real-time information, and these commands can be refreshed using the CANFLS command. The following is the C2000's current CANopen master data conversion area, which has a range of D2001+100\*n - D2033+100\*n, as shown below:

1. The range of n is 0-7

2. ●Indicates PDOTX, ▲Indicates PDORX; unmarked special D can be refreshed using the CANFLS command

Special D	Description of Function	Default	F	PDO E	Default	:	R/W
Special D	Description of Function	:	1	2	3	4	

D2000+100*n	Station number n of slave station Setting range: 0~127 0: No CANopen function	0		RW
D2002+100*n	Manufacturer code of slave station number n (L)	0		R
D2003+100*n	Manufacturer code of slave station number n (H)	0		R
D2004+100*n	Manufacturer's product code of slave station number n (L)	0		R
D2005+100*n	Manufacturer's product code of slave station number n (H)	0		R

Basic definitions

Special D	Description of Function	Default:		PDO D	efault:		R/W
Special D	Description of Function	Delault.	1	2	3	4	
D2006+100*n	Communications break handling method of slave station number n	0					RW
D2007+100*n	Error code of slave station number n error	0					R
D2008+100*n	Control word of slave station number n	0	٠		•	٠	RW
D2009+100*n	Status word of slave station number n	0					R
D2010+100*n	Control mode of slave station number n	2					RW
D2011+100*n	Actual mode of slave station number n	2					R

Velocity Control

Special D	Description of Function	Default		PDO D	efault:		R/W
Special D	Description of Function	:	1	2	3	4	
D2001+100*n	Torque restriction on slave station number n	0					RW
D2012+100*n	Target speed of slave station number n (rpm)	0	•				RW
D2013+100*n	Actual speed of slave station number n (rpm)	0					R
D2014+100*n	Error speed of slave station number n (rpm)	0					R
D2015+100*n	Acceleration time of slave station number n (ms)	1000					RW
D2016+100*n	Deceleration time of slave station number n (ms)	1000					RW

Torque control

Special D	Description of Function	Default:	PDO Default:				R/W
Special D	Description of Function	Delault.	1	2	3	4	
D2017+100*n	Target torque of slave station number n(-100.0%~+100.0%)	0				•	RW
D2018+100*n	Actual torque of slave station number n(XX.X%)	0					R
D2019+100*n	Actual current of slave station number n(XX.XA)	0					R

### Position control

Special D	Description of Function	Default:	ŀ	PDO D	)efault	:	R/W
Special D	Description of Function	Delault.	1	2	3	4	
D2020+100*n	Target of slave station number n (L)	0					RW
	Target of slave station number n (H)				•		RW
D2022+100*n	Actual position of slave station number n (L)	0					R
D2023+100*n	Actual position of slave station number n (H)	0					R

D2024+100*n	Speed number	chart n (L)	of	slave	station	10000		RW	
D2025+100*n	Speed number	chart n (H)	of	slave	station	0			RW

Remote I/O

Special D	Description of Function	Default:		PDO D	Default	:	R/W
Special D	Description of Function	Delault.	1	2	3	4	
D2026+100*n	MI status of slave station number n	0					R
D2027+100*n	MO setting of slave station number n	0		•			RW
D2028+100*n	Al1 status of slave station number	0					R
D2029+100*n	Al2 status of slave station number	0					R
D2030+100*n	Al3 status of slave station number	0					R
D2031+100*n	AO1 setting of slave station number n	0		•			RW
D2032+100*n	AO2 setting of slave station number n	0		•			RW
D2033+100*n	AO3 setting of slave station number n	0		•			RW

After gaining an understanding of special D definitions, we return to setting steps. After entering the values corresponding to D1090 to D1099, D2000+100\*n, D2034+100\*n and D2067+100\*n, we cannot begin to perform downloading, which is performed in accordance with the following steps: (1. D2000 and D2100 are set as 20 and 21, and D2200, D2300, D2400, D2500, D2600, and D2700 are set as 0; if a setting of 0 causes problems, D1091 can be set as 3, and slave stations 2 to 7 can be closed. 2. Switch PLC to Stop status. 3. Press the transmit button. 4. click on write memory after exiting the window. 5. Ignore D0-D399. 6. Change the second range to D1090-D1099. 7. Click on Confirm.)

Wy rile						<u>Options</u>				
0 🖨		9 O )	X D D	9 3 0	299	0 2 🔫	301	÷	5 4	
	1 2 4	1 1 1	50			0 0 9	<b>S S</b> and		런히	🖾 Q Q 🗛 🤮
D Regist Data Ty 16 bi C 32 bi	pe E	gister C Display Moo Decimal Hexadeci Binary Float		bits) T Re 3 Transr Clear A		Hint				
	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9
D1990	0	0	0	0	0	0	0	0	0	0
D2000	20	0	0	0	Transmi	ssion Setup				×
D2010	0	0	0	0					077	
D2020	0	0	0	0		ead from PLC I	and the second	_	OK	
D2030	0	0	0	0	C W	rite to PLC De	evice Registe	r _	Cancel	
D2040	0	0	0	0	-Pault A	rea Setup				
D2050	0	0	0	0		ank 0		Start 0	End	300
D2060	0	0	0	0	YL B	ank 0		otari lo	- Inter I	
D2070	0	0	0	0			Range:D	00 ~ D399		
D2080	0	0	0	0				6	_	
D2090	0 1	0	0	0	I I B	ank 1		Start 1090	End	1099
D2100	21	0	0	0			Range:D	01000 ~ D109	9	
D2110	0	0	0	0						
D2120	0	0	0	0	Г В	ank 2		Start 2000	End	2799
D2130	0	0	0	0			Pangar	02000 ~ D279	0	
D2140	0	0	0	0			Kange.L	2000~ 1219	,	
D2150	0	0	0	0	L	-	-	-	-	
			1.1	1.0	1					

Another method can be used to set D1091: Determine which of slave stations 0 to 7 will not be needed, and set the corresponding bits to 0. For instance, if it is not necessary to control slave stations 2, 6 and 7, merely set D1091 = 003B, and the setting method is the same as described above: Use WPL to initiate communications > use register edit (T C D) function to perform settings.

# Step 3: Set the master's communications station number and communications speed

- ☑ When setting the master's station number (parameter 09-46, default is set as 100), make sure not to use the same number as a slave station.
- Set the CANopen communications speed (parameter 09-37); regardless of whether the driver is defined as a master or slave station, the communications speed is set via this parameter.

### Step 4: Write program code

Real-time access: Can directly read/write to or from the corresponding D area. Non real-time access:

- Read command: Use the CANRX command for reading. M1066 will be 1 when reading is complete; M1067 will be 1 if reading is successful, and M1067 will be 0 if an error has occurred.
- Write command: Use the CANTX command for writing. M1066 will be 1 when writing is complete; M1067 will be 1 if writing is successful, and M1067 will be 0 if an error has occurred.
- **Refresh command:** Use CANFLS command to refresh (if there are RW attributes, the master will write to the slave station; if there are RO attributes, the slave station will return the read values to the master); M1066 will be 1 if refresh has been completed; M1067 will be 1 if refresh is successful, and M1067 will be 0 if an error has occurred.

#### 

When using CANRX, CANTX or CANFLS, internal implementation commands will wait until M1066 is completed before executing the next CANRX, CANTX or CANFLS.

Afterwards, download program to the driver (Please note that the PLC's default communications format is ASCII 7N2 9600, and the station number is 2. The WPL must therefore be modified, and the WPL setting pathway is **settings > communications settings**)

# Step 5: Set the slave stations' station numbers, communications speed, control source, and command source

Delta's C2000 and EC series devices currently support the CANopen communications interface driver, and the corresponding slave station numbers and communications speed parameters are as follows:

	Correspond param		Value	Definition
	C2000	E-C		
Slave station	09-36	09-20	0	Disable CANopen hardware interface
address	09-30	09-20	1~127	CANopen Communication address
			0	1M
			1	500K
Communication	00.07	00.01	2	250K
speed	speed 3	09-21	3	125K
		4	100K	
			5	50K
O a strad a surray	00-21	-	3	
Control source	-	02-01	5	
<b>F</b>	00-20	-	6	
Frequency source	-	02-00	5	
Tarana	11-33	-	3	
Torque source	-	-	-	
Desition source	11-40	-	3	
Position source	-	-	-	

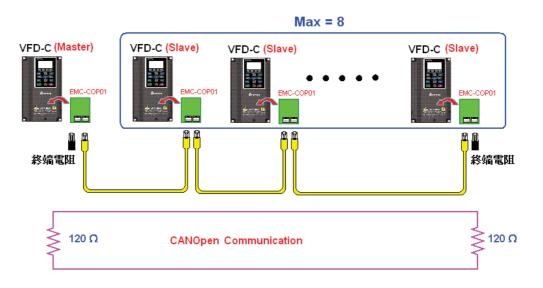
Delta's A2 Servo currently supports the CANopen communications interface, and the corresponding slave station numbers and communications speed parameters are as follows:

	Corresponding device parameters A2	Value	Definition
Slave station address	03-00	1~127	CANopen Communication address
Communication		R= 0	125K
Communication	03-01 bit 8-11 XRXX	R= 1	250K
speed		R= 2	500K

		R= 3	750K
		R= 4	1M
Control/command source	01-01	В	

## Step 6: Connect hardware wiring

When performing wiring, note the head and tail terminal resistance; connection methods are as follows:



### Step 7: Initiate control

After a program has been written and downloaded, switch the PLC mode to Run. Merely turn power to master and slave stations off and then on again.

Refer to CANMasterTest 1 vs. 2 driver.dvp

### Example

C2000 driver one-to-two control

### Step 1: Activating CANopen Master functions

- Parameter 09-45=1 (initiates Master functions); restart power after completing setting, the status bar on the KPC-CC01 digital keypad will display "CAN Master".
- Parameter 00-02=6 reset PLC (please note that this action will reset the program and PLC registers to the default values)
- $\square$  Turn power off and on again.
- ☑ Use the KPC-CC01 digital keypad to set the PLC control mode as "PLC Stop" (if the KPC-CE01 digital keypad is used, set as "PLC 2"; if a newly-introduced driver is used, the blank internal PLC program will cause a PLFF warning code to be issued).

### Step 2: Master memory correspondences

- ☑ Enable WPL
- ☑ Use keypad set PLC mode as Stop (PLC 2)
- WPL read D1070 to D1099 D2000 to D2799
- ☑ Set D2000=10 D2100=11

- ☑ Set D2100 2200 2300 2400 2500 2600 2700=0
- ☑ Download D2000 to D2799 settings

#### Step 3: Set the master's communications station number and communications speed

- ☑ When setting the master's station number (parameter 09-46, default is set as 100), make sure not to use the same number as a slave station.
- Set the CANopen communications speed as 1M (parameter 09-37=0); regardless of whether the driver is defined as a master or slave station, the communications speed is set via this parameter.

#### Step 4: Write program code

Real-time access: Can directly read/write to or from the corresponding D area. Non real-time access:

- **Read command**: Use the CANRX command for reading. M1066 will be 1 when reading is complete; M1067 will be 1 if reading is successful, and M1067 will be 0 if an error has occurred.
- Write command: Use the CANTX command for writing. M1066 will be 1 when writing is complete; M1067 will be 1 if writing is successful, and M1067 will be 0 if an error has occurred.
- **Refresh command:** Use CANFLS command to refresh (if there are RW attributes, the master will write to the slave station; if there are RO attributes, the slave station will return the read values to the master); M1066 will be 1 if refresh has been completed; M1067 will be 1 if refresh is successful, and M1067 will be 0 if an error has occurred.

#### 

When using CANRX, CANTX or CANFLS, internal implementation commands will wait until M1066 is completed before executing the next CANRX, CANTX or CANFLS.

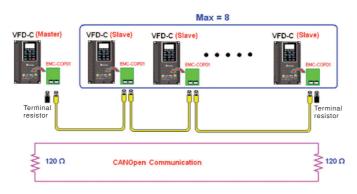
Afterwards, download program to the driver (Please note that the PLC's default communications format is ASCII 7N2 9600, and the station number is 2. The WPL must therefore be modified, and the WPL setting pathway is **settings** > **communications settings**)

#### Step 5: Set the slave stations' station numbers and communications speed

 $\begin{aligned} Slave \ station \ no. \ 1: \ 09-37 = 0 (Speed \ 1M) & 09-36 = 10 (Node \ ID \ 10 \ ) \\ Slave \ station \ no. \ 2: \ 09-37 = 0 (Speed \ 1M) & 09-36 = 10 (Node \ ID \ 11 \ ) \end{aligned}$ 

#### Step 6: Connect hardware wiring

When performing wiring, note the head and tail terminal resistance; connection methods are as follows:



#### Step 7: Initiate control

After a program has been written and downloaded, switch the PLC mode to Run. Merely turn power to master and slave stations off and then on again.

Refer to CANMasterTest 1 vs. 2 driver.dvp

# 16-9 Explanation of various PLC mode controls (speed, torque,

# homing, and position)

The torque mode and position mode are based on FOC vector control and speed mode also supports FOC vector control. Control therefore cannot be performed successfully unless you study motor parameters ahead of time for the torque mode and position mode, and the speed mode based on FOC.

In addition, motors are classified as two types: IM and PM. You therefore need to study IM motor parameters. For PM motors, after completing motor parameter study, you must also complete study of motor origin angle of deviation. Please refer to parameters 12-58 Pr. 05-00 detailed explanation.

If a PM motor belongs to Delta's ECMA series, motor parameters can be directly input from data in the servo motor catalog, and parameter study will not be needed.

Control methods and settings are explained as follows:

Speed control:

Register table for speed mode:

#### Control special M

Special	Description of Function	Attributes
M		
M1025	Driver frequency = set frequency (ON)/driver frequency =0 (OFF)	RW
M1026	Driver operating direction FWD(OFF)/REV(ON)	RW
M1040	Hardware power (Servo On)	RW
M1042	Quick stop	RW
M1044	Pause (Halt)	RW
M1052	Lock frequency (lock, frequency locked at the current operating frequency)	RW

#### Status special M

Special M	Description of Function	Attributes
M1015	Frequency attained (when used together with M1025)	RO
M1056	Servo On Ready	RO
M1058	On Quick Stopping	RO

#### Control special D

Spe [	Description of Function	Attri	butes
D1(	060 Mode setting (speed mode is 0)	P	RM

#### Status special D

Special D	Description of Function	Attributes
D1037	Converter output frequency (0.00~600.00)	RO
D1050	Actual operating mode (speed mode is 0)	RO

**S**3

#### Speed mode control commands:

FREQ(P) S1 S2

#### Target speed

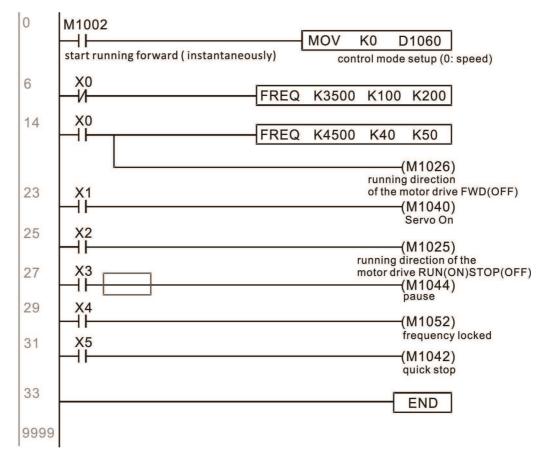
The first acceleration time setting The first

deceleration time setting

Example of speed mode control:

Before performing speed control, if the FOC (magnetic field orientation) control method is used, setting of electromechanical parameters must first be completed.

- 1. Setting D1060 = 0 will shift the converter to the speed mode (default).
- 2. Use the FREQ command to control frequency, acceleration time, and deceleration time.
- 3. Set M1040 = 1, the driver will now be excited, but the frequency will be 0.
- 4. Set M1025 = 1, the driver frequency command will now jump to the frequency designated by FREQ, and acceleration/deceleration will be controlled on the basis of the acceleration time and deceleration time specified by FREQ.
- 5. M1052 can be used to lock the current operating frequency.
- 6. M1044 can be used to temporarily pause operation, and the deceleration method will comply with deceleration settings.
- 7. M1042 can be used to perform quick stop, and deceleration will be as quick as possible without giving rise to an error. (There may still be a jump error if the load is too large.)
- 8. Control user rights: M1040(Servo ON) > M1042(Quick Stop) > M1044(Halt) > M1052(LOCK)



#### Torque control:

Register table for torque mode:

Control special M

Special	Description of Function	Attributes
М		
M1040	Servo On	RW

Status special M

Special M	Description of Function	Attributes
M1056	Servo On Ready	RO
M1063	Torque attained	RO

Control special D

Special D	Description of Function	Attributes
D1060	Operating mode setting (torque mode is 2)	RW

Status special D

Special	Description of Function	Attributes
D		
D1050	Actual operating mode (speed mode is 0)	RO
D1053	Actual torque	RO

Torque mode control commands:

TORQ(P)	S1	S2	
	Target to	rque (with numbers)	Frequency restrictions

Example of torque mode control:

The setting of electromechanical parameters involved in torque control must be completed before implementing torque control.

- 1. Set D1060 = 2 to change the converted to the torque mode.
- 2. Use the TORQ command to implement torque control and speed limits.
- 3. Set M1040 = 1; the driver will now be excited, and immediately jump to the target torque or speed limit. D1053 can be used to find out the current torque.

0	M1002	MOV K2 D1060
	ON only for 1scan a	Set control mode (0:V)
6	M1000	- TMR T0 K30
	Normally open contact	Power on delay
	T0 Power on delay	————( M0 ) Ready
13	X1 	-TORQ K100 K1000
19	X1 	- TORQ K-200 K1000
25	M0 X4	(M1040) Power on
28		END
9999		

#### Homing control/position control:

Register table in homing mode/position mode:

#### Control special M

Special M	Description of Function	Attributes
M1040	Servo On	RW
M1048	Move to new position, must use control mode as position mode (D1060 = 1) and $M1040 = 1$	RW
M1050	Absolute position/relative position (0: relative/1: absolute)	RW
	Search for origin (home start), must use control mode as position mode (D1060 = 3) and M1040 = 1	RW

#### Status special M

Special	Description of Function	Attributes
M		
M1064	Target reached	RO
M1070	Return home complete	RO
M1071	Homing error	RO

#### Control special D

Special D	Description of Function	Attributes
D1060	Operating mode setting (position mode is 1, homing mode is 3)	RW

Status special D

Special	Description of Function	Attributes
D		
D1050	Actual operating mode (speed mode is 0)	RO
D1051	Actual position (Low word)	RO
D1052	Actual position (High word)	RO

X D1051 and D1052 must be combined to give the actual location, and it has a serial number.

Position mode control commands:

DPOS(P) S1

Target (with numbers)

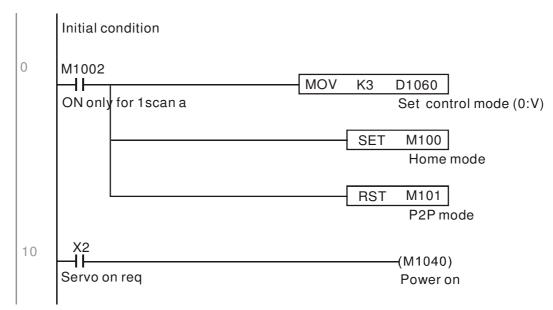
Example of homing mode/position mode control:

First complete setting of electromechanical parameters connected with position before implementing homing control or position control.

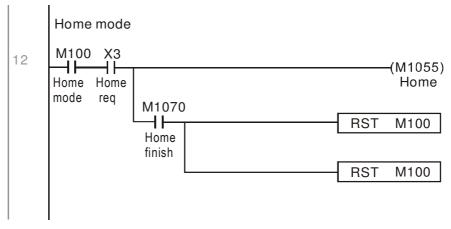
- 1. Set 00-40 to select the homing method and the corresponding limit sensors and origin. (Setting the MI function gives a reverse rotation limit of 44, a forward rotation limit of 45, and an origin proximity of 46. Because the C2000 current only supports a Z-phase origin, the encoder card must a provide Z-phase.)
- 2. Set D1060 = 3 to change the converter to the homing mode.

- Set M1040 = 1
   In the VF/SVC/VFPG mode, will enter the STANDBY mode (01-34 can be used to access the STANDBY mode's action options).
   In the FOC+PG mode, zero speed holding will occur
- 4. Set M1055 = 1, and the driver will now start to search for the origin.
- 5. When homing is complete, M1070 will change to ON. If you now set D1060 = 1, the control mode will switch to position mode (please note that M1040 will not change to off; this mechanical origin move).
- 6. The DPOS command can now be used to designate the driver's target location. M1050 or parameter 00-12 can be used to set a change in absolute or relative position.
- Implement M1048 Pulse ON once (must be more than 1 ms in duration), and the converter will begin to move toward the target (M1040 must be 1 to be effective). The current position can be obtained from D1051 and D1052.

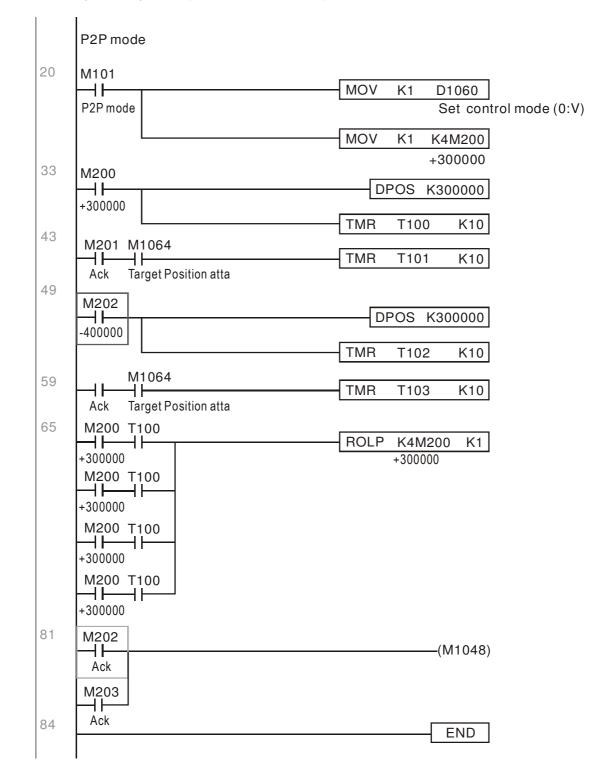
Part 1: The initialization mode is defined as the "homing" mode from the beginning (set D1060 = 3). X2 is used to implement converter excitation.



Part 2—homing: Use X3 to trigger homing action; will automatically switch to position mode after completion.



Part 3—point-to-point movement: Switch to position mode (set D1060 = 1), and move back and forth between position points. (+300000 ~ -300000)



If homing is not needed in an application, the first and second parts can be skipped. However, the M1040 condition from Part 1 must be included, and the writing method in Part 1 involve the use of X2 to achieve direct access. In addition, when M101 is used at the beginning of Part 3 to set the control mode, it can be rewritten as M1002, which will put the PLC immediately into the position mode when it starts running.

# 16-10 Internal communications main node control

The protocol has been developed in order to facilitate the use of 485 instead of CANopen in certain application situations. The 485 protocol offers similar real-time characteristics as CANopen; this protocol can only be used on the C2000 and CT2000 devices. The maximum number of slave devices is 8.

Internal communications have a master-slave structure. The initiation method is very simple:

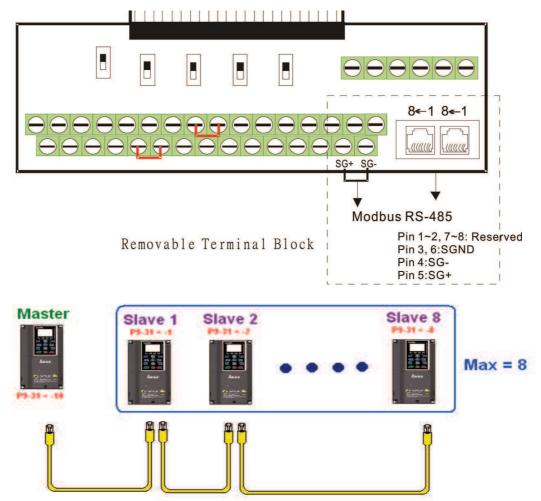
#### Slave device:

Set parameter 09-31 = -1 to -8 in order to access 8 nodes, and set parameter 00-20 = 1 to define the control source as 485 and access the reference sources that must be controlled, namely speed command (00-21 = 2), torque command (11-33 = 1), and position command (11-40=2). This will complete slave device settings. (PLC functions do not need to be activated)

#### System

Setting the master is even simpler; it is only necessary to set parameter 09-31 = -10, and enable the PLC.

Hardware wiring: The master and slave stations are connected via the 485 serial port. The C2000 provide two types of 485 serial port interfaces, see the figure below: (please refer to 06 Control terminals concerning detailed terminal connections)



Master programming: In a program, D1110 can be used to define a slave station to be controlled (1-8, if set as 0, can jump between 8 stations). Afterwards, M1035 is set as 1, and the memory positions of the master and slave stations will correspond. At this time, it is only necessary to send commands to the correlation slave station address to control that station. The following is a register table connected with internal communications:

#### Control special M

Special M	Description of Function	Attributes
M1035	Initiates internal communications control	RW

#### Control special D

Special D	Description of Function	Attributes
	Internal node communications number 1-8 (set the station number of the slave station to be controlled)	RW

			De	scription of F	Function					
Special D	Definition	bit	User rights	Speed mode	Location mode	Torque mode	Homing mode	Attributes		
				0	4	Command functions	-	-	Homing Origin	
		1	4	Reverse rotation requirements	Immediate change	-	-			
		2	4	-	-	-	-			
		3	3	Temporary pause	Temporary pause	-	-			
	-	4	4	Frequency locking	-	-	Temporary pause			
D1120 + 10*N		5	4	JOG	-	-	-	RW		
		6	2	Quick Stop	Quick Stop	Quick Stop	Quick Stop			
		7	1	Servo ON	Servo ON	Servo ON	Servo ON			
		11	11~8	4	Speed interval switching	Speed interval switching	-	-		
		13~12	4	Deceleration time change	-	-	-			
				14	4	Enable Bit 13 ~ 8	Enable Bit 13 ~ 8	-	-	
		15	4	Clear error code	Clear error code	Clear error code	Clear error code			
D1121 + 10*N	Internal node N control mode			0	1	2	3	RW		
	Internal node N reference command L			Speed command (no number)	Position command (with numbers)	Torque command (with numbers)	-	RW		
D1123 + 10*N	Internal node N reference command H			-		Speed limit	_	RW		

#### ₩ N = 0 ~ 7

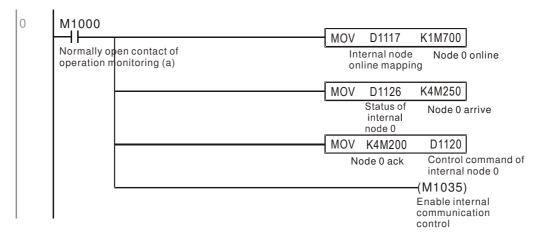
Status special D

Special D	Description of Function	Attributes
D1115	Internal node synchronizing cycle (ms)	RO
	Internal node error (bit0 = slave device 1, bit1 = slave device 2,bit7 = slave device 8)	RO
	Internal node online correspondence (bit0 = slave device 1, bit1 = slave device 2,bit7 = slave device 8)	RO

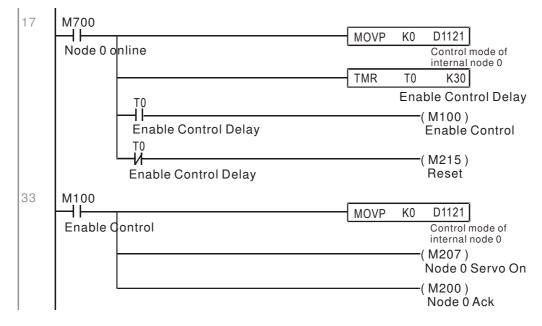
Special D			Description of	Function		Attributes
Special D	bit	Speed mode	Location mode	Torque mode	Homing mode	Allibules
	0	Frequency command	Position command	Torque command	Zero command	
	0	arrival	attained	attained	completed	
	-1	Clockwise	Clockwise	Clockwise	Clockwise	
		Counterclockwise:	Counterclockwise:	Counterclockwise:	Counterclockwise:	]
D1126 + 10*N	2	Warning	Warning	Warning	Warning	RO
	3	Error	Error	Error	Error	
	5	JOG				]
	6	Quick Stop	Quick Stop	Quick Stop	Quick Stop	]
	7	Servo ON	Servo ON	Servo ON	Servo ON	]
D1127 + 10*N		Actual fraguianay	Actual position	Actual torque		
D1127 + 10 N		Actual frequency	Actual position (with numbers)	(with numbers)	-	RO
D1128 + 10*N		-	(with humbers)	-	-	

₩ N = 0 ~ 7

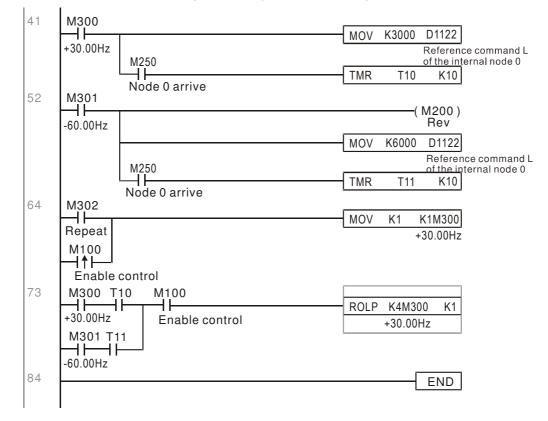
Example: Assume it is desired to control slave station 1 operation at frequencies of 30.00Hz and 60.00 Hz, status, and online node correspondences:



When it is judged that slave station 1 is online, delay 3 sec. and begin control



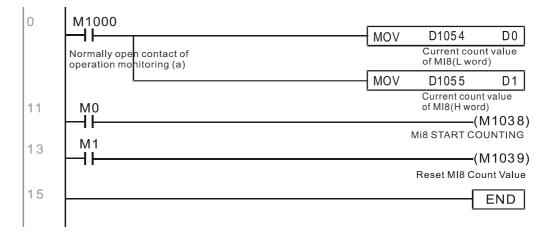
It is required slave station 1 maintain forward rotation at 30.00Hz for 1 sec., and maintain reverse rotation at 60.00 Hz for 1 sec., and repeat this cycle continuously.



# 16-11 Count function using MI8

# 16-11-1 High-speed count function

The C2000's MI8 supports one-way pulse counting, and the maximum speed is 100K. The starting method is very simple, and only requires setting M1038 to begin counting. The 32 bit count value is stored on D1054 and D1055 in non-numerical form. M1039 can reset the count value to 0.



\* When the PLC program defines MI8 for use as a high-speed counter, and also for use in PLC procedures, it must be written to M1038 or M1039, and the original MI8 functions will be disabled.

## 16-11-2 Frequency calculation function

Apart from high-speed counting, the C2000's MI8 can also convert a received pulse to frequency. The following figure shows that there is no conflict between frequency conversion and count calculations, which can be performed simultaneously.

PLC speed calculation formula D1057 Speed D1058 Interval between calculations D1059 Decimal places Assuming that there are 5 input pulses each second, (see figure below) we set D1058=1000ms=1.0 sec. as the calculation interval. This enables five pulses to be sent to the converter each second. D1058 D1058 Time Interval between calculations Assuming that each 5 pulses correspond to 1Hz, we set D1057=5.

Assuming that we wish to display numbers to two decimal places, we set D1059=2, which is also 1.00Hz. The numerical value displayed at D1056 is 100. For simplicity, the D1059 conversion formula can be expressed as in the following table:

D1058=  $\frac{\text{Pulses per second}}{\text{D1057}} \times \frac{1000}{\text{D1057}} \times 10^{\text{D1059}}$ 

# 16-12 Modbus remote IO control applications (use MODRW)

The C2000's internal PLC supports 485 read/write functions, which can be realized using the MODRW command. However, the 485 serial port must be defined as available for the PLC's 485 use before writing a program, and the parameter 09-31 must be set as -12. After completing settings, the standard functions defined by 485 can be used to implement read/write commands at other stations. Communications speed is defined by parameter 09-01, the communications format is defined by parameter 09-04, and the PLC's current station number is defined by parameter 09-35. The C2000 currently supports the functions

read coil (0x01), read input (0x02), read register (0x03), write to single register (0x06), write to several coils (0x0F), and write to several registers (0x10). Explanations and the usage of these functions are provided as follows:

	MODRW command						
S1	S2	S3	S4	S5	General	Slave device is Delta's PLC	Slave device is Delta's
Node ID	Comman d	Address	Return: D area	Length :	meaning meaning conver		converter meaning
КЗ	H01	H500	D0	K18	Read coil (Bit)	Read 18 bits of data corresponding to slave station 3 PLC Y0 to Y21. This data is stored by bit 0 to 15 of the this station's D0 and bit 0 to bit 3 of D1.	Does not support this function
K3	H02	H400	D10	K10	Read input (Bit)	Read 10 bits of data corresponding to slave station 3 PLC X0 to X11. This data is stored by bit 0 to 9 of this station's D10.	Does not support this function
КЗ	H03	H600	D20	K3	Read register (word)	Read 3 words of data corresponding to slave station 3 PLC T0 to T2. This data is stored by D20 to D22.	Read 3 words of data corresponding to slave station 3 converter parameters 06-00 to 06-02. This data is stored by D20 to D22
K3	H06	H610	D30	XX	Write to single register (word)	Write slave station 3 PLC's 116 to this	Write slave station 3 converter 06 to 16 parameter to this station's D30 value
К3	H0F	H509	D40		Write to multiple coils (Bit)	Write slave station 3 PLC's Y11 to Y22 to bit 0 to 9 of D40.	Does not support this function
K3	H10	H602	D50		Write to multiple registers (word)	Write slave station 3 PLC's 12 to 15 to	Write slave station 3 converter 06-02 to 06-05 parameters to this station's D50 to D53

※ XX indicates doesn't matter

After implementing MODRW, the status will be displayed in M1077 (485 read/write complete), M1078 (485 read/write error), and M1079 (485 read/write time out). M1077 is defined so as to immediately revert to 0 after the MODRW command has been implemented. However, any of three situations—a report of no error, a data error report, or time out with no report—will cause the status of M1077 to change to On.

Example program: Testing of various functions

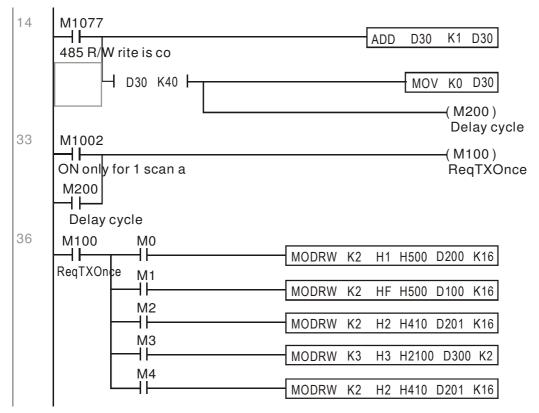
At the start, will cause the transmitted time sequence to switch to the first data unit.

)	M1002		_			
				MOV	K1	K4M0
	On only	for 1 scan a	•			

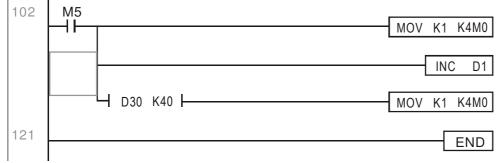
When the reported message indicates no error, it will switch to the next transmitted command

6	M1077 M1078 M1079			
		ROLP	K4M0	K1
	485 R/W 485 R/W 485 R/W			
	rite is co rite is fail rite is time 0			

If time out occurs or an error is reported, the M1077 will change to On. At this time, after a delay of 30 scanning cycles, it will re-issue the original command once



It will repeat after sending all commands



Practical applications:

Actual use to control the RTU-485 module.

Step 1: Set the communications format. Assume that the communications format is 115200, 8,N,2, RTU

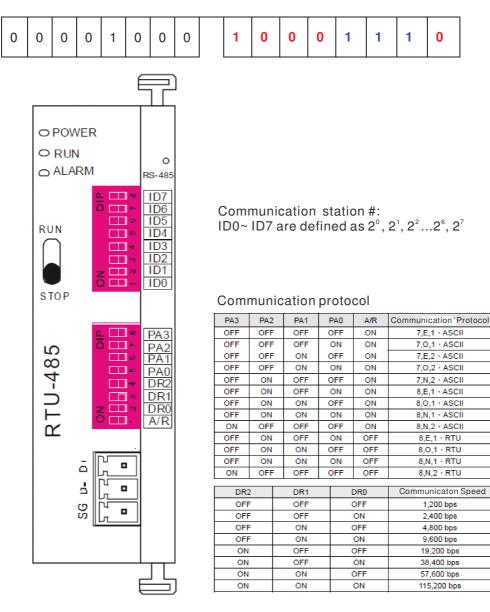
C2000 : The default PLC station number is set as 2 (09-35)

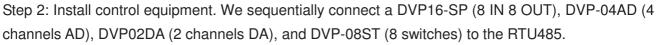
09-31=-12(COM1 is controlled by the PLC ), 09-01=115.2(The communications speed is 115200 )

09-04=13(The format is 8,N,2, RTU)

RTU485: The station number = 8 (give example)

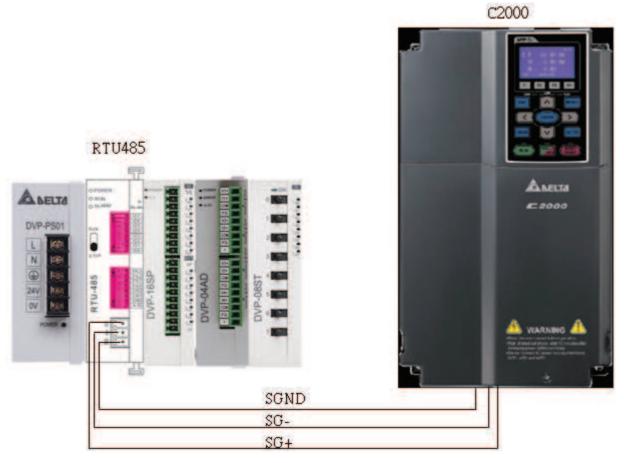


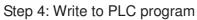




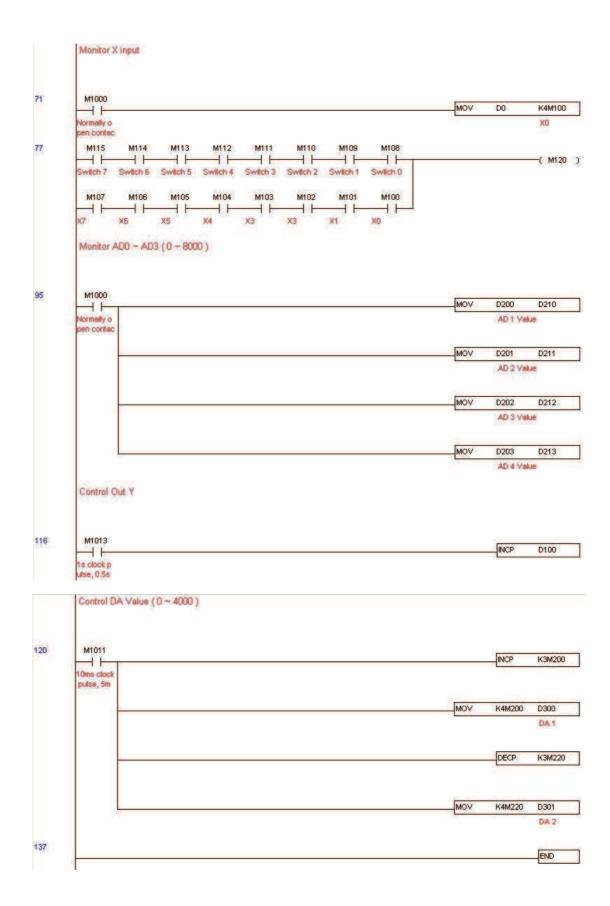
The following corresponding locations can be obtained from the RTU485's configuration definitions:

Module	Terminals	485 Address
DVP16-SP	X0 ~ X7	0400H ~ 0407H
DVF10-5F	Y0 ~ Y7	0500H ~ 0507H
DVP-04AD	AD0 ~ AD3	1600H ~ 1603H
DVP02DA	DA0 ~ DA1	1640H ~ 1641H
DVP-08ST	Switch 0 ~ 7	0408H ~ 040FH



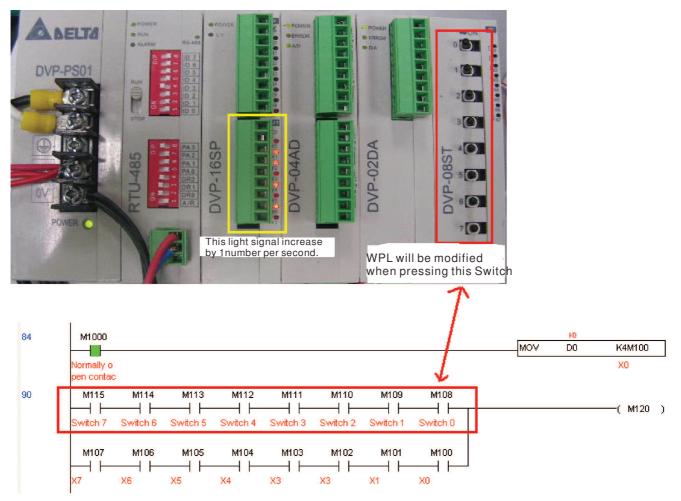


ON only fo         X input in ed           M3         I           M1002         M0           M1002         M0           M1002         M0           M1002         M0           M3         I           M48.word         M2           M50         M1           M50         M1           M50         M1           M2         MODRW           M2         M0DRW           M2         M0DRW           M2         M0DRW           M2         M0DRW           M2         M0DRW           M2         M0DRW           M1077         M1078           M1079         M1079           M1077         M1078           M1077         M1078           M1077         M1078           M1077         M1078           M1077         M1078	M1002				MOV	K1	K4M0
M1002         M0           Image: M1002         M0           Image: M1002         M0           Image: M101         M00RVV           Image: M101         M00RVV           MS0         M1           Image: M101         M00RVV           MS0         M1           Image: M101         M00RVV           MS0         M1           Image: M101         M00RVV           Image: M1011         M00RVV           M10071         M1078           Image: M1011         M1079           Image: M1011         M1071           Image: M1011         M1011	ON only fo r1 acan a M3						X Input re ad
MODRW         K8         H2         H400         D0         K16           ON only to         X input re         r1 scan e         sd	1 10 10 10 10 10 10 10 10 10 10 10 10 10						
Image: bit with the second s	ON only to X input re	MODRVV	K8	H2	H400	DO	K16
Delay cycl         Multi-Y ou           e         M2           M0DRVV         K8           M1077         M1078           M1077         M1078           M1077         M1078           M1077         M1078           M1077         ROLP           K4M0         K1           K5 read/w         K5 read/w           M1077         INC           M1077         Delay cycl           M1077         INC           M1077         Etail           M1077         M0V           K0         Datay cycl		MODRW	K8	HF	H500	D100	K8
MODRW         K8         H3         H1606         D200         K4           Word read         AD 1 Value           M1077         M1078         M1079           +         -         -         ROLP         K4M0         K1           485 read/w         485 read/w         485 read/w         X input re           rite is co         rite timeo         ed         -           M1077         INC         D30         Delay cycl         -           A65 read/w         -         -         -         -           +         D30         K10	Delay cycl Multi-Y ou						
M1077         M1078         M1079         ROLP         K4M0         K1           465 read/w         465 read/w         X input read         ad           M1077         INC         D30         Datay cycl         Datay cycl	0.3263	MODRW	K8	H3	H1606	D200	K4
Image: Non-Stread/w         K4M0         K1           485 read/w         485 read/w         X input read           485 read/w         x input read         ad           M1077         INC         D30           485 read/w         z input read         ad           930         K10         MOV         K0         D30           Delay cycl         Delay cycl         Delay cycl         Delay cycl	Word read					AD 1 Val	ue
rite is co         rite timeo         ed           M1077					ROLP	K4M0	K1
H         INC         D30           465 read/w         Delay cr         e times           +         D30         K10         MOV         K0         D30           Delay cr         Delay cr         Delay cr         Delay cr         D30					10		
465 read/w rite is co         Delay cr         Stimes           →         D30         K10         MOV         K0         D30           Delay cycl         Delay cycl         Delay cycl         Delay cycl							D30
Delay cycl Delay c	485 read/w					N.	Delay cycl e times
	ц» D30 K10 Ц				MOV	KO	D30
							Delay cycl e times

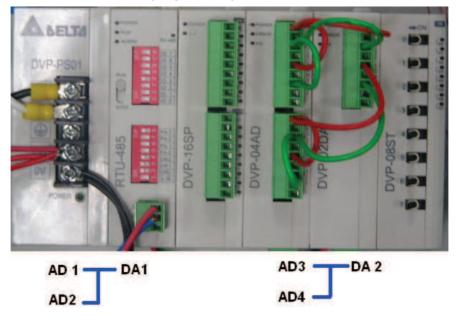


Step 5: Actual testing situation:

I/O testing: When the switch is activated, it can be discovered that the display corresponds to M115 -M108. Furthermore, it can be seen that one output point light is added every 1 sec. (the display uses a binary format)



AD DA testing: It can be discovered that D200 and D201 are roughly twice the D300, and continue to increase progressively. For their part, the D202 and D203 are roughly twice the D301, and continue to decrease progressively.



	Monitor AD0 ~ AD3 ( 0 ~ 8000 )			
108	M1000		K5152	K5152
		MOV I	D200	D210
	Normally o		AD 1 Valu	le
	pen contac			
			K5153 D201	K5153 D211
			AD 2 Valu	
				-
			K3040	K3040
			D202	D212
			AD 3 Valu	le
			K3040	K3040
			D203	D213
			AD 4 Valu	ie
	1s clock p ulse, 0.5s Control DA Value ( 0 ~ 4000 )		INCP	D100
	M1011		INCP	K3M200
133				
133	10ms clock pulse, 5m			
133	10ms clock	hiov 1	K4M200	12501 D300
133	10ms clock	MOV	K4M200	D300
133	10ms clock	MOV	K4M200	
133	10ms clock		K4M200 DECP	D300 DA 1
133	10ms clock			D300

# 16-13 Calendar functions

The C2000's internal PLC includes calendar functions, but these may only be used when a keypad (KPC-CC01) is connected, and otherwise cannot be used. Currently-support commands include TCMP (comparison of calendar data), TZCP (calendar data range comparison), TADD (calendar data addition), TSUB (calendar data subtraction), and TRD (calendar reading). Please refer to the explanation of relevant commands and functions for the usage of these commands.

In real applications, the internal PLC can judge whether calendar function have been activated; if they have been activated, calendar warning codes may be displayed in some situations. The basis for whether a calendar function has been activated is whether the program has written the calendar time (D1063 to D1069) in connection with the foregoing calendar commands or programs.

Special D	Item	Content	Attributes
D1063	Year (Western)	20xx (2000~2099)	RO
D1064	Weeks	1~7	RO
D1065	Month	1~12	RO
D1066	Day	1~31	RO
D1067	Hour	0~23	RO
D1068	Minute	0~59	RO
D1069	Second	0~59	RO

The calendar's time display is currently assigned to D1063 to D1069, and is defined as follows:

Calendar-related special M items are defined as follows:

Special D	Item	Attributes
	Calendar time error	RO
M1076	Calendar time error or refresh time out	RO
M1036	Ignore calendar warning	RW

\*When a program writes to the commands TCMP, TZCP, TADD, or TSUB, if it is discovered that a value exceeds the reasonable range, M1026 will be 1.

\*When the keypad display is PLra (RTC correction warning) or PLrt (RTC time out warning), M1076 will be ON.

\*When M1036 is 1, the PLC will ignore the calendar warning.

Calendar trigger warning code is defined as follows:

Warning	Description	Reset	Whether it affects PLC
		approach	operation
PLra	Calendar time correction	Requires	Will not have any effect
ГЦА		power restart	· · · · · · · · · · · · · · · · · · ·
PLrt	Calendar time refresh time out	Requires	Will not have any effect
FLIL	Calendar time renesh time out	power restart	

\*When the PLC's calendar functions are operating, if the keypad is replaced with another keypad, it will jump to PLra.

\*When it is discovered at startup that the keypad has not been powered for more than 7 days, or the time is wrong, PLra will be triggered.

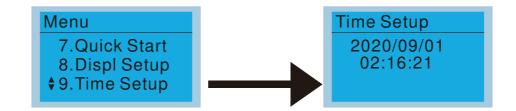
\*When it is discovered that the C2000 has no keypad 10 sec. after startup, PLrt will be triggered.

\*If the keypad is suddenly pulled out while the calendar is operating normally, and is not reconnected for more than 1 minute, PLrt will be triggered.

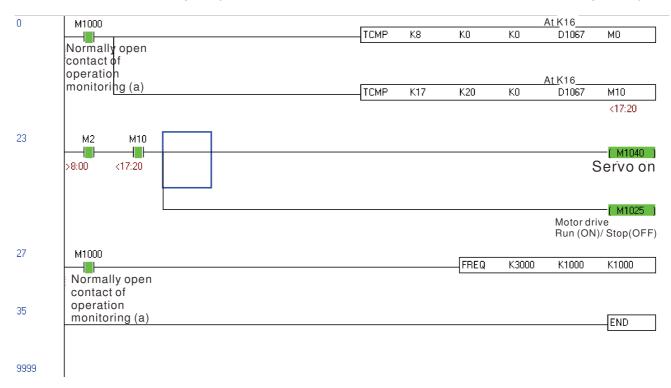
Practical applications:

We will perform a demo of simple applications.

We first correct the keypad time. After pressing Menu on the keypad, select the 9th time setting option. After selection, set the current time.



We set converter on during the period of 8:00-17:20, which allows us to write the following example



# Chapter 17 How to Select the Right AC Motor Drive

17-1 Capacity formula 17-2 General Precautions

17-3 How to choose a suitable motor

The choice of the right AC motor drive for the application is very important and has great influence on its lifetime. If the capacity of AC motor drive is too large, it cannot offer complete protection to the motor and motor maybe damaged. If the capacity of AC motor drive is too small, it cannot offer the required performance and the AC motor drive maybe damaged due to overloading.

But by simply selecting the AC motor drive of the same capacity as the motor, user application requirements cannot be met completely. Therefore, a designer should consider all the conditions, including load type, load speed, load characteristic, operation method, rated output, rated speed, power and the change of load capacity. The following table lists the factors you need to consider, depending on your requirements.

		Rel	ated Spec	d Specification				
	Item		Time	Overload	Starting			
		characteristics	ratings	capacity	torque			
Load type	Friction load and weight load Liquid (viscous) load Inertia load Load with power transmission	•			•			
Load speed and torque characteristics	Constant torque Constant output Decreasing torque Decreasing output	•	•					
Load characteristics	Constant load Shock load Repetitive load High starting torque Low starting torque	•	•	•	•			
Long-time operation	on, Short-time operation at medium/low speeds		•	•				
Maximum output current (instantaneous) Constant output current (continuous)		•		•				
Maximum frequency, Base frequency								
Power supply transformer capacity or percentage impedance Voltage fluctuations and unbalance Number of phases, single phase protection Frequency				•	•			
Mechanical friction,	losses in wiring							
Duty cycle modifica	tion							

# **17-1 Capacity Formulas**

### 1. When one AC motor drive operates one motor

The starting capacity should be less than 1.5x rated capacity of AC motor drive The starting capacity=

 $\frac{k \times N}{973 \times \eta \times \cos \varphi} \left( T_L + \frac{GD^2}{375} \times \frac{N}{t_A} \right) \leq 1.5 \times the \_capacity\_of\_AC\_motor\_drive(kVA)$ 

### 2. When one AC motor drive operates more than one motor

- 2.1 The starting capacity should be less than the rated capacity of AC motor drive
  - Acceleration time  $\leq 60$  seconds

The starting capacity=

$$\frac{k \times N}{\eta \times \cos \varphi} [n_{\tau} + n_{s}(k_{s-1})] = P_{C1} \left[ 1 + \frac{n_{s}}{n_{\tau}} (k_{s-1}) \right] \leq 1.5 \times the \_capacity\_of\_AC\_motor\_drive(kVA)$$

• Acceleration time  $\geq$  60 seconds

The starting capacity=

$$\frac{k \times N}{\eta \times \cos \varphi} [n_{\tau} + n_{s}(k_{s-1})] = P_{C1} \left[ 1 + \frac{n_{s}}{n_{\tau}}(k_{s-1}) \right] \leq the \_capacity\_of\_AC\_motor\_drive(kVA)$$

- 2.2 The current should be less than the rated current of AC motor drive(A)
  - Acceleration time  $\leq 60$  seconds

$$|n_{\tau} + I_M| 1 + \frac{n_s}{n_{\tau}} (k_{s-1})| \le 1.5 \times the \_rated \_current\_of \_AC\_motor\_drive(A)$$

• Acceleration time  $\geq 60$  seconds

$$n_{T} + I_{M} \Big[ 1 + \frac{n_{s}}{n_{T}} (k_{s} - 1) \Big] \leq the \_rated \_current\_of \_AC\_motor\_drive(A)$$

- 2.3 When it is running continuously
  - The requirement of load capacity should be less than the capacity of AC motor drive(kVA) The requirement of load capacity=

$$\frac{k \times P_M}{\eta \times \cos \varphi} \le the \_capacity\_of\_AC\_motor\_drive(kVA)$$

■ The motor capacity should be less than the capacity of AC motor drive

 $k \times \sqrt{3} \times V_M \times I_M \times 10^{-3} \le the\_capacity\_of\_AC\_motor\_drive(kVA)$ 

■ The current should be less than the rated current of AC motor drive(A)

 $k \times I_M \leq the\_rated\_current\_of\_AC\_motor\_drive(A)$ 

#### Symbol explanation

- $P_M$  : Motor shaft output for load (kW)
- $\eta$  : Motor efficiency (normally, approx. 0.85)
- $\cos \varphi$  : Motor power factor (normally, approx. 0.75)
- *V<sub>M</sub>* : Motor rated voltage(V)
- $I_M$  : Motor rated current(A), for commercial power
- *k* : Correction factor calculated from current distortion factor (1.05-1.1, depending on PWM method)
- *P*<sub>C1</sub> : Continuous motor capacity (kVA)
- *ks* : Starting current/rated current of motor
- $n_T$  : Number of motors in parallel
- *ns* : Number of simultaneously started motors
- $GD^2$  : Total inertia (GD<sup>2</sup>) calculated back to motor shaft (kg m<sup>2</sup>)
- *T*<sup>*L*</sup> : Load torque
- *t*<sub>A</sub> : Motor acceleration time
- N : Motor speed

## **17-2 General Precaution**

#### **Selection Note**

- When the AC Motor Drive is connected directly to a large-capacity power transformer (600kVA or above) or when a phase lead capacitor is switched, excess peak currents may occur in the power input circuit and the converter section may be damaged. To avoid this, use an AC input reactor (optional) before AC Motor Drive mains input to reduce the current and improve the input power efficiency.
- When a special motor is used or more than one motor is driven in parallel with a single AC Motor Drive, select the AC Motor Drive current ≥1.25x(Sum of the motor rated currents).
- 3. The starting and accel./decel. characteristics of a motor are limited by the rated current and the overload protection of the AC Motor Drive. Compared to running the motor D.O.L. (Direct On-Line), a lower starting torque output with AC Motor Drive can be expected. If higher starting torque is required (such as for elevators, mixers, tooling machines, etc.) use an AC Motor Drive of higher capacity or increase the capacities for both the motor and the AC Motor Drive.
- 4. When an error occurs on the drive, a protective circuit will be activated and the AC Motor Drive output is turned off. Then the motor will coast to stop. For an emergency stop, an external mechanical brake is needed to quickly stop the motor.

#### **Parameter Settings Note**

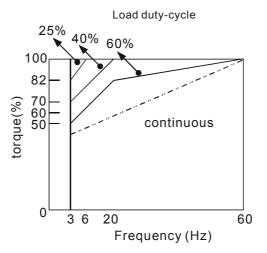
- 1. The AC Motor Drive can be driven at an output frequency up to 400Hz (less for some models) with the digital keypad. Setting errors may create a dangerous situation. For safety, the use of the upper limit frequency function is strongly recommended.
- 2. High DC brake operating voltages and long operation time (at low frequencies) may cause overheating of the motor. In that case, forced external motor cooling is recommended.
- 3. Motor accel./decel. time is determined by motor rated torque, load torque, and load inertia.
- 4. If the stall prevention function is activated, the accel./decel. time is automatically extended to a length that the AC Motor Drive can handle. If the motor needs to decelerate within a certain time with high load inertia that can't be handled by the AC Motor Drive in the required time, either use an external brake resistor and/or brake unit, depending on the model, (to shorten deceleration time only) or increase the capacity for both the motor and the AC Motor Drive.

### 17-3 How to Choose a Suitable Motor

#### Standard motor

When using the AC Motor Drive to operate a standard 3-phase induction motor, take the following precautions:

- 1. The energy loss is greater than for an inverter duty motor.
- 2. Avoid running motor at low speed for a long time. Under this condition, the motor temperature may rise above the motor rating due to limited airflow produced by the motor's fan. Consider external forced motor cooling.
- 3. When the standard motor operates at low speed for long time, the output load must be decreased.
- 4. The load tolerance of a standard motor is as follows:



- 5. If 100% continuous torque is required at low speed, it may be necessary to use a special inverter duty motor.
- 6. Motor dynamic balance and rotor endurance should be considered once the operating speed exceeds the rated speed (60Hz) of a standard motor.
- 7. Motor torque characteristics vary when an AC Motor Drive instead of commercial power supply drives the motor. Check the load torque characteristics of the machine to be connected.
- 8. Because of the high carrier frequency PWM control of the VFD series, pay attention to the following motor vibration problems:
  - Resonant mechanical vibration: anti-vibration (damping) rubbers should be used to mount equipment that runs at varying speed.
  - Motor imbalance: special care is required for operation at 50 or 60 Hz and higher frequency.
  - To avoid resonances, use the Skip frequencies.
- 9. The motor fan will be very noisy when the motor speed exceeds 50 or 60Hz.

#### Special motors:

1. Pole-changing (Dahlander) motor:

The rated current is differs from that of a standard motor. Please check before operation and select the capacity of the AC motor drive carefully. When changing the pole number the motor needs to be stopped first. If over current occurs during operation or regenerative voltage is too high, please let the motor free run to stop (coast).

2. Submersible motor:

The rated current is higher than that of a standard motor. Please check before operation and choose the capacity of the AC motor drive carefully. With long motor cable between AC motor drive and motor, available motor torque is reduced.

3. Explosion-proof (Ex) motor:

Needs to be installed in a safe place and the wiring should comply with the (Ex) requirements. Delta AC Motor Drives are not suitable for (Ex) areas with special precautions.

4. Gear reduction motor:

The lubricating method of reduction gearbox and speed range for continuous operation will be different and depending on brand. The lubricating function for operating long time at low speed and for high-speed operation needs to be considered carefully.

5. Synchronous motor:

The rated current and starting current are higher than for standard motors. Please check before operation and choose the capacity of the AC motor drive carefully. When the AC motor drive operates more than one motor, please pay attention to starting and changing the motor.

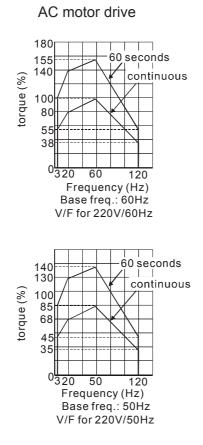
#### **Power Transmission Mechanism**

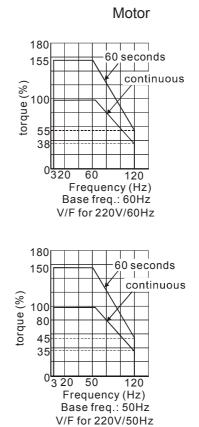
Pay attention to reduced lubrication when operating gear reduction motors, gearboxes, belts and chains, etc. over longer periods at low speeds. At high speeds of 50/60Hz and above, lifetime reducing noises and vibrations may occur.

#### Motor torque

The torque characteristics of a motor operated by an AC motor drive and commercial mains power are different.

Below you'll find the torque-speed characteristics of a standard motor (4-pole, 15kW):





## Chapter 18 Suggestions and Error Corrections for Standard AC Motor Drives

18-1 Maintenance and Inspections
18-2 Greasy Dirt Problem
18-3 Fiber Dust Problem
18-4 Erosion Problem
18-5 Industrial Dust Problem
18-6 Wiring and Installation Problem
18-7 Multi-function Input/Output Terminals Problem

The AC motor drive has a comprehensive fault diagnostic system that includes several different alarms and fault messages. Once a fault is detected, the corresponding protective functions will be activated. The following faults are displayed as shown on the AC motor drive digital keypad display. The six most recent faults can be read from the digital keypad or communication.

The AC motor drive is made up by numerous components, such as electronic components, including IC, resistor, capacity, transistor, and cooling fan, relay, etc. These components can't be used permanently. They have limited-life even under normal operation. Preventive maintenance is required to operate this AC motor drive in its optimal condition, and to ensure a long life.

Check your AC motor drive regularly to ensure there are no abnormalities during operation and follows the precautions:

	V	Wait 5 seconds after a fault has been cleared before performing reset via keypad of
		input terminal.
	$\checkmark$	When the power is off after 5 minutes for $\leq$ 22kW models and 10 minutes for $\geq$
CAUTION		30kW models, please confirm that the capacitors have fully discharged by
		measuring the voltage between + and The voltage between + and - should be less
		than 25VDC.
	V	Only qualified personnel can install, wire and maintain drives. Please take off any
		metal objects, such as watches and rings, before operation. And only insulated tools
		are allowed.
	$\checkmark$	Never reassemble internal components or wiring.
	$\checkmark$	Make sure that installation environment comply with regulations without abnormal
		noise, vibration and smell.

## 18-1 Maintenance and Inspections

Before the check-up, always turn off the AC input power and remove the cover. Wait at least 10 minutes after all display lamps have gone out, and then confirm that the capacitors have fully discharged by measuring the voltage between DC+ and DC-. The voltage between DC+ and DC-should be less than 25VDC.

#### **Ambient environment**

Check Items	Methods and Criterion	Maintenance Period			
		Daily	Half Year	One Year	
Check the ambient temperature, humidity,	Visual inspection and				
vibration and see if there are any dust, gas,	measurement with equipment	$\bigcirc$			
oil or water drops	with standard specification				
If there are any dangerous objects	Visual inspection	$\bigcirc$			

#### Voltage

Check Items	Methods and Criterion	Maintenance Period			
		Daily	Half Year	One Year	
Check if the voltage of main circuit and	Measure with multimeter with	$\bigcirc$			
control circuit is correct	standard specification				

#### **Digital Keypad Display**

Check Items	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
Is the display clear for reading	Visual inspection	0		
Any missing characters	Visual inspection	0		

#### **Mechanical parts**

Check Items	Methods and Criterion	Maintenance Period		
	-	Daily	Half Year	One Year
If there is any abnormal sound or vibration	Visual and aural inspection		$\bigcirc$	
If there are any loose screws	Tighten the screws		0	
If any part is deformed or damaged	Visual inspection		0	
If there is any color change by overheating	Visual inspection		$\bigcirc$	
If there is any dust or dirt	Visual inspection		0	

#### Main circuit

		Maintenance Period			
Check Items	Methods and Criterion				
		Daily	Half Year	One Year	
If there are any loose or missing screws	Tighten or replace the screw	0			
If machine or insulator is deformed, cracked,	Visual inspection				
damaged or with color change due to	NOTE: Please ignore the		$\bigcirc$		
overheating or ageing	color change of copper		$\bigcirc$		
	plate				
If there is any dust or dirt	Visual inspection		$\bigcirc$		

#### Terminals and wiring of main circuit

	Methods and Criterion	Maintenance			
Check Items			Period Half	One	
		Daily	Year	Year	
If the terminal or the plate is color change or	Visual inspection		$\bigcirc$		
deformation due to overheat					
If the insulator of wiring is damaged or color	Visual inspection		0		
change					
If there is any damage	Visual inspection	0			

#### DC capacity of main circuit

Check Items	Methods and Criterion	Maintenance Period			
		Daily	Half Year	One Year	
If there is any leak of liquid, color change, crack or deformation	Visual inspection	0			
If the safety valve is not removed? If valve is inflated?	Visual inspection	0			
Measure static capacity when required		0			

#### **Resistor of main circuit**

		Maintenance			
Check Items	Methods and Criterion	Period			
		Daily	Half Year	One Year	
If there is any peculiar smell or insulator	Visual inspection, smell	$\bigcirc$			
cracks due to overheat					
If there is any disconnection	Visual inspection	0			
If connection is damaged?	Measure with multimeter with	0			
	standard specification				

#### Transformer and reactor of main circuit

Check Items	Methods and Criterion	Maintenance Period			
		Daily	Half Year	One Year	
If there is any abnormal vibration or peculiar	Visual, aural inspection and	$\cap$			
smell	smell				

#### Magnetic contactor and relay of main circuit

Check Items	Methods and Criterion	Maintenance Period			
		Daily	Half Year	One Year	
If there are any loose screws	Visual and aural inspection	0			
If the contact works correctly	Visual inspection	0			

#### Printed circuit board and connector of main circuit

		Maintenance			
Check Items	Methods and Criterion	Period			
		Daily	Half Year	One Year	
	Tighten the screws and		$\bigcirc$		
If there are any loose screws and connectors	press the connectors firmly				
	in place.				
If there is any peculiar smell and color change	Visual and smell inspection		0		
If there is any crack, damage, deformation or corrosion	Visual inspection		0		
If there is any liquid is leaked or deformation in capacity	Visual inspection		0		

#### Cooling fan of cooling system

		Maintenance			
Check Items	Methods and Criterion	Period			
		Daily	Half Year	One Year	
	Visual, aural inspection and				
	turn the fan with hand (turn				
If there is any abnormal sound or vibration	off the power before		$\bigcirc$		
	operation) to see if it rotates				
	smoothly				
If there is any loose screw	Tighten the screw		0		
If there is any color change due to overheat	Change fan		0		

#### Ventilation channel of cooling system

	Check Items Methods and Criterion		Maintenance		
Check Items			Period		
		Daily	Half	One	
		Daily	Year	Year	
If there is any obstruction in the heat sink, air	Visual inspection		0		
intake or air outlet					



Please use the neutral cloth for clean and use dust cleaner to remove dust when necessary.

## 18-2 Greasy Dirt Problem

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

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

#### Solution:

Install the AC motor drive in a standard cabinet to keep it away from dirt. Clean and remove greasy dirt regularly to prevent damage of the drive.





## 18-3 Fiber Dust Problem

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

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

#### Solution:

Install the AC motor drive in a standard cabinet to keep it away from fiber dust. Clean and remove fiber dust regularly to prevent damage to the drive.





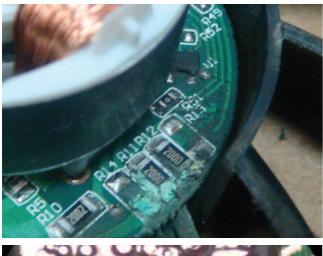


## 18-4 Erosion Problem

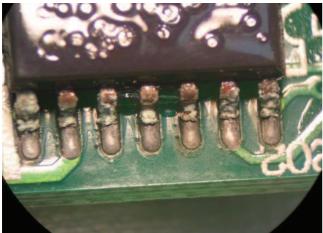
Erosion problems may occur if any fluids flow into the drives. Please be aware of the damages that erosion may cause to your drive.

1. Erosion of internal components may cause the drive to malfunction and possibility to explode. **Solution:** 

Install the AC motor drive in a standard cabinet to keep it away from fluids. Clean the drive regularly to prevent erosion.







## 18-5 Industrial Dust Problem

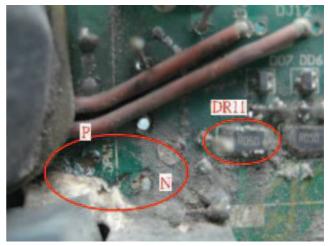
Serious industrial dust pollution frequently occurs in stone processing plants, flour mills, cement plants, and so on. Please be aware of the possible damage that industrial dust may cause to your drives:

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

#### Solution:

Install the AC motor drive in a standard cabinet and cover the drive with a dust cover. Clean the cabinet and ventilation hole regularly for good ventilation.





## 18-6 Wiring and Installation Problem

When wiring the drive, the most common problem is wrong wire installation or poor wiring.

Please be aware of the possible damages that poor wiring may cause to your drives:

- 1. Screws are not fully fastened. Occurrence of sparks as impedance increases.
- 2. If a customer has opened the drive and modified the internal circuit board, the internal components may have been damaged.

#### Solution:

Ensure all screws are fastened when installing the AC motor drive. If the AC motor drive functions abnormally, send it back to the repair station. DO NOT try to reassemble the internal components or wire.







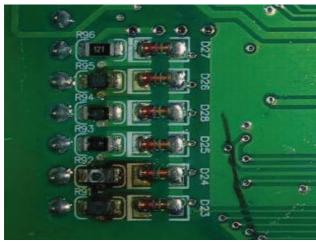
## 18-7 Multi-function Input/Output Terminals Problem

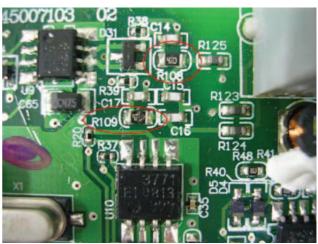
Multi-function input/output terminal errors are generally caused by over usage of terminals and not following specifications. Please be aware of the possible damages that errors on multi-function input/output terminals may cause to your drives:

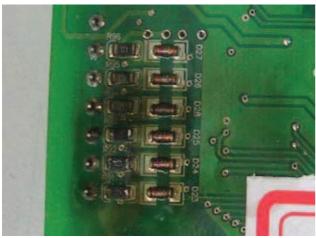
1. Input/output circuit may burns out when the terminal usage exceeds its limit.

#### Solution:

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









# **AC Motor Drives**

## EMC Standard Installation Guide EMC Compliance Practice



When an AC motor drive is installed in a noisy environment, radiated and/or conducted noise via signal and power cables can interfere with the correct functioning, cause errors or even damage to the drive. To prevent this, some AC motor drives have an enhanced noise resistance but the results are limited and it is not economical. Therefore, an effective method would be finding the cause of the noise and use the right solution to achieve "no emission, no transmission and no reception of noise". All three solutions should be applied.

#### **Finding the Noise**

- Ascertain whether the error is caused by noise.
- Find the source of the noise and its transmission path.
- Confirm the signal and the source of noise

#### Solutions

- Grounding
- Shielding
- Filtering

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#### 1.1 What is EMC?

Electromagnetic Compatibility (EMC) is the ability of an electrical device to function properly in electromagnetic environments. It does not emit electromagnetic noise to surrounding equipment and is immune to interference from surrounding equipment. The goal is to achieve high immunity and low emission; these two properties define the quality of EMC. In general, electrical devices react to high and low frequency phenomena. High frequency phenomena are electrostatic discharge (ESD); pulse interference; radiated electromagnetic field; and conducted high frequency electrical surge. Low frequency phenomena refer to mains power harmonics and imbalance.

The standard emission and immunity levels for compliance depend on the installation location of the drive. A Power Drive System (PDS) is installed in an industrial or domestic environment. A PDS in a domestic environment must have lower emission levels and is allowed to have lower immunity levels. A PDS in an industrial environment is allowed to have higher emission levels but must have more severe immunity levels.

#### **1.2 EMC for AC Motor Drive**

When an AC motor drive is put into operation, harmonic signal will occur at the AC drive's power input and output side. It creates a certain level of electromagnetic interference to the surrounding electrical devices and the mains power network. An AC motor dive is usually applied in industrial environments with a strong electromagnetic interference. Under such conditions, an AC drive could disturb or be disturbed.

Delta's AC motor drives are designed for EMC and comply with EMC standard EN61800-3 2004. Installing the AC motor drive accurately will decrease EMI influences and ensure long term stability of the electricity system. It is strongly suggested to follow Delta's user manual for wiring and grounding. If any difficulties or problems arise, please follow the instructions and measures as indicated in this EMC Standard Installation Guide.

#### 2.1 Types of EMI: Common-mode and differential-mode noise

The electromagnetic noise of an AC motor drive can be distinguished into common-mode and differential-mode noise. Differential-mode noise is caused by the stray capacitance between the conducting wires and common-mode noise is caused by the common-mode coupling current path created by the stray capacitance between the conducting wires and ground.

Basically, differential-mode noise has a greater impact to the AC motor drive and common-mode noise has a greater impact to high-sensitivity electronic devices. An excessive amount of differential-mode noise may trigger the circuit protection system of the AC motor drive. Common-mode noise affects peripheral electronic devices via the common ground connection.

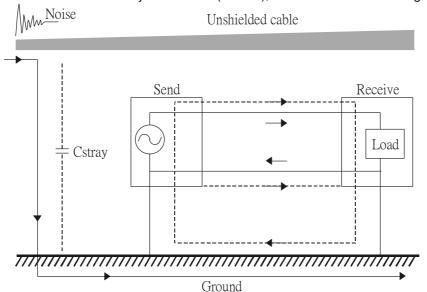
EMC problems can be more serious when the following conditions apply:

- When a large horsepower AC motor drive is connected to a large horsepower motor.
- The AC motor drive's operation voltage increases.
- Fast switching of the IGBTs.
- When a long cable is used to connect the motor to the AC motor drive.

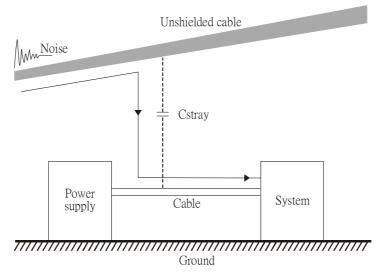
#### 2.2 How does EMI transmit? (Noise transmission path)

Noise disturbs peripheral high-sensitivity electrical devices/systems via conduction and radiation, their transmission paths are shown hereafter:

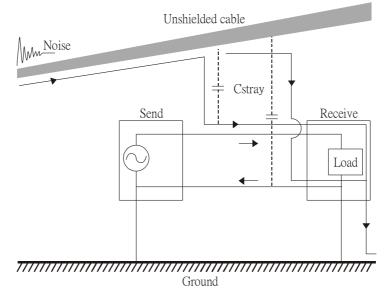
1. Noise current in the unshielded power cable is conducted to ground via stray capacitances into a common-mode voltage. Whether or not other modules are capable to resist this common-mode noise depends on their Common-Mode Rejection Ratio (CMRR), as shown in the following figure.



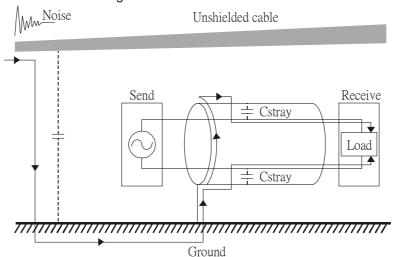
2. Common-mode noise in the power cable is transmitted through the stray capacitance and coupled into the adjacent signal cable, as shown in Figure 2. Several methods can be applied to reduce the effect of this common-mode noise; for example, shield the power cable and/or the signal cables, separate the power and signal cables, take the input and output side of the signal cable and twist them together to balance out the stray capacitance, let power cables and signal cables cross at 90°, etc.



3. Common-mode noise is coupled via the power cable to other power systems then the cable of such a power system is coupled to the transmission system, as shown in Figure 3.



4. The common-mode noise of an unshielded power cable is transmitted to the ground via the stray capacitance. Since both shielded wire and unshielded wire are connected to a common ground, other systems can be interfered with by the common-mode noise that is transmitted from the ground back to the system via the shield. See Figure 4.



5. When excessive pulse modulated currents pass through an un-grounded AC drive cable, it acts as an antenna and creates radiated interference.

## Chapter 3 Solution to EMI: Grounding

The leakage current of an electronic equipment is conducted to ground via the grounding wire and the ground electrode. According to Ohm's law, potential differences may arise when the electrode's ground and the ground's ground resistance are different.

According to Ohm's law, the earth resistance for electrode and the ground are different, in this case potential differences may arise.

#### 3.1 Protective Grounding & Functional Grounding

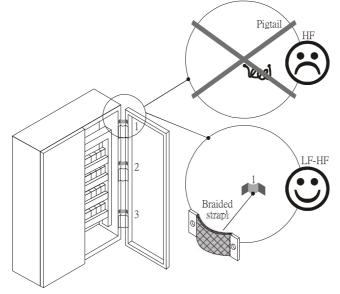
Please carefully read the following instruction if two types of grounding are applied at the same time.

Protective grounding is applied outside buildings and must have low resistance. On the other hand, functional grounding can be applied inside buildings and must have low impedance.

The goal of EMC is to avoid any interference effects. Grounding for EMC can be distinguished by frequency. For frequencies lower than 10kHz, a *single-point ground* system should be used and for frequencies higher than 10 kHz, a *multiple point ground* system should be used.

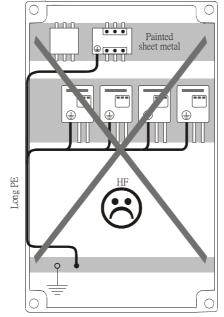
- Single Point Grounding: all signal grounds of all IT equipment are connected in series to form a single reference point. This point can be grounded directly to earth; to the designated grounding point or to the safety point that is already grounded.
- Multiple Point Grounding: all signals of all IT equipment are grounded independently.
- *Hybrid Grounding:* this type of grounding behaves differently for low and high frequencies. When two pieces of IT equipment (A and B) are connected via a shielded cable, one end is connected directly to ground while the other end is connected to ground via a capacitor. This type of grounding system fulfils the criteria for high and low frequency grounding.
- Floating grounding: the signals of all IT equipment are isolated from each other and are not grounded.

DC current flows evenly throughout the conductor section. But AC current flows towards the conductor's surface as frequency increases; this is called the "skin effect". It causes the effective cross-section area to be reduced with increasing frequency. Therefore it is suggested to increase the effective ground cross-section area for high frequencies by replacing pigtail grounding by braided conductors or strip conductors. Refer to the following figure.



This is why a thick short ground wire must be implemented for connecting to the common grounding path or the ground busbar. Especially when a controller (e.g. PLC) is connected to an AC motor drive, it must be grounded by a short and thick conducting wire. It is suggested to use a flat braided conductor (ex: metal mesh) with a lower impedance at high frequencies.

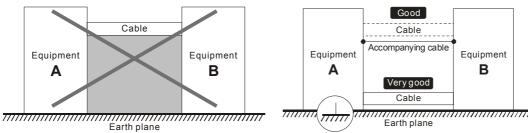
If the grounding wire is too long, its inductance may interfere structure of the building or the control cabinet and form mutual inductance and stray capacitance. As shown in the following figure, a long grounding wire could become a vertical antenna and turn into a source of noise.



#### 3.2 Ground Loops

A *ground loop* occurs when the pieces of equipment are connected to more than one grounding path. In this case, the ground current may return to the grounding electrode via more than one path. There are three methods to prevent ground loops

- 1. Use a common power circuit
- 2. Single point grounding
- 3. Isolate signals, e.g. by photocouplers



In order to avoid "Common Mode Noise", please use parallel wires or twisted pair wiring. Follow this rule and also avoid long wires, it is suggested to place the two wires as close to each other as possible.

#### 3.3 Earthing Systems

•

The international standard IEC60364 distinguishes three different earthing system categories, using the two-letter codes TN, TT, IT.

• The *first letter* indicates the type of earthing for the power supply equipment (generator or transformer).

**T**: One or more points of the power supply equipment are connected directly to the same earthing point.

I: Either no point is connected to earth (isolated) or it is connected to earth via a high impedance.

The second letter indicates the connection between earth and the power supply equipment.
 T: Connected directly to earth (This earthing point is separate from other earthing points in the power supply system.)

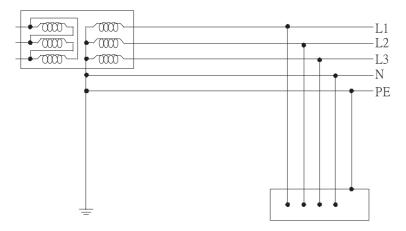
N: Connected to earth via the conductor that is provided by the power supply system

- The *third and forth letter* indicate the location of the earth conductor.
- S: Neutral and earth conductors are separate
  - C: Neutral and earth are combined into a single conductor

#### **TN system**

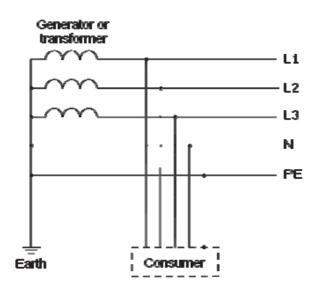
**TN***:* The neutral point of the low voltage transformer or generator is earthed, usually the star point in a three-phase system. The body of the electrical device is connected to earth via this earth connection at the transformer.

*protective earth (PE)*: The conductor that connects the exposed metallic parts of the consumer. *neutral (N)*: The conductor that connects to the start point in a 3-phase system or that carries the return current in a single phase system.



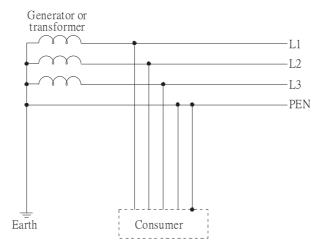
#### **TN-S system**

**TN-S**: PE and N are two separate conductors that are combined together only near the power source (transformer or generator). It is the same as a three-phase 5-wire system.



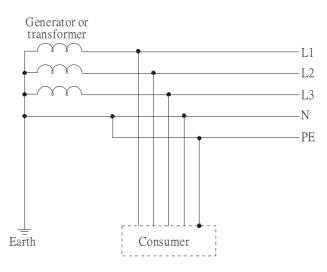
#### **TN-C** system

**TN-C**: PE and N are two separate conductors in an electrical installation similar to a three-phase 5wire system, but near the power side, PE and N are combined into a PEN conductor similar to a three-phase 4 wire system.



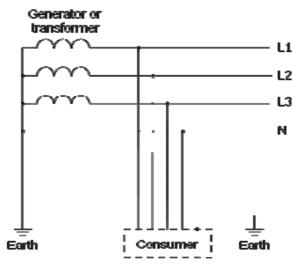
#### **TN-C-S** system

**TN-C-S**: A combined earth and neutral system (PEN conductor) is used in certain systems but eventually split up into two separate conductors PE and N. A typical application of combined PEN conductor is from the substation to the building but within the building PEN is separated into the PE and N conductors. Direct connection of PE and N conductors to many earthing points at different locations in the field will reduce the risk of broken neutrals. Therefore this application is also known as *protective multiple earthing (PME)* in the UK or as *multiple earthed neutral (MEN)* in Australia



#### **TT system**

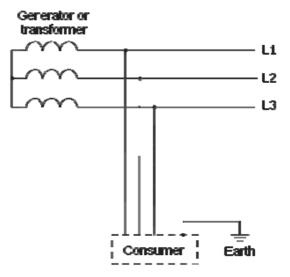
**TT**: The neutral point (N) of the low voltage transformer and the equipment frames (PE) are connected to a separate earthing point. The Neutral (N) of the transformer and electrical equipment are connected.



#### **IT system**

**IT**: The neutral point of the transformer and electrical equipment are not earthed, only the equipment frames PE are earthed.

In the IT network, the power distribution system Neutral is either not connected to earth or is earthed via a high impedance. In such a system, an insulated monitoring device is used for impedance monitoring. A built-in filter should be disconnected by the RFI-jumper and an external filter should not be installed



when the AC motor drive or the AC servo motor drive is connected to an IT system.

#### Criteria for earthing system and EMC

	TN-S	TN-C	TT	IT
Safety of	Good	Good	Good	Good
Personnel				
	Continuity of the PE conductor must be ensured throughout the installation	Continuity of the PE conductor must be ensured throughout the installation	RCD is mandatory	Continuity of the PE conductor must be ensured throughout the installation
Safety of property	Poor	Poor	Good	Good
	High fault current (around 1kA)	High fault current (around 1kA)	Medium fault current (< a few dozen amperes)	Low current at the first fault (< a few dozen mA) but high current at the second fault

Availability of energy	Good	Good	Good	Excellent
EMC behavior	Excellent	Poor (prohibited)	Good	Poor (should be avoided)
	Few equipotential Problems:	- Neutral and PE are the same	- Over-voltage risk - Equipotential	- Over-voltage risk - Common–mode
	<ul> <li>Need to handle the high leaking currents problem of the device</li> <li>High fault current (transient disturbances)</li> </ul>	<ul> <li>Circulation of disturbance currents in exposed conductive parts (high magnetic-field radiation)</li> <li>High fault currents (transient distinguised)</li> </ul>	Problems: - Need to handle the high leaking currents problem of the device - RCD (Residual- current device)	filters and surge arrestors must handle the phase to phase voltage. - RCDs subject to nuisance tripping when common- mode capacitors
		disturbances)		are present - Equivalent to TN system for second fault

#### 4.1 What is Shielding?

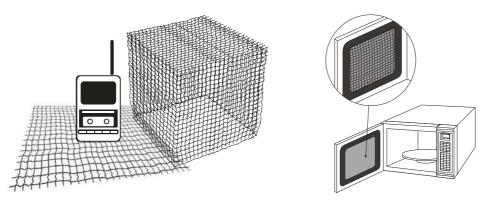
*Electrostatic shielding* is used to isolate equipment so that it will not create electromagnetic field interference or be influenced by an external electromagnetic field. A conductive material is used for electrostatic shielding to achieve this isolation.

A *Faraday cage* can be made from a mesh of metal or a conductive material. One characteristic of metal is that it is highly conductive and not electrostatic,, which offers shielding and prevents interference by external electrical fields. Metal with its high conductivity protects the internal devices from high voltages—no voltage will enter the cage even when the cage is experiencing a high current. In addition, electromagnetic fields can also pass through the Faraday cage without causing any disturbance.

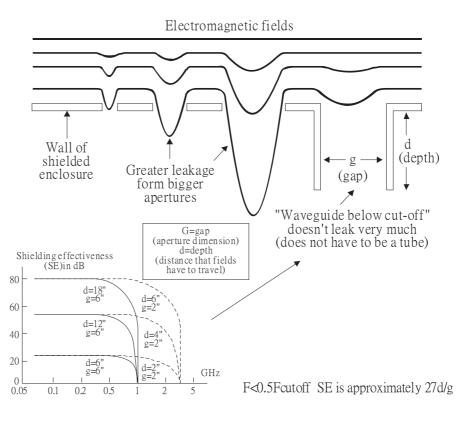
Electromagnetic shielding is applied to some electrical devices and measurement equipment for the purpose of blocking interference. Examples of shielding include:

- earth high-voltage indoor equipment using a metal frame or a high-density metal mesh
- shielding a power transformer is achieved by wrapping a metal sheet between the primary and secondary windings or by adding an enamel wire to the winding wire which is then earthed.
- a shielding coating, which is made of metal mesh or conductive fibres to provide effective protection for the workers who work in a high-voltage environment.

In the picture below, the radio appears to be not fully covered by metal but if the conductivity of the metal is high, radio waves are completely blocked and the radio will not receive any signal.



Mobile phone connections are also established through the transmission of radio waves. This is why the mobile phone reception is often cut off when we walk into an elevator. The metal walls of the elevator create the same shielding effect just as if we had entered a metal cage. Another example is a microwave oven. The microwave door may seem transparent in visible light, but the density of the metal mesh in the microwave door blocks the electromagnetic waves. A higher density of the metal mesh offers better shielding.



#### 4.2 How to reduce EMI by Shielding?

Iron and other metals are high conductivity materials that provide effective shielding at extremely low frequencies. But conductivity will decrease as:

- 1. High frequency signals are applied to the conductor.
- 2. Equipment is located in a strong magnetic field
- 3. The shielding frame is forced into a specific form by machines.

It is difficult to select a suitable high-conductivity material for shielding without the help from a shielding material supplier or a related EMI institution.

#### Metallic Shielding Effectiveness

is:

Shielding Effectiveness (SE) is used to assess the applicability of the shielding shell. The formula

SEdB=A+R+B (Measures in dB) where A= Absorption loss (dB) R= Reflection loss (dB) B= Correction factor (dB) (for multiple reflections in thin shields)

The absorption loss refers to the amount of energy loss as the electromagnetic wave travels through the shield. The formula is:

AdB=1.314(fσμ)1/2t	where	f= frequency (MHz)
		µ= permeability relative to copper
		$\sigma$ = conductivity relative to copper
		t= thickness of the shield in centimetres

The reflection loss depends on the source of the electromagnetic wave and the distance from that source. For a rod or straight wire antenna, the wave impedance increases as it moves closer to the source and decreases as it moves away from the source until it reaches the plane wave impedance (377) and shows no change. If the wave source is a small wire loop, the magnetic field is dominant and the wave impedance decreases as it moves closer to the source and increases as it moves away from the source; but it levels out at 377 when the distance exceeds one-sixth of the wavelength.

#### **Electrical Cabinet Design**

In a high frequency electric field, shielding can be achieved by painting a thin layer of conductive metal on the enclosure or on the internal lining material. However, the coating must be thorough and all parts should be properly covered without any seams or gaps (just like a Faraday cage). That is only the ideal. Making a seamless shielding shell is practically impossible since the cage is composed of metal parts. In some conditions, it is necessary to drill holes in the shielding enclosure for installation of accessories (like optional cards and other devices).

- 1. If the metallic components are properly welded using sophisticated welding technology to form an electrical cabinet, deformation during usage is unlikely to occur. But if the electrical cabinet is assembled with screws, the protective insulating layer under the screw must be properly removed before assembly to achieve the greatest conductivity and best shielding.
- 2. Drilling holes for the installation of wires in the electrical cabinet lowers the shielding effectiveness and increases the chance of electric waves leaking through the openings and emitting interference. We recommend that the drilled holes are as narrow as possible. When the wiring holes are not used, properly cover the holes with metal plates or metal covers. The paint or the coating of the metal plate and metal cover should be thoroughly removed to ensure a metal-to-metal contact or a conductive gasket should be installed.
- 3. Install industrial conductive gaskets to completely seal the electrical cabinet and the cabinet door without gaps. If conductive gaskets are too costly, please screw the cabinet door to the electrical cabinet with a short distance between the screws.
- 4. Reserve a grounding terminal on the electrical cabinet door. This grounding terminal shall not be painted. If the paint already exists, please remove the paint before grounding.

#### **Electrical wires and cables**

Shielded Twisted Pair (STP) is a type of cable where two insulated copper wires are twisted together with a metal mesh surrounding the twisted pair that forms the electromagnetic shielding and can also be used for grounding.

The individual electrical wires and complete cable are surrounded by (synthetic) rubber, that provides insulation and also protects against damage.

There are two types of electrical cables: high voltage and low voltage. The high voltage cable differs from the low voltage cable in that it has an additional insulation layer called the dielectric insulator within the plastic sleeve. The dielectric insulator is the most important component in insulation. The low voltage cable is usually only filled with a soft polymer material for keeping the internal copper wire in place.

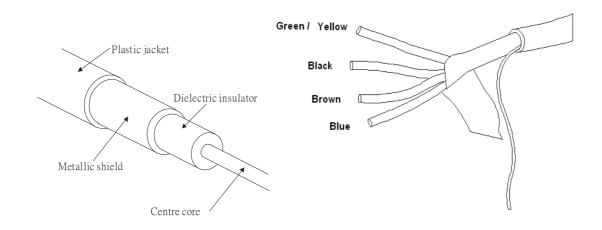
The shield has two functions.

1. To shield the electrical wire and cable.

A. Electric currents increase as power flows through the power cable and generate an electrical field. Such interference can be suppressed inside the cable by shielding the power cables or the electrical wires.

B. To form a protective earthing. When the cable core is damaged, the leakage current will flow via the shield to ground

2. To protect the cable. A power cable used for the computer control purpose generates only relatively low amount of current inside the cable. Such power cable will not become the source of interferences but has great possibility to be interfered by the surrounding electrical devices.

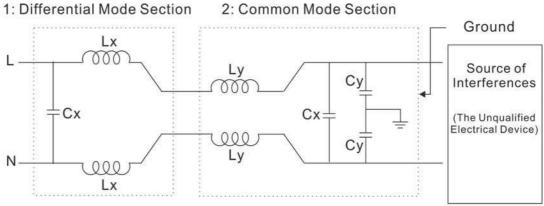


#### 5.1 Filter

Electromagnetic interference is transmitted in two ways, by radiation and by conduction. The most effective and economical method of reducing radiated interference is to use shielding and of reducing conducted interference is to use an electromagnetic filter.

Noise interference can be divided into two categories: high frequency (150kHz~300MHz) and low frequency (100Hz~3000Hz). High-frequency noise fades more over distance and has a shorter wave-length, while low-frequency noise fades less over distance and has a longer wave-length.. Both types of interference are transmitted through power cables and power leads, affecting the power supply side.

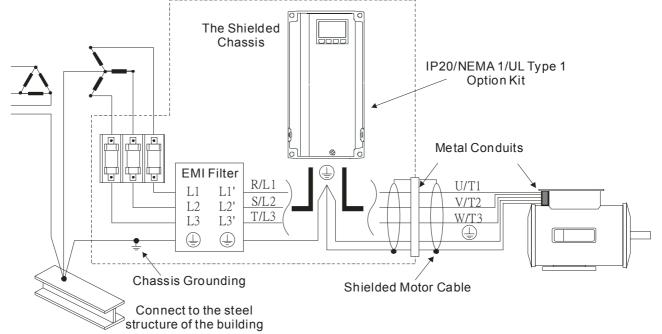
High-frequency interference at the power side can be eliminated or attenuated by mounting a filter. The filter consists of coils and capacitors. Some drives do not have a built-in filter, in which case the installation of an external option filter is required. The drawing below shows a standard filter diagram:



A filter is composed of a Differential Mode section (to eliminate noise below 150kHz) and a Common Mode section (to eliminate noise above 150kHz). For high-frequency noise, the inductor acts as a high impedance to form an open circuit and the capacitor acts as a low impedance to form a short circuit. Proper design and dimensioning of inductors and capacitors give a resonant circuit to absorb harmonic currents. Capacitor Cy is earthed to lead the harmonic currents to the ground.

#### **External Filter**

The filter and the AC drive should be installed in the control cabinet or on the mounting plate that is earthed to ground. The motor cable must be shielded and as short as possible. Please use the filters recommended by Delta to ensure compliance with EMC standards.



#### AC Motor Drives with Built-in Filter

- 1. Since interferences are suppressed by installing an earthed capacitor in the filter, the amount of current to ground (leakage current) could result in electric shocks to personnel or the power system. Please be aware of this problem.
- 2. Since the leakage current to ground can be high, it is crucial to implement protective earthing to prevent electrical shocks.

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#### Filter Installation (With and Without)

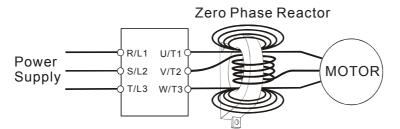
#### Zero Phase Reactor (Choke)

Interferences can also be suppressed by installing a zero phase reactor at the power supply side and/or the AC Motor Drive's output, depending on where the interference is. Since currents are large at the power input and the AC Motor Drive's output, please carefully select the magnetic core with suitable current handling capability. An ideal magnetic material for large currents is compound magnetic powder. It has a higher current handling capability and higher impedance compared to pure metallic magnetic cores. It is therefore suitable to implement in a high frequency environment. The impedance can also be enhanced by increasing the turn ratio.

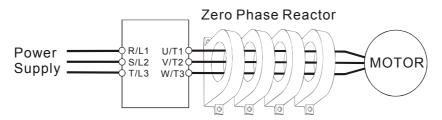
#### **Zero Phase Reactor Installation**

There are two installation methods, depending on the size of the zero phase reactor and the motor cable length.

1. Wind the motor cable through the middle of a zero-phase reactor 4 times. Place the reactor and the AC Motor Drive as close to each other as possible.



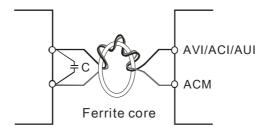
2. Place all wires through the middle of four zero-phase reactors without winding.



#### **Analog Input Signals**

If the analog input signals are affected by noise from the AC motor drive, please connect a capacitor and a ferrite core as indicated in the following diagram.

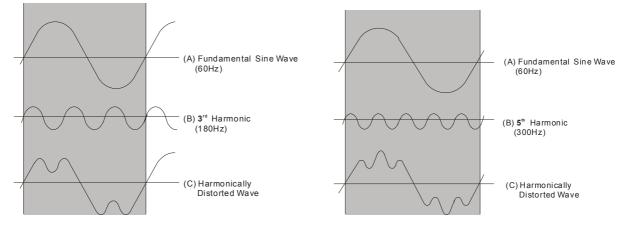
Wind the wires around the core in same direction for 3 times or more.



#### 5.2 Harmonic Interference

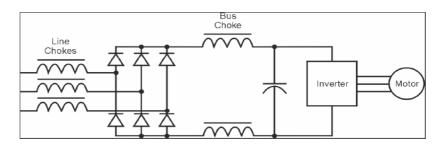
The AC motor drive's input current is non-linear, the input rectifier generates harmonics. Harmonics must be limited to within a certain range to avoid impact the mains power and to avoid current distortion to ensure surrounding devices are not influenced. An AC Motor Drive with built-in DC reactor suppresses harmonic currents (Total Harmonic Current Distortion THID) effectively and therefore reduces the harmonic voltage peaks (Total Harmonic Voltage Distortion).

#### Harmonic Current at the Power Supply Side



#### **Suppression of Harmonic Currents**

When a large portion of lower order harmonic currents (5<sup>th</sup>, 7<sup>th</sup>, 11<sup>th</sup> etc) occur at the power input, surrounding devices will be disturbed and the power factor will be low as a result of reactive power. Installing a reactor at the AC Motor Drive's input effectively suppresses lower order harmonic currents.



#### **AC Reactor**

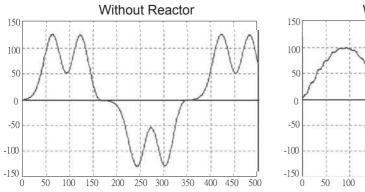
Installed in series with the power supply and is effective in reducing low order current harmonics. Features of an AC reactor include:

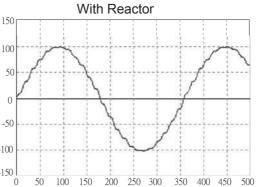
- 1. Reduces the harmonic currents to the AC Motor Drive and increases the impedance of the power supply.
- 2. Absorbs interferences generated by surrounding devices (such as surge voltages, currents, and mains surge voltages) and reduce their effect on the AC Motor Drive.
- 3. Increases the power factor.

#### **DC Reactor**

A DC-Reactor is installed between the rectifier and the DC-bus capacitor to suppress harmonic currents and to achieve a higher power factor.

#### **Current Wave Diagrams**





## Chapter 20 Safety Torque Off Function

- 20-1 The drive safety function failure rate
- 20-2 Safety torque off terminal function description
- 20-3 Wiring diagram
- 20-4 Parameter
- 20-5 Operating sequence description
- 20-6 New error code for STO function

#### 20-1 The drive safety function failure rate

Item	Definition	Standard	Performance
SFF	Safe Torque Off	IEC61508	Channel 1: 80.08% Channel 2: 68.91%
HFT (Type A subsystem)	Hardware Fault Tolerance	IEC61508	1
SIL	Safety Integrity Level		SIL 2
SIL		IEC62061	SILCL 2
PFH	Average frequency of dangerous failure [h-1]	IEC61508	9.56×10 <sup>-10</sup>
PFD <sub>av</sub>	Probability of Dangerous Failure on Demand	IEC61508	4.18×10 <sup>-6</sup>
Category	Category	ISO13849-1	Category 3
PL	Performance level	ISO13849-1	d
MTTF <sub>d</sub>	Mean time to dangerous failure	ISO13849-1	High
DC	Diagnostic coverage	ISO13849-1	Low

#### 20-2 Safety Torque Off terminal function description

The safety Torque Off function is to cut off the power supply to motor through the hardware, thereby the motor couldn't produce torque.

The safety Torque Off function is respectively by two independent hardware to control the motor current drive signal, and thus cut off the inverter power module output in order to achieve the status of safety stop.

Operation principle Description as below table 1:

#### Table 1: Terminal operation description

hoto-coupler status ligh) OFF(Low) OFF(Low)
ligh) OFF(Low) OFF(Low)
Low) ON(Low) OFF(Low)
mode STL1 mode STO mode que (torque (Torque output t off) output off) off)
r

STO means Safe Torque Off

STL1~STL3 means Safety Torque Off hardware abnormal.

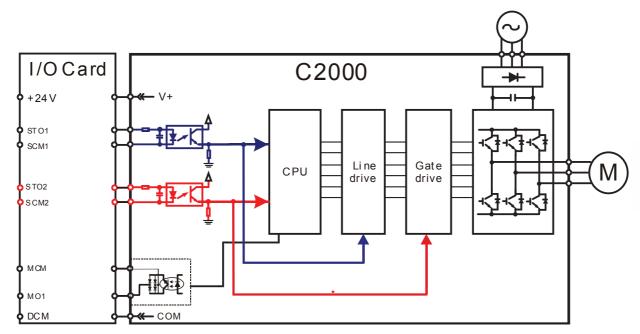
STL3 means STO1~SCM1 and STO2~SCM2 internal circuit detected abnormal.

STO1~SCM1 ON(High): means STO1~SCM1has connect to a +24VDC power supply.

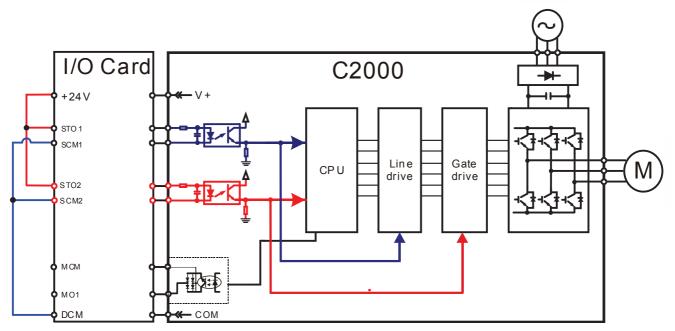
STO2~SCM2 ON(High): means STO2~SCM2 has connect to a +24V power supply.

STO1~SCM1 OFF(Low): means STO1~SCM1hasn't connect to a +24VDC power supply.

STO2~SCM2 OFF(Low): means STO2~SCM2hasn't connect to a +24VDC power supply.

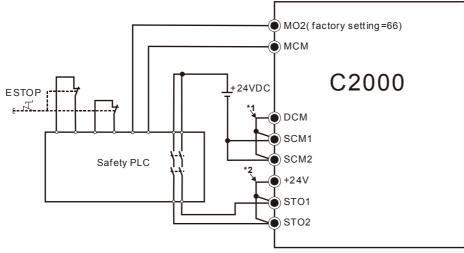


20-3-2 In the figure below, the factory setting for +24V-STO1-STO2 and SCM1-SCM2-DCM is short circuit:



20-3-3 The control loop wiring diagram:

- 1. Remove the shot-circuit of +24V-STO1-STO2 and DCM-SCM1-SCM2.
- 2. The wiring as below diagram. The ESTOP switch must at Close status in normal situation and drive will be able to Run.
- 3. STO mode, switch ESTOP open. Drive output stop and keypad display STO.



#### 

\*1: factory short circuit of DCM-SCM1-SCM2. To use the Safety function, please remove this short circuit \*2: factory short circuit of +24V-STO1-STO2. to use the Safety function, please remove this short circuit.

#### 20-4 Parameter

×	08-44	STO Alarm Latch						
							Factory setting: 0	
		Settings	5 0 : S	: STO Alarm Latch				
			1 : S	: STO Alarm no Latch				

Pr06-44=0 STO Alarm Latch: after the reason of STO Alarm is cleared, a Reset command is need to clear STO Alarm.

- Pr06-44=1 STO Alarm no Latch: after the reason of STO Alarm is cleared, the STO Alarm will be cleared automatically.
- All of STL1~STL3 error are "Alarm latch" mode (in STL1~STL3 mode, the Pr06-44 function is no effective).

×	82-13	Multi-function Output 1 (Relay1)					
					Factor	ry Setti	ing:11
~	81 - 50	Multi-function Output 2 (Relay2)					
		Factory Setting:1					
~	81 - 58	Multi-function Output 3 (MO1)					
		Factory Setting:0					
×	[]	Multi-function Output 4 (MO2)					
					Factor	ry Setti	ing:66
		Settings					
		66: SO N.O. output					
		68: SO N.C. output					

Settings	Functions	Descriptions
66	SO Logic A output	Safety Output Normal Open
68	SO Logic B output	Safety Output Normal Close

C2000 factory setting Pr02-17(MO2)=66(N.O.) and Multi-function Output setting item has add 2 new function: 66 and 68.

	Safety Out	put status
Drive status	N.O. (MO=66)	N.C. (MO=68)
Normal run	Open	Close
STO	Close	Open
STL1~STL3	Close	Open

00-04	Content of Multi-function Display								
								Factory	setting: 3
	Settings		45: Hardware version						

00-04=45

Hardware version

#### 20-5 Operating sequence description

#### 20-5-1Normal operation status

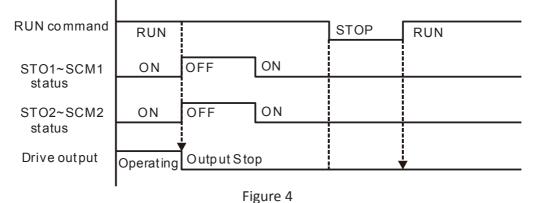
As shown in Figure 3: When the STO1~SCM1 and STO2~SCM2=ON (no STO function is need), the drive will execute "Operating" or "Output Stop" according to RUN/STOP command.

RUN command	RUN	STOP
STO1~SCM1 status	ON(no STC	D function need, Pr06-44=0)
STO2~SCM2 status	ON(no STC	D function need, Pr06-44=0)
Drive output	Operating	Output Stop

Figure 3

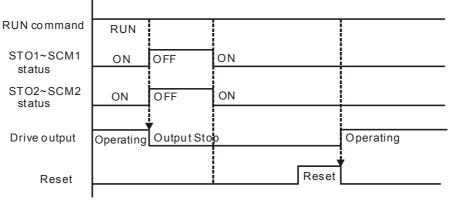
#### 20-5-2-1 STO , Pr06-44=0 , Pr02-35=0

As shown in Figure 4: When both of STO1~SCM1 and STO2~SCM2 channel has turn off during operating, the STO function enabling and the drive will stop output regardless of Run command is ON or OFF status.



#### 20-5-2-2 STO , Pr06-44=0 , Pr02-35=1

As shown in Figure 5: As same as the figure 4. But, because the Pr02-35=1, therefore, after the Reset command, if the operating command still exists, then the drive will immediately execute the run command again.





#### 20-5-3 STO , Pr06-44=1

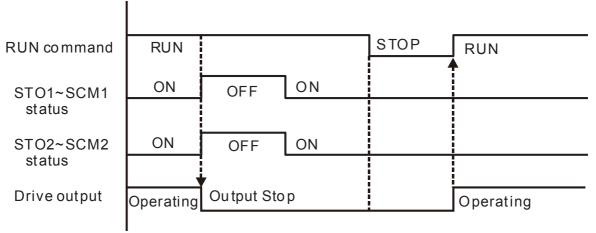


Figure 6

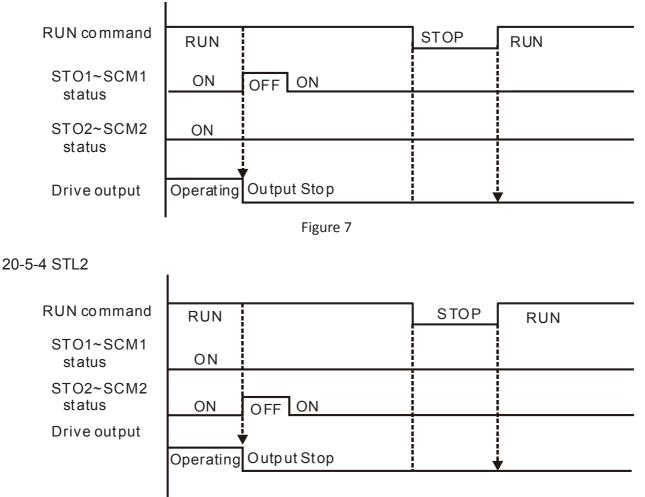


Figure 8

#### 20-6 New Error code for STO function

88-17	Present Fault Record					
81 - 30	Second Most Recent Fault Record					
86 - 19	Third Most Recent Fault Record					
06-20	Fourth Most Recent Fault Record					
86-21	Fifth Most Recent Fault Record					
88-88	Sixth Most Recent Fault Record					
	Settings					
	72 : Channel 1(STO1~SCM1)internal hardware error					
	76 : STO(Safety Torque Off					
	77 : Channel 2(STO2~SCM2)internal hardware error					
	78 : Channel 1 and Channel 2 internal hardware error					

Error code	Name	Description		
76	STO	Safety Torque Off function active		
72	STL1 (STO1~SCM1)	STO1~SCM1 internal hardware detect error		
77	STL2 (STO2~SCM2)	STO2~SCM2 internal hardware detect error		
78	STL3	STO1~SCM1 and STO2~SCM2 internal hardware detect error		

The Old/New control board and Old/New I/O card: :

C2000	v1.12 firmware	v1.20 firmware
v1.12 control board + old I/O card(no STO function)	OK	OK
v1.12 control board + new I/O card(with STO function)	Error	Error
v1.20 control board + old I/O card(no STO function)	Error	Error
v1.20 control board + new I/O card(with STO function)	Error	OK

# Appendix A. Publication History

V1.12→V1.20						
Explanations	Coverage					
Add						
STO (Safety Torque Off) Function	Chapter 4 – Wiring					
	Chapter 5 – Main Circuit Terminals					
	Chapter 6 – Control Terminals					
	Group 02 Parameters					
	Group 06 Parameters					
	Chapter 14 – Fault Codes and Descriptions					
	Chapter 20 – Safety Torque Off Function NEW					
Parameters of PM Sensorless & Tuning Process	Group 00 Parameters (00-10),					
	Group 05 Parameters (05-00, 05-33),					
	Group 10 Parameters (10-42)					
Mechanical Brake Check	Group 02 Parameters (MI=55; 02-56)					
EMC-PG02L, EMC-PG02O, EMC-PG02U	Chapter 8					
PLC Buffer	Group 04 Parameters (04-50~04-69)					
Electronic Thermal Relay	Group 06 Parameters (06-13, 06-14, 06-27, 06-28)					
Output Phase Loss	Group 06 Parameters (06-46, 06-47, 06-48)					
Command of PLC as 0	Group 09 Parameters (09-33)					
Rev	vise					
Ambient Temperature and Control Derating Curve	Chapter 2, Chapter 9, Group 06 Parameters					
Block Diagrams of Different Speed Mode Control	Group 00 Parameters (00-10, 00-13)					
Protection Password Parameter	Group 00 Parameters (00-08)					
Mid-point Voltage & Frequency Factory Setting of High	Group 01 Parameters (01-03, 01-04, 01-06, 01-37,					
Power Models (above 185kW)	01-38, 01-40)					
Upper/Lower Limit of Output Frequency Curve Diagram	Group 01 Parameters (01-10, 01-11)					
1 <sup>st</sup> /4 <sup>th</sup> Accel./Decel. Time Curve Diagram	Group 01 Parameters (01-23)					
UP/DOWN Key Function Sequence Diagram	Group 02 Parameters (02-09, 02-10)					
The Factory Setting of Induction Motor with No-load	Group 05 Parameters (05-05, 05-17)					
Current and above 110kW.						
Y-connection Switch Delay Diagram of Induction Motor	Group 05 Parameters (05-25)					
Over-torque Detection TiME Diagram	Group 06 Parameters (06-07, 06-08, 06-10, 06-11)					
IGBT OH Setting	Group 06 Parameters (06-15)					
dEB Function	Group 06 Parametes (06-62), Group 07 Parameters					
	(07-13, 07-14)					
PLC Functions	Chapter 16					