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C2000

Classical Field Oriented Control AC Motor Drive

2011-01-08
5011694701-2CE1

DELTA ELECTRONICS, INC.

User Manual

www.delta.com.tw/industrialautomation

PLEASE READ PRIOR TO INSTALLATION FOR SAFETY.

DANGER	☑ 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.
CAUTION	☑ 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.

NOTE

The content of this manual may be revised without prior notice. Please consult our distributors or download the most updated version at http://www.delta.com.tw/industrialautomation

Table of Contents

Application	Control BD V1.00; Keypad V1.00;

Summary of Updates

The following changes summarize the differences to the C2000 Simplified Manual, Version 5011694700.

Chatpers	Changes	Detail
[Table of Content]	New	New Chapters: • Chapter 2 Installation • Chapter 7 Optional Accessories • Chapter 12 Description of Parameter Settings • Chapter 15 CANopen Overview • Chapter 16 PLC Function • (Applicable model, AC motor drive selection) Applicable model AC motor drive selection
[01 Introduction]	New	Frame FRAME A~H KPC-CC01 digital keypad
	Update	Serial number
[02 Installation]	New	Mounting clearances and wiring information
	Update	Unpacking details moved to CH3
[03 Unpacking]	New	FRAME F~H FRAME H secure the drive FRAME F~H lifting weight
[04Wiring]	New	RB-RC power protection system diagram
	Updates	Wiring diagram 1, 2 Control circuit description Figure1,2 Figure 3 FRAME E-H DC-LINK
[05 Main circuit terminal]	New	Main circuit terminal specification FRAME F~H
	Update	Main circuit terminal diagram 3
		Terminal signs +1, - and description
		Main circuit terminal specifications Frame A~E (max. and min. wire gauge,torque, note, diagram)
[06 Control circuit terminal]	New	Steps to removes the key cover and wiring
		Removable terminal block figure
	Update	Control terminal specification: wire gauge, torque, Descripton and factory settings: MI11~MI8 terminals, SG+ & SG- terminals Steps to remove the terminal block
[08 Option cards]	New	Steps to remove key cover **EMC-D611A** I/O & Relay extension card **EMC-PG01L** PG card and wiring diagrams(can be operate by Pr.10-00~10-02) **EMC-PG01O** PG card and wiring diagrams(can be operate by Pr.10-00~10-02) **EMC-PG01U**: description, wiring diagram, terminal Screw Sepecifications **EMC-PG01R**: description, wiring diagram, terminal Screw Sepecifications **CMC-MOD01**: feature, product file, CMC-MOD01 installation to C2000, parameter setting for Ethernet, removal, basic register, LED indicator& troubleshoots **CMC-PD01**: feature, product file, installation, LED indicator& troubleshoots **CMC-DN01**: feature, product file, LED indicator& troubleshoots **CMC-EIP01**: feature, product file, installation, Connecting CMC-EIP01 to VFD-C2000, parameter setting for Ethernet, removal, basic register, LED indicator& troubleshoots

		EMC-COP01: RJ45 Pin definition, Specification
	Update	RJ45 (Socket) for digital keypad Option card diagrams for Slot 1~3 **EMC-D42A**: Descriptons for COM and MI10~MI13 **EMC-R6AA**: Description EMC-PG01O PG OUT V+, V-, A/O, B/O, Z/O
	Remove	ABZ1 Encoder signal type, AB2 Pulse signal type
[09 Specification]	New	230V FRAME F specification 460V FRAME F~H specification
		Operation temperature and protection level
	Update	230V/460V Nomal load: carrier frequency Operational voltage range
		230V EMC Filter ➔ EMI Filter
		460V EMI Filter Description and Note
		Control method Certification
	Delete	230V/460V Heavy load& Normal load: load capacity and max. output frequency (Hz)
		Torque characteristic Overload capacity Ambient temperature
		*Reduced by 2%Irated/1℃
[10 Digital Keypad]	New	Digital Keypad: KPC-CC01 Function
	Update	Keypad picture
		Descriptions of Keypad Functions
		Change LED keypad to KPC-CE01 CANopen~"RUN" CANopen~"ERR"
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[11 Summary of Parameters]	New Parameters	Group 00 Pr.00-00 Settings: 39, 41, 43, 45, 47, 49, 51, 93 Pr.00-04 Settings: 2~8, 21,24~31 Pr 00-05 Pr.00-25~Pr.00-50
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	Update	Goup 00 Pr00-09 → Reserved Pr.00-10 Settings: 1~3 Pr.00-11 Settings: 0~5 Pr. 00-12 point-to-point position mode Pr.00-13 Settings: 0~2 Pr.00-14 Reserved Pr.00-17 Normal load 230V (460V) 1-15HP [1-20HP] 2~15KHz 20-50HP [25-100HP] 2~10KHz 60-100HP [125-475HP] 2~09KHz Heavy load 1-475HP 2~6KHz

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	Goup 02 Pr.02-09 1: up/down constant speed (Pr.02-10) Pr.02-11 Pr.02-13~02-17 Settings: 10, 13, 14, 39, 40, 43~49, 51, 52 Pr.02-19 Terminal counting value attained (returns to 0) Pr.02-20 Preliminary counting value attained (not return to 0) Pr.02-33 Output Current Level Setting for Multi-function External Terminals Pr.02-34 Pr.02-35 Pr.02-37 Pr.02-48
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	Group 07 Pr.07-05 Pr.07-07 Pr.07-10 Pr.07-24~07-27 Pr.07-29 Pr.07-31~07-33
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	Group 09 Pr.09-30 Pr.09-35 Pr.09-37~09-39 Pr.09-43 Pr.09-45
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	Update	LED display content “ANL” description
	Remove	LCM display example All display icons
[14 Fault Codes and Descriptions]	New	Fault display screen example Fault code: “ovA”, “ovd”, “ovn”, “ovS”, “PWR”, “uC”, “LMIT”, “ryF”, “PGF5”, “ocU”, “ocV”, “OPHL”, “OPHL”, “OPHL”, “TRAP”
	Update	LCM display icons Fault codes: “CE1”, “CE2”, “CE3”, “CE4”, “CE10”, “CP10” , “dEb”, “Uocc” A, “Vocc” B, “Wocc” C
	Remove	LED display content Fault code: “UC1”, “UC2”

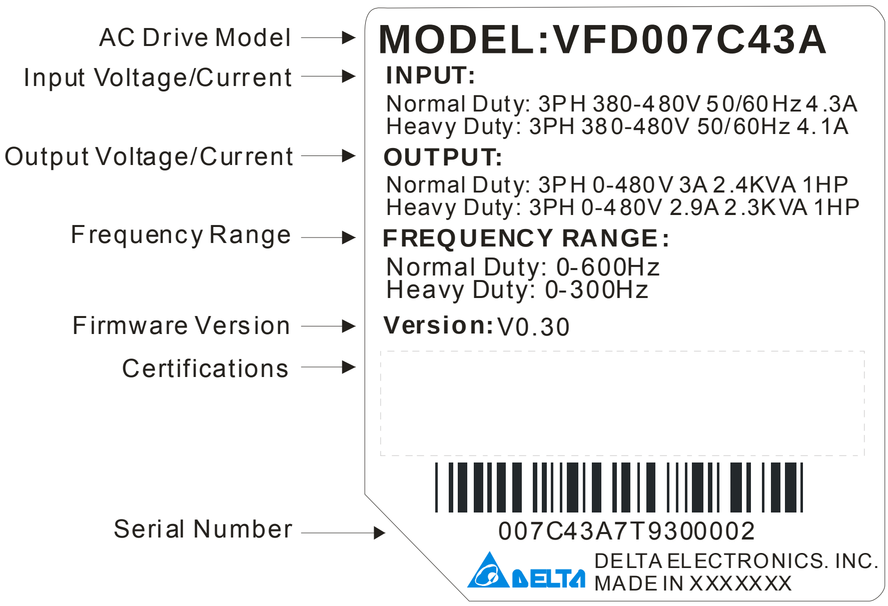
Chapter 1 Introduction

Receiving and Inspection

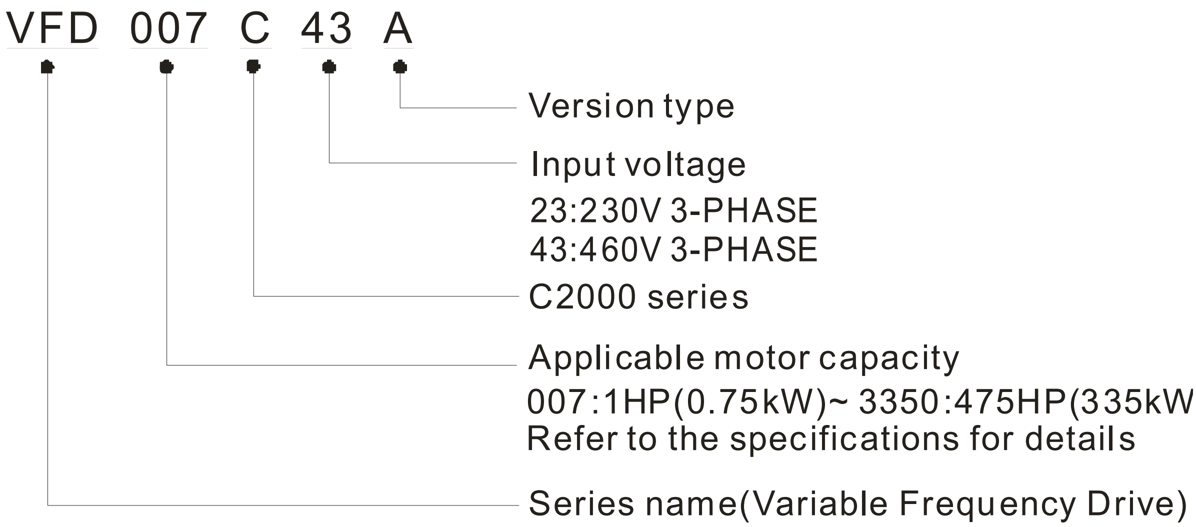
After receiving the AC motor drive, please check for the following:

1. Please inspect the unit after unpacking to assure it was not damaged during shipment.
2. Make sure that the part number printed on the package corresponds with the part number indicated on the nameplate.
3. Make sure that the voltage for the wiring lie within the range as indicated on the nameplate.
4. Please install the AC motor drive according to this manual.
5. Before applying the power, please make sure that all the devices, including power, motor, control board and digital keypad, are connected correctly.
6. 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.
7. When power is applied, select the language and set the parameter groups via the digital keypad (KPC-CC01).
8. After applying the power, please trial run with the low speed and then increase the speed gradually to the desired speed.

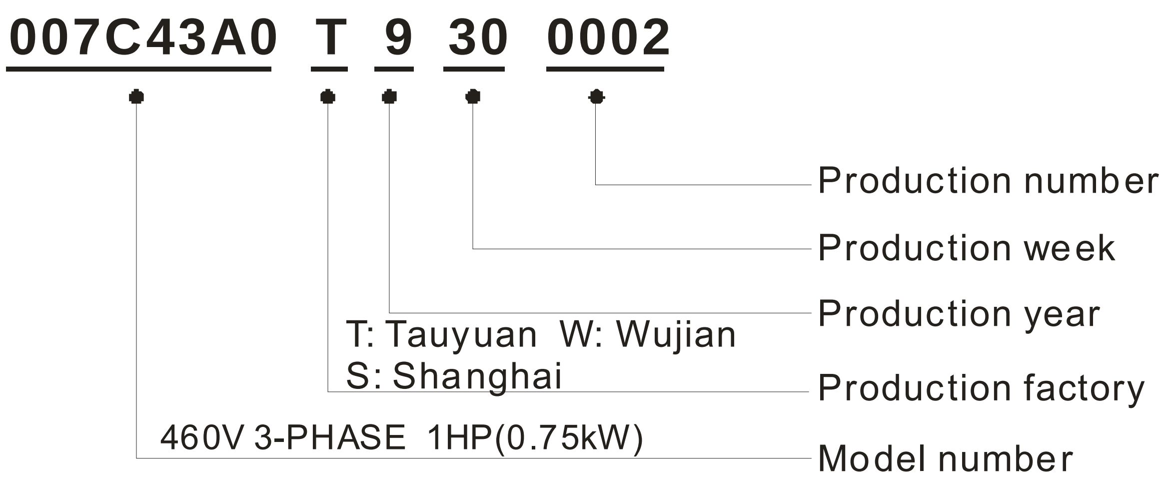
Nameplate Information



Model Name



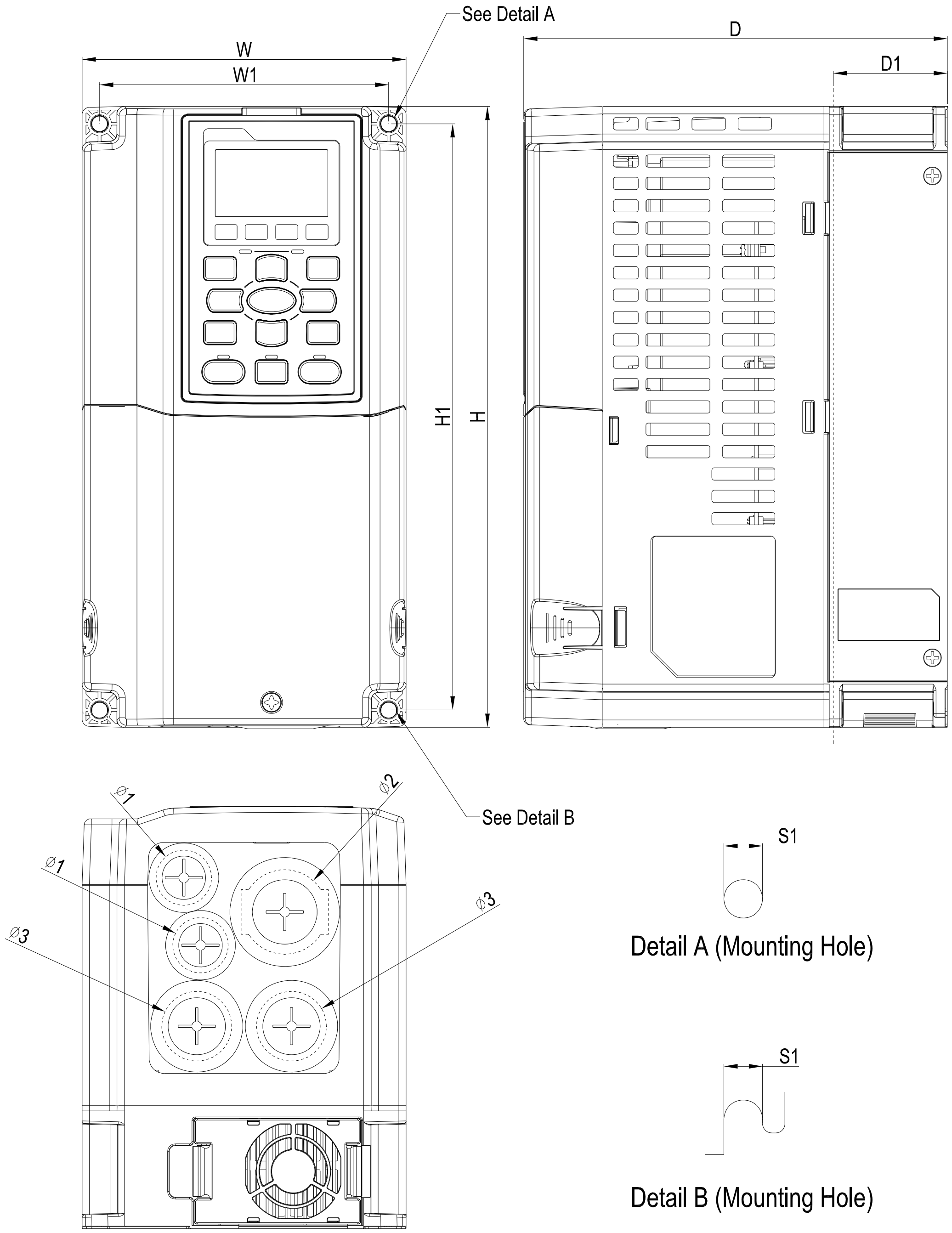
Serial Number



Dimensions

Frame A

VFD007C23A; VFD007C43A/E; VFD015C23A; VFD015C43A/E; VFD022C23A; VFD022C43A/E; VFD037C23A; VFD037C43A/E; VFD040C43A/E; FD055C43A/E



Unit: mm [inch]

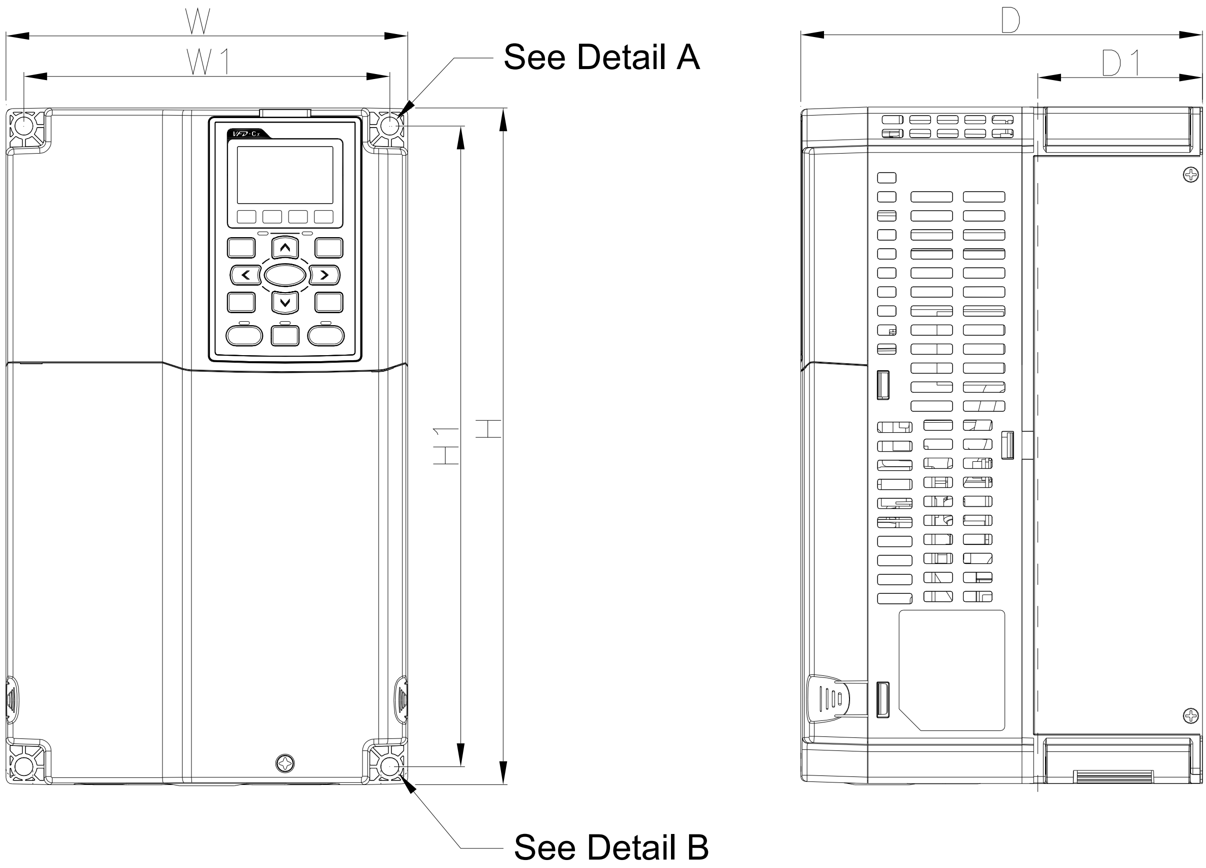
Frame	W	H	D	W1	H1	D1*	S1	Φ1	Φ2	Φ3
A1	130.0 [5.12]	250.0 [9.84]	170.0 [6.69]	116.0 [4.57]	236.0 [9.29]	45.8 [1.80]	6.2 [0.24]	22.2 [0.87]	34.0 [1.34]	28.0 [1.10]

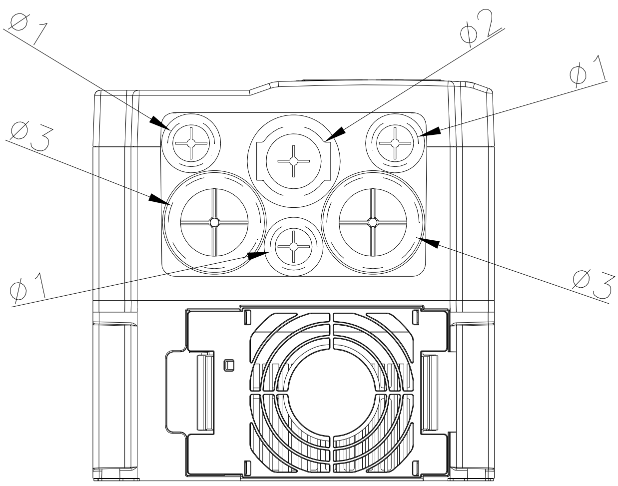
D1*: Flange mounting

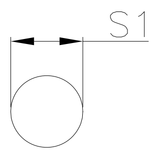
NOTE: Model VFD007C43E; VFD015C43E; VFD022C43E; VFD037C43E; VFD040C43E; VFD055C43E will be available for ordering soon. Please contact your local distributor or Delta representative for detailed launch schedule.

Frame B

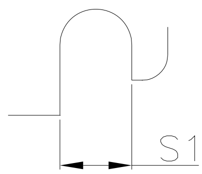
VFD055C23A; VFD075C23A; VFD075C43A/E; VFD110C23A; VFD110C43A/E; VFD150C43A/E







Detail A (Mounting Hole)



Detail B (Mounting Hole)

Unit: mm [inch]

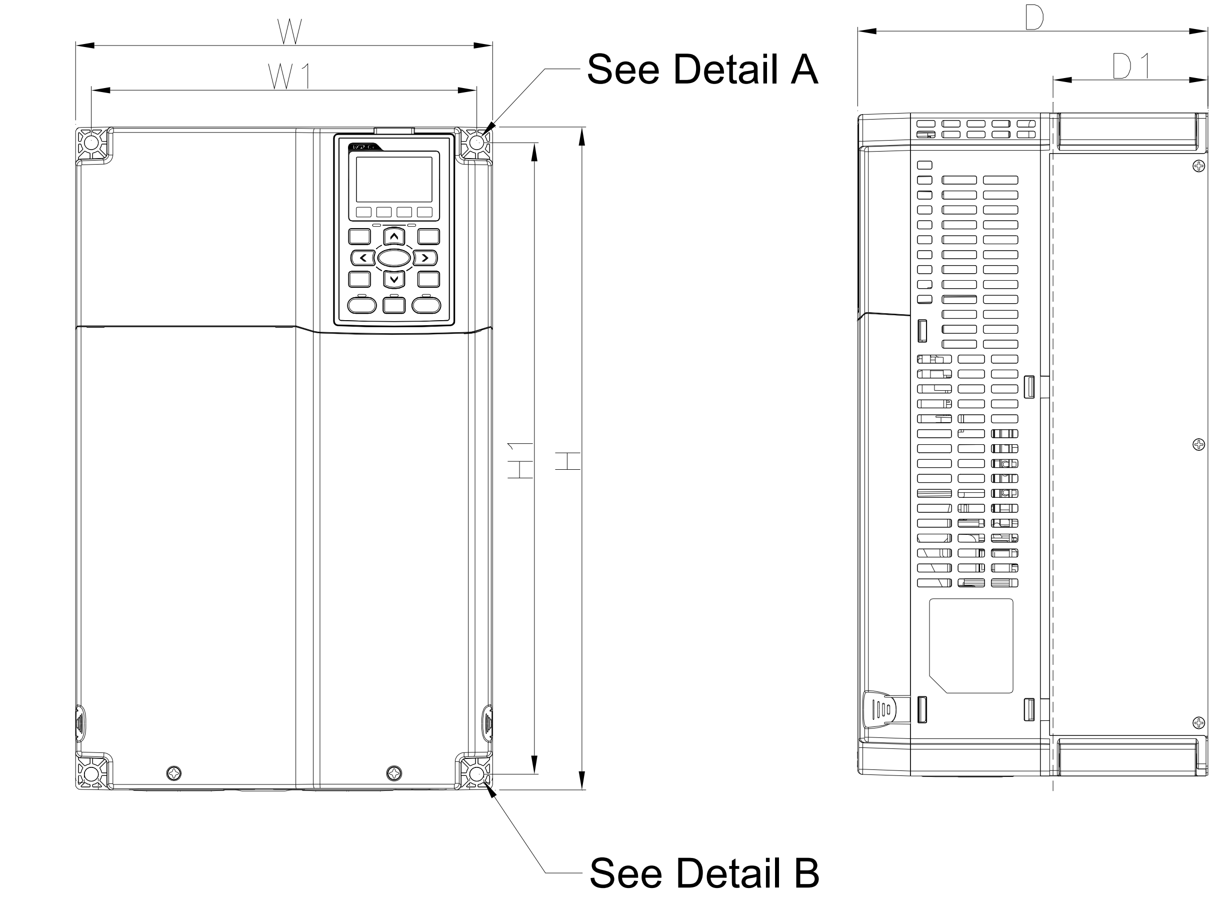
Frame	W	H	D	W1	H1	D1*	S1	Φ1	Φ2	Φ3
B1	190.0 [7.48]	320.0 [12.60]	190.0 [7.48]	173.0 [6.81]	303.0 [11.93]	77.9 [3.07]	8.5 [0.33]	22.2 [0.87]	34.0 [1.34]	28.0 [1.10]

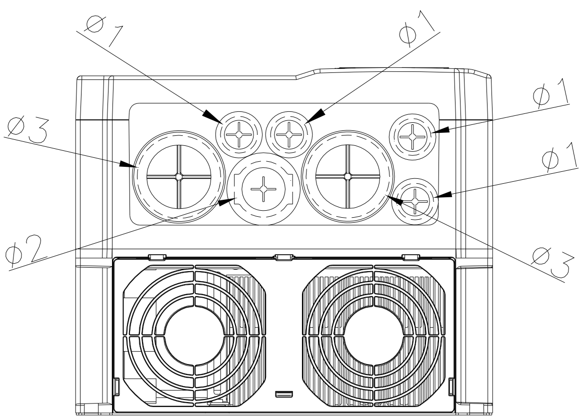
D1*: Flange mounting

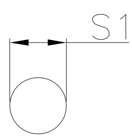
NOTE: Model VFD075C43E; VFD110C43E; VFD150C43E will be available for ordering soon. Please contact your local distributor or Delta representative for detailed launch schedule.

Frame C

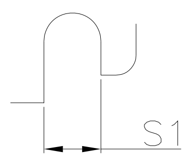
VFD150C23A; VFD185C23A; VFD185C43A/E; VFD220C23A; VFD220C43A/E; VFD300C43A/E







Detail A (Mounting Hole)



Detail B (Mounting Hole)

Unit: mm [inch]

Frame	W	H	D	W1	H1	D1*	S1	Φ1	Φ2	Φ3
C1	250.0 [9.84]	400.0 [15.75]	210.0 [8.27]	231.0 [9.09]	381.0 [15.00]	92.9 [3.66]	8.5 [0.33]	22.2 [0.87]	34.0 [1.34]	50.0 [1.97]

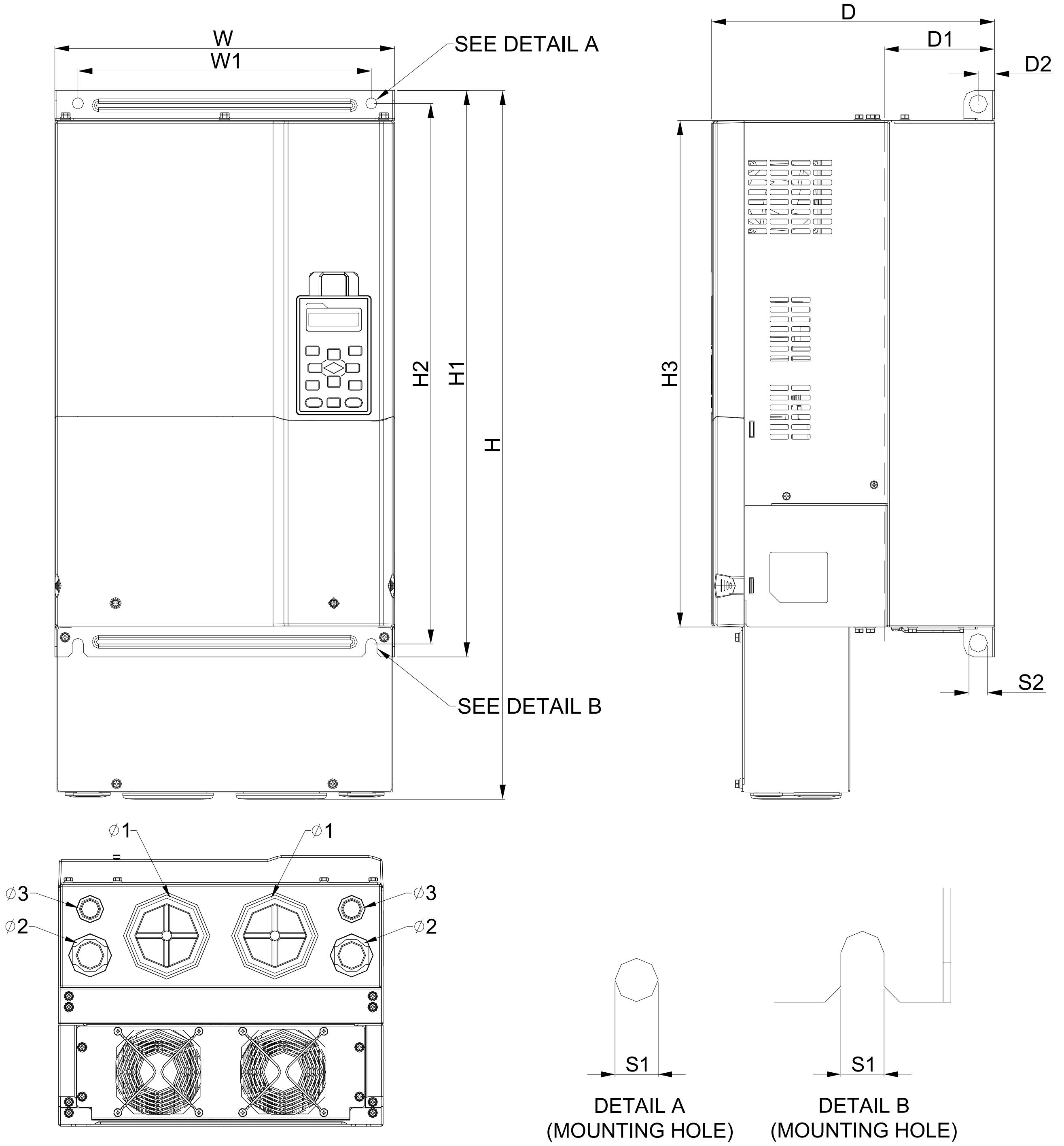
D1*: Flange mounting

NOTE: Mode VFD185C43E; VFD220C43E; VFD300C43E will be available for ordering soon. Please contact your local distributor or Delta representative for detailed launch schedule.

Frame D

D1: VFD300C23A; VFD370C23A; VFD370C43A; VFD450C43A; VFD550C43A; VFD750C43A

D2: VFD300C23E; VFD370C23E; VFD370C43E; VFD450C43E; VFD550C43E; VFD750C43E



Unit: mm [inch]

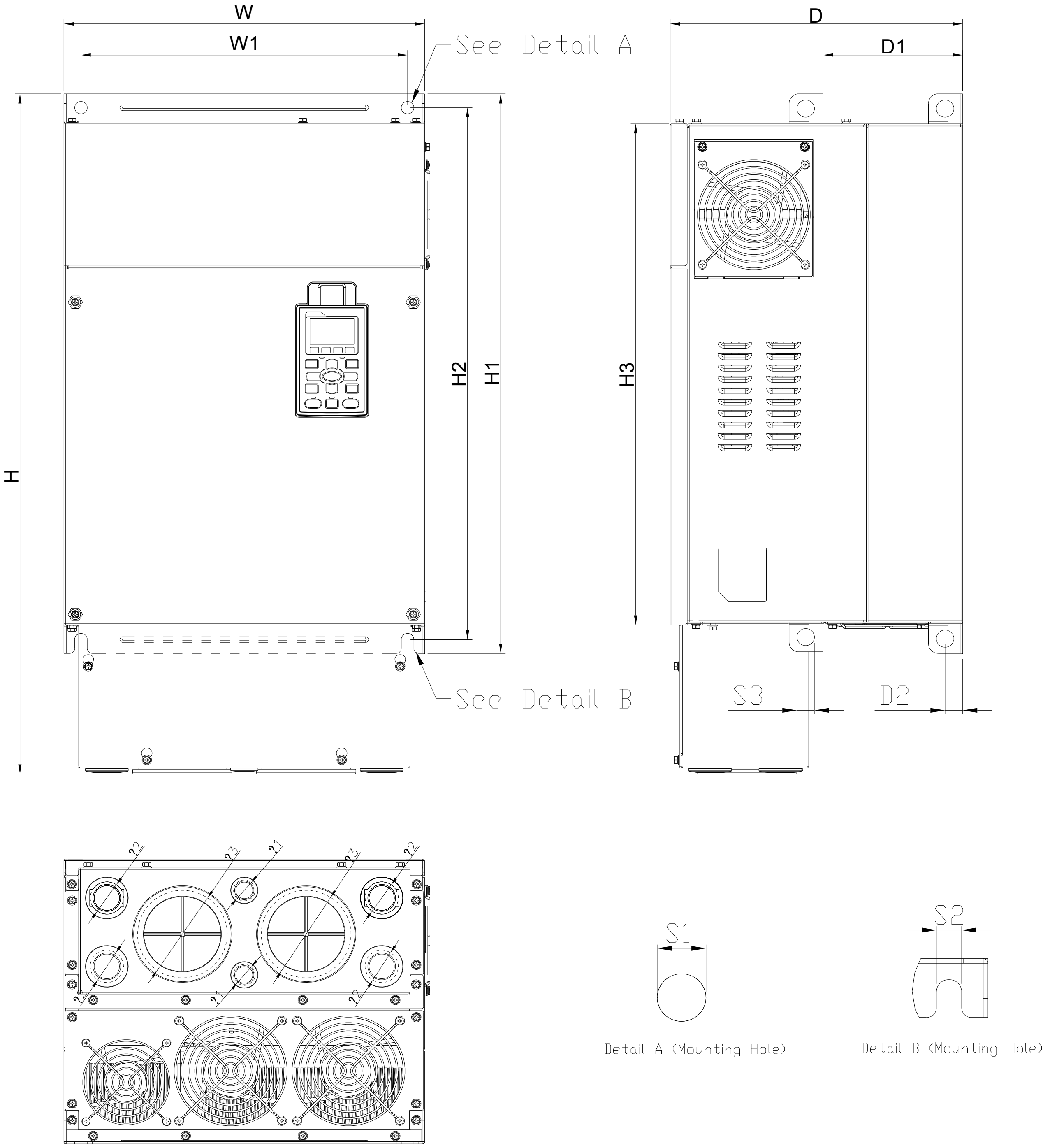
Frame	W	H	D	W1	H1	H2	H3	D1*	D2	S1	S2	Φ1	Φ2	Φ3
D1	330.0 [12.99]	-	275.0 [10.83]	285.0 [11.22]	550.0 [21.65]	525.0 [20.67]	492.0 [19.37]	107.2 [4.22]	16.0 [0.63]	11.0 [0.43]	18.0 [0.71]	-	-	-
D2	330.0 [12.99]	688.3 [27.10]	275.0 [10.83]	285.0 [11.22]	550.0 [21.65]	525.0 [20.67]	492.0 [19.37]	107.2 [4.22]	16.0 [0.63]	11.0 [0.43]	18.0 [0.71]	76.2 [3.00]	34.0 [1.34]	22.0 [0.87]

D1*: Flange mounting

Frame E

E1: VFD450C23A; VFD550C23A; VFD750C23A; VFD900C43A; VFD1100C43A

E2: VFD450C23E; VFD550C23E; VFD750C23E; VFD900C43E; VFD1100C43E



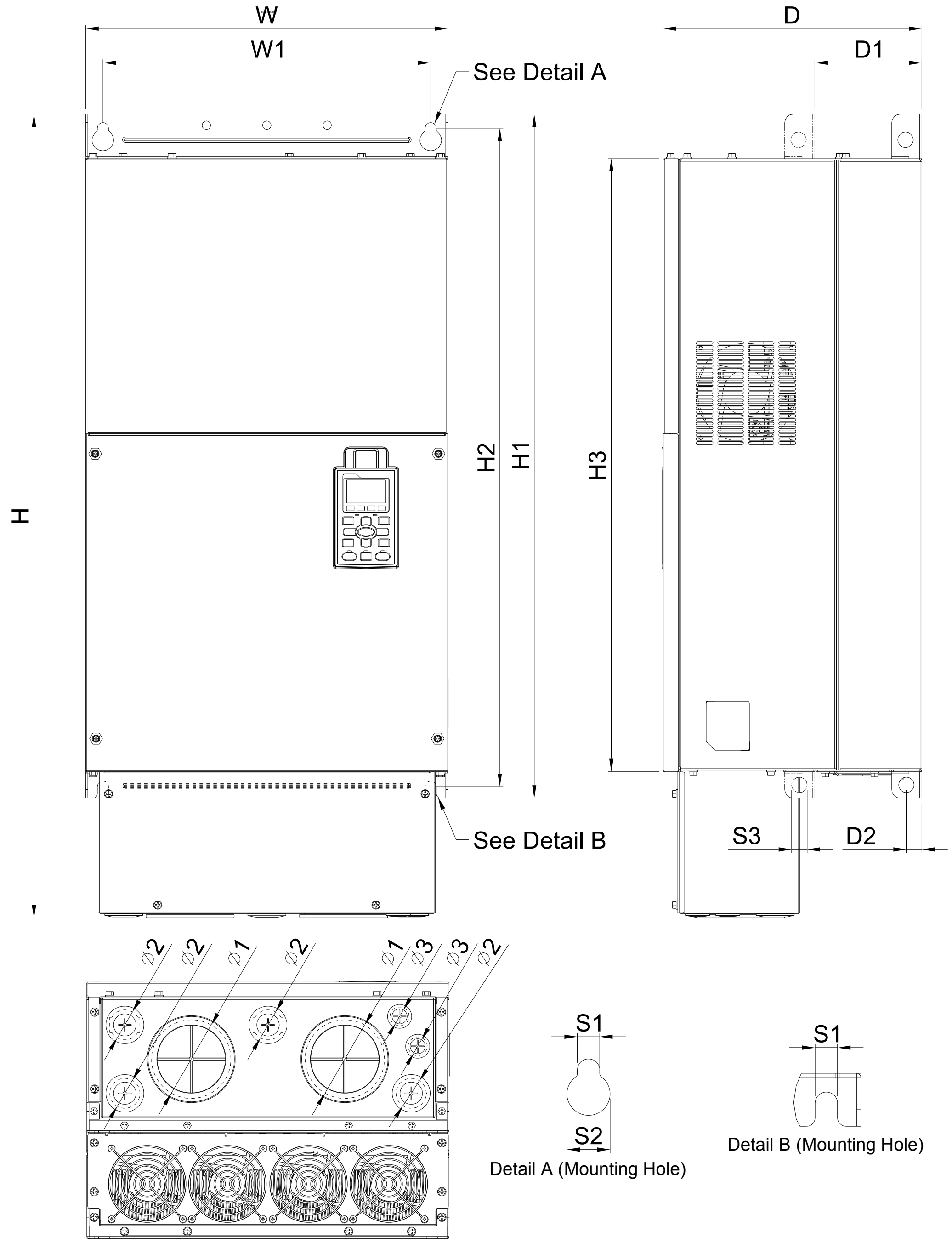
Unit: mm [inch]

Frame	W	H	D	W1	H1	H2	H3	D1*	D2	S1, S2	S3	ψ1	ψ2	ψ3
E1	370.0 [14.57]	-	300.0 [11.81]	335.0 [13.19	589 [23.19]	560.0 [22.05]	528.0 [20.80]	143.0 [5.63]	18.0 [0.71]	13.0 [0.51]	18.0 [0.71]	-	-	-
E2	370.0 [14.57]	715.8 [28.18]	300.0 [11.81]	335.0 [13.19	589 [23.19]	560.0 [22.05]	528.0 [20.80]	143.0 [5.63]	18.0 [0.71]	13.0 [0.51]	18.0 [0.71]	22.0 [0.87]	34.0 [1.34]	92.0 [3.62]

D1*: Flange mounting

Frame F

F1: VFD900C23A; VFD1320C43A; VFD1600C43A; F2: VFD900C23E; VFD1320C43E; VFD1600C43E



Unit: mm [inch]

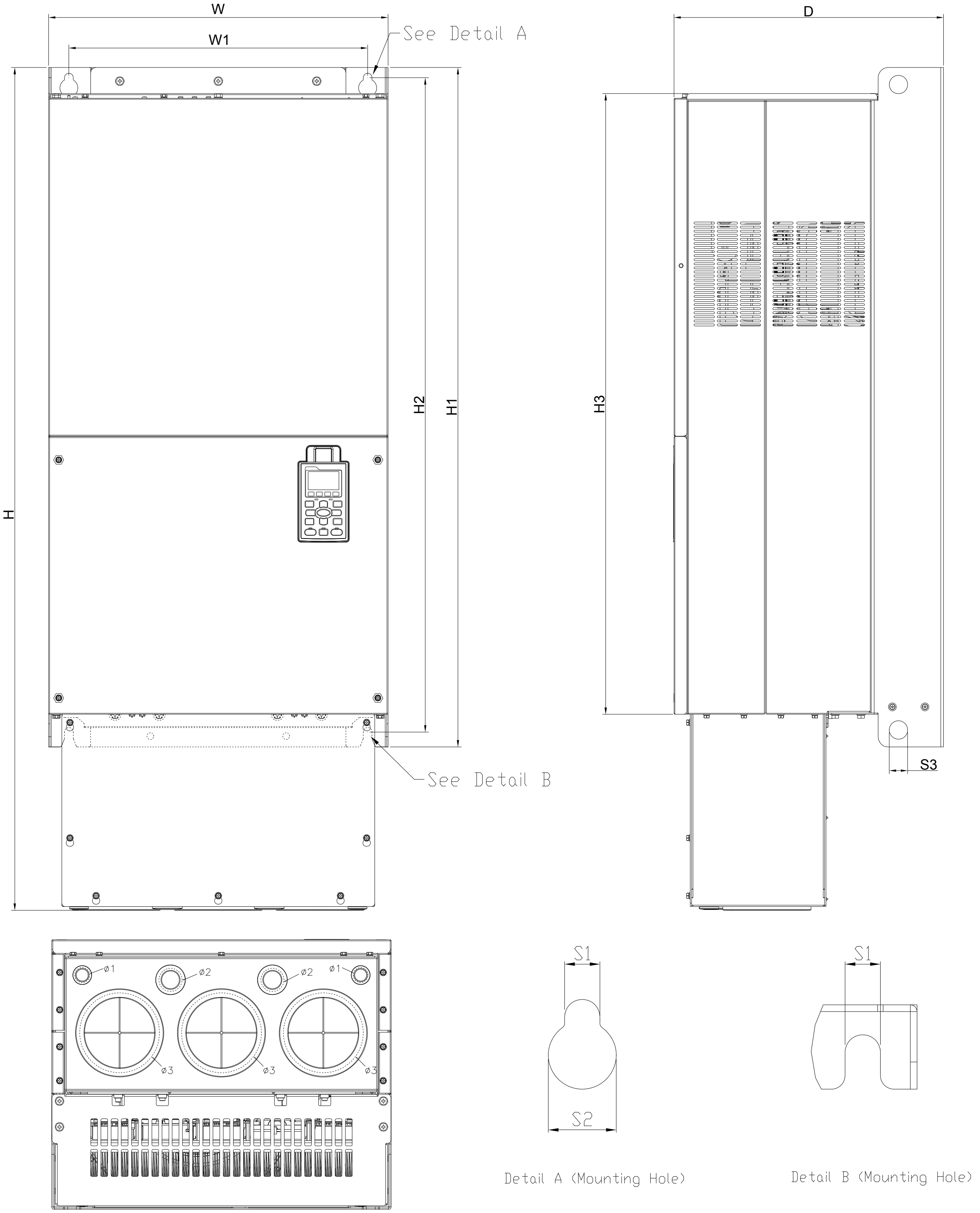
Frame	W	H	D	W1	H1	H2	H3	D1*	D2	S1	S2	S3
F1	420.0 [16.54]		300.0 [11.81]	380.0 [14.96]	800.0 [31.50]	770.0 [30.32]	717.0 [28.23]	124.0 [4.88]	18.0 [0.71]	13.0 [0.51]	25.0 [0.98]	18.0 [0.71]
F2	420.0 [16.54]	940.0 [37.00]	300.0 [11.81]	380.0 [14.96]	800.0 [31.50]	770.0 [30.32]	717.0 [28.23]	124.0 [4.88]	18.0 [0.71]	13.0 [0.51]	25.0 [0.98]	18.0 [0.71]

Frame	ψ1	ψ2	ψ3
F1	92.0 [3.62]	35.0 [1.38]	22.0 [0.87]
F2	92.0 [3.62]	35.0 [1.38]	22.0 [0.87]

D1*: Flange mounting

Frame G

G1: VFD1850C43A; VFD2200C43A; G2: VFD1850C43E; VFD2200C43E



Unit: mm [inch]

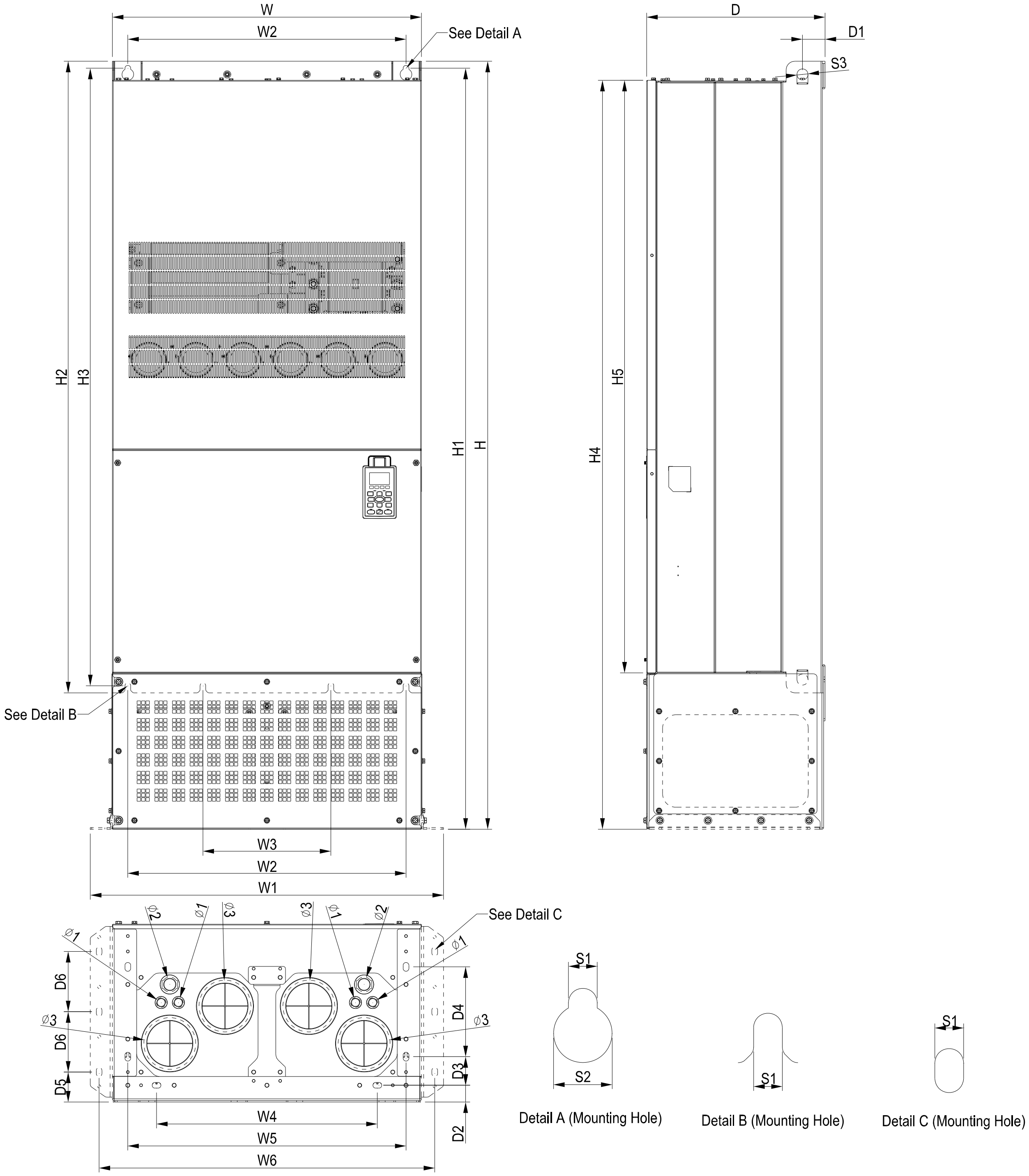
Frame	W	H	D	W1	H1	H2	H3	S1	S2	S3	ψ1	ψ2	ψ3
G1	500.0 [19.69]	-	397.0 [15.63]	440.0 [217.32]	1000.0 [39.37]	963.0 [37.91]	913.6 [35.97]	13.0 [0.51]	26.5 [1.04]	27.0 [1.06]	-	-	-
G2	500.0 [19.69]	1240.2 [48.83]	397.0 [15.63]	440.0 [217.32]	1000.0 [39.37]	963.0 [37.91]	913.6 [35.97]	13.0 [0.51]	26.5 [1.04]	27.0 [1.06]	22.0 [0.87]	34.0 [1.34]	117.5 [4.63]

Frame H

H1: VFD2800C43A; VFD3150C43A; VFD3550C43A

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

H3: VFD2800C43E; VFD3150C43E; VFD3550C43E



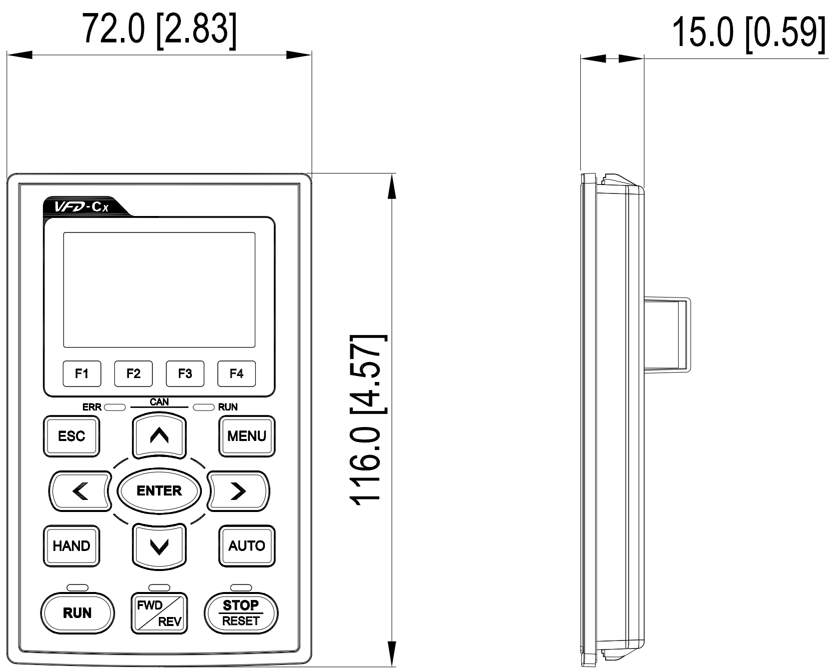
Unit: mm [inch]

Frame	W	H	D	W1	W2	W3	W4	W5	W6	H1	H2	H3	H4
H1	700.0 [27.56]	-	398.0 [15.67]	-	630.0 [24.80]	290.0 [11.42]	-	-	-	-	1435.0 [56.50]	1403.0 [55.24]	-
H2	700.0 [27.56]	1745.0 [68.70]	404.0 [15.91]	800.0 [31.50]	-	-	500.0 [19.69]	630.0 [24.80]	760.0 [29.92]	1729.0 [68.07]	-	-	1701.6 [66.99]
H3	700.0 [27.56]	1745.0 [68.70]	404.0 [15.91]	800.0 [31.50]	-	-	500.0 [19.69]	630.0 [24.80]	760.0 [29.92]	1729.0 [68.07]	-	-	1701.6 [66.99]

Frame	H5	D1	D2	D3	D4	D5	D6	S1	S2	S3	ψ1	ψ2	ψ3
H1	1346.6 [53.02]	45.0 [1.77]	-	-	-	-	-	13.0 [0.51]	26.5 [1.04]	25.0 [0.98]	-	-	-
H2	1346.6 [53.02]	51.0 [2.01]	38.0 [1.50]	65.0 [2.56]	204.0 [8.03]	68.0 [2.68]	137.0 [5.39]	13.0 [0.51]	26.5 [1.04]	25.0 [0.98]	-	-	-
H3	1346.6 [53.02]	51.0 [2.01]	38.0 [1.50]	65.0 [2.56]	204.0 [8.03]	68.0 [2.68]	137.0 [5.39]	13.0 [0.51]	26.5 [1.04]	25.0 [0.98]	22.0 [0.87]	34.0 [1.34]	117.5 [4.63]

Digital Keypad

KPC-CC01

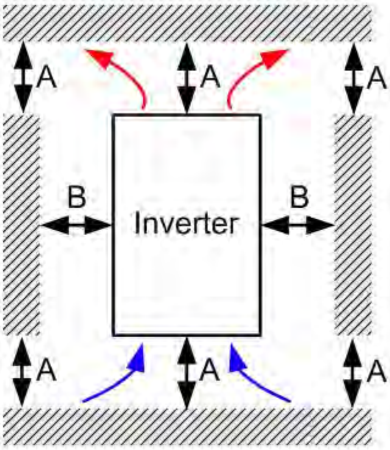


Chapter 2 Installation

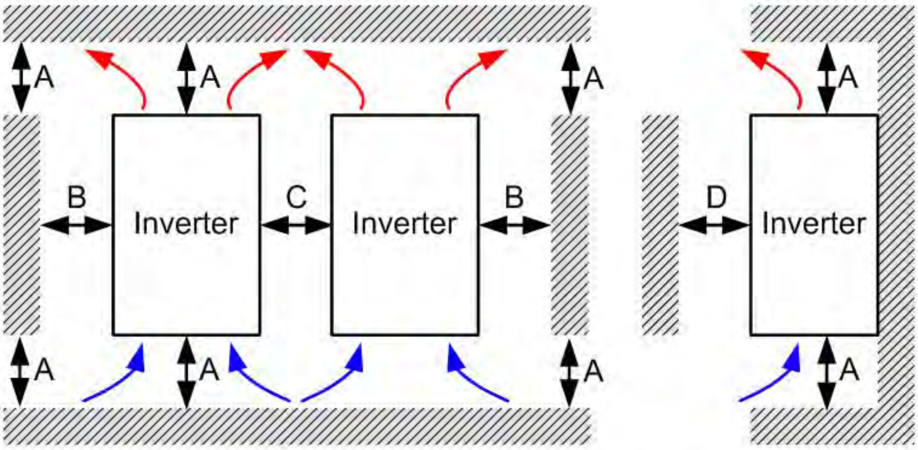
The appearances shown in the following figures are for reference only.

Airflow direction: (Blue arrow) inflow (Red arrow) outflow

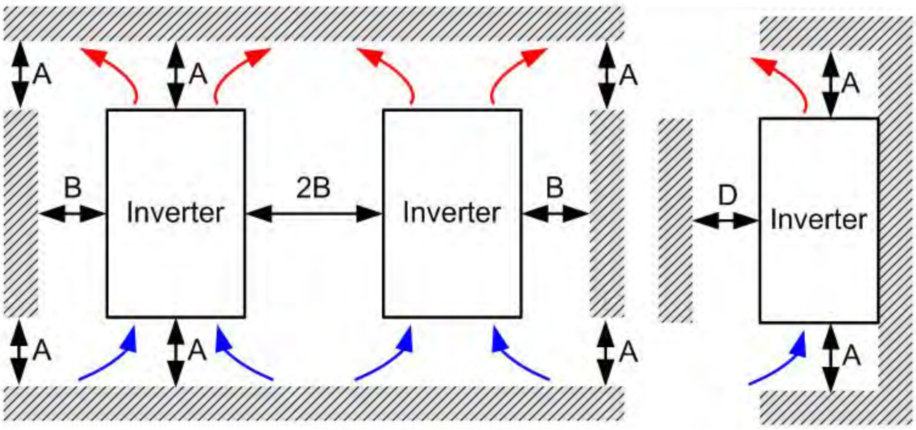
Single drive: installation (Frame A-H)



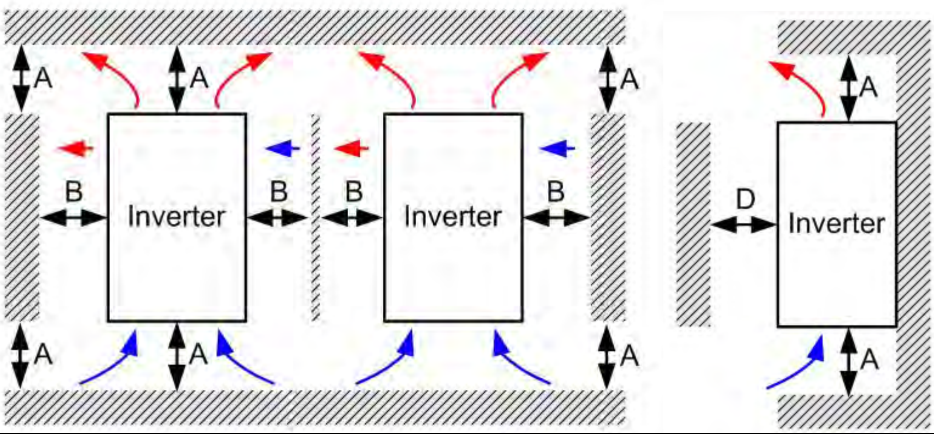
Side-by-side installation(Frame A-C)



Multiple drives: side-by-side installation（Frame A,B,C, G, H）



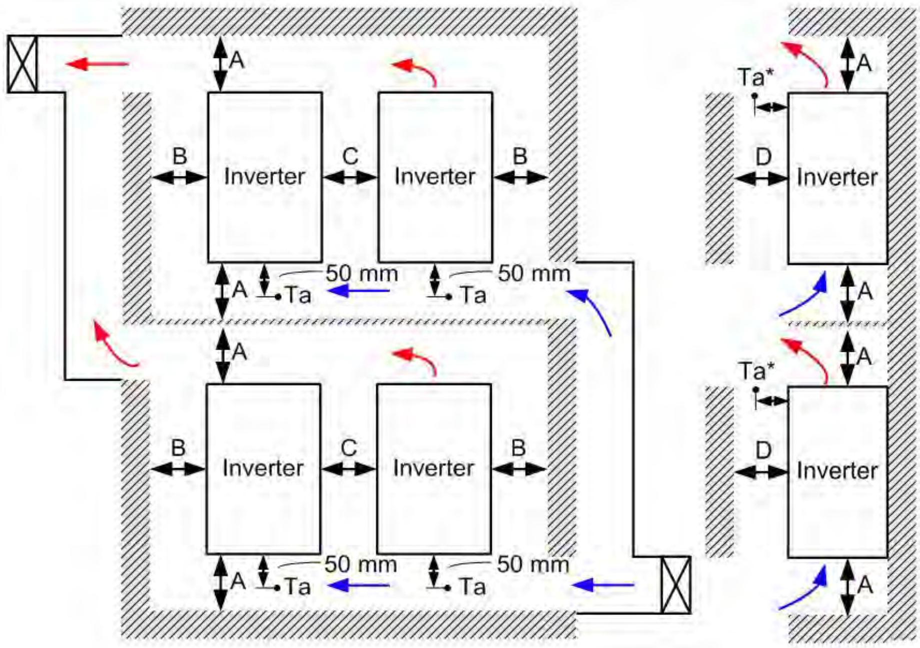
Multiple drives: side-by-side installation (Frame D, E, F) Install a barrier between the drives.



Multiple drives side-by-side installation in rows (Frame A,B,C)

Ta: Frame A~G Ta*: Frame H

For installation in rows, it is recommended installing a barrier between the drives. Adjust the size/depth of the barrier till the temperature measured at the fan's inflow side is lower than the operation temperature. Operation temperature is the defined as the temperature measured 50mm away from the fan's inflow side. (As shown in the figure below)



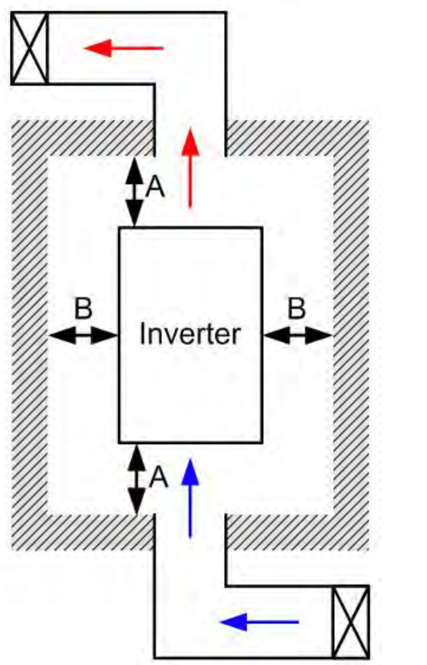
Minimum mounting clearance

Frame	A (mm)	B (mm)	C (mm)	D (mm)
A~C	60	30	10	0
D~F	100	50	-	0
G	200	100	-	0
H	350	0	0	200 (100, 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 D	VFD300C23A/E; VFD370C23A/E; VFD370C43A/E; VFD450C43A/E; VFD550C43A/E; VFD750C43A/E;
Frame E	VFD450C23A/E; VFD550C23A/E; VFD750C23A/E; VFD900C43A/E; VFD1100C43A/E;
Frame F	VFD900C23A/E; VFD1320C43A/E; VFD1600C43A/E;
Frame G	VFD1850C43A; VFD2200C43A; VFD1850C43E; VFD2200C43E;
Frame H	VFD2800C43A; VFD3150C43A; VFD3550C43A; VFD2800C43E-1; VFD3150C43E-1; VFD3550C43E-1;VFD2800C43E; VFD3150C43E; VFD3550C43E;

NOTE

1. It is the minimum distance required for frame A~D. If drives are installed closer than the minimum mounting clearance, the fan may not function properly.
2. Model VFD007C43E; VFD015C43E; VFD022C43E; VFD037C43E; VFD040C43E; VFD055C43E; VFD075C43E; VFD110C43E; VFD150C43E; VFD185C43E; VFD220C43E; VFD300C43E will be available for ordering soon. Please contact your local distributor or Delta representative for detailed launch schedule,



NOTE

※ The mounting clearances shown in the left figure are **NOT** for installing the drive in a confined space (such as cabinet or electric box). When installing in a confined space, besides the same minimum mounting clearances, it needs to have the ventilation equipment or air conditioner to keep the surrounding temperature lower than the operation temperature.

※ The following table shows heat dissipation and the required air volume when installing a single drive in a confined space. When installing multiple drives, the required air volume shall be multiplied by the number the drives.

※ Refer to the chart (Air flow rate for cooling) for ventilation equipment design and selection.

※ Refer to the chart (Power dissipation) for air conditioner design and selection.

Air flow rate for cooling							Power dissipation of AC motor drive		
Model No.	Flow Rate (cfm)			Flow Rate (m^3/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	146	12	158	248	20	268	649	216	865
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	59
VFD015C43A/E	-	-	-	-	-	-	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

Model No.	Air flow rate for cooling: Flow Rate (cfm) External	Internal	Total	Flow Rate (m^3/hr) External	Internal	Total	Power dissipation of AC motor drive: Power Dissipation Loss External (Heat sink)	Internal	Total
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

※ The required airflow shown in chart is for installing single drive in a confined space.
※ When installing the multiple drives, the required air volume should be the required air volume for single drive X the number of the drives.
※ Model VFD007C43E; VFD015C43E; VFD022C43E; VFD037C43E; VFD040C43E; VFD055C43E; VFD075C43E; VFD110C43E; VFD150C43E; VFD185C43E; VFD220C43E; VFD300C43E will be available for ordering soon. Please contact your local distributor or Delta representative for detailed launch schedule.

※ The heat dissipation shown in the chart is for installing single drive in a confined space.
※ When installing the multiple drives, volume of heat dissipation should be the heat dissipated for single drive X the number of the drives.
※ Heat dissipation for each model is calculated by rated voltage, current and default carrier.

Derating curve diagram: Normal Duty

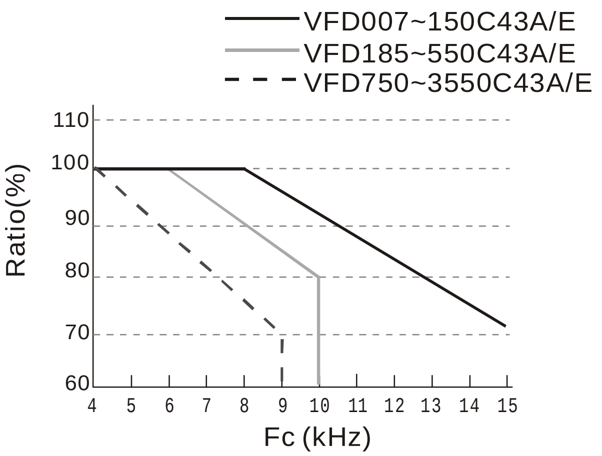
Setting =1

Setting = 0 or 2

(50℃: UL open-type)

(40℃:UL type1 or open type_size by size)

460V

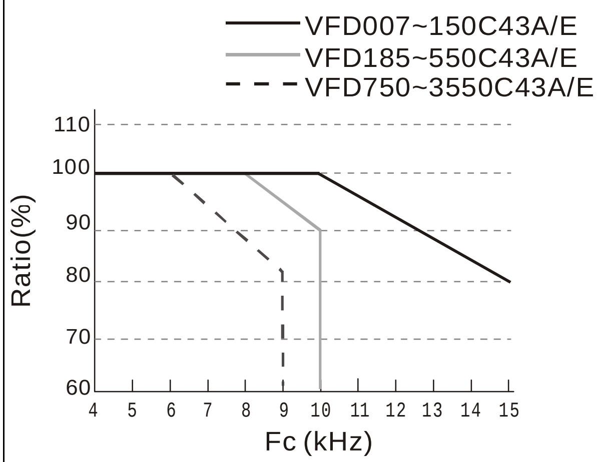


Setting = 0 or 2

(40℃: UL open-type)

(30℃: UL type1 or open type_size by size)

460V



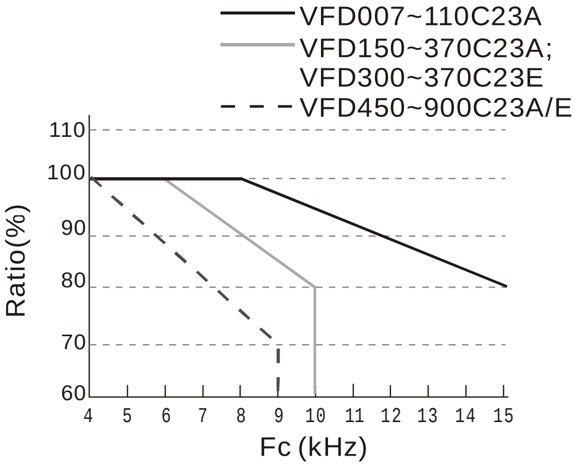
Setting =1

Setting = 0 or 2

Setting = 0 or 2

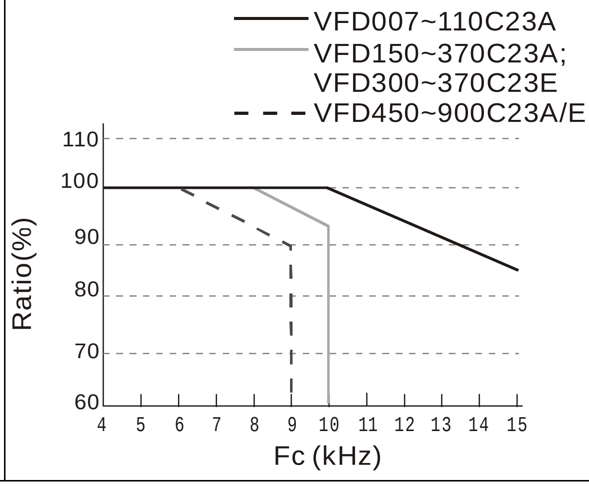
(50℃: UL open-type)
(40℃:UL type1 or open type_size by size)

230V



(40℃: UL open-type)
(30℃: UL type1 or open type_size by size)

230V



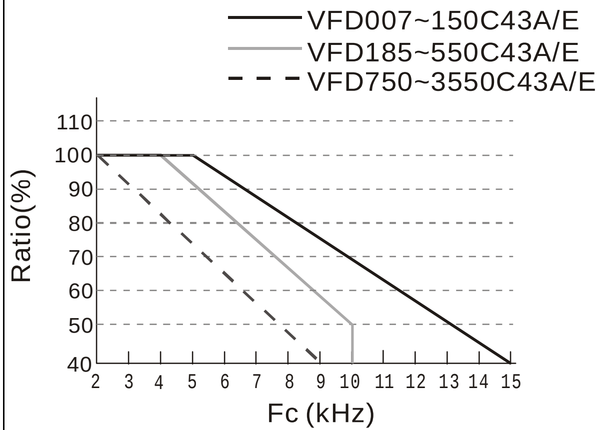
Derating curve diagram: Heavy Duty

Setting =1

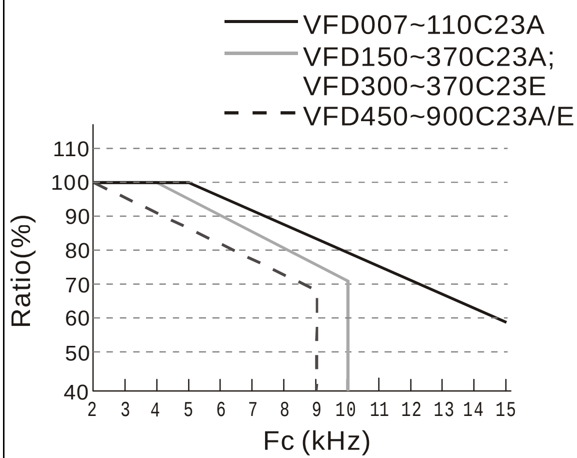
Setting = 0 or 2

(50℃: UL open-type)
(40℃: UL type1 or open type_size by size)

460V



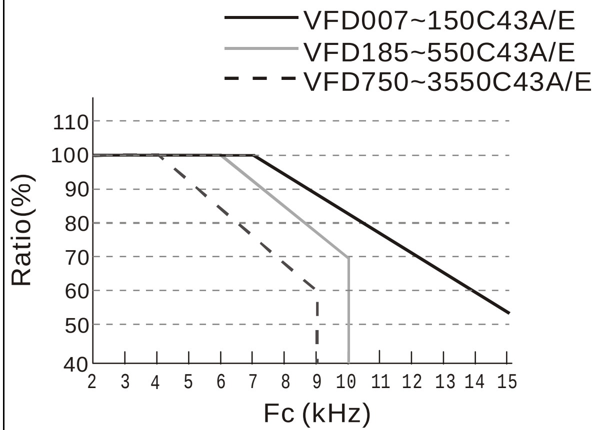
230V



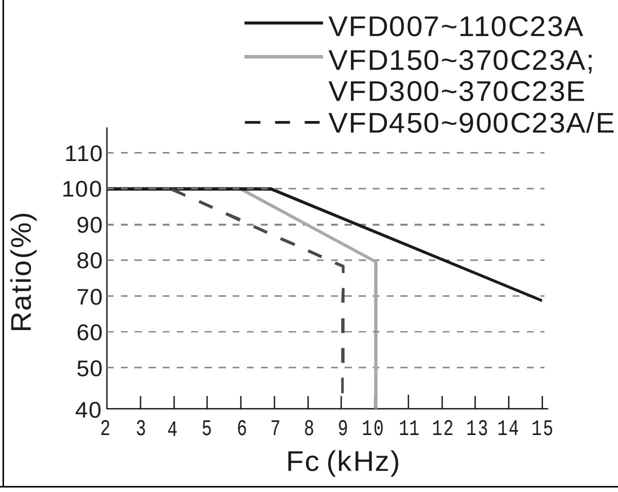
Setting = 0 or 2

(40℃: UL open-type)
(30℃: UL type1 or open type_size by size)

460V



230V

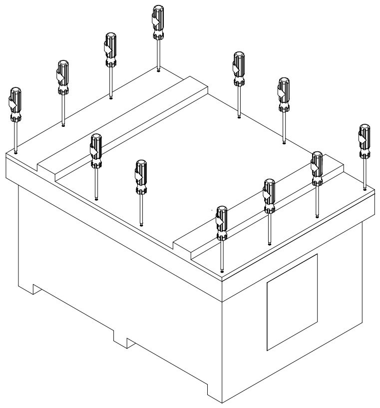
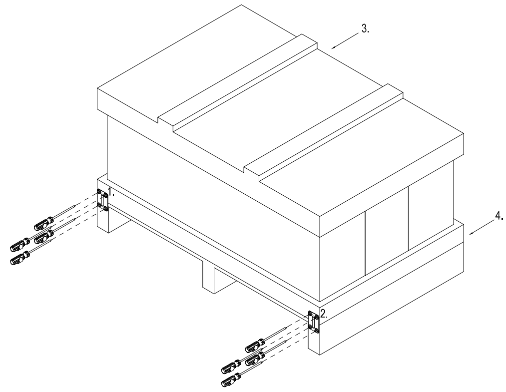
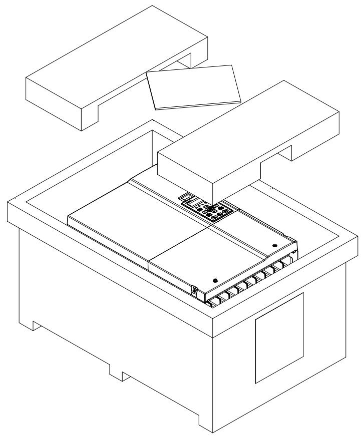
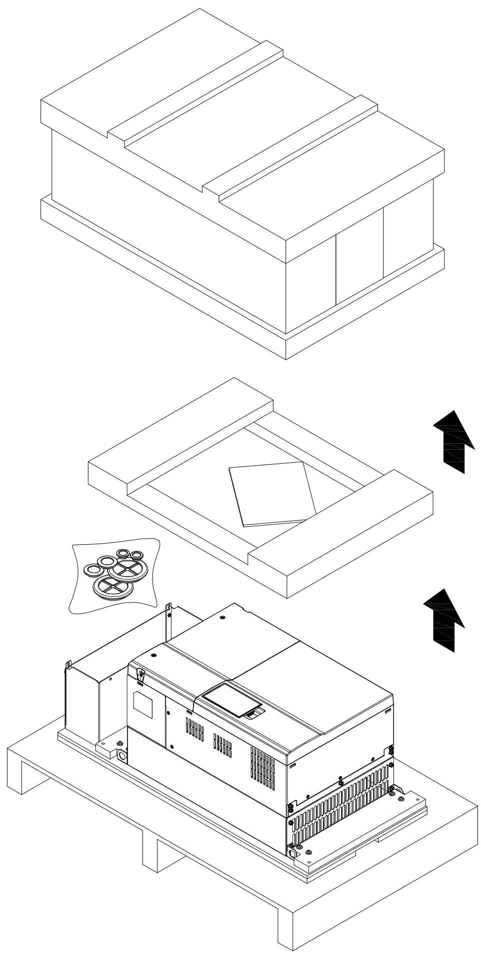
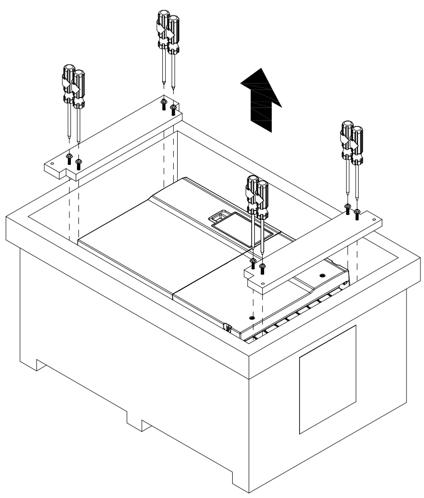


Chapter 3 Unpacking

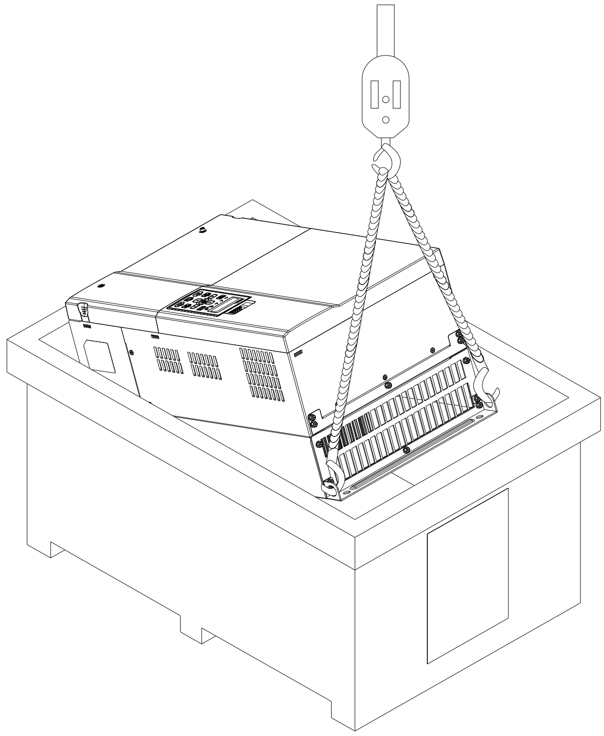
The AC motor drive should be kept in the shipping carton or crate before installation. In order to retain the warranty coverage, the AC motor drive should be stored properly when it is not to be used for an extended period of time.

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

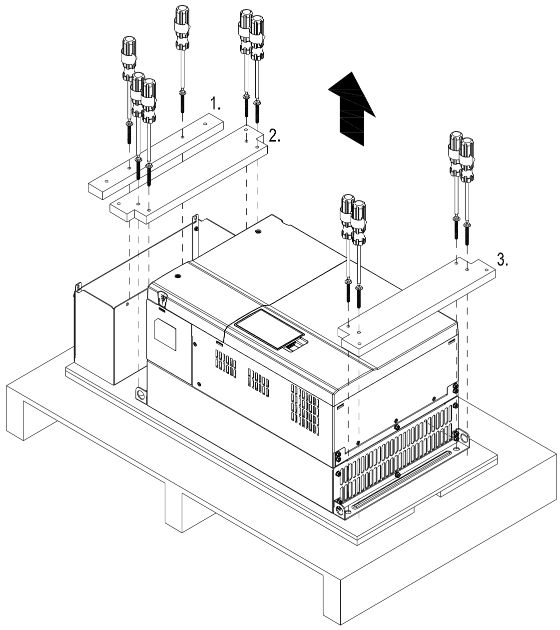
Frame D

Crate 1 (VFDXXXCXXA)	Crate 2 (VFDXXXCXXE)
Loosen the 12 cover screws to open the crate. 	Loosen all of the screws on the 4 iron plates at the four bottom corners of the crate. 4 screws on each of the iron plate. 
Remove the EPEs and manual. 	Remove the crate cover, EPEs, rubber and manual. 
Loosen the 8 screws that fastened on the pallet, remove the wooden plate. 	

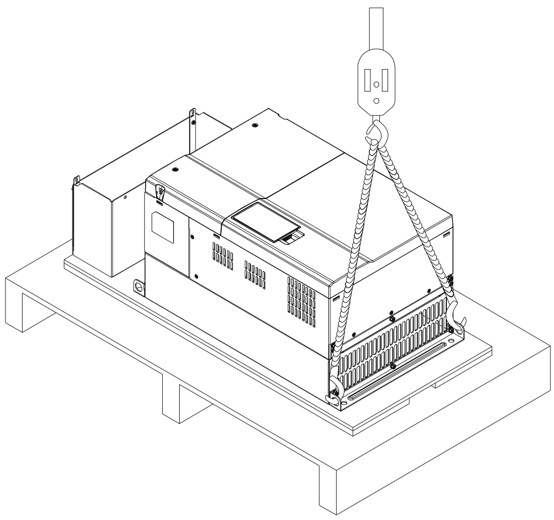
Lift the drive by hooking the lifting hole. It is now ready for installation.



Loosen the 10 screws on the pallet, remove the wooden plate.



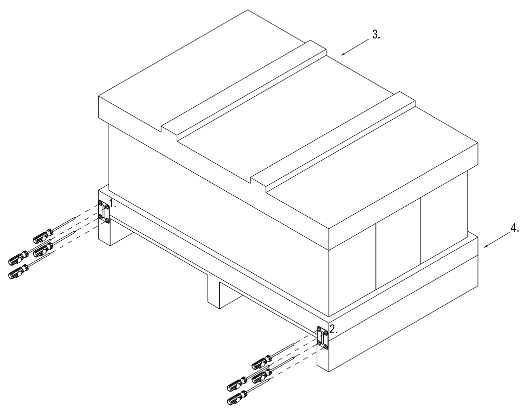
Lift the drive by hooking the lifting hole. It is now ready for installation.



Frame E

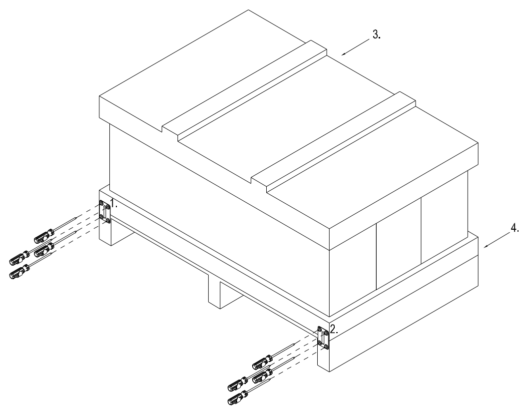
Crate 1 (VFDXXXCXXA)

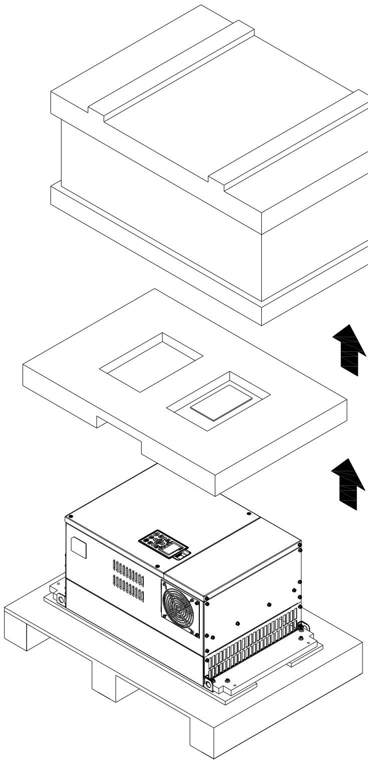
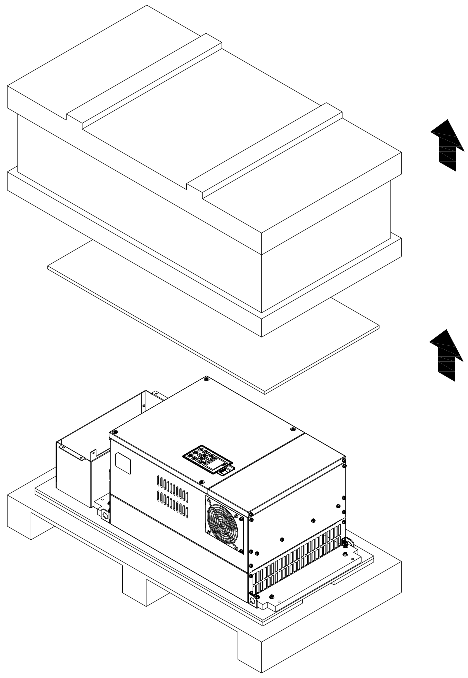
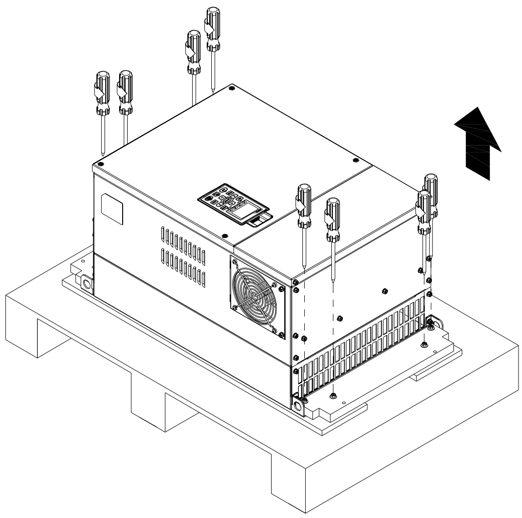
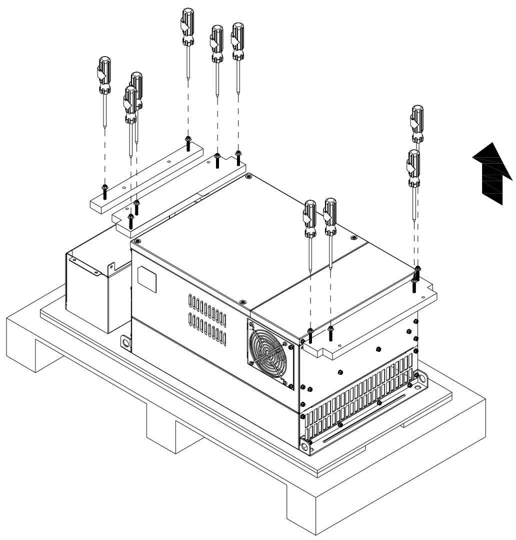
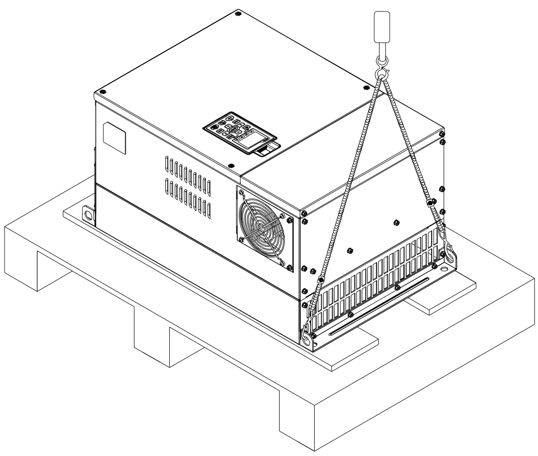
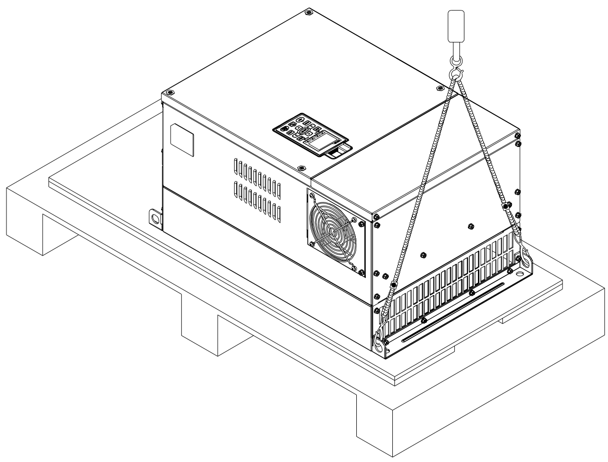
Loosen the 4 screws on the iron plates. There are 4 iron plates and in total of 16 screws.



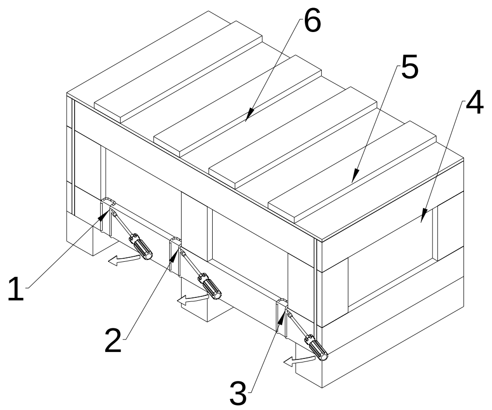
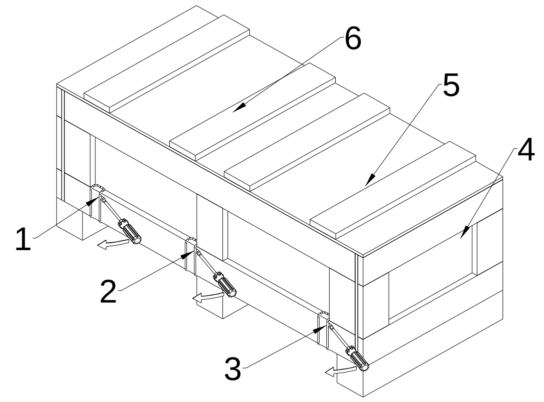
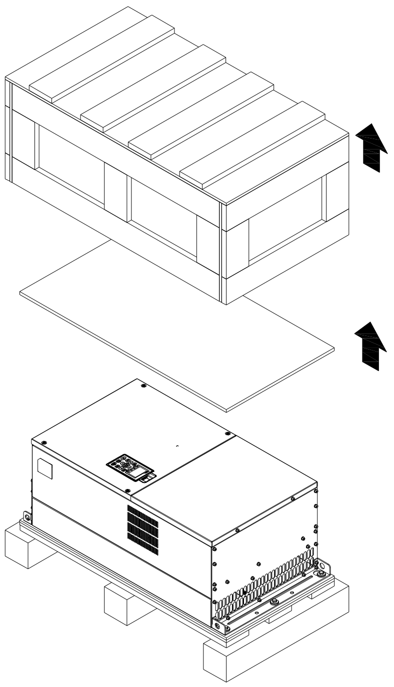
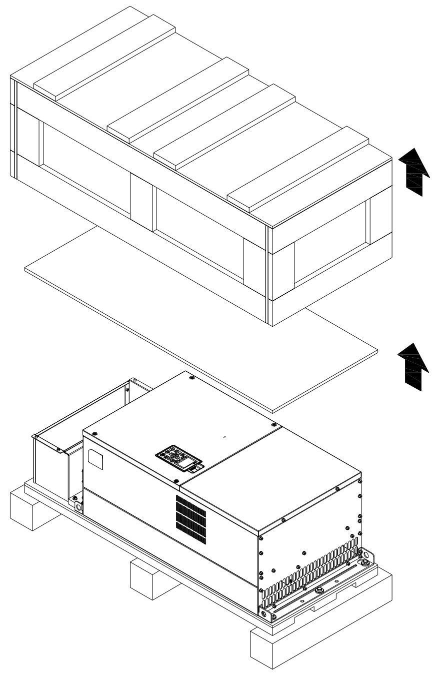
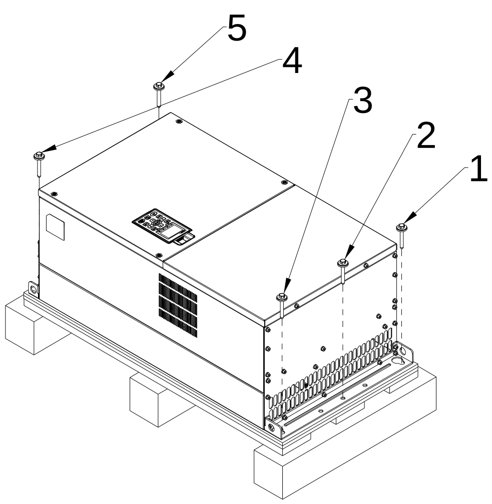
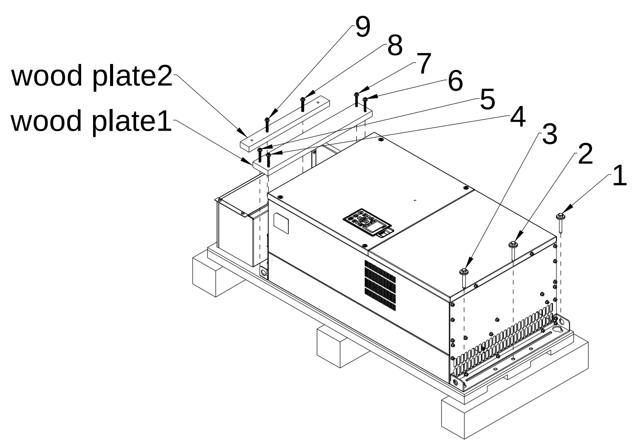
Crate 2 (VFDXXXCXXE)

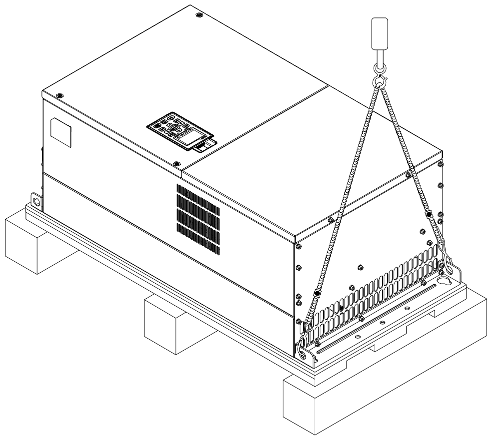
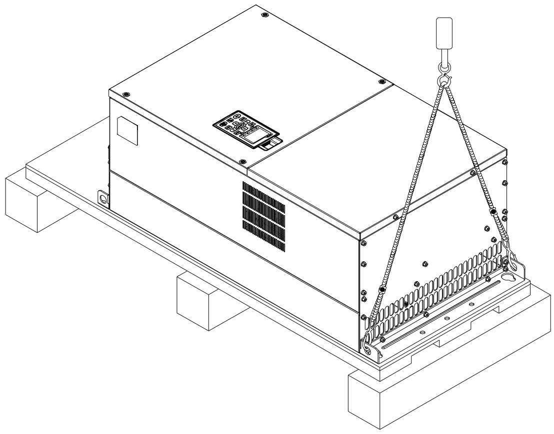
Loosen the 4 screws on the iron plates. There are 4 iron plates and in total of 16 screws.



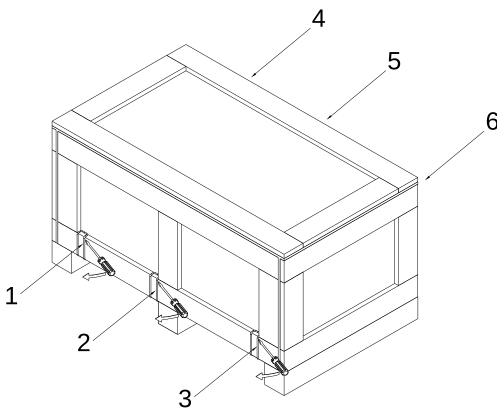
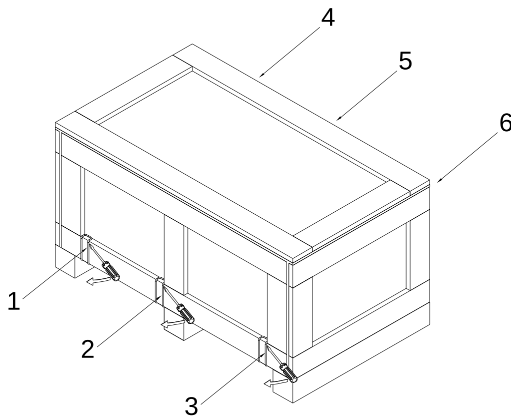
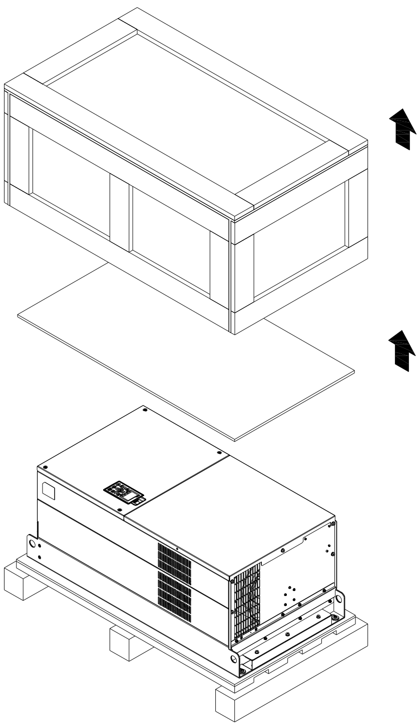
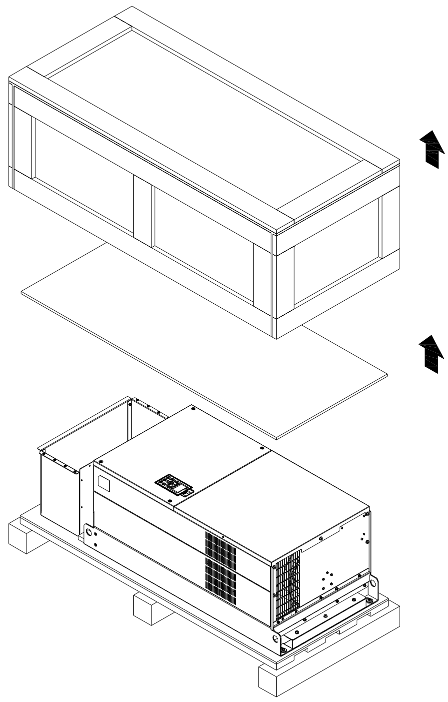
Remove the crate cover, EPEs and manual. 	Remove the crate cover, EPEs, rubbers and manual. 
Loosen the 8 screws on the pallet as shown in the following figure. 	Loosen the 10 screws on the pallet and remove the wooden plate. 
Lift the drive by hooking the lifting hole. It is now ready for installation. 	Lift the drive by hooking the lifting hole. It is now ready for installation. 

Frame F

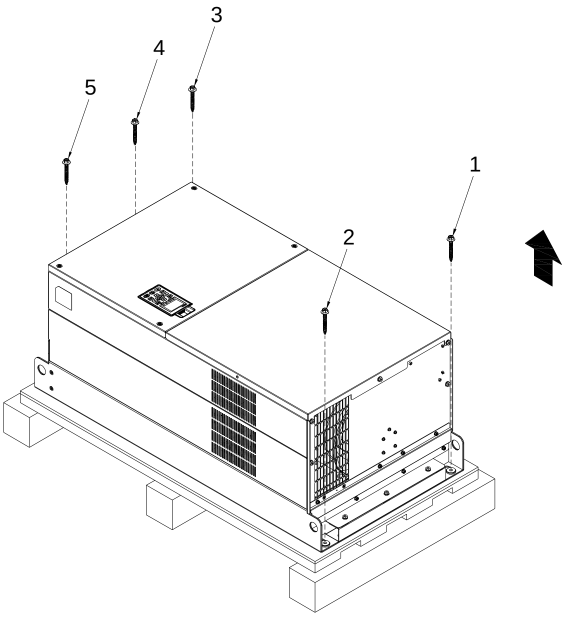
Crate 1 (VFDXXXCXXA)	Crate 2 (VFDXXXCXXE)
Remove the 6 clips on the side of the crate with a flat-head screwdriver. (As shown in figure below.)  	Remove the 6 clips on the side of the crate with a flat-head screwdriver. (As shown in figure below.) 
Remove the crate cover, EPEs and manual. 	Remove the crate cover, EPEs, rubbers and manual. 
Loosen the 5 screws on the pallet as shown in the following figure.  	Loosen the 9 screws on the pallet and remove the wooden plate. 

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

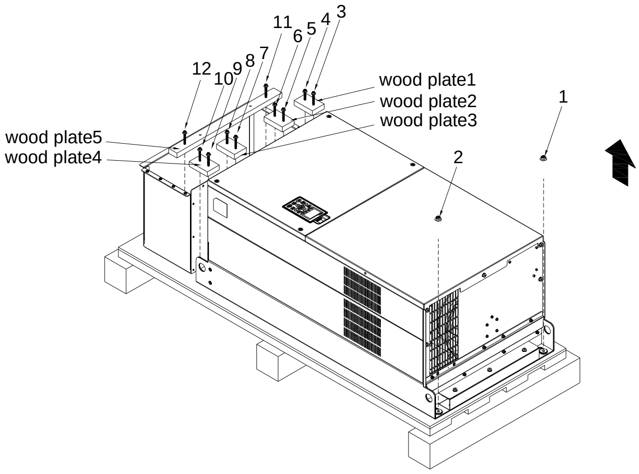
Frame G

Crate 1 (VFDXXXCXXA)	Crate 2 (VFDXXXCXXE)
Remove the 6 clips on the side of the crate with a flathead screwdriver. (As shown in figure below.) 	Remove the 6 clips on the side of the crate with a flathead screwdriver. (As shown in figure below.) 
Remove the crate cover, EPEs and manual. 	Remove the crate cover, EPEs, rubber and manual. 

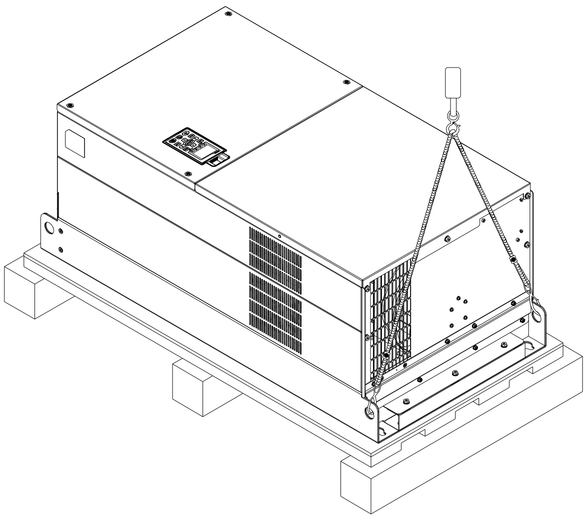
Loosen the 5 screws as shown in following figure:



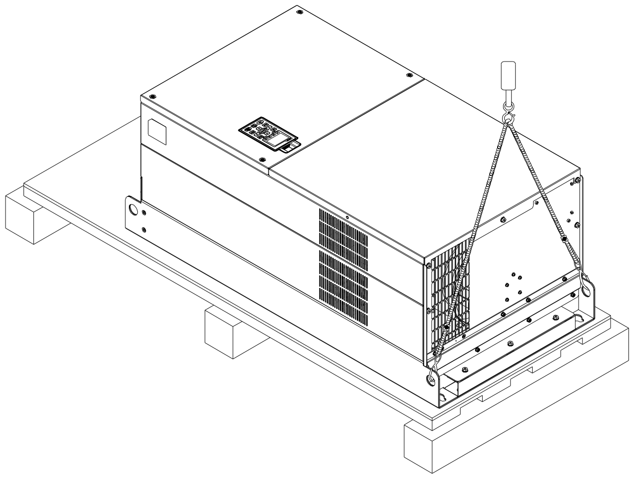
Loosen the 9 screws and remove the wooden plate.

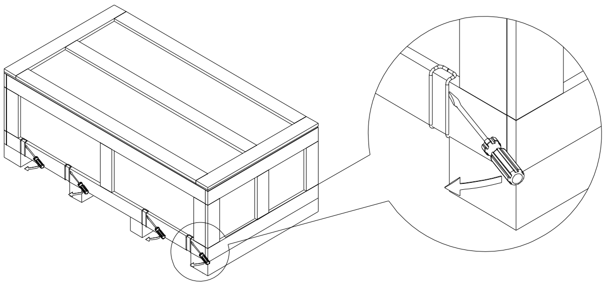
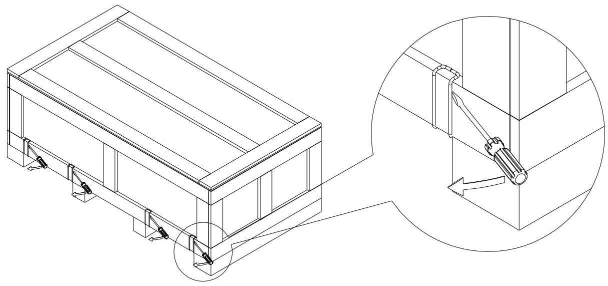
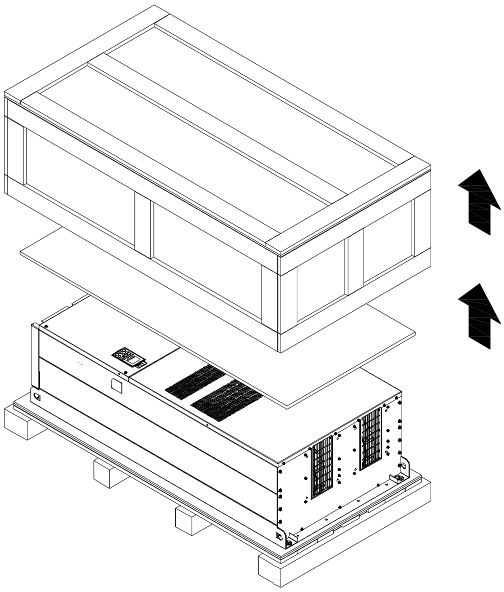
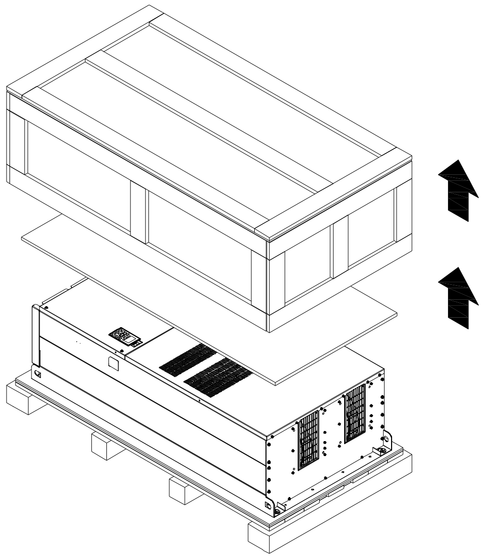
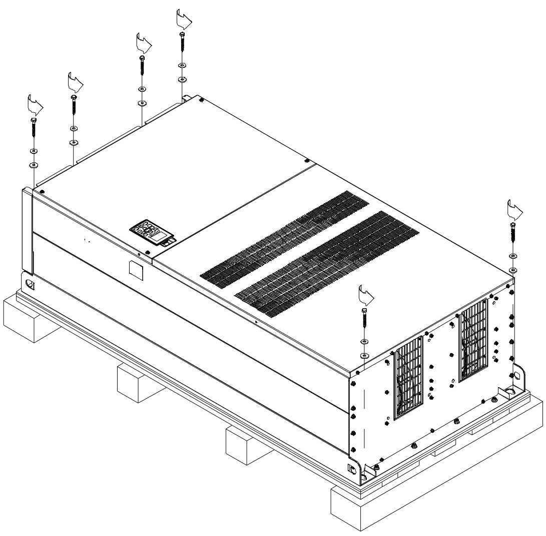
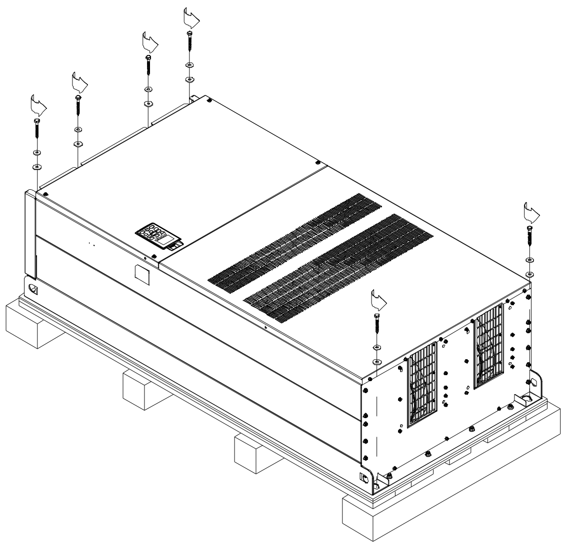


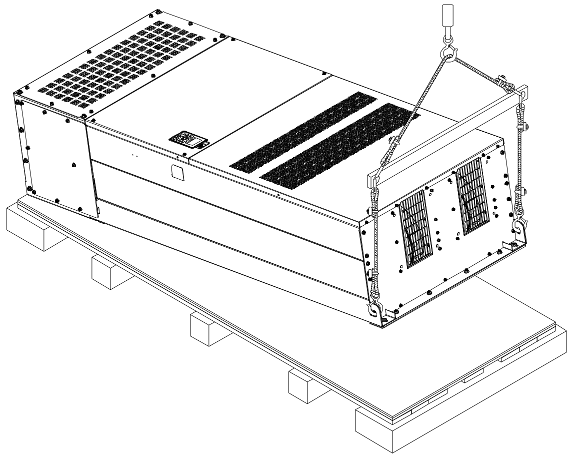
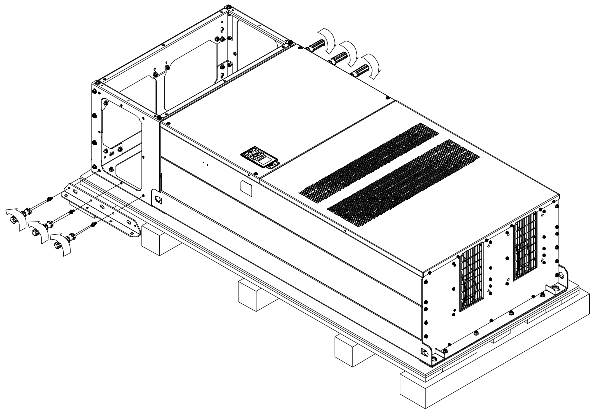
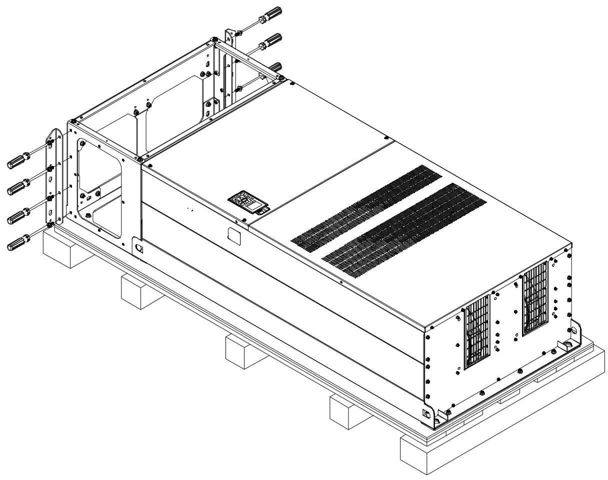
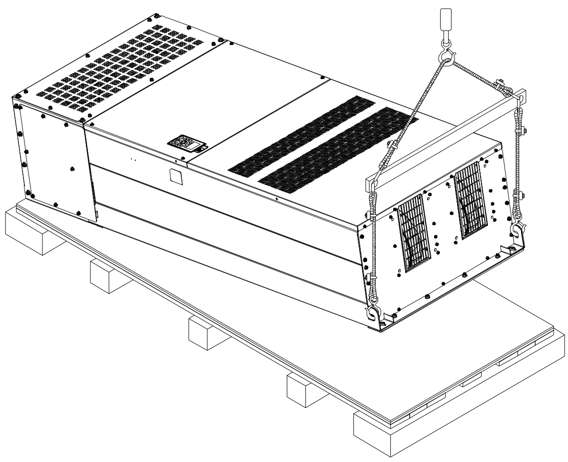
Lift the drive by hooking the lifting hole. It is now ready for installation.



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



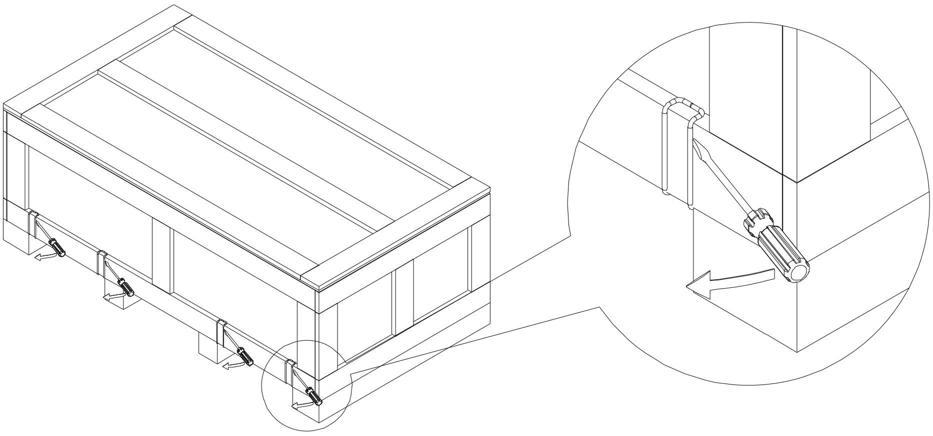
Frame H	
Crate 1 (VFDXXXCXXA) Remove the 8 clips on the side of the crate with a flathead screwdriver. (As shown in figure below.) 	Crate 2 (VFDXXXCXXE-1) Remove the 8 clips on the side of the crate with a flathead screwdriver. (As shown in figure below.) 
Remove the crate cover, EPEs and manual. 	Remove the crate cover, EPEs, rubbers and manual. 
Loosen the 6 screws on the top then remove 6 metal washers and 6 plastic washers as shown in figure below. 	Loosen the 6 screws on the top then remove 6 metal washers and 6 plastic washers as shown in figure below. 

Lift the drive by hooking the lifting hole. It is now ready for installation. 	Loosen 6 of the M6 screws on the side and remove the 2 plates, as shown in below. The removed screws and plates can be used to secure the AC motor drive from the external. 
	Secure the drive from the external. (Skip to the next step if it is not necessary in your case.) 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. 

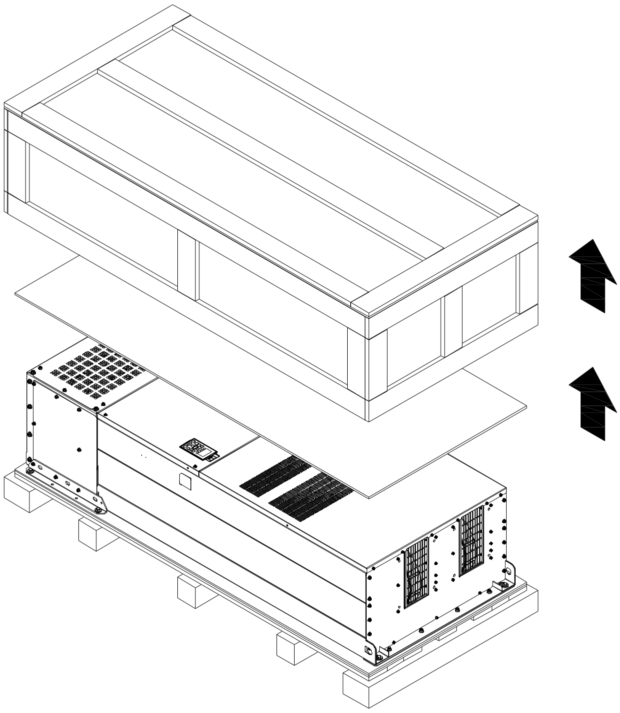
Frame H

Crate 3 (VFDXXXCXXE)

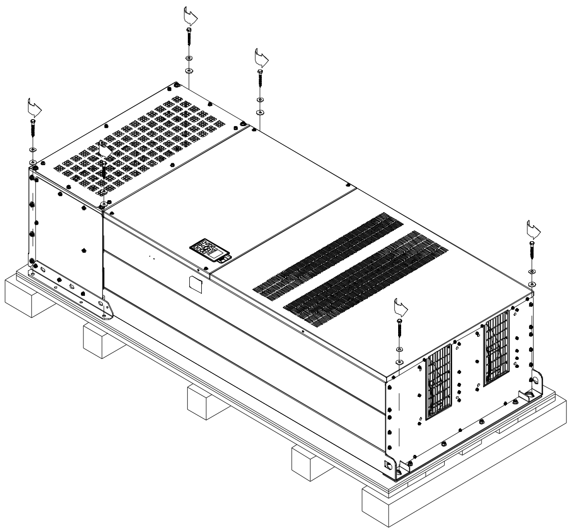
Use flathead screwdriver to remove the clips on the side of the crate, 8 clips in total.



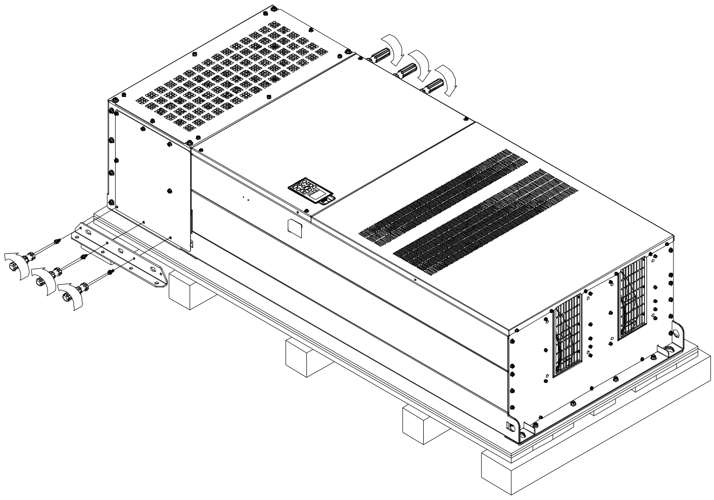
Remove the crate cover, EPEs, rubber and manual.



Loosen the 6 screws on the cover, remove 6 metal washers and 6 plastic washers as shown in below:



Loosen 6 of the M6 screws on the side and removes the 2 plates, as shown in following figure. The removed screws and plates can be used to secure AC motor drive from the external.



Secure the drive from the internal.

Loosen 18 of the M6 screws and remove the top cover as shown in figure 2. Mount the cover (figure 1) back to the drive by fasten the M6 screws to the two sides of the drive, as shown in figure 2.

Torque: 35~45kg-cm (30.38~39.06lb-in.)

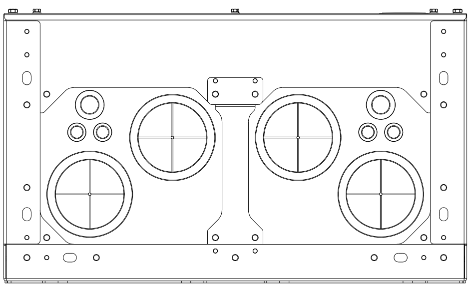


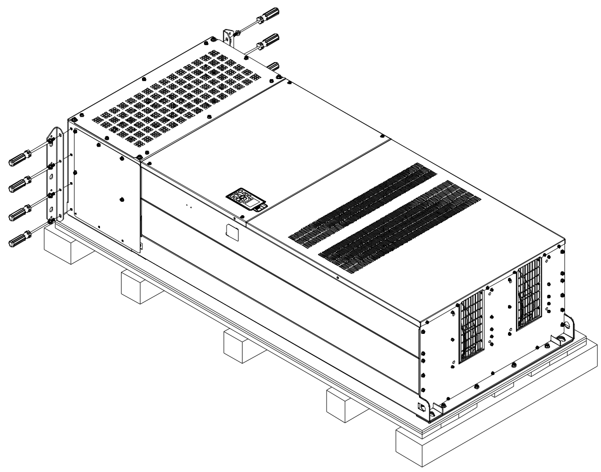
Figure 1

Top cover (Use M12 screws)

Secure the drive from the external.

Loosen 8 of the M8 screws on the both sides and place the 2 plates that were removed from the last step. Fix the plates to rive by fasten 8 of the M8 screws. (As shown in figure below).

Torque: 150~180kg-cm (130.20~156.24lb-in.)



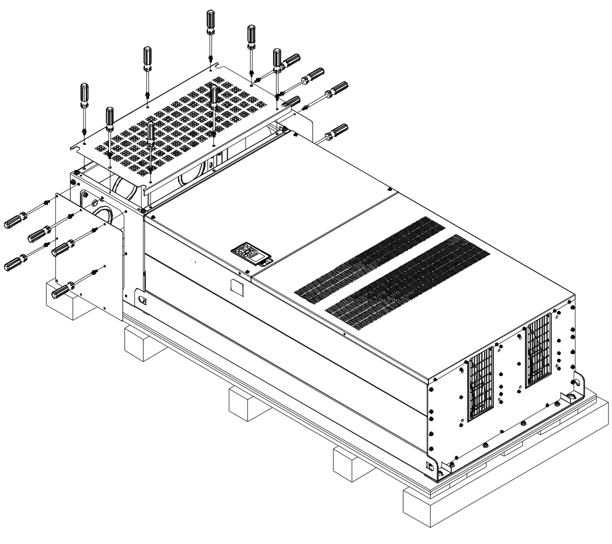
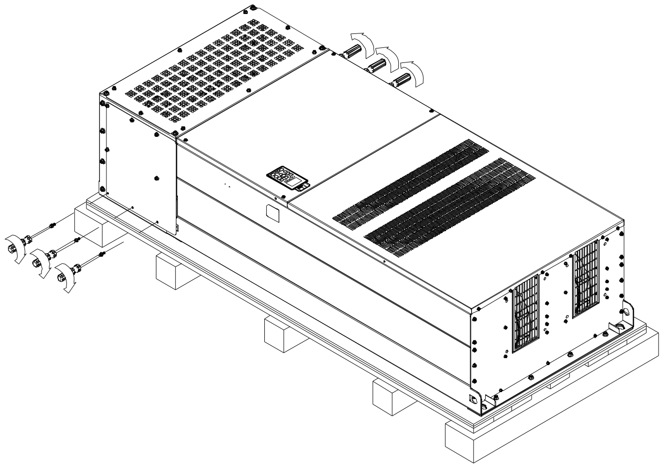
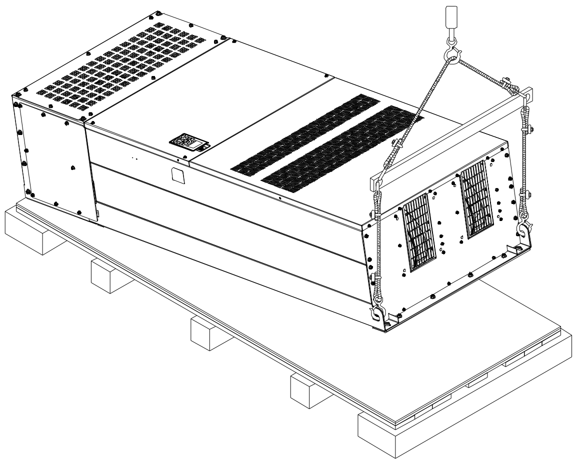


Figure 2

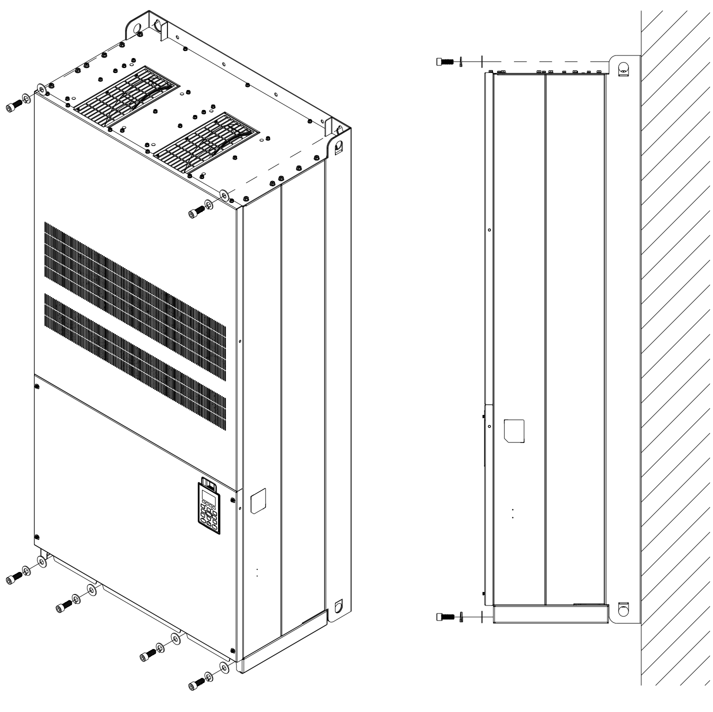
Fasten 6 of the M6 screws that were removed from last step back to the AC motor drive. As shown in figure below: 
Lift the drive by hooking the lifting hole. It is now ready for installation. 

Frame H Secure the drive

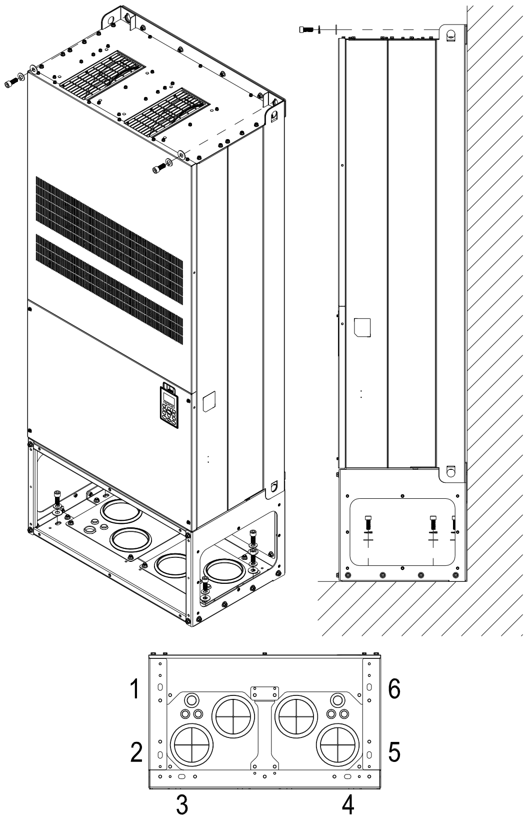
(VFDXXXCXXA)

Screw: M12*6

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



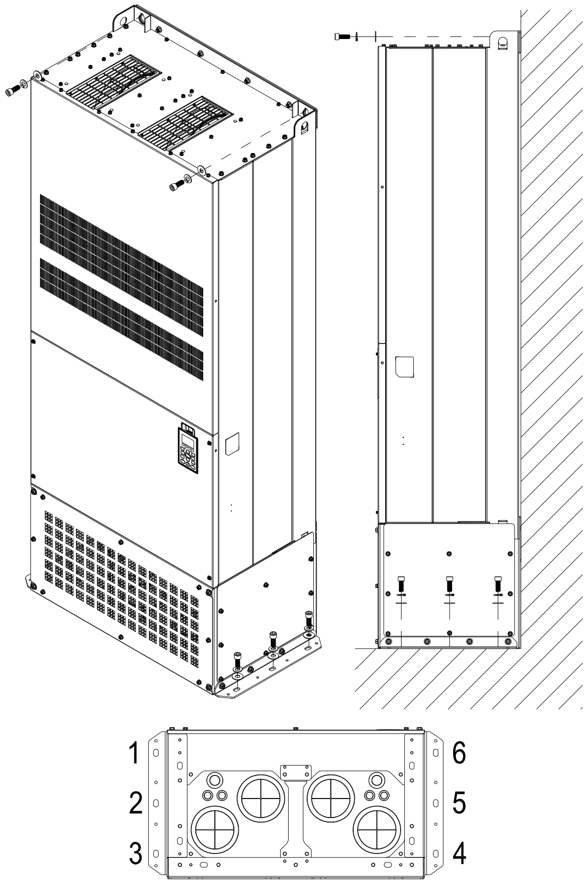
(VFDXXXCXXE) & (VFDXXXCXXE-1)



Secure the drive from 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.]

The Lifting Hook

The arrows indicate the lifting holes, as in figure below: (Frame D~H).

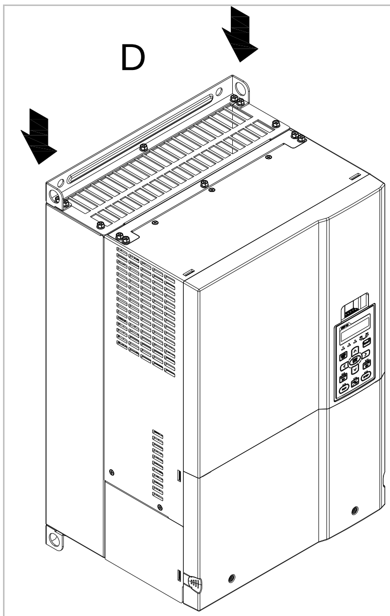


Figure 1

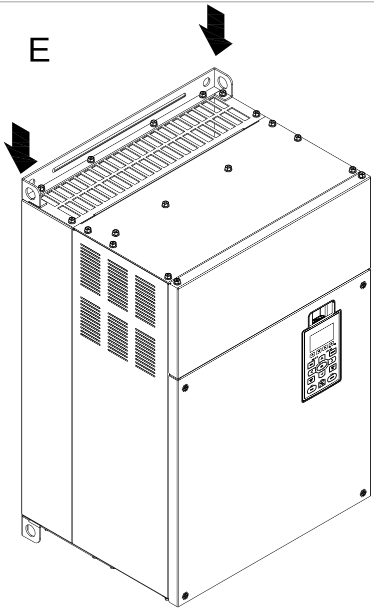


Figure 2

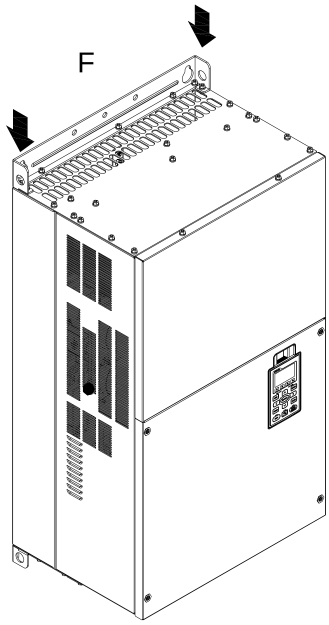


Figure 3

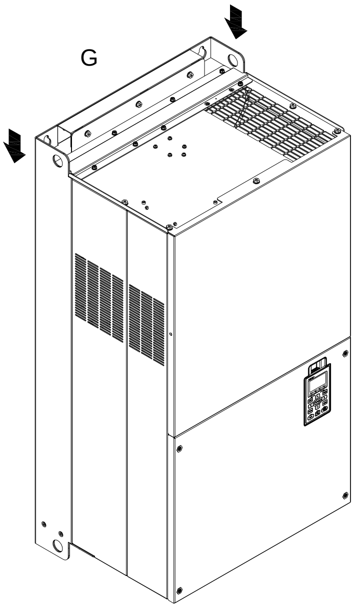


Figure 4

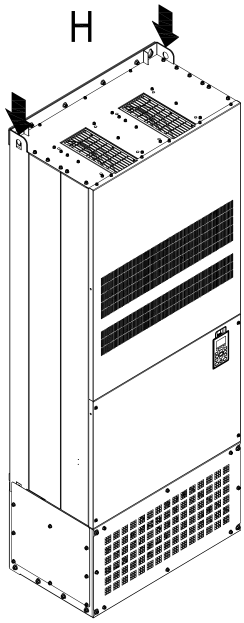
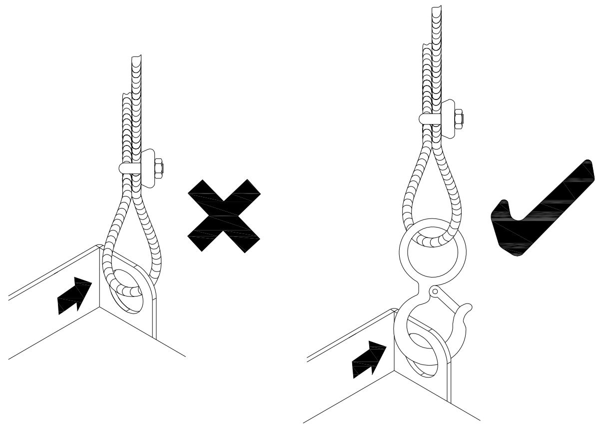
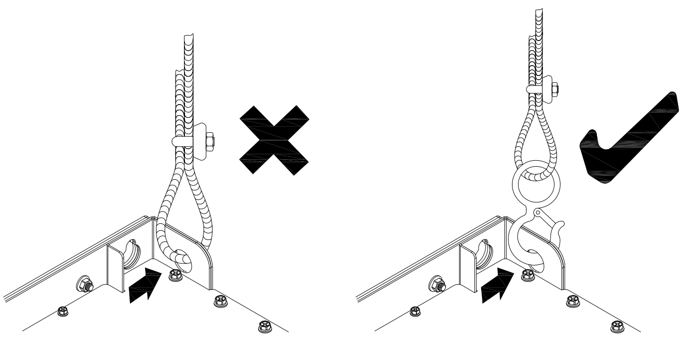


Figure 5

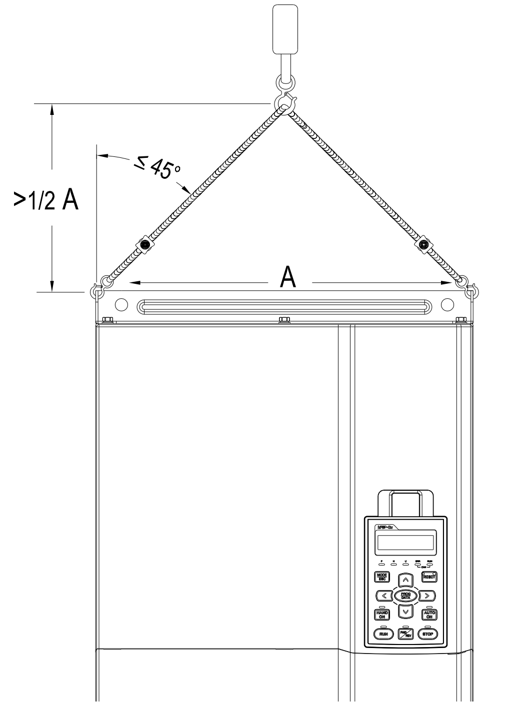
Ensure the lifting hook properly goes through the lifting hole, as shown in the following diagram.
(Applicable for Frame D~G)

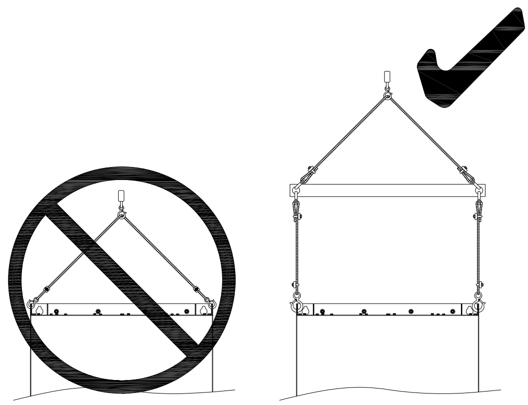


(Applicable to Frame H)

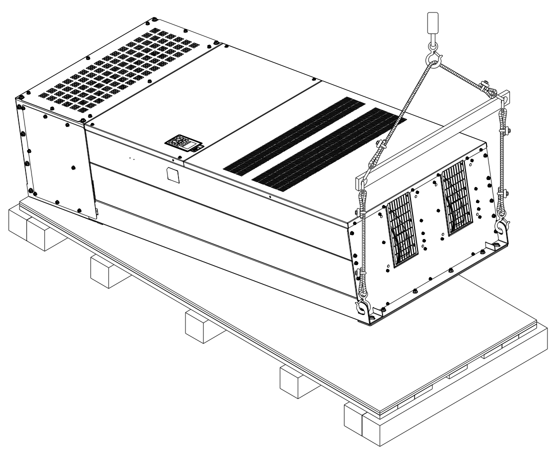


Ensure the angle between the lifting holes and the lifting device is within the specification, as shown in the following diagram.



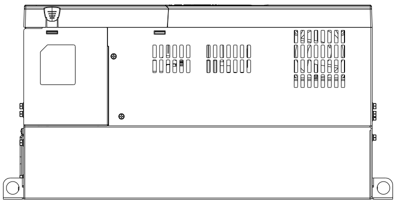


(Applicable to Frame H)

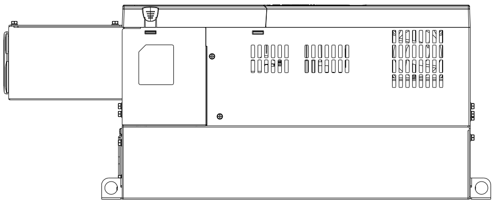


Weight

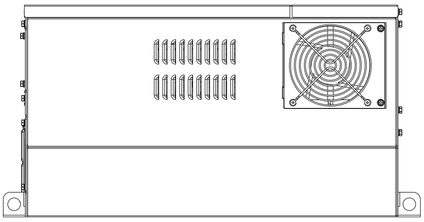
VFDXXXXCXXA D 37.6 kg(82.9 lbs.)



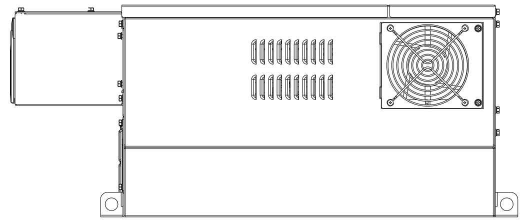
VFDXXXXCXXE D 40 kg(88.2 lbs.)



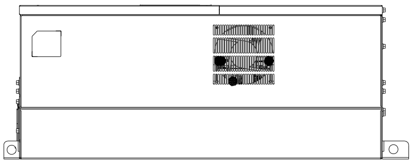
VFDXXXXCXXA E 63.6 kg(140.2 lbs.)



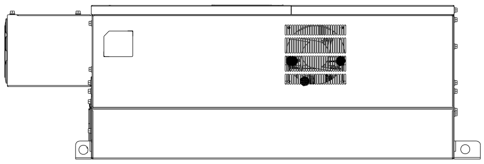
VFDXXXXCXXE E 66 kg(145.5 lbs.)



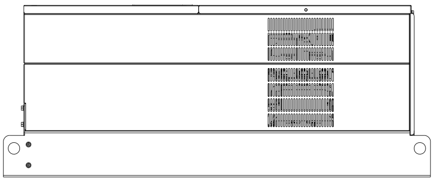
VFDXXXXCXXA F 85kg(187.2 lbs.)



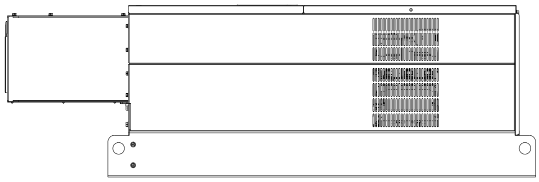
VFDXXXXCXXE F 88kg(193.8 lbs.)



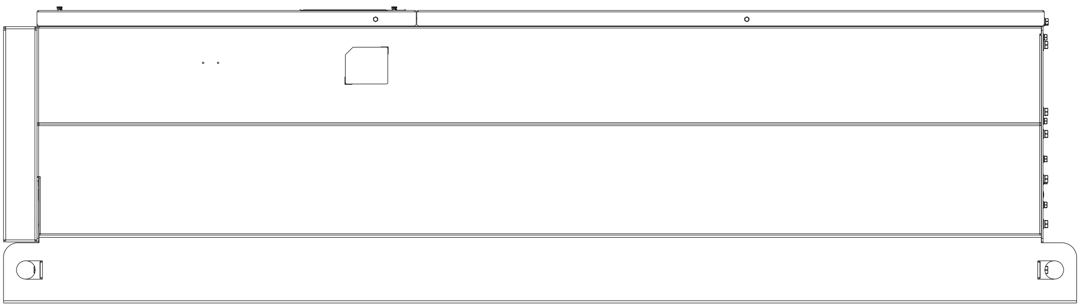
VFDXXXXCXXA G 130kg(286.5 lbs.)



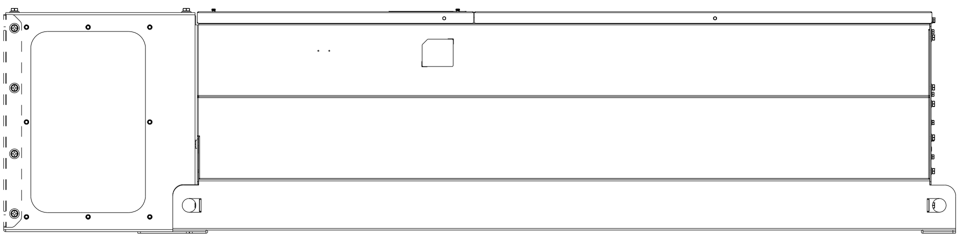
VFDXXXXCXXE G 138kg(303.9 lbs)



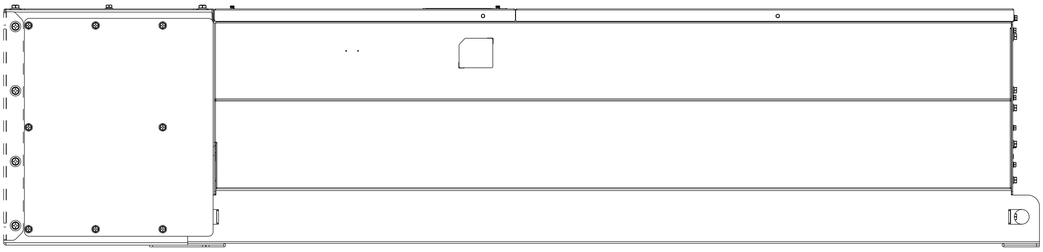
H1: VFD2800C43A; VFD3150C43A; VFD3550C43A; 235kg (518.1lbs)



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

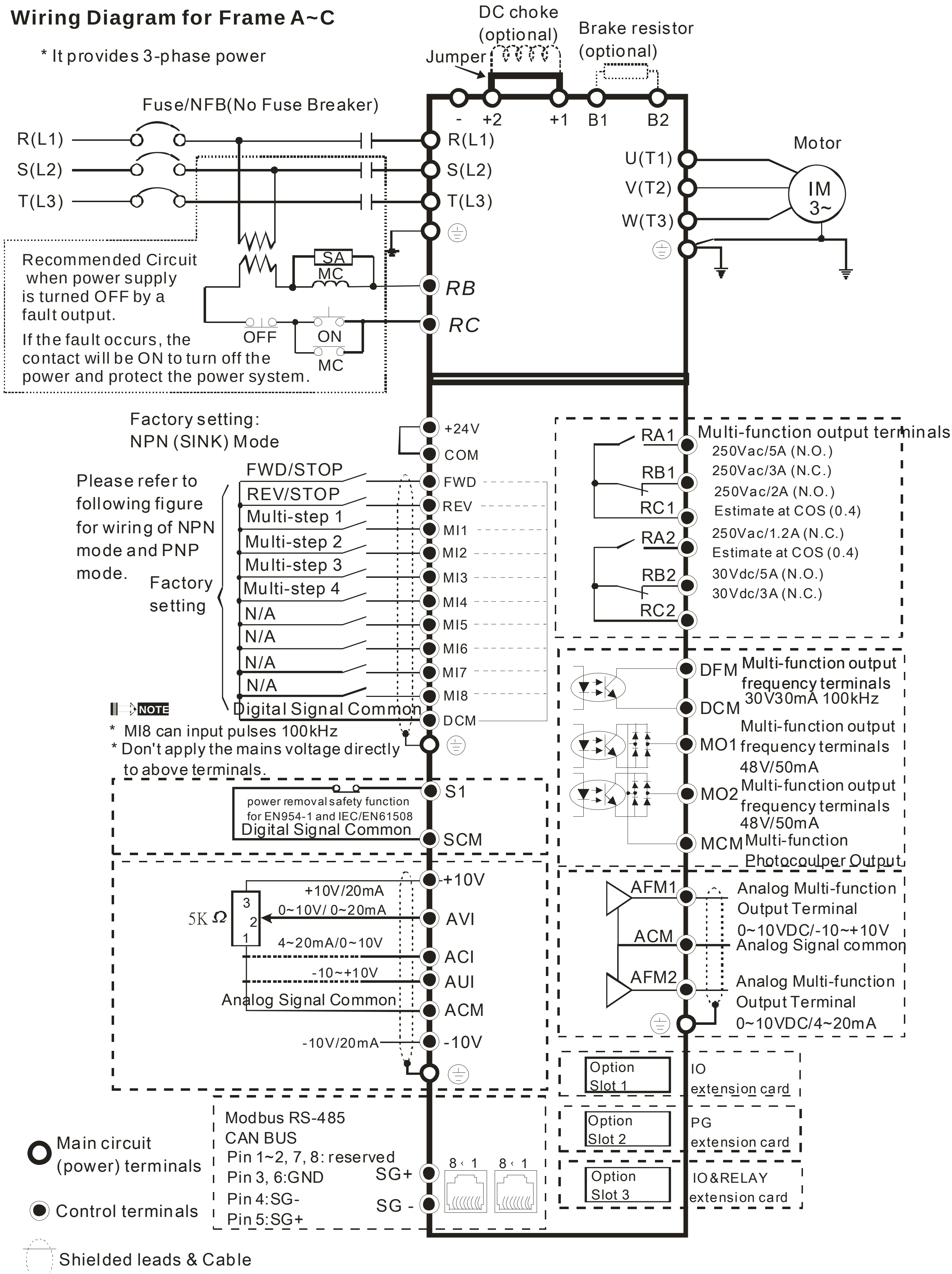


H3: VFD2800C43E; VFD3150C43E; VFD3550C43E; 263kg (579.8lbs)



Chapter 4 Wiring

Wiring Diagram for Frame A~C



Wiring diagram for frame D and above

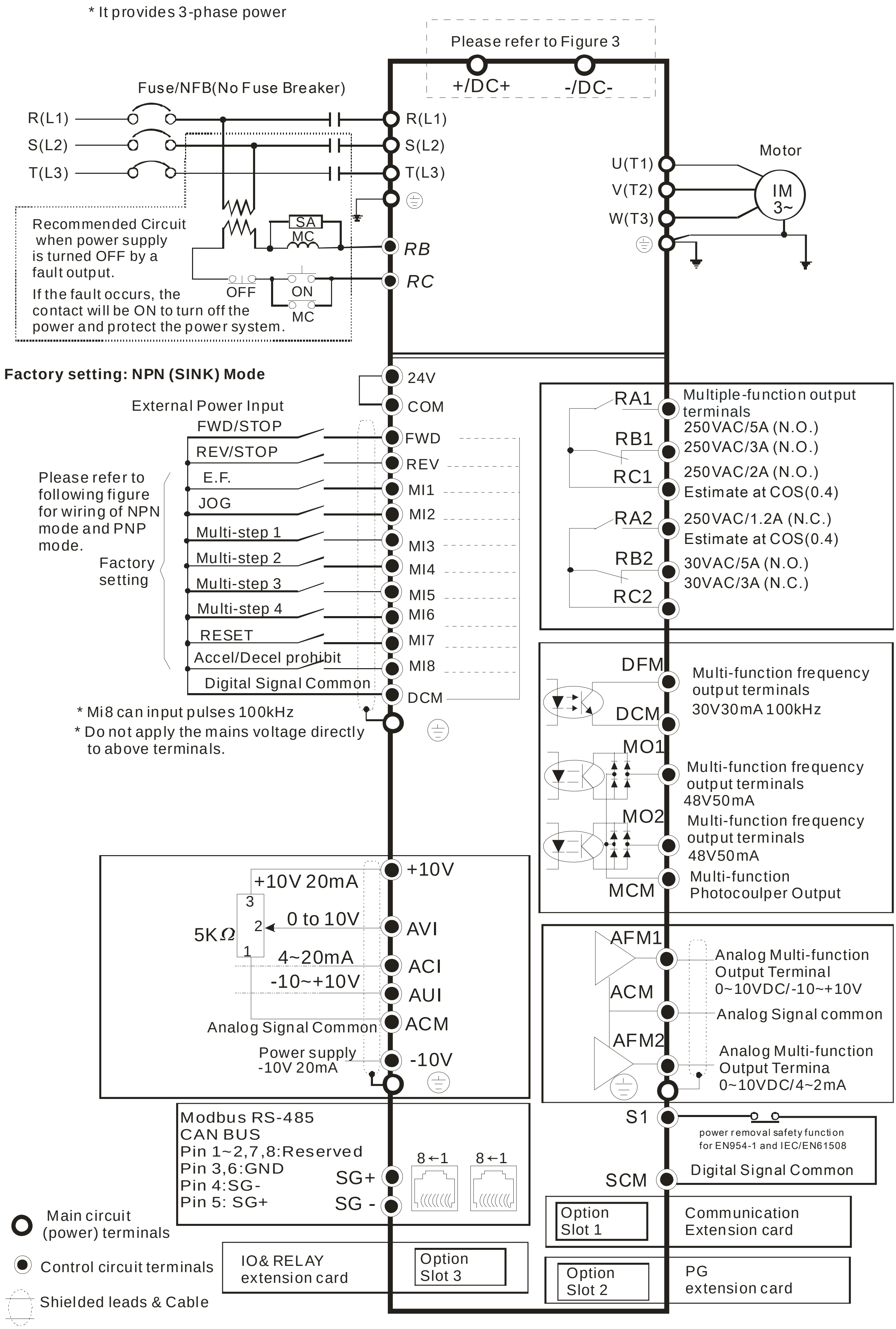


Figure 1

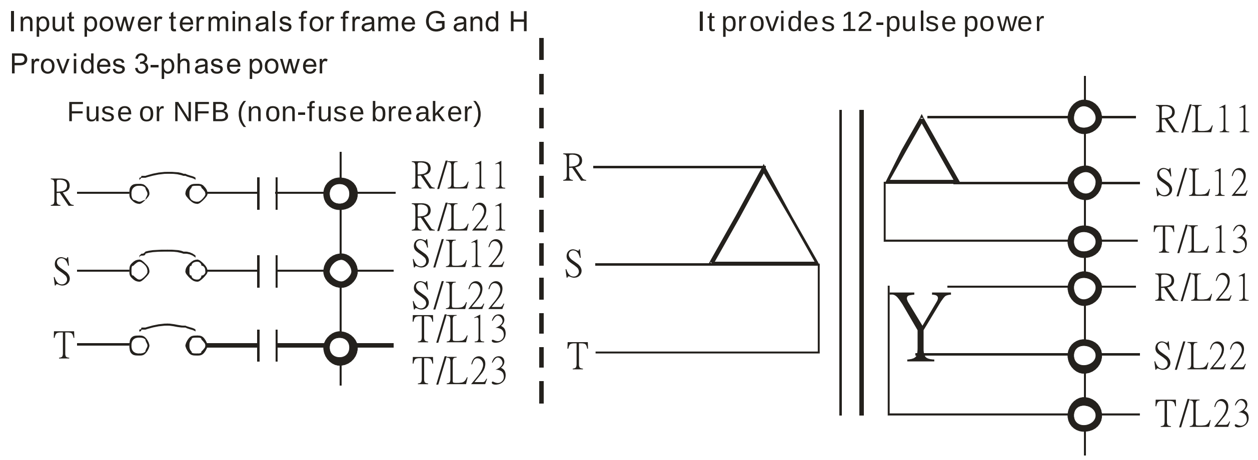


Figure 2

SINK（NPN）/SOURCE（PNP）Mode

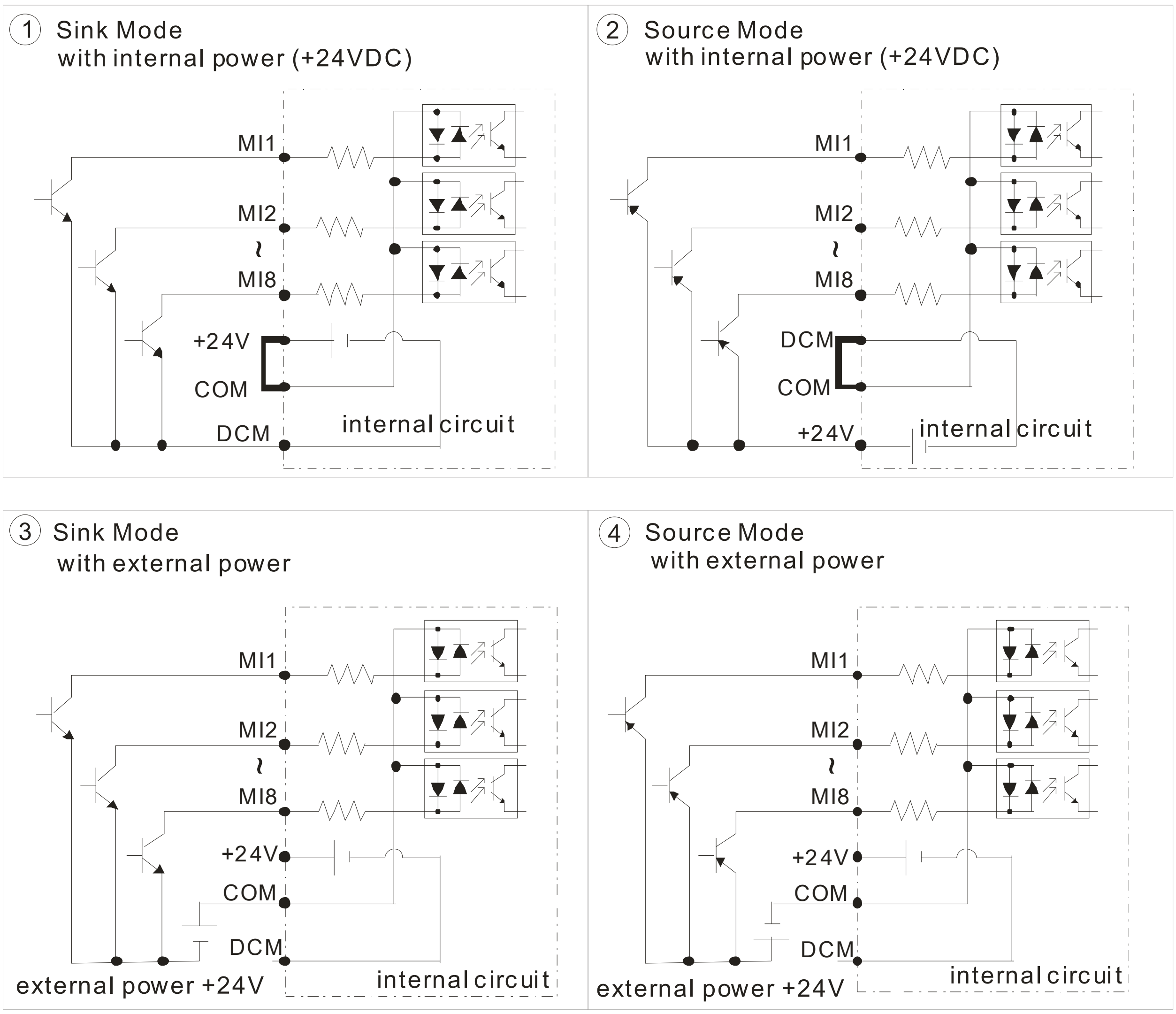
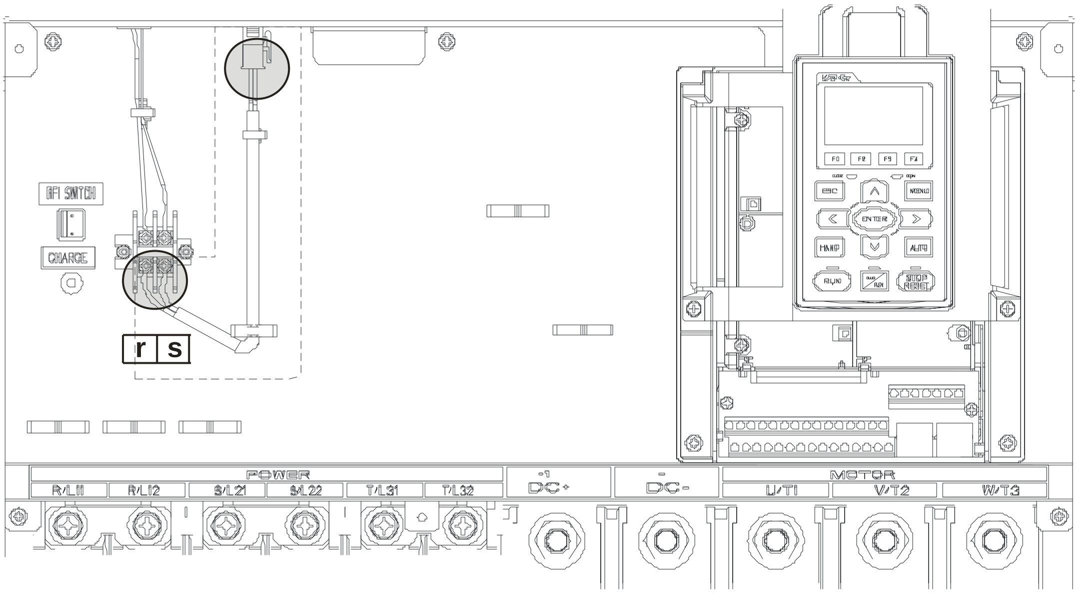


Figure 3

Frame E~H, remove terminal r and terminal s before using DC-Link. (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.)



Chapter 5 Main Circuit Terminals

Figure 1

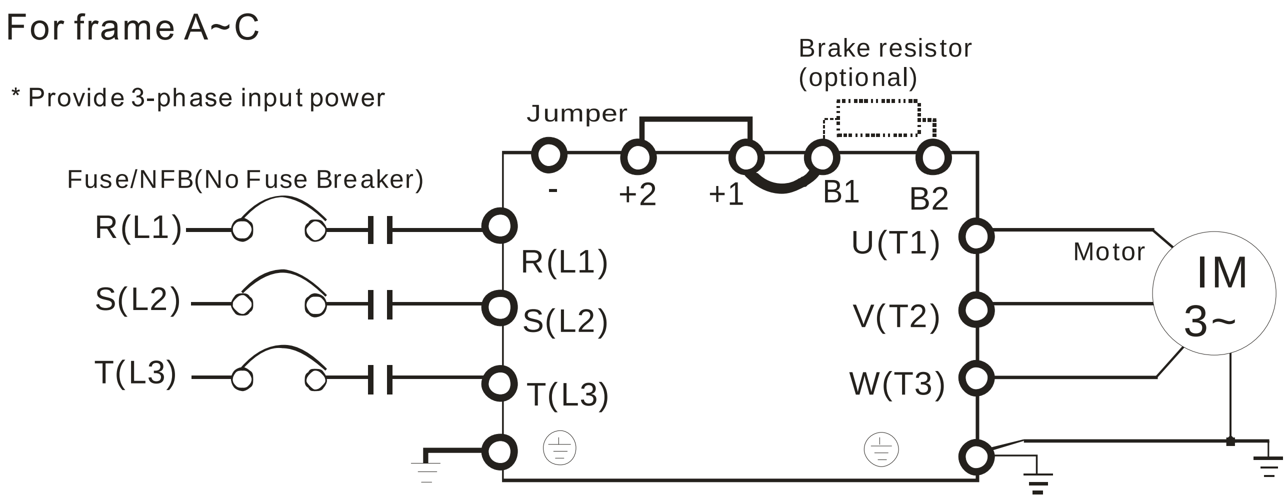


Figure 2

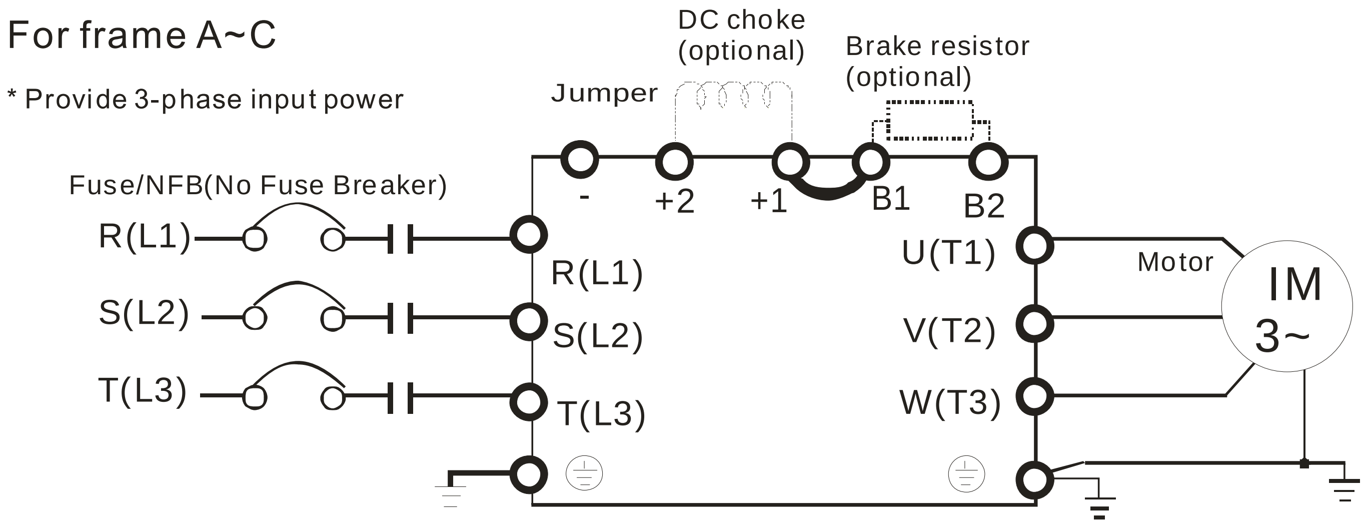
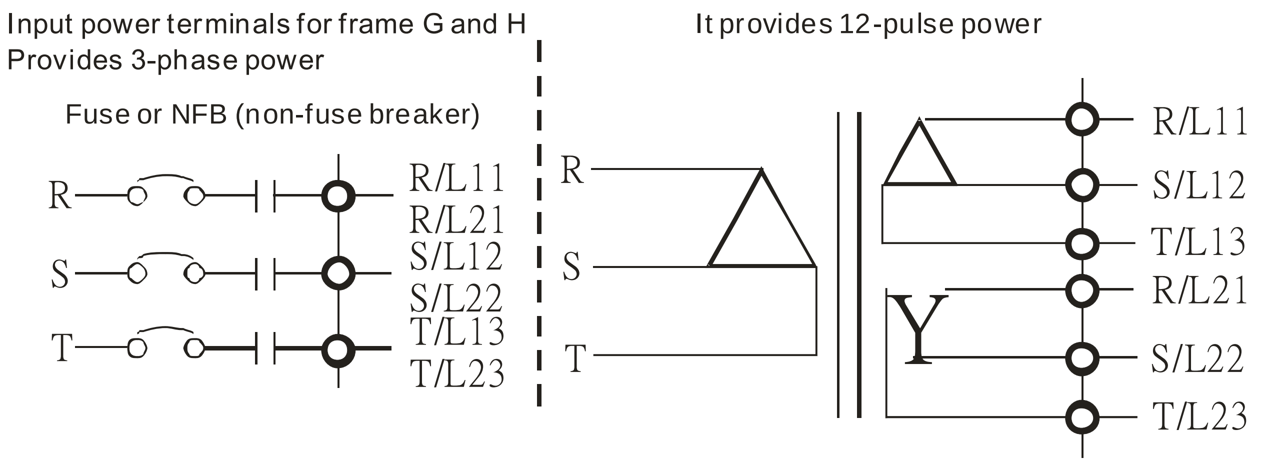


Figure 3



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
+1, +2	Applicable to frame A~C Connections for DC reactor to improve the power factor. It needs to remove the jumper for installation.
+1/DC+, -/DC-	Connections for brake unit (VFDB series) (for 230V models: ≦22kW, built-in brake unit) (for 460V models: ≦30kW, built-in brake unit) Common DC Bus
B1, B2	Connections for brake resistor (optional)
⏚	Earth connection, please comply with local regulations.
CAUTION	Main power terminals ☑ Do not connect 3-phase model to one-phase power. It is unnecessary to consider phase-sequence for these terminals R/L1, S/L2 and T/L3. ☑ It is recommended to add a magnetic contactor (MC) in 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. ☑ 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. ☑ 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.

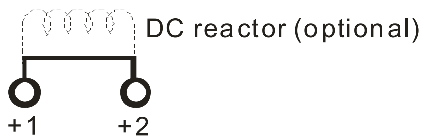
Run/stop AC motor drives by RUN/STOP command via control terminals or keypad. If you still need to run/stop AC motor drives by turning power ON/OFF, it is recommended to do so only ONCE per hour.

Output terminals for main circuit

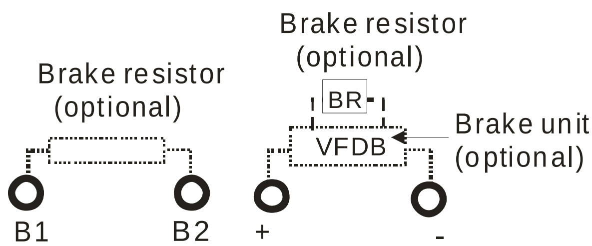
- ☑ When it needs to install the filter at the output side of terminals U/T1, V/T2, W/T3 on the AC motor drive. Please use inductance filter. Do not use phase-compensation capacitors or L-C (Inductance-Capacitance) or R-C (Resistance-Capacitance), unless approved by Delta.
- ☑ DO NOT connect phase-compensation capacitors or surge absorbers at the output terminals of AC motor drives.
- ☑ Use well-insulated motor, suitable for inverter operation.

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.



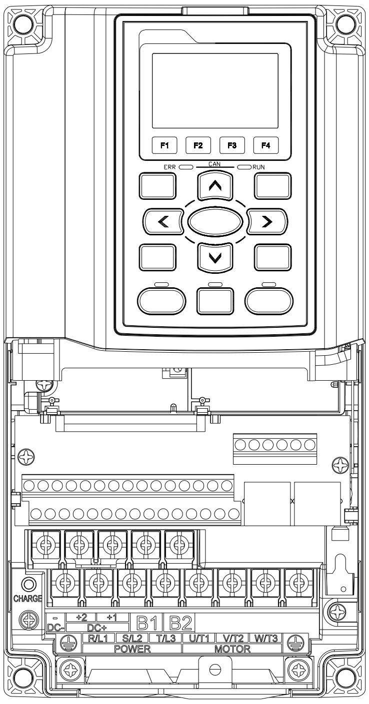
- ☑ Connect a brake resistor or brake unit in applications with frequent deceleration ramps, short deceleration time, too low brake torque or requiring increased brake torque.



- ☑ The external brake resistor 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.

Main Circuit Terminals

Frame A

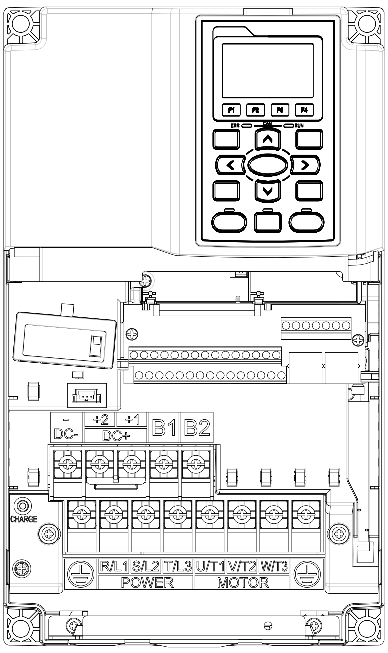


Main circuit terminals:

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%)
VFD007C23A	8 AWG (8.4mm^2)	14 AWG (2.1mm^2)	M4 20kg-cm (17.4 lb-in.) (1.962Nm)
VFD015C23A		12 AWG (3.3mm^2)	
VFD022C23A		10 AWG (5.3mm^2)	
VFD037C23A		8 AWG (8.4mm^2)	
VFD007C43A		14 AWG (2.1mm^2)	
VFD007C43E		14 AWG (2.1mm^2)	
VFD015C43A		14 AWG (2.1mm^2)	
VFD015C43E		14 AWG (2.1mm^2)	
VFD022C43A		14 AWG (2.1mm^2)	
VFD022C43E		14 AWG (2.1mm^2)	
VFD037C43A		10 AWG (5.3mm^2)	
VFD037C43E		10 AWG (5.3mm^2)	
VFD040C43A		10 AWG (5.3mm^2)	
VFD040C43E		10 AWG (5.3mm^2)	
VFD055C43A		10 AWG (5.3mm^2)	
VFD055C43E		10 AWG (5.3mm^2)	
UL installations must use 600V, 75℃ or 90℃ wire. Use copper wire only.			

Frame B



Main circuit terminals:

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

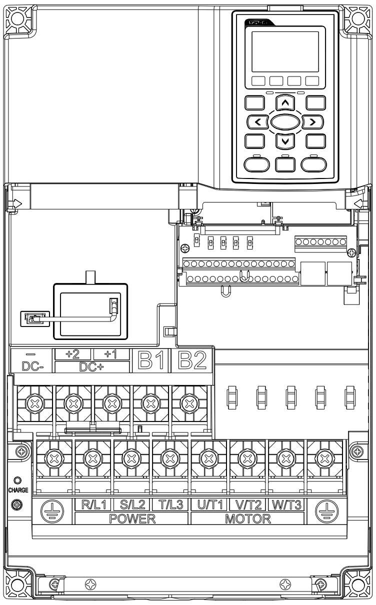
Models	Max. Wire Gauge	Min. Wire Gauge	Torque (±10%)
VFD055C23A	4 AWG (21.2mm^2)	8 AWG (8.4mm^2)	M5 35kg-cm (30.4 lb-in.) (3.434Nm)
VFD075C23A		6 AWG (13.3mm^2)	
VFD110C23A		4 AWG (21.2mm^2)	
VFD075C43A		8 AWG (8.4mm^2)	
VFD075C43E		10 AWG (5.3mm^2)	
VFD110C43A		8 AWG (8.4mm^2)	
VFD110C43E		8 AWG (8.4mm^2)	
VFD150C43A		6 AWG (13.3mm^2)	
VFD150C43E		8 AWG (8.4mm^2)	
UL installations must use 600V, 75℃ or 90℃ wire. Use copper wire only.			

NOTE

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

VFD110C23A must use 600V, 90℃ wire when surrounding temperature exceeds 45℃.

Frame C



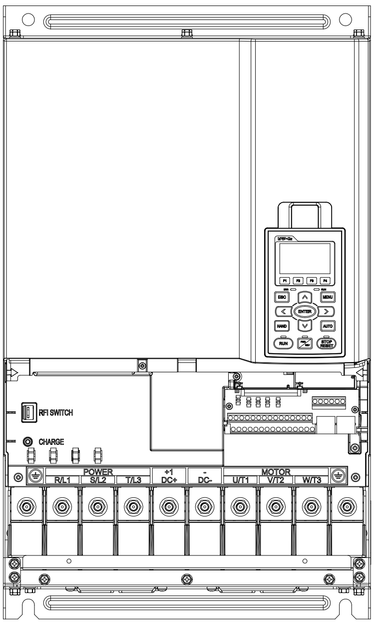
Main circuit terminals:
R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, ⏚, B1, B2, +1, +2, -

Models	Max. Wire Gauge	Min. Wire Gauge	Torque (±10%)
VFD150C23A	1/0 AWG ($53.5mm^2$)	1 AWG ($42.4mm^2$)	M8 80kg-cm (69.4 lb-in.) (7.85Nm)
VFD185C23A		1/0 AWG ($53.5mm^2$)	
VFD220C23A		1/0 AWG ($53.5mm^2$)	
VFD185C43A		4 AWG ($21.2mm^2$)	
VFD185C43E		6 AWG ($13.3mm^2$)	
VFD220C43A		4 AWG ($21.2mm^2$)	
VFD220C43E		4 AWG ($21.2mm^2$)	
VFD300C43A		2 AWG ($33.6mm^2$)	
VFD300C43E		3 AWG ($26.7mm^2$)	
UL installations must use 600V, 75℃ or 90℃ wire. Use copper wire only.			

NOTE

Terminal D+ [+2 & +1]: Torque: 90 kg-cm [78.2lb-in.] (8.83Nm) (±10%)
VFD220C23A must use 600V, 90℃ wire when surrounding temperature exceeds 45℃.

Frame D



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%)
VFD300C23A	300MCM ($152mm^2$)	4/0 AWG ($107mm^2$)	M8 200kg-cm (173 lb-in.) (19.62Nm)
VFD370C23A		250MCM ($127mm^2$)	
VFD370C43A		1/0 AWG ($53.5mm^2$)	
VFD450C43A		2/0 AWG ($67.4mm^2$)	
VFD550C43A		3/0 AWG ($85mm^2$)	
VFD750C43A		300MCM ($152mm^2$)	
VFD300C23E	4/0 AWG. ($107mm^2$)	3/0 AWG ($85mm^2$)	
VFD370C23E		4/0 AWG ($107mm^2$)	
VFD370C43E		1/0 AWG ($53.5mm^2$)	
VFD450C43E		1/0 AWG ($53.5mm^2$)	
VFD550C43E		2/0 AWG ($67.4mm^2$)	
VFD750C43E		4/0 AWG ($107mm^2$)	

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 (600C, YDPU2).

Figure 1

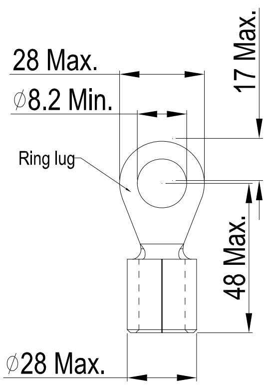
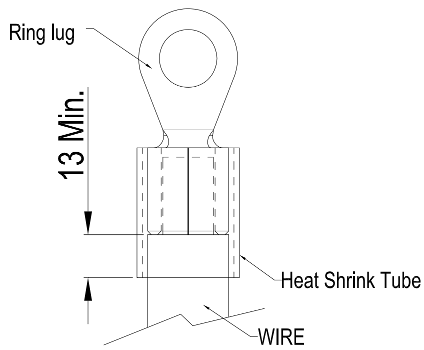
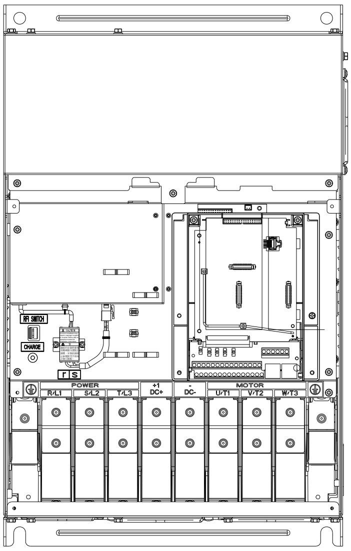


Figure 2



Frame E



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%)
VFD450C23A	300MCM*2 (152mm^2*2)	1/0AWG*2 (53.5mm^2*2)	M8 200kg-cm (173 lb-in.) (19.62Nm)
VFD550C23A		3/0AWG*2 (85mm^2*2)	
VFD750C23A		4/0 AWG*2 (107mm^2*2)	
VFD900C43A		1/0AWG*2 (53.5mm^2*2)	
VFD1100C43A		3/0AWG*2 (85mm^2*2)	
VFD450C23E	4/0 AWG*2 (107mm^2*2)	1/0AWG*2 (53.5mm^2*2)	
VFD550C23E		2/0AWG*2 (67.4mm^2*2)	
VFD750C23E		3/0AWG*2 (85mm^2*2)	
VFD900C43E		1/0AWG*2 (53.5mm^2*2)	
VFD1100C43E		2/0AWG*2 (67.4mm^2*2)	

1. UL installations must use 600V, 75°C or 90 °C wires. Use copper wire only.
2. Specification of grounding wire ⏚ : 300MCM [152 mm^2]
   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).

Figure 1

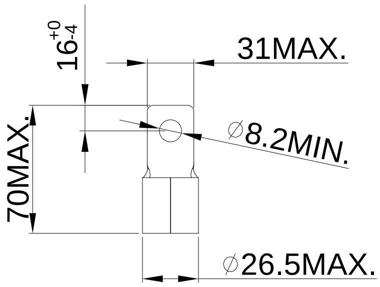


Figure 2 ⏚ E

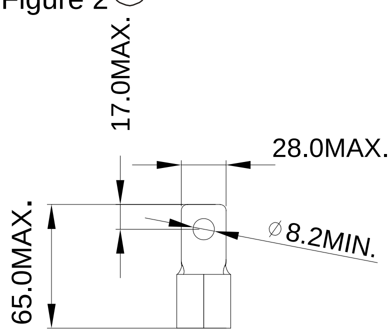
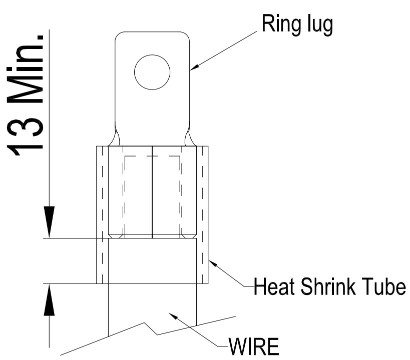
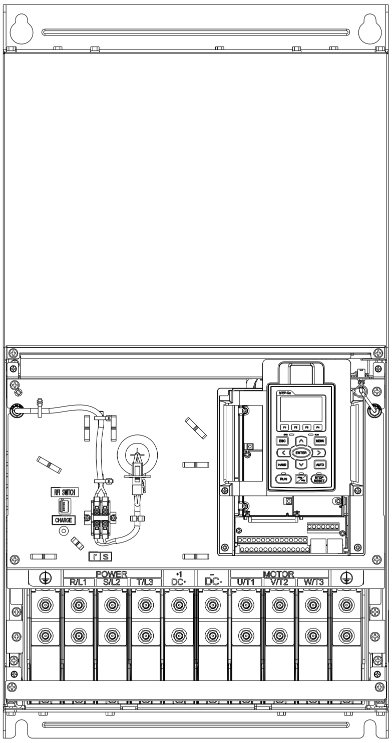


Figure 3



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 ($152mm^2$*2)	300MCM*2 ($152mm^2$*2)	M8 200kg-cm (173 lb-in.) (19.62Nm)
VFD1320C43A		4/0 AWG*2 ($107mm^2$*2)	
VFD1600C43A		300MCM*2 ($152mm^2$)	
VFD900C23E	4/0 AWG*2 ($107mm^2$*2)	4/0 AWG*2 ($107mm^2$*2)	
VFD1320C43E		3/0AWG*2 ($85mm^2$*2)	
VFD1600C43E		4/0 AWG*2 ($107mm^2$*2)	

1. VFD900C23A/E installations must use 90℃ wire.
2. For other model, UL installations must use 600V, 75℃ or 90℃ wire. Use copper wire only.
3. Specification of grounding wire ⏚ : 300MCM*2 [152 mm^2*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).

Figure 1

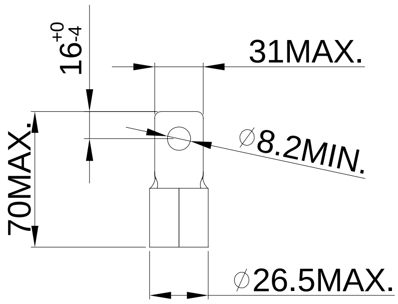
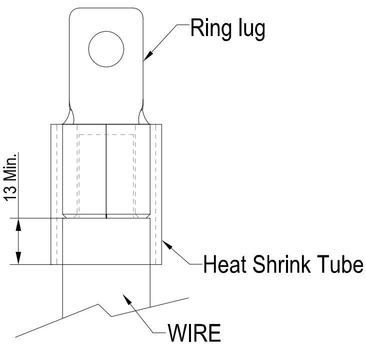
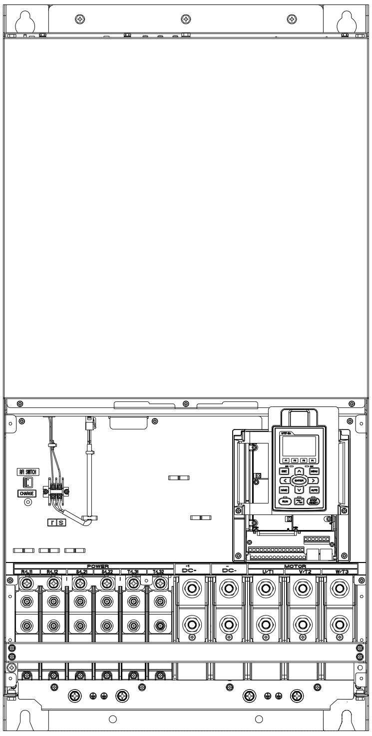


Figure 2



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 ($152mm^2$*4)	2/0AWG*4 ($67.4mm^2$*4)	M8 200kg-cm (173 lb-in.) (19.62Nm)
VFD2200C43A		3/0AWG*4 ($85mm^2$*4)	
VFD1850C43E		1/0AWG*4 ($53.5mm^2$*4)	
VFD2200C43E		2/0AWG*4 ($67.4mm^2$*4)	

Main circuit terminals:
U/T1, V/T2, W/T3, +1/DC+, -/DC-

Models	Max. Wire Gauge	Min. Wire Gauge	Torque (±10%)
VFD1850C43A	500MCM*2 ($253mm^2$*2)	400MCM*2 ($203mm^2$*2)	M12 408kg-cm (354lb-in.) (40Nm)
VFD2200C43A		500MCM*2 ($253mm^2$*2)	
VFD1850C43E		300MCM*2 ($152mm^2$*2)	
VFD2200C43E		400MCM*2 ($203mm^2$*2)	

1. UL installations must use 600V, 75℃ or 90℃ wire. Use copper wire only.
2. Use 600V, 90℃wire for VFD2200C43A when the surrounding temperature is over 45℃.
3. Figure 1 and Figure 2 show the specification for using ring lug.
4. Specification for grounding wire ⏚: 300MCM*4 [152 mm^2*2]
   Torque: M8 180kg-cm (156 lb-in.) (17.64Nm) (±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).

Figure 1
R/L11, R/L12, S/L21, S/L22, T/L31, T/L32,

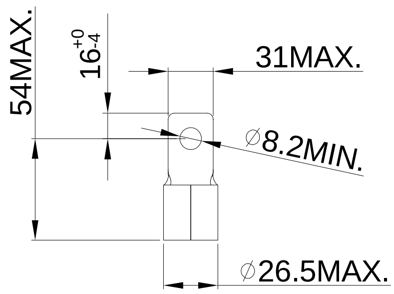


Figure2
U/T1, V/T2, W/T3, +1/DC+, -/DC-

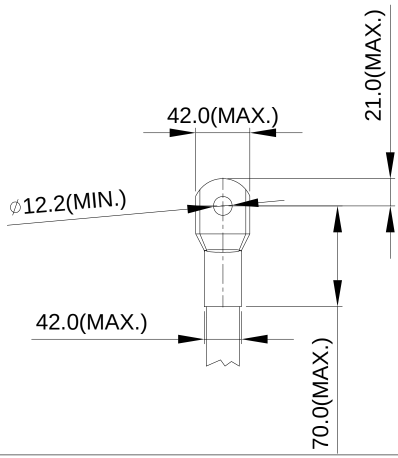


Figure 3

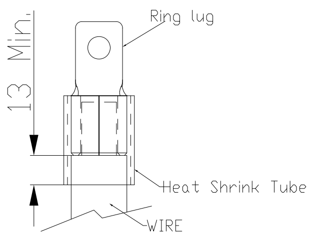
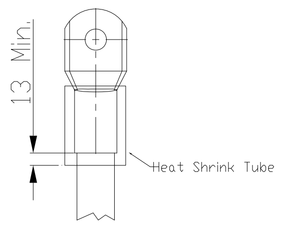
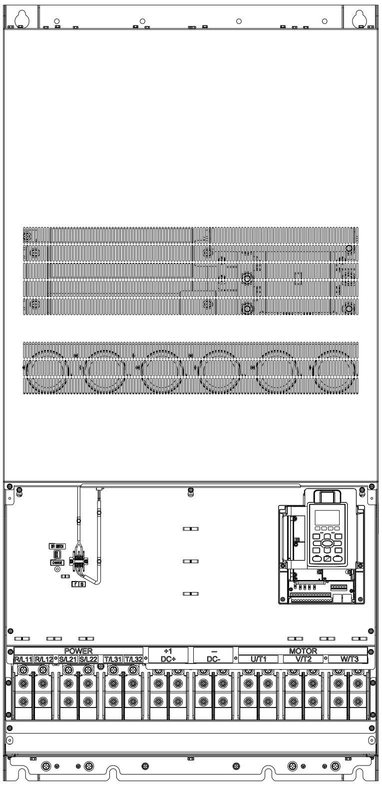


Figure 4



Frame H



Main circuit terminals:

R/11,R12,S/21,S/22,T/31,T/32, U/T1,V/T2, W/T3, +1/DC+, -/DC-

Models	Max. Wire Gauge	Min. Wire Gauge	Torque (±10%)
VFD2800C43A	300MCM*4 ($152mm^2$*4)	4/0 AWG*4 ($107mm^2$*4)	M8 200kg-cm (173 lb-in.) (19.62Nm)
VFD3150C43A		300MCM*4 ($152mm^2$*4)	
VFD3550C43A		300MCM*4 ($152mm^2$*4)	
VFD2800C43E-1		3/0 AWG*4 ($85mm^2$*4)	
VFD3150C43E-1		4/0 AWG*4 ($107mm^2$*4)	
VFD3550C43E-1		250MCM*4 ($127mm^2$*4)	
VFD2800C43E		3/0 AWG*4 ($85mm^2$*4)	
VFD3150C43E		4/0 AWG*4 ($107mm^2$*4)	
VFD3550C43E		250MCM*4 ($127mm^2$*4)	

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

Figure 1

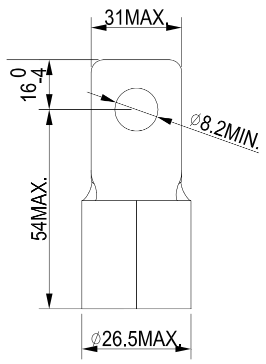
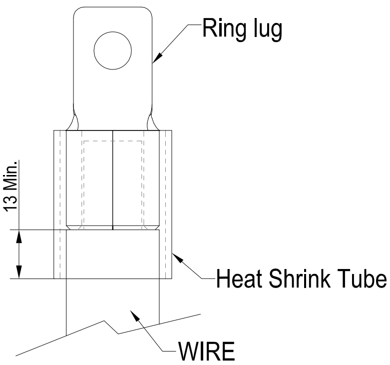


Figure 2



Chapter 6 Control Terminals

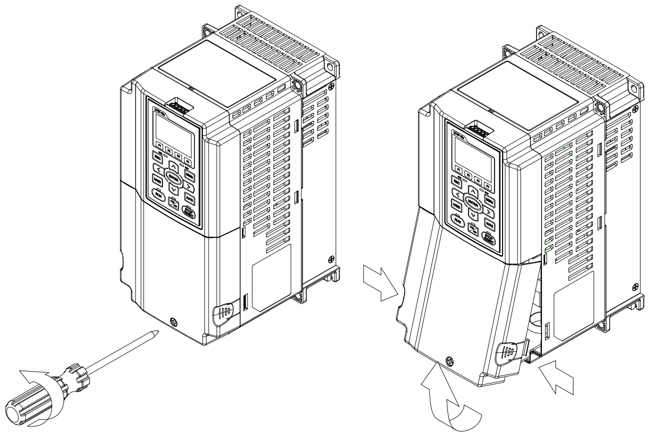
For multi-function input and output terminal, remove the top cover before wiring

The appearances of following figures are for reference only.

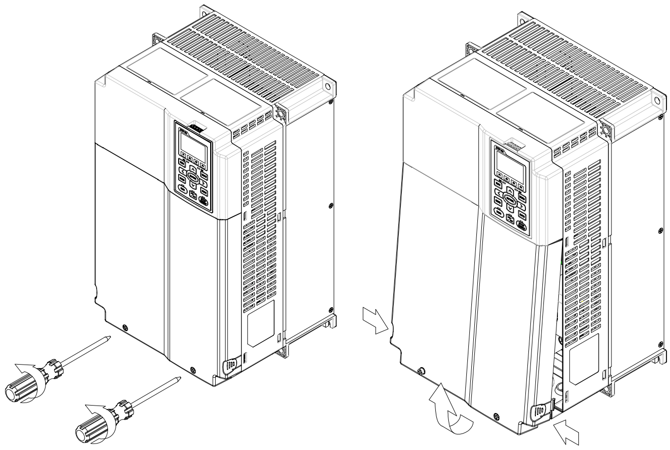
The figures shown in the diagram below are for reference only.

Remove the cover for wiring. Frame A~H

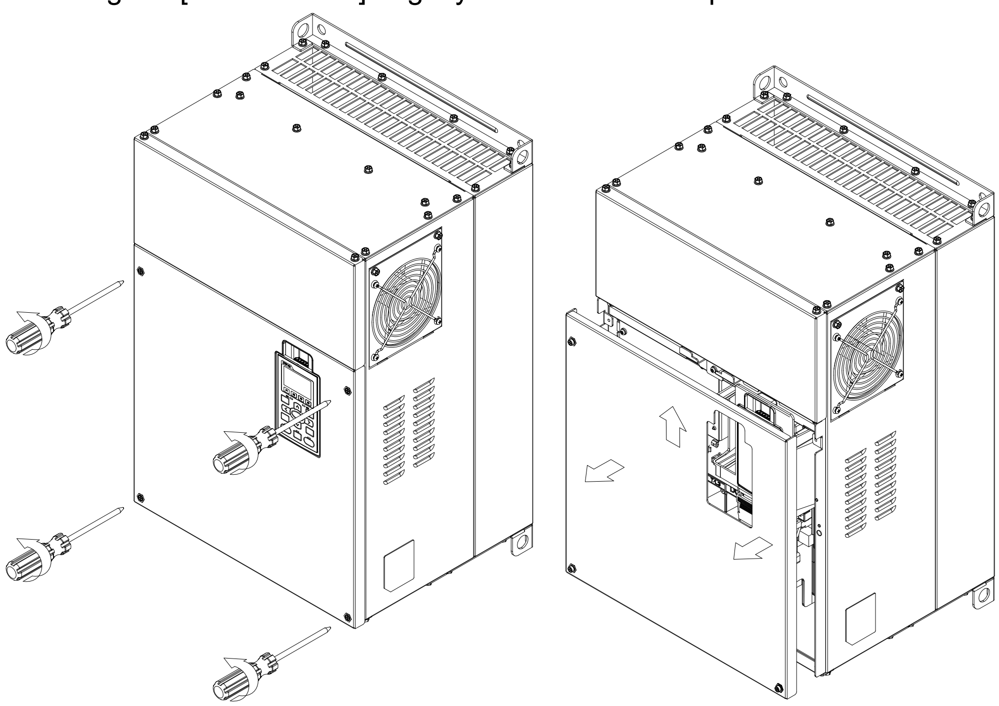
Frame A&B
Loosen the screws and press the tabs on both sides to remove the cover.
Screw torque: 12~15Kg-cm [10.4~13lb-in.]



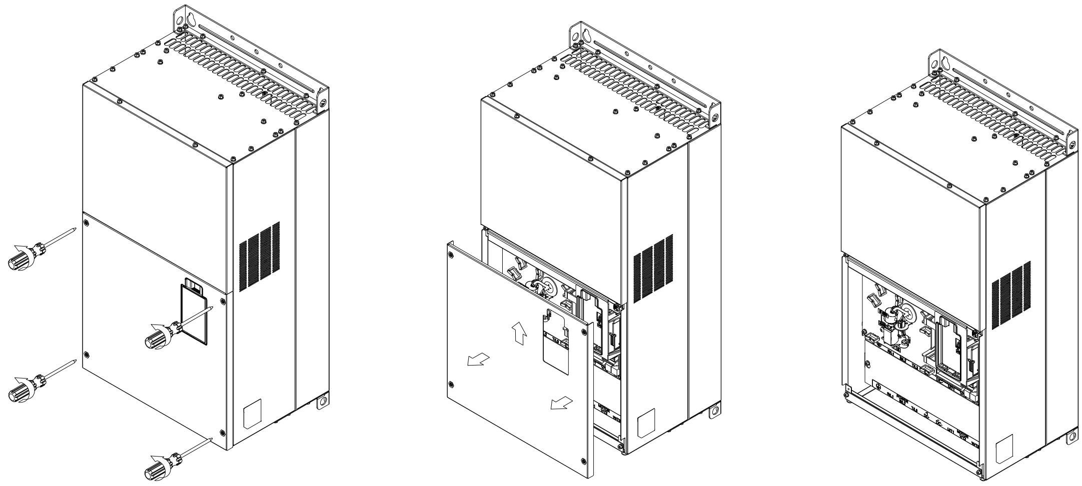
Frame C&D
Screw torque: 12~15Kg-cm [10.4~13lb-in.]



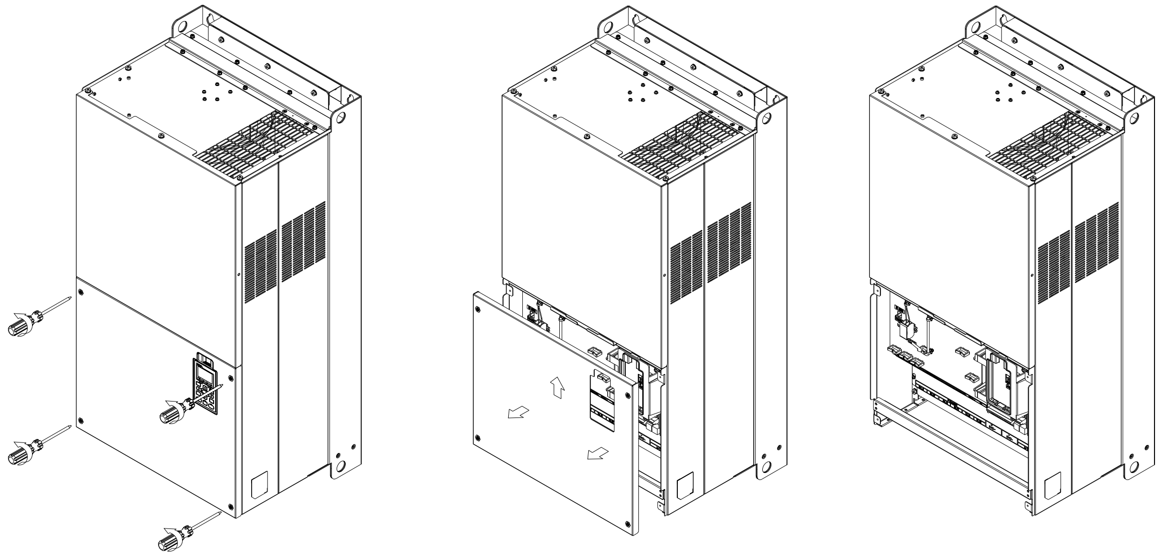
Frame E
Screw torque: 12~15Kg-cm [10.4~13lb-in.] Slightly lift the cover then pull outward for removal.



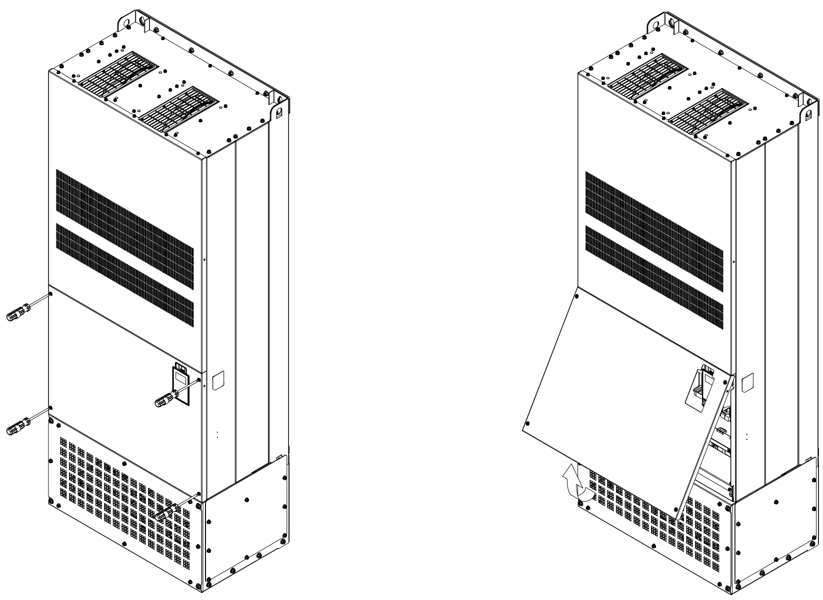
Frame F
Screw torque: 12~15Kg-cm [10.4~13lb-in.]   Slightly lift the cover then pull outward for removal.

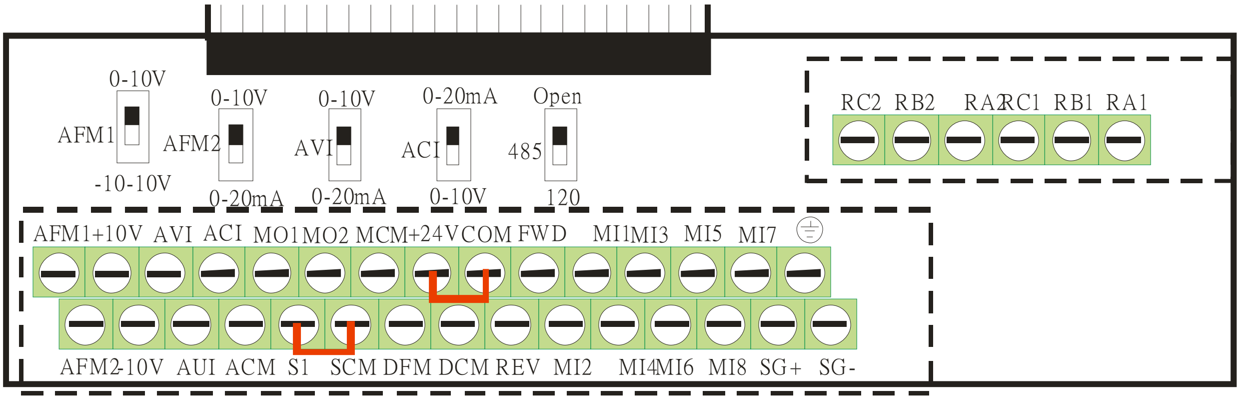


Frame G
Screw torque: 12~15Kg-cm [10.4~13lb-in.] Slightly lift the cover then pull outward for removal.



Frame H   Screw torque: 14~16Kg-cm [12.15~13.89lb-in.] Slightly lift the cover then pull outward for removal.





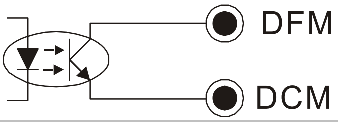
Removable Terminal Block

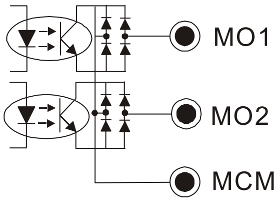
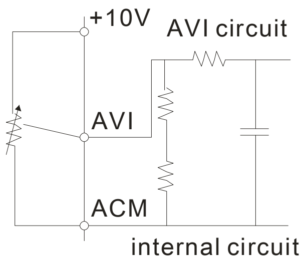
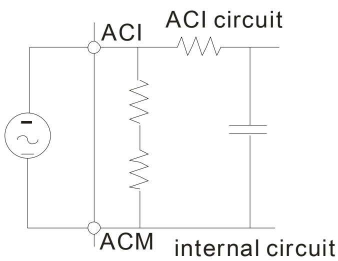
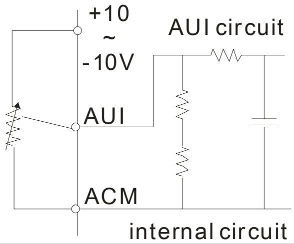
Control Terminal Specifications

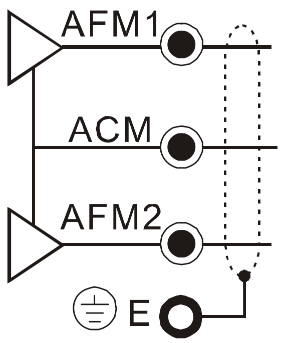
Wire Gauge: 26~16AWG（0.1281-1.318mm^2）,
Torque: (A) 5kg-cm [4.31Ib-in.] (0.49Nm) (As shown in figure above)
(B) 8kg-cm [6.94Ib-in.] (0.78Nm) (As shown in figure above)

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 (Source)	+24V±5% 200mA
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. ON: the activation current is 6.5mA≧11Vdc OFF: leakage current tolerance is 10μA≦11Vdc
DFM	Digital frequency meter 	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	

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

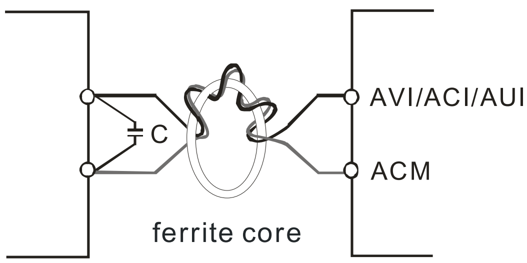
Terminals	Terminal Function	Factory Setting (NPN mode)
AFM1		Impedance: 100kΩ (voltage output) Output current: 20mA max Resolution: 0~10V corresponds to Max. operation frequency Range: 0~10V → -10~+10V AFM Switch, factory setting is 0~10V
AFM2		Impedance: 100Ω (current output) Output current: 20mA max Resolution: 0~10V corresponds to Max. operation frequency Range: 0~10V → 4~20mA AFM Switch, factory setting is 0~10V
ACM	Analog Signal Common	Common for analog terminals
S1	Power removal safety function for EN954-1 and IEC/EN61508	
SCM		
SG+	Modbus RS-485	
SG-	PIN 1,2,7,8 :Reserved PIN 4: SG-	PIN 3, 6: GND PIN 5: SG+

NOTE: Wire size of analog control signals: 18 AWG (0.75 mm^2) with shielded wire

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.

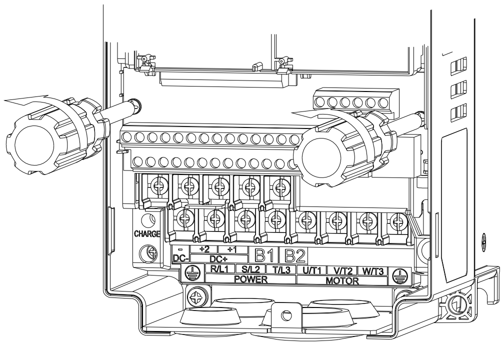
Transistor outputs (MO1, MO2, MCM)

☑ Make sure to connect the digital outputs to the right polarity.

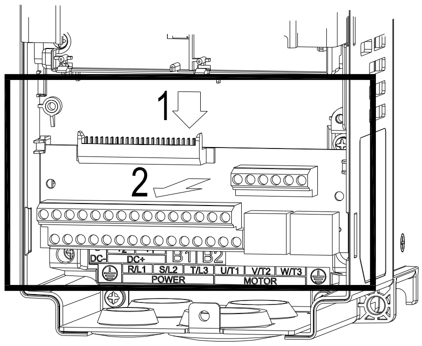
☑ When connecting a relay to the digital outputs, connect a surge absorber across the coil and check the polarity.

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

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

- All Brake Resistors and Brake Units Used in AC Motor Drives
- Non-fuse Circuit Breaker
- Fuse (Specification Chart)
- AC Reactor
- Zero Phase Reactor
- DC Reactor
- EMI Filter
- Digital Keypad
- Panel Mounting
- Conduit Box Kit
- Fan Kit
- Flange Mounting Kit
- USB/RS-485 Communication Interface

All Brake Resistors and Brake Units Used in AC Motor Drives

230V

Applicable Motor		*1 125%Braking Torque 10%ED						*2 Max. Brake Torque		
HP	kW	Braking Torque (kg-m)	Brake Unit *4VFDB	*3Braking Resistor series for each Brake 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	-	BR080W200*1		80W200Ω	1.9	63.3	6	2.3
2	1.5	1.0	-	BR200W091*1		200W91Ω	4.2	47.5	8	3.0
3	2.2	1.5	-	BR300W070*1		300W70Ω	5.4	38.0	10	3.8
5	3.7	2.5	-	BR400W040*1		400W40Ω	9.5	19.0	20	7.6
7.5	5.5	3.7	-	BR1K0W020*1		1000W20Ω	19	14.6	26	9.9
10	7.5	5.1	-	BR1K0W020*1		1000W20Ω	19	14.6	26	9.9
15	11	7.5	-	BR1K5W013*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

Applicable Motor		*1 125%Braking Torque 10%ED						*2 Max. Brake Torque		
HP	kW	Braking Torque (kg-m)	Brake Unit *4VFDB	*3Braking Resistor series for each Brake Unit		Resistor value spec. for each AC motor Drive	Total Braking Currnet (A)	Min. Resistor Value (Ω)	Max. Total Braking Current (A)	Peak Power (kW)
1	0.7	0.5	-	BR080W750*1		80W750Ω	1	190.0	4	3.0
2	1.5	1.0	-	BR200W360*1		200W360Ω	2.1	126.7	6	4.6
3	2.2	1.5	-	BR300W250*1		300W250Ω	3	108.6	7	5.3
5	3.7	2.5	-	BR400W150*1		400W150Ω	5.1	84.4	9	6.8
5 7.5	4.0 5.5	2.7 3.7	-	BR1K0W075*1		1000W75Ω	10.2	54.3	14	10.6
10	7.5	5.1	-	BR1K0W075*1		1000W75Ω	10.2	47.5	16	12.2
15	11	7.5	-	BR1K5W043*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	40	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	BR1K2W015*4	4 parallel	7200W10Ω	76	9.5	80	60.8
100	75	50.8	4045*2	BR1K2W015*8	2 parallel, 2 series	9600W7.5Ω	100	6.3	120	91.2
125	90	60.9	4045*2	BR1K5W013*8	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
175	132	89.4	4160*1	BR1K5W012*12	6 parallel, 2 series	18000W4Ω	190	4.0	190	144.4

460V

Applicable Motor		*1 125%Braking Torque 10%ED						*2 Max. Brake Torque		
HP	kW	Braking Torque (kg-m)	Brake Unit	*3Braking Resistor series for each Brake Unit		Resistor value spec. for each AC motor Drive	Total Braking Currnet (A)	Min. Resistor Value (Ω)	Max. Total Braking Current (A)	Peak Power (kW)
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

*1 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).

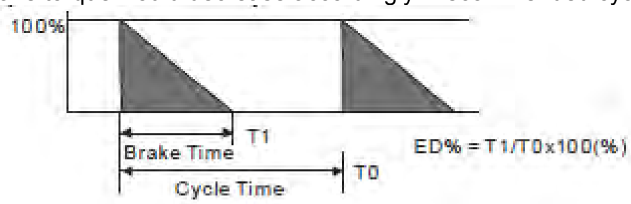
*2 Please refer to the Brake Performance Curve for “Operation Duration & ED” vs. “Braking Current”.

*3 For heat dissipation, a resistor of 400W or lower should be fixed to the frame and maintain the surface temperature below 50℃; a resistor of 1000W and above should maintain the surface temperature below 350℃.

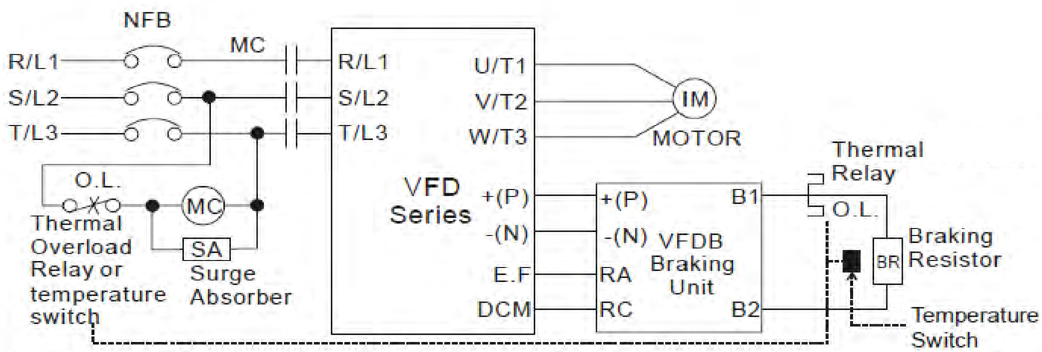
*4 Please refer to VFDB series Braking Module Instruction for more detail on braking resistor.

NOTE

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.

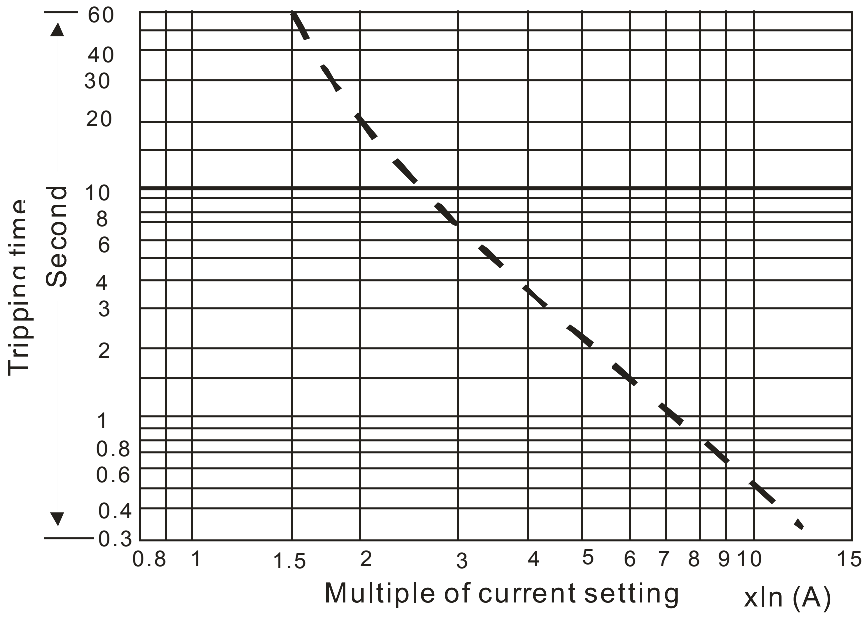


Note1: When using the AC drive with DC reactor, please refer to wiring diagram in the AC drive user manual for the wiring of terminal +(P) of Braking unit.
Note2: **Do NOT** wire terminal -(N) to the neutral point of power system.

2. 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
5. 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.



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	150
VFD450C43A/E	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

NOTE:

Model VFD007C43E; VFD015C43E; VFD022C43E; VFD037C43E; VFD040C43E; VFD055C43E; VFD075C43E; VFD110C43E; VFD150C43E; VFD185C43E; VFD220C43E; VFD300C43E will be available for ordering soon. Please contact your local distributor or Delta representative for detailed launch schedule.

Fuse Specification Chart

Fuses with specification smaller than the following table indicates are allowed.

230V Model	Input Currnet I(A)		Line Fuse	
	Heavy Duty	Normal Duty	I (A)	Bussmann P/N
VFD007C23A	6.1	6.4	15	JJN-15
VFD015C23A	11	12	20	JJN-20
VFD022C23A	15	16	30	JJN-30
VFD037C23A	18.5	20	40	JJN-40
VFD055C23A	26	28	50	JJN-50
VFD075C23A	34	36	60	JJN-60
VFD110C23A	50	52	100	JJN-100
VFD150C23A	68	72	125	JJN-125
VFD185C23A	78	83	150	JJN-150
VFD220C23A	95	99	200	JJN-200
VFD300C23A/E	118	124	225	JJN-225
VFD370C23A/E	136	143	250	JJN-250
VFD450C23A/E	162	171	300	JJN-300
VFD550C23A/E	196	206	400	JJN-400
VFD750C23A/E	233	245	450	JJN-450
VFD900C23A/E	315	331	600	JJN-600

460VModel	Input Current I(A)		Line Fuse	
	Heavy Duty	Normal Duty	I (A)	Bussmann P/N
VFD007C43A/E	4.1	4.3	10	JJS-10
VFD015C43A/E	5.6	5.9	10	JJS-10
VFD022C43A/E	8.3	8.7	15	JJS-15
VFD037C43A/E	13	14	20	JJS-20
VFD040C43A/E	14.5	15.5	20	JJS-20
VFD055C43A/E	16	17	30	JJS-30
VFD075C43A/E	19	20	40	JJS-40
VFD110C43A/E	25	26	50	JJS-50
VFD150C43A/E	33	35	60	JJS-60
VFD185C43A/E	38	40	75	JJS-75
VFD220C43A/E	45	47	100	JJS-100
VFD300C43A/E	60	63	125	JJS-125
VFD370C43A/E	70	74	150	JJS-150
VFD450C43A/E	96	101	175	JJS-175
VFD550C43A/E	108	114	250	JJS-250
VFD750C43A/E	149	157	300	JJS-300
VFD900C43A/E	159	167	300	JJS-300
VFD1100C43A/E	197	207	400	JJS-400
VFD1320C43A/E	228	240	500	JJS-500
VFD1600C43A/E	285	300	600	JJS-600
VFD1850C43A/E	361	380	600	JJS-600
VFD2200C43A/E	380	400	800	JJS-800
VFD2800C43A/E	469	494	1000	KTU-1000
VFD3150C43A/E	527	555	1200	KTU-1200
VFD3550C43A/E	594	625	1350	KTU-1350

NOTE:

Model VFD007C43E; VFD015C43E; VFD022C43E; VFD037C43E; VFD040C43E; VFD055C43E; VFD075C43E; VFD110C43E; VFD150C43E; VFD185C43E; VFD220C43E; VFD300C43E will be available for ordering soon. Please contact your local distributor or Delta representative for detailed launch schedule.

AC Reactor

230V, 50/60Hz, 3-phase

kW	HP	Fundamental Amps	Max. continuous Amps	Inductance（mh）	
				3% impedance	5% impedance
0.75	1	4	6	3	6.5
1.5	2	8	12	1.5	3
2.2	3	12	18	1.25	2.5
3.7	5	18	27	0.8	1.5
5.5	7.5	25	37.5	0.5	1.2
7.5	10	35	52.5	0.4	0.8
11	15	45	67.5	0.3	0.7
15	20	55	82.5	0.25	0.5
18.5	25	80	120	0.2	0.4
22	30	100	150	0.15	0.3
30	40	130	195	0.1	0.2
37	50	160	240	0.075	0.15
45	60	200	300	0.055	0.110
55	75	250	375	0.090	0.150
75	100	320	480	0.040	0.075
90	125	400	600	0.03	0.006

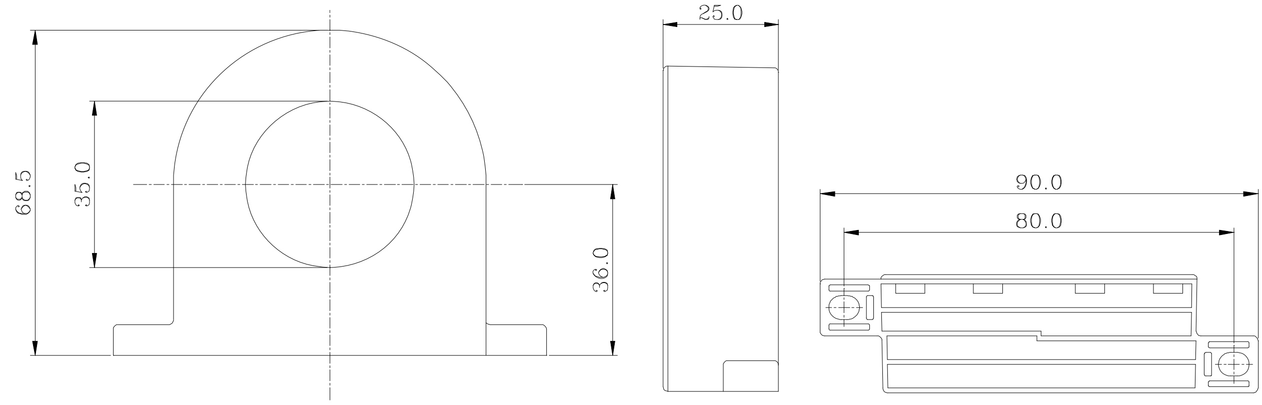
460V, 50/60Hz, 3-phase

kW	HP	Fundamental Amps	Max. continuous Amps	Inductance（mh）	
				3% impedance	5% impedance
0.75	1	4	6	9	12
1.5	2	4	6	6.5	9
2.2	3	8	12	5	7.5
3.7	5	12	18	2.5	4.2
4	5	12	18	2.5	4.2
5.5	7.5	18	27	1.5	2.5
7.5	10	18	27	1.5	2.5
11	15	25	37.5	1.2	2
15	20	35	52.5	0.8	1.2
18.5	25	45	67.5	0.7	1.2
22	30	45	67.5	0.7	1.2
30	40	80	120	0.4	0.7
37	50	80	120	0.4	0.7
45	60	100	150	0.3	0.45
55	75	130	195	0.2	0.3
75	100	160	240	0.15	0.23
90	125	200	300	0.110	0.185
110	150	250	375	0.090	0.150
175	132	320	480	0.075	0.125
215	160	400	600	0.03	0.06
250	185	400	600	0.03	0.06
300	220	500	750	0.025	0.05
375	280	600	900	0.02	0.04
425	315	750	1125	0.029	0.048
475	355	750	1125	0.029	0.048

Zero Phase Reactors

RF220X00A

UNIT: mm (inch)



Cable type (Note)	Recommended Wire Size (mm²)			Qty.	Wiring Method
	AWG	mm²	Nominal (mm²)		
Single-core	≤10	≤5.3	≤5.5	1	Diagram A
	≤2	≤33.6	≤38	4	Diagram B
Three-core	≤12	≤3.3	≤3.5	1	Diagram A
	≤1	≤42.4	≤50	4	Diagram B

NOTE

600V insulated cable wire

1. The table above gives approximate wire size for the zero phase reactors but the selection is ultimately governed by the type and the diameter of the cable, i.e. the cable diameter must small enough to go through the center of the zero phase reactor.
2. When wiring, do not goes through the earth core. It only needs to pass through the motor cable or the power cable.
3. When a long motor cable for output is used, a zero phase reactor may be necessary to reduce the radiated emission.

Diagram A

Please wind each wire around the core for 4 times. The reactor must be placed at the AC motor drive output side as close as possible.

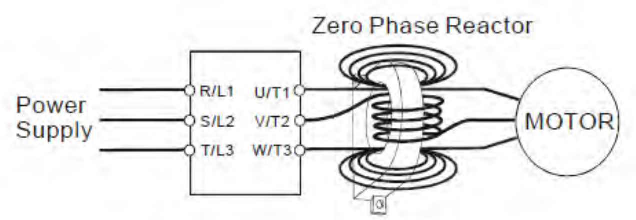
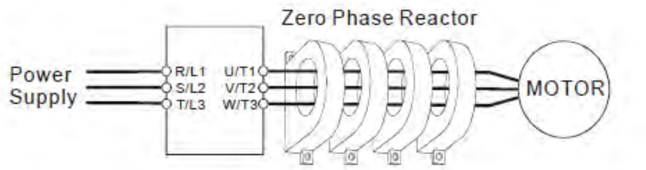


Diagram B

Please put wires through 4 cores in series without winding.



DC Reactor

230V DC Choke

Input Voltage	kW	HP	DC Amps	Inductance（mh）
230Vac 50/60Hz 3-Phase	0.75	1	9.4	3.43
	1.5	2	18	1.83
	2.2	3	24	1.37
	3.7	5	30	1.1
	5.5	7.5	42	0.78
	7.5	10	53	0.61
	11	15	76	0.42
	15	20	106	0.31
	18.5	25	122	0.26
	22	30	145	0.22

460V DC Choke

Input Voltage	kW	HP	DC Amps	Inductance（mh）
460Vac 50/60Hz 3-Phase	0.75	1	6	9.77
	1.5	2	9	7.12
	2.2	3	13	4.83
	3.7	5	23	2.7
	5.5	7.5	25	2.47
	7.5	10	30	2.1
	11	15	38	1.62
	15	20	52	1.2
	18.5	25	60	1.05
	22	30	70	0.89
	30	40	93	0.67

EMI Filter

Model	Applicable EMI Filter	Reference Website
VFD007C23A; VFD015C23A; VFD022C23A; VFD037C23A;	KMF325A	http://www.dem-uk.com/roxburgh/products/emc_emi_industrial_filters/ KMF325A Three Phase Industrial Mains Filters - High Performance 25 Amps
VFD055C23A; VFD075C23A; VFD110C23A;	KMF370A	http://www.dem-uk.com/roxburgh/products/emc_emi_industrial_filters/ KMF370A Three Phase Industrial Mains Filters - High Performance 70 Amps
VFD150C23A; VFD185C23A; VFD220C23A;	KMF3100A	http://www.dem-uk.com/roxburgh/products/emc_emi_industrial_filters/ KMF3100A Three Phase Industrial Mains Filters - High Performance 100 Amps
VFD300C23A; VFD370C23A;	KMF3150A MIF3150	http://www.dem-uk.com/roxburgh/products/emc_emi_industrial_filters/ KMF3150A Three Phase Industrial Mains Filters - High Performance 150 Amps MIF3150 Three Phase Industrial Multi Stage Drive Filters - Very High Performance 150 Amps
VFD450C23A; VFD550C23A; VFD750C23A; VFD900C43A; VFD1100C23A;	MIF3400	http://www.dem-uk.com/roxburgh/products/emc_emi_industrial_filters/ MIF3400 Three Phase Industrial Drive Filters - Very High Performance 340 Amps
VFD007C43A; VFD015C43A; VFD022C43A; VFD037C43A; VFD040C43A; VFD055C43A;	KMF318	http://www.dem-uk.com/roxburgh/products/emc_emi_industrial_filters/ KMF318 Three Phase Industrial Mains Filters - General Purpose 18 Amps
VFD075C43A; VFD110C43A; VFD150C43A;	KMF350	http://www.dem-uk.com/roxburgh/products/emc_emi_industrial_filters/ KMF350 Three Phase Industrial Mains Filters - General Purpose 50 Amps
VFD185C43A; VFD220C43A; VFD300C43A;	KMF370	http://www.dem-uk.com/roxburgh/products/emc_emi_industrial_filters/ KMF370 Three Phase Industrial Mains Filters - General Purpose 70 Amps
VFD370C43A; VFD450C43A; VFD550C43A; VFD750C43A;	MIF3150	http://www.dem-uk.com/roxburgh/products/emc_emi_industrial_filters/ MIF3150 Three Phase Industrial Multi Stage Drive Filters - Very High Performance 150 Amps
VFD450C23A; VFD550C23A VFD750C23A; VFD900C43A; VFD1100C43A;	KMF3400B	http://www.dem-uk.com/roxburgh/products/emc_emi_industrial_filters/ MIF3400B Three Phase Industrial Multi Stage Drive Filters - Very High Performance 400 Amps
VFD900C23A; VFD1320C23A; VFD1600C23A;	-	-
VFD1850C43A; VFD2200C43A;	-	-
VFD2800C43A; VFD3150C43A; VFD3550C43A;	-	-

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 + A11: 2000**
- **EN55011 (1991) Class A Group 1 (1st Environment, restricted distribution)**

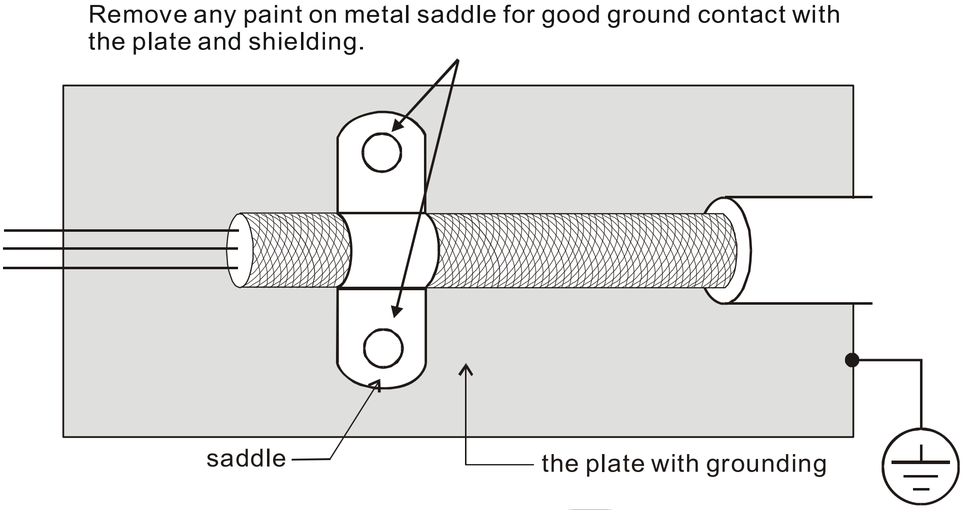
General precaution

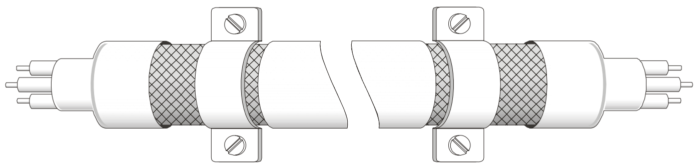
1. EMI filter and AC motor drive should be installed on the same metal plate.
2. Please install AC motor drive on footprint EMI filter or install EMI filter as close as possible to the AC motor drive.
3. Please wire as short as possible.
4. Metal plate should be grounded.
5. The cover of EMI filter and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

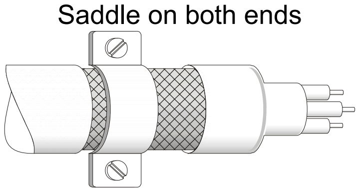
Improper installation and choice of motor cable will affect the performance of EMI filter. Be sure to observe the following precautions when selecting motor cable.

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.





Saddle on both ends



Saddle on one end

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/5.5kW 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/3.7kW 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)

NOTE

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).

NOTE

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.

Digital Keypad

KPC-CE01

A: LED Display

Display frequency, current, voltage and error etc.

B: Status Indicator

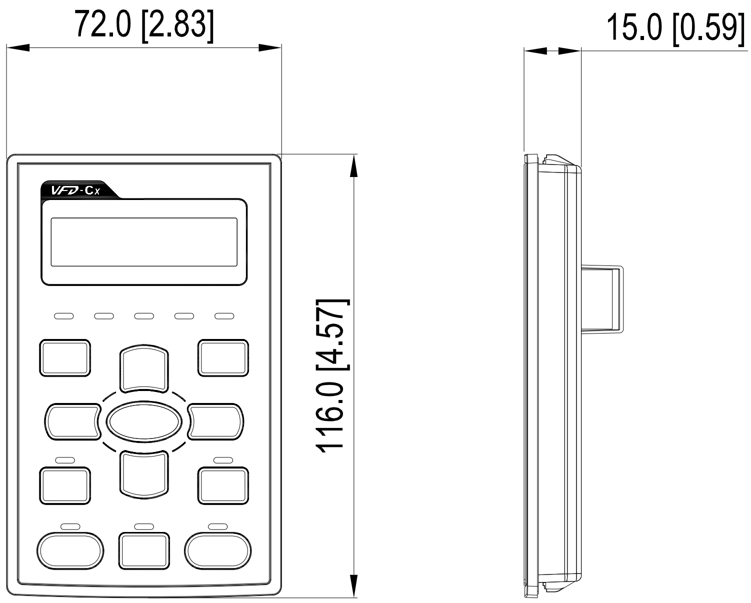
F: Frequency Command
H: Output Frequency
U: User Defined Units
ERR: CAN Error Indicator
RUN: CAN Run Indicator

C: Function

(Refer to the chart follows for detail description)

Key	Description
ESC	ESC Key When ESC key is pressed, it will return to the previous menu. It is also functioned as a return key in the sub-menu.
MENU	Menu Key It can return to the main menu after pressing MENU key. 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. 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. If pressed at stop status, it will switch to Hand setting of frequency source and operation source. If HAND ON key is pressed during operation, it will stop the AC motor drive first then switch to Hand setting. 3. Hand mode display: H/A LED is ON.
AUTO	Auto Operation Key 1. 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). 2. If auto is pressed in steady status, it will switch to the auto-setting. However if auto key is pressed during operation, it will stop AC motor drive first then switch to auto-setting. 3. Switch is complete: H/A LED is OFF
FWD/REV	Operation Direction Key 1. This key is only control the operation direction NOT for activate the drive. FWD: forward, REV: reverse. 2. Refer to the LED descriptions for more details.
RUN	Start Key 1. It is only valid when the source of operation command is from the keypad. 2. It can operate the AC motor drive by the function setting and the RUN LED will be ON. 3. It can be pressed again and again during stop. When enabling "HAND" mode, it is only valid when the source of operation command is from the keypad.
STOP	Stop Key. (When Stop key is pressed, all operation will stop in all condition.) This key has the highest priority in all condition. 1. When a STOP command is given, the AC motor drive's operation will stop under any condition. 2. The RESET key can be used to reset the drive when faults occur. If the RESET key is not responding, check MENU → Fault Records search for the most recent fault.

Dimension



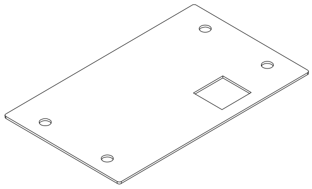
Panel Mounting (MKC-KPPK)

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).

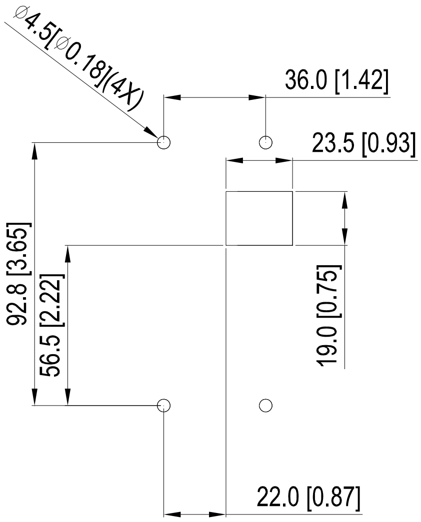
Wall Mounting

accessories*1



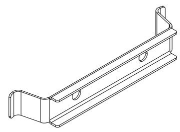
Screw *4 ~M4*p 0.7 *L8mm
Torque: 10-12kg-cm (8.7-10.4lb-in.)

Panel cutout dimension Unit: mm [inch]



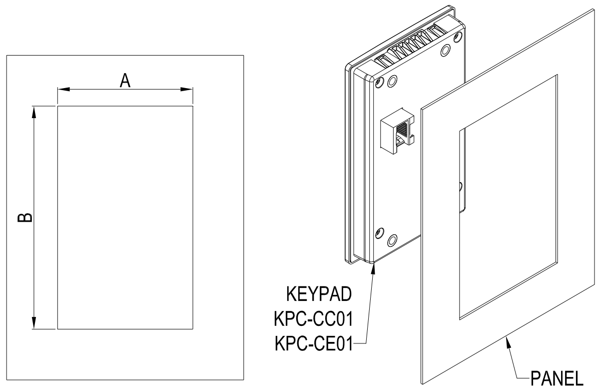
Embedded Mounting

accessories*2



Screw *4 ~M4*p 0.7 *L8mm
Torque: 10-12kg-cm (8.7-10.4lb-in.)

Panel cutout dimension Unit: mm [inch]



Normal cutout dimension

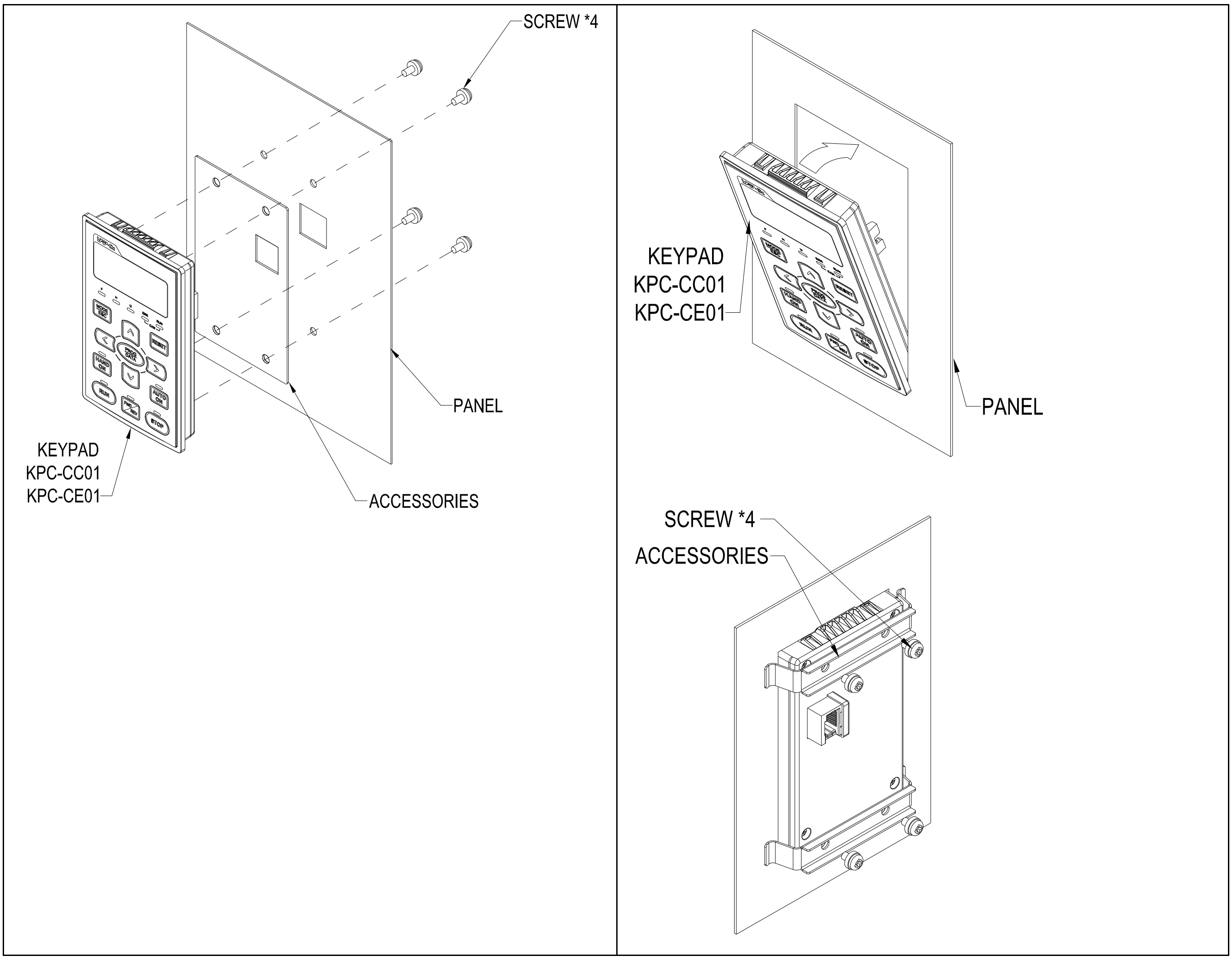
Panel thickness	1.2mm	1.6mm	2.0mm
A	66.4 [2.614]		
B	110.2 [4.339]	111.3 [4.382]	112.5 [4.429]

*Deviation: ±0.15mm /±0.0059inch

Cutout dimension (Waterproof level: IP56)

Panel thickness	1.2mm	1.6mm	2.0mm
A	66.4 [2.614]		
B	110.8 [4.362]		

*Deviation: ±0.15mm /±0.0059inch


SCREW *4
PANEL
KEYPAD
KPC-CC01
KPC-CE01
ACCESSORIES
KEYPAD
KPC-CC01
KPC-CE01
PANEL
SCREW *4
ACCESSORIES

Conduit Box Kit

■ Appearance

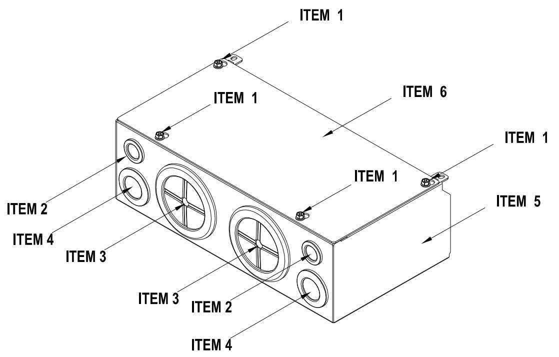
Frame D

Applicable models

VFD300C23A/23E; VFD370C23A/23E;VFD370C43A/43E; VFD450C43A/43E; VFD550C43A/43E; VFD750C43A/43E

Model number『MKC-DN1CB』

ITEM	Description	Qty.
1	Screw M5*0.8*10L	4
2	Rubber28	2
3	Rubber44	2
4	Rubber88	2
5	Conduit box cover	1
6	Conduit box base	1



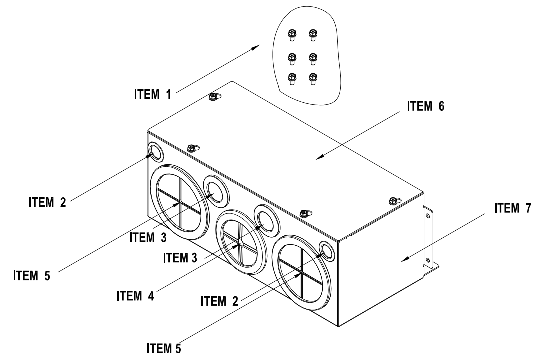
Frame E

Applicable models

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

Model number『MKC-EN1CB』

ITEM	Description	Qty.
1	Screw M5*0.8*10L	6
2	Bushing Rubber 28	2
3	Bushing Rubber 44	4
4	Bushing Rubber 100	2
5	Conduit box cover	1
6	Conduit box base	1



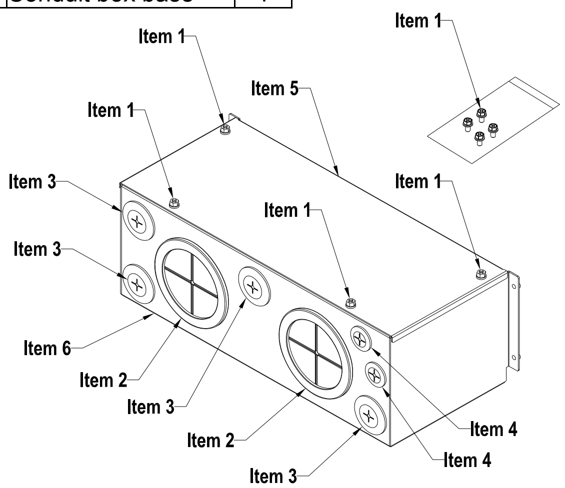
Frame F

Applicable models

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

Model number『MKC-FN1CB』

ITEM	Description	Qty.
1	Screw M5*0.8*10L	8
2	Bushing Rubber28	2
3	Bushing Rubber 44	4
4	Bushing Rubber 100	2
5	Conduit box cover	1
6	Conduit box base	1



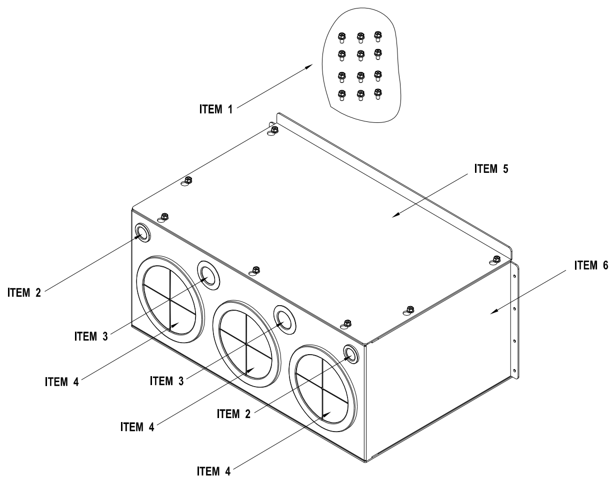
Frame G

Applicable models

VFD1850C23A/23E; VFD2200C43A/43E

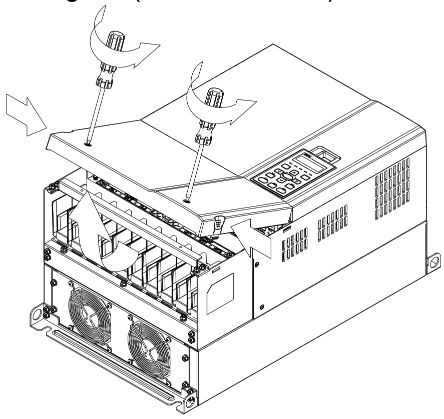
Model number『MKC-GN1CB』

ITEM	Description	Qty.
1	Screw M5*0.8*10L	12
2	Bushing Rubber 28	2
3	Bushing Rubber 44	2
4	Bushing Rubber 130	3
5	Conduit box base	1
6	Conduit box cover	1

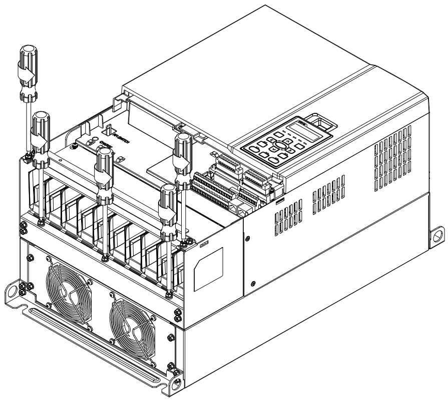


Frame D

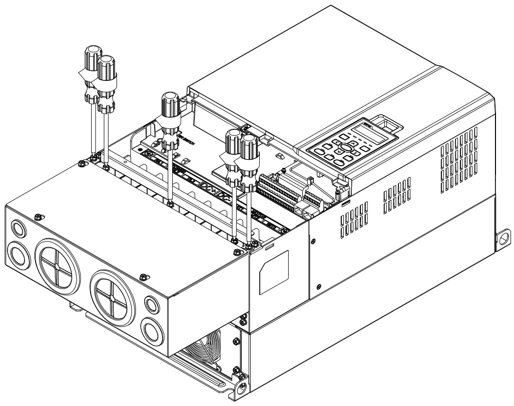
1. Loosen the cover screws and press the tabs on each side of the cover to remove the cover, as shown in the following figure. Screw torque: 10~12kg-cm (8.66~10.39lb-in)



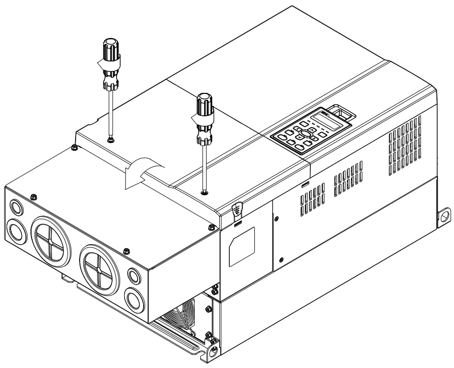
2. Remove the 5 screws shown in the following figure. Screw torque: 24~26kg-cm (20.8~22.6lb-in).



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).

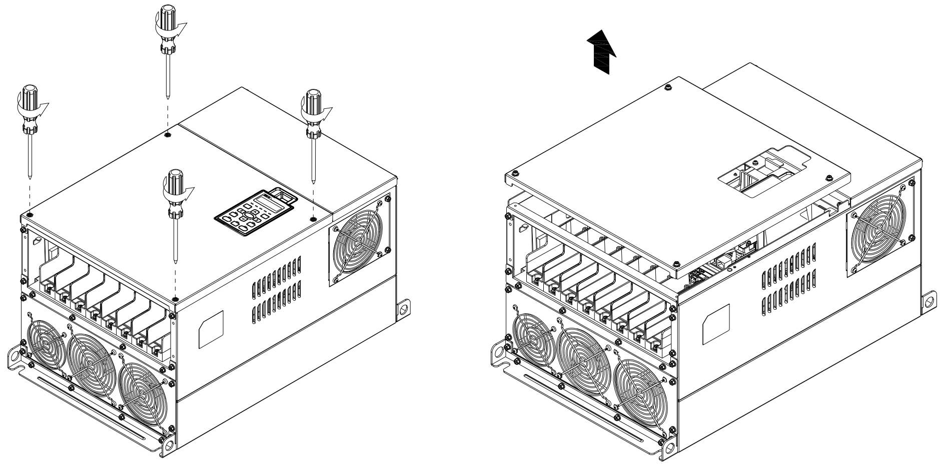


4. Fasten the 4 screws shown in the following figure. Screw torque: 10~12kg-cm (8.66~10.39lb-in).

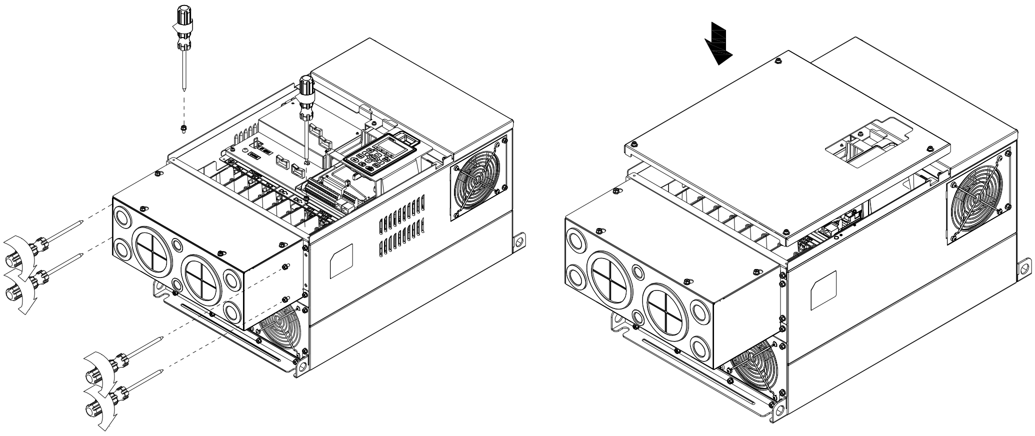


Frame E

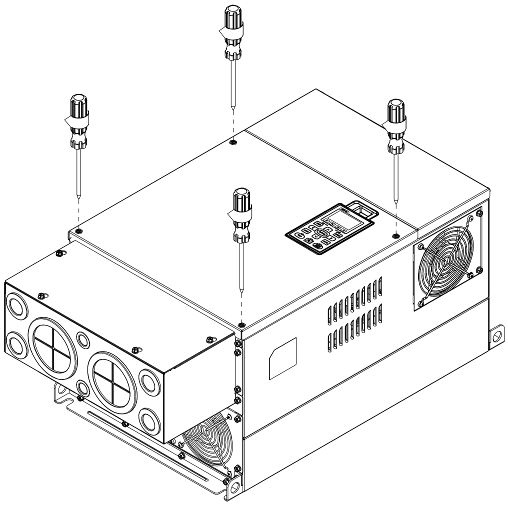
1. Loosen the 4 cover screws and lift the cover; Screw torque: 12~ 15 kg-cm (10.4~13Ib-in).



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

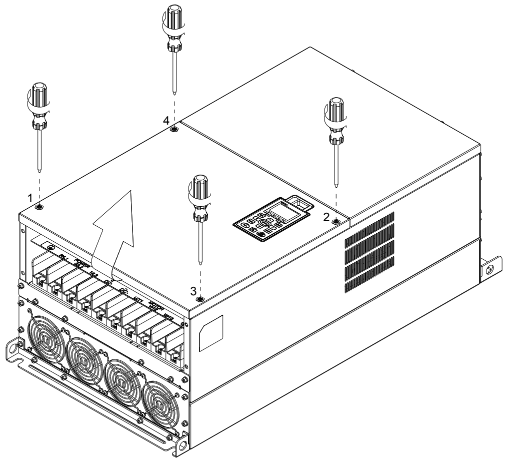


3. Fasten the 4 screws shown in the following figure. Screw torque:12~15kg-cm (10.4~13Ib-in)』

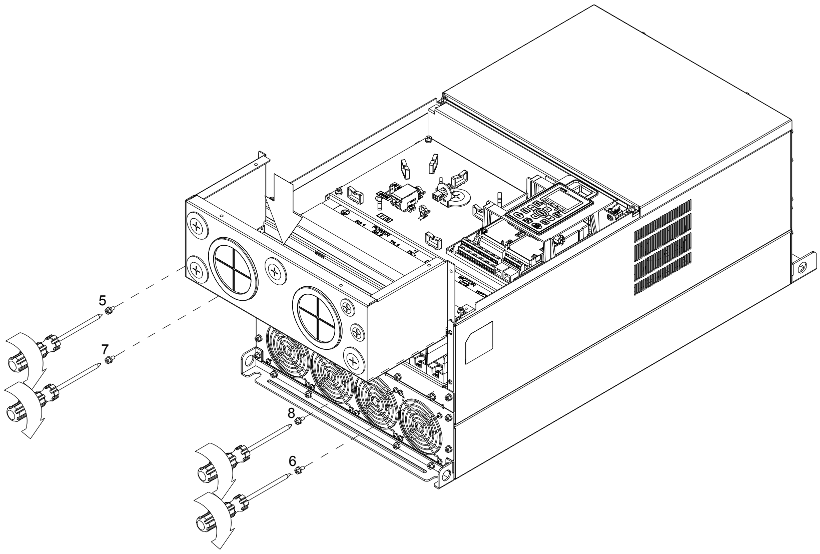


Frame F

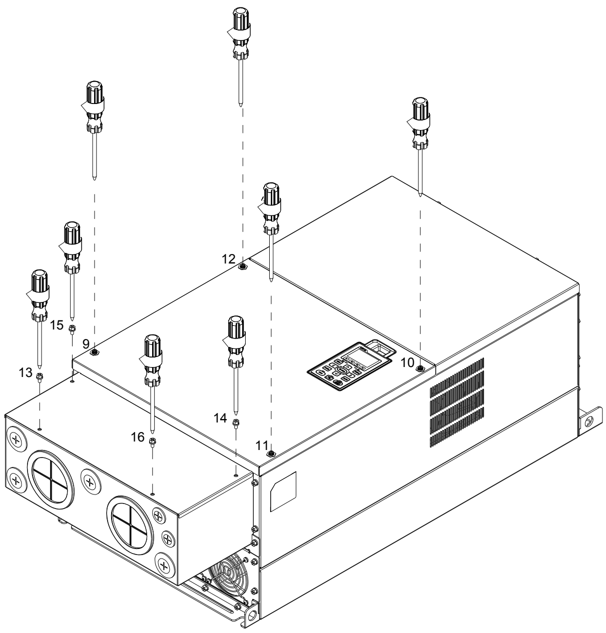
1. Loosen the cover screws and press the tabs on each side of the cover to remove the cover, as shown in the following figure. Screw torque: 14~16kg-cm (12.2~13.9Ib-in).



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

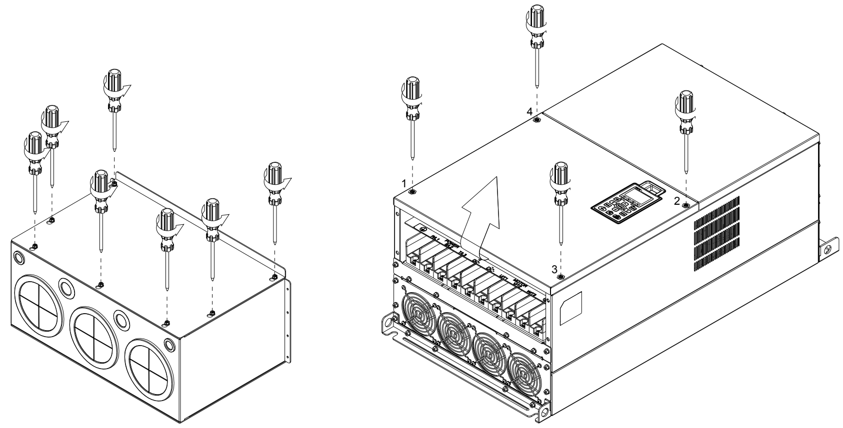


3. Install the conduit box by fasten all the screws shown in the following figure

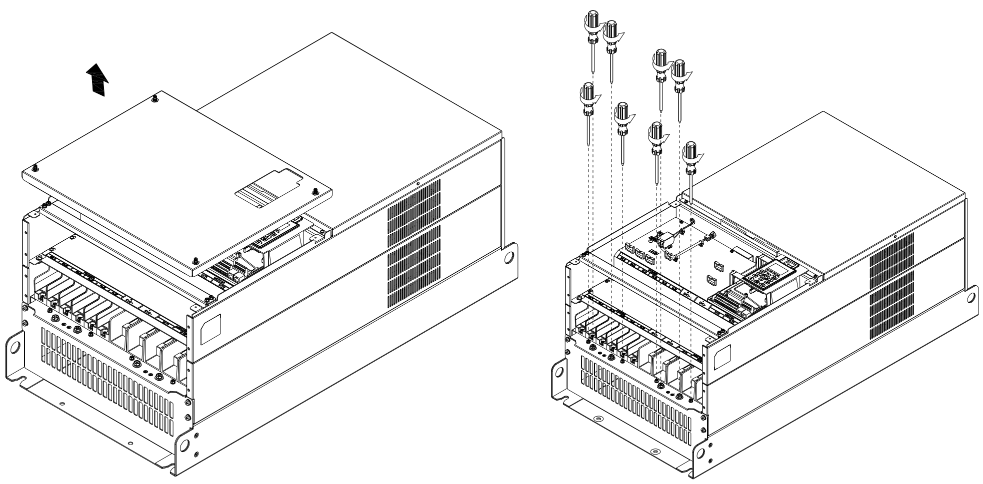


Frame G

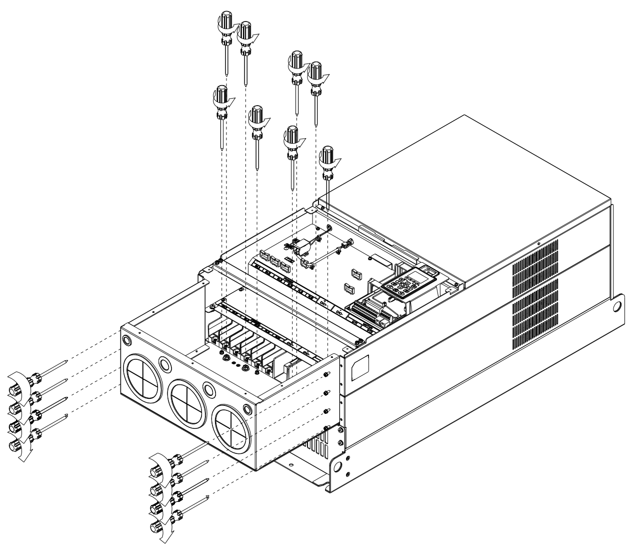
1. On the conduit box, loosen 7 of the cover screws and remove the cover. On the drive, loosen 4 of the cover screws and press the tabs on each side of the cover to remove the cover, as shown in the following figure. Screw torque: 12~15kg-cm (10.4~13Ib-in).



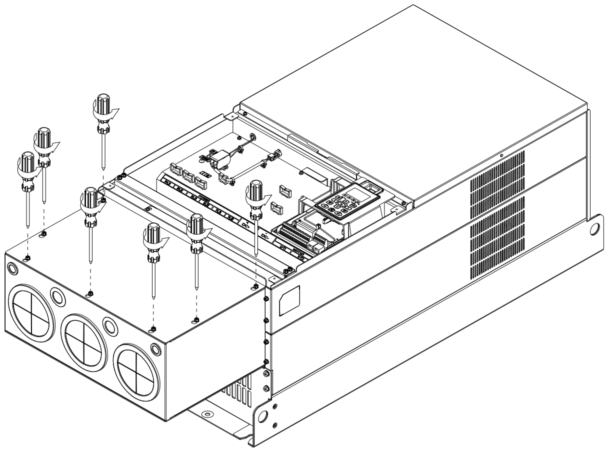
Remove the top cover and loosen the screws. Screw torque: 12~15kg-cm (10.4~13Ib-in).



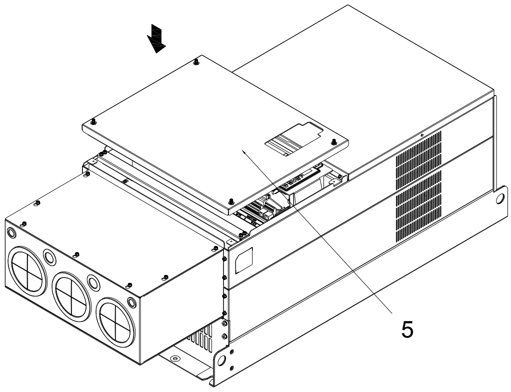
2. Install the conduit box by fastening all the screws shown in the following figure.
   Screw torque: 25~30kg-cm (20.8~30Ib-in); Screw torque: 12~15kg-cm (10.4~13Ib-in)

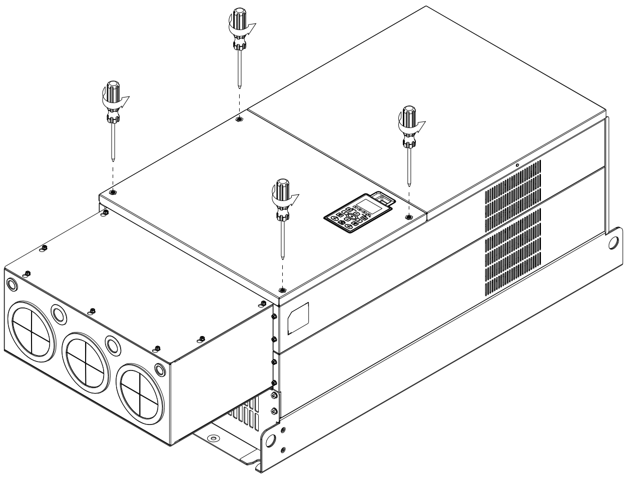


Fasten all the screws. Screw torque: 25~30kg-cm (20.8~30Ib-in).



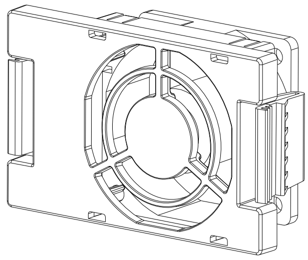
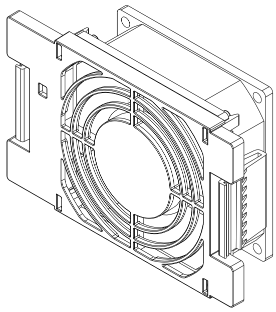
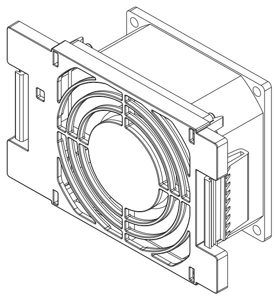
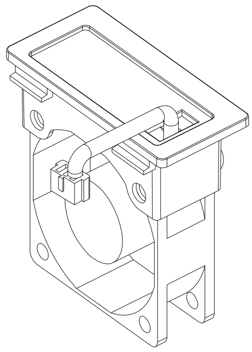
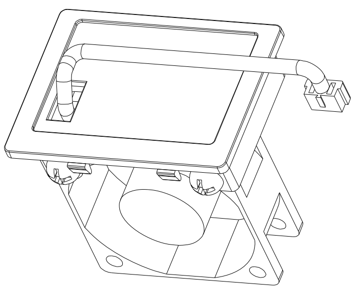
Place the cover back to the top and fasten the screws (as shown in the figure).
Screw torque: 12~15kg-cm (10.4~13Ib-in).

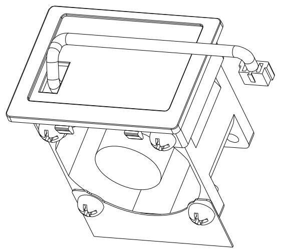
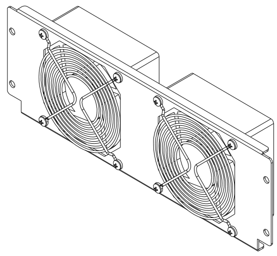
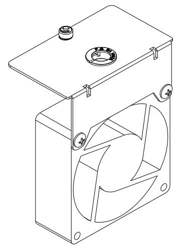
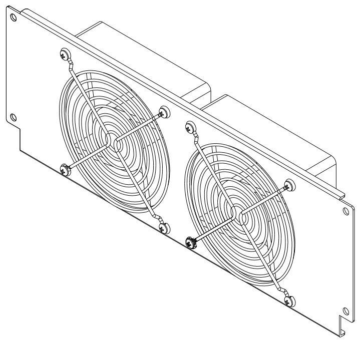
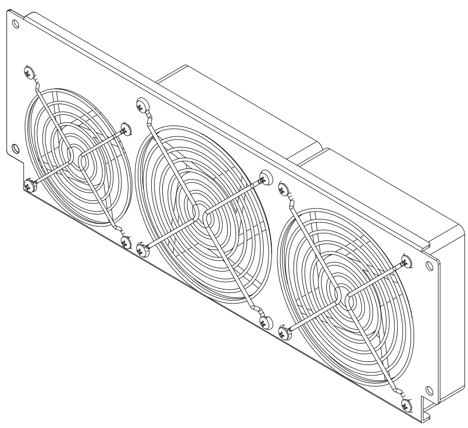
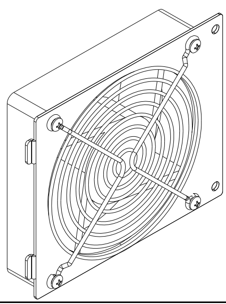


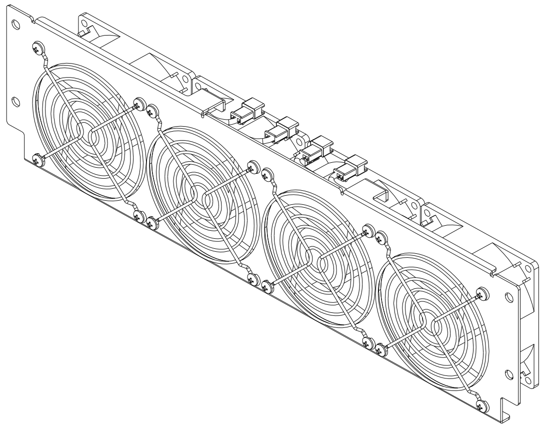
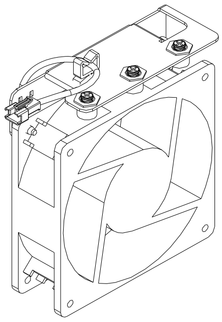
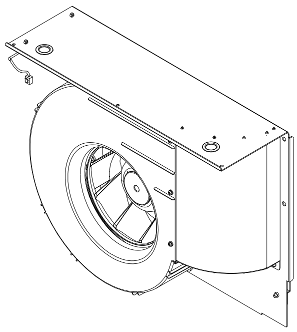
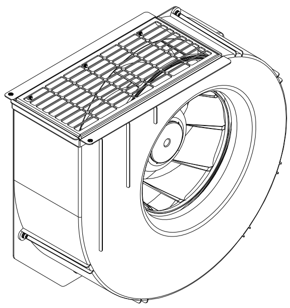


Fan Kit

- Frames of the fan kit

Frame A Applicable Model VFD015C23A; VFD022C23A; VFD037C23A;VFD022C43A/43E; VFD037C43A/43E;VFD040C43A/43E; VFD055C43A/43E	Model『MKC-AFKM』 
Frame B Applicable Model VFD055C23A; VFD075C43A/43E	Model『MKC-BFKM1』 
Frame B Applicable Model VFD075C23A; VFD110C23A; VFD110C43A/43E; VFD150C43A/43E	Model 『MKC-BFKM2』 
Frame B Applicable Model VFD055C23A; VFD075C23A; VFD110C23A;VFD075C43A/43E; VFD110C43A/43E;VFD150C43A/43E	Model 『MKC-BFKB』 
Frame C Applicable Model VFD150C23A; VFD185C23A; VFD220C23A	Model 『MKC-CFKB1』 

Frame C Applicable Model VFD185C43A/43E; VFD220C43A/43E;VFD300C43A/43E	Model 『MKC-CFKB2』 	
Frame D Applicable Model VFD300C23A/23E; VFD370C23A/23E; VFD370C43A/43E; VFD450C43A/43E; VFD550C43A/43E; VFD750C43A/43E	Model 『MKC-DFKM』 	Model 『MKC-DFKB』 
Frame E Applicable Model VFD450C23A/23E; VFD550C23A/23E	Model 『MKC-EFKM1』 	
Frame E Applicable Model VFD750C23A/23E; VFD900C43A/43E; VFD1100C43A/43E	Model『MKC-EFKM2』 	
Frame E Applicable Model VFD450C23A/23E; VFD550C23A/23E; VFD750C23A/23E; VFD900C43A/43E; VFD1100C43A/43E	Model 『MKC-EFKB』 	

Frame F Applicable Model VFD900C23A/23E; VFD1320C43A/43E; VFD1600C43A/43E ;	Model 『MKC-FFKM』 
Frame F Applicable Model VFD900C23A/23E; VFD1320C43A/43E; VFD1600C43A/43E	Model 『MKC-FFKB』 
Frame G Applicable Model VFD1850C43A/43E; VFD2200C43A/43E	Model 『MKC-GFKM』 
Frame H Applicable Model VFD2800C43A/43E; VFD3150C43A/43E; VFD3550C43A/43E; VFD2800C43E-1; VFD3150C43E-1; VFD3550C43E-1	Model 『MKC-HFKM』 

NOTE:

Model VFD007C43E; VFD015C43E; VFD022C43E; VFD037C43E; VFD040C43E; VFD055C43E; VFD075C43E; VFD110C43E; VFD150C43E; VFD185C43E; VFD220C43E; VFD300C43E will be available for ordering soon. Please contact your local distributor or Delta representative for detailed launch information.

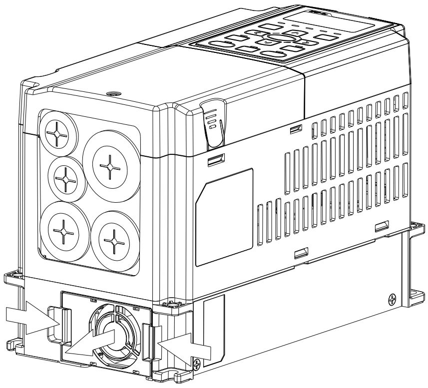
■ Fan Removal

Frame A

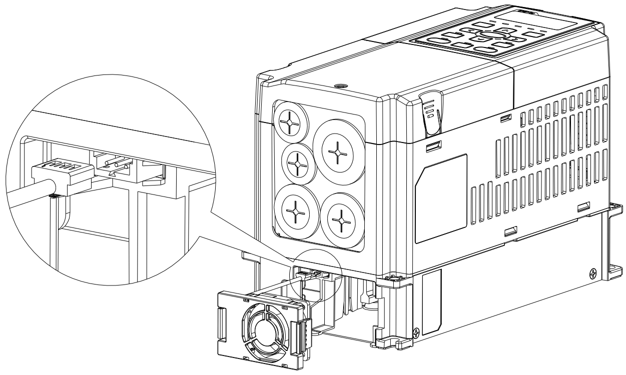
Applicable model

VFD015C23A; VFD022C23A; VFD022C43A/43E; VFD037C23A; VFD037C43A/43E; VFD040C43A/43E; VFD055C43A/43E

1. Press the tabs on both side of the fan to successfully remove the fan. (The arrow)



2. Disconnect the power terminal before removing the fan. (As shown below.)

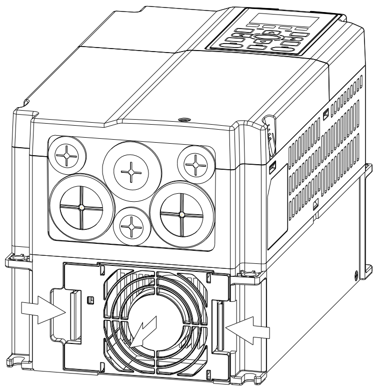


Frame B

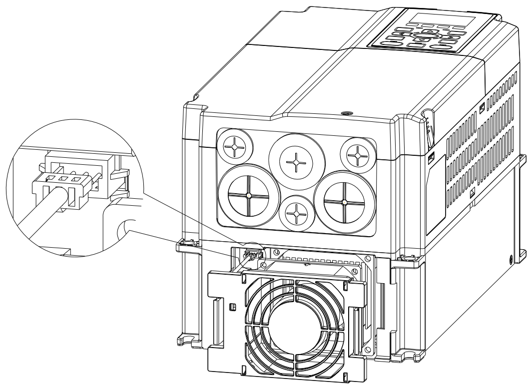
Applicable model

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

1. Press the tab on both side of the fan to successfully remove the fan.



2. Disconnect the power terminal before removing the fan.

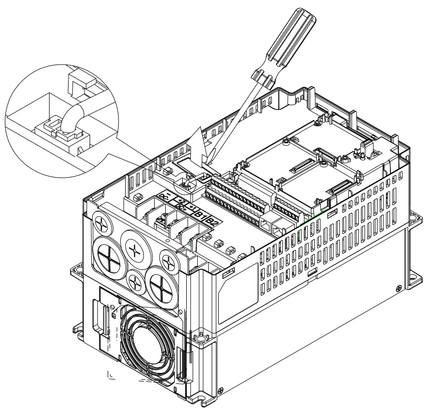


Frame B&C

Applicable model

VFD055C23A; VFD075C23A; VFD075C43A/43E; VFD110C23A; VFD110C43A/43E;
VFD150C43A/43E; VFD150C23A; VFD185C23A; VFD220C23A; VFD185C43A/43E;
VFD220C43A/43E; VFD300C43A/43E

Disconnect the power terminal by slotted screwdriver to remove the fan cover.



Frame D

Applicable model

VFD300C23A/23E; VFD370C23A/23E; VFD370C43A/43E; VFD450C43A/43E; VFD550C43A/43E; VFD750C43A/43E

1. (Figure 1) Loosen screw 1 and screw 2, press the on the right and the left to remove the cover, follow the direction the arrows indicate. Press on top of digital keypad KPC-CE01 to properly remove the keypad. Screw torque: 10~12kg-cm (8.6~10.4in-lbf).

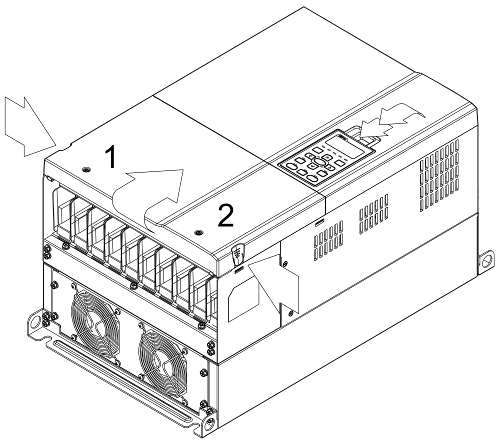


Figure 1

2. (Figure 2) Loosen screw 3 and screw 4, press the tab on the right and the left to remove the cover. Screw torque: 6~8kg-cm (5.2~6.9in-lbf).

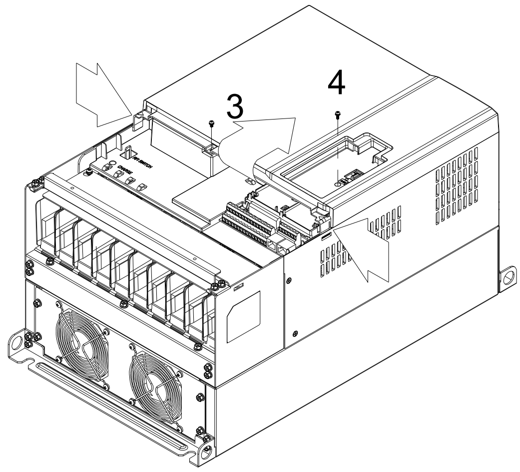


Figure 2

3. (Figure 3) Loosen screw 5 and disconnect the fan power. Screw torque: 10~12kg-cm (8.6~10.4in-lbf).

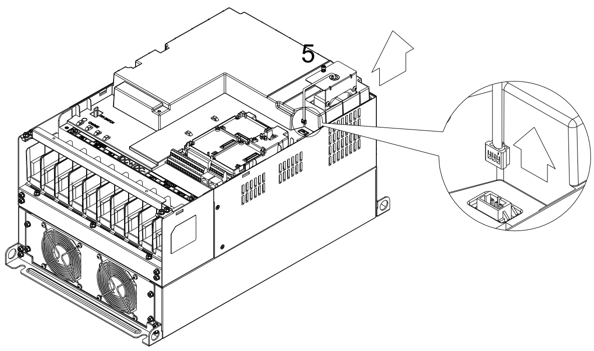


Figure 3

4. (Figure 4) Loosen the screws. Screw torque: 24~26kg-cm (20.8~25.6in-lbf).
5. Disconnect fan power and pull out the fan. (As shown in the larger picture)

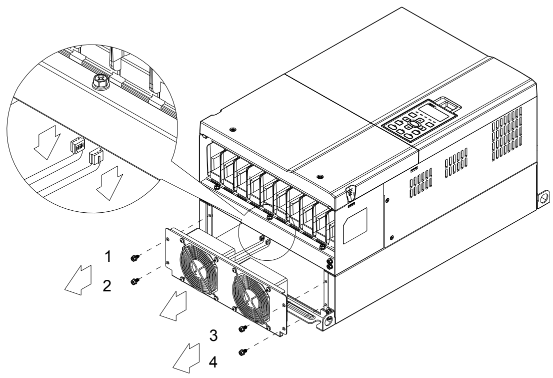
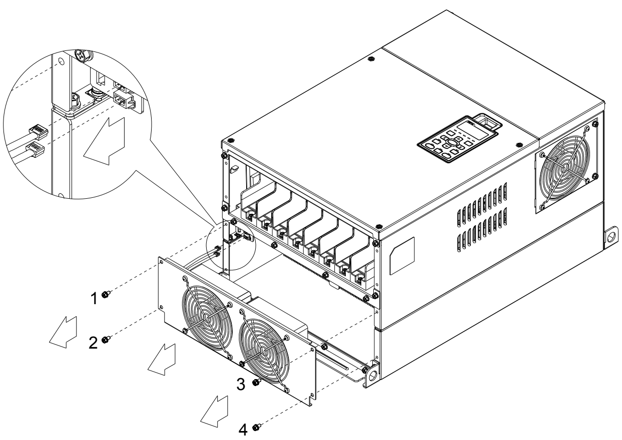


Figure 4

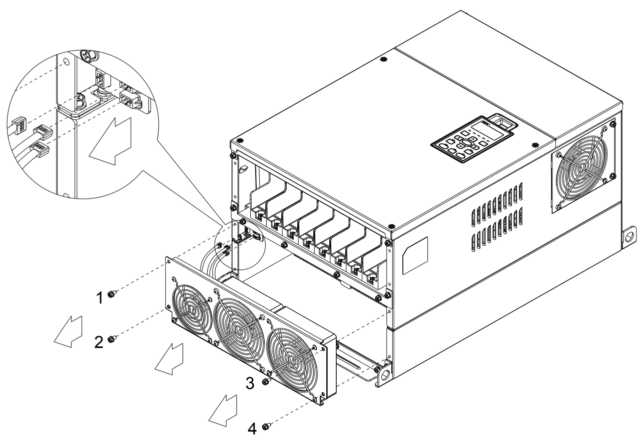
Frame E

Applicable model:
VFD450C23A/23E; VFD550C23A/23E; VFD750C23A/23E; VFD900C43A/43E; VFD1100C43A/43E

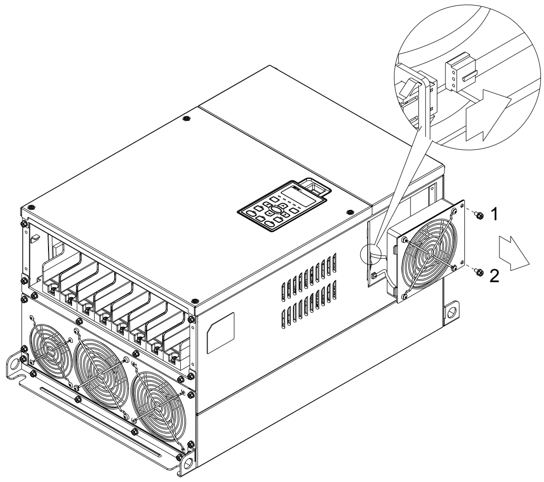
Loosen screw 1~4 (as shown in the figure below), and disconnect the fan power then remove the fan. Screw torque: 24~26kg-cm (20.8~25.6in-lbf).



Loosen screw 1~4(as shown in the figure below), and disconnect the fan power then remove the fan. Screw torque: 24~26kg-cm (20.8~25.6in-lbf).



Loosen screw 1 and screw 2 (as shown in the figure below), and disconnect fan power before removing the fan. Screw torque: 24~26kg-cm (20.8~25.6in-lbf).



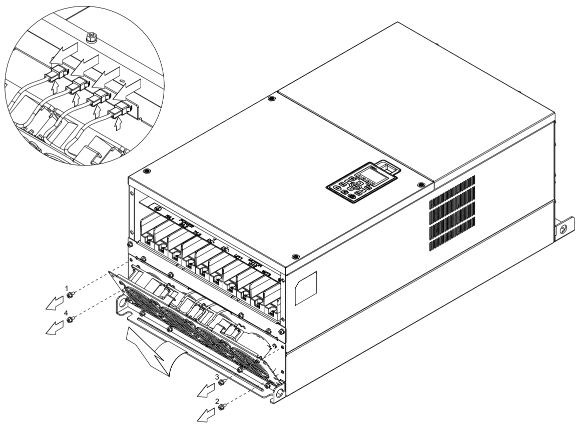
Frame F

Applicable model

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

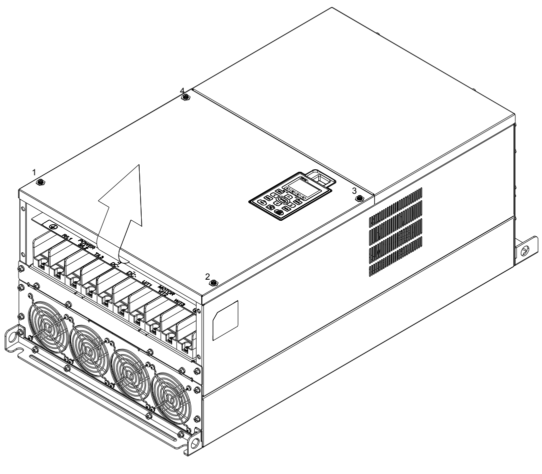
Fan model『MKC-FFKM』

Loosen the screws and removes the fan (as shown in figure below). Screw torque: 24~26kg-cm (20.8~22.6Ib-in』

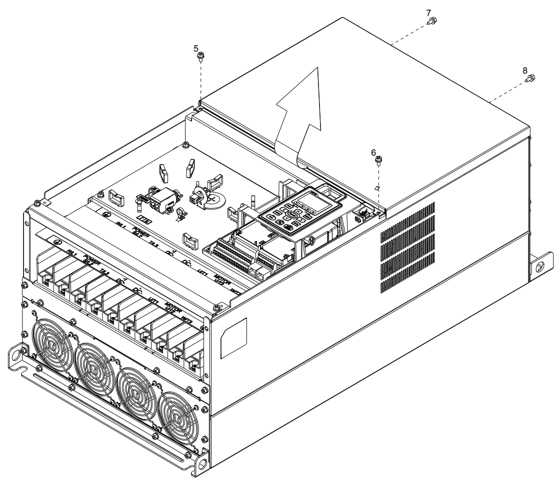


Fan model 『MKC-FFKB』

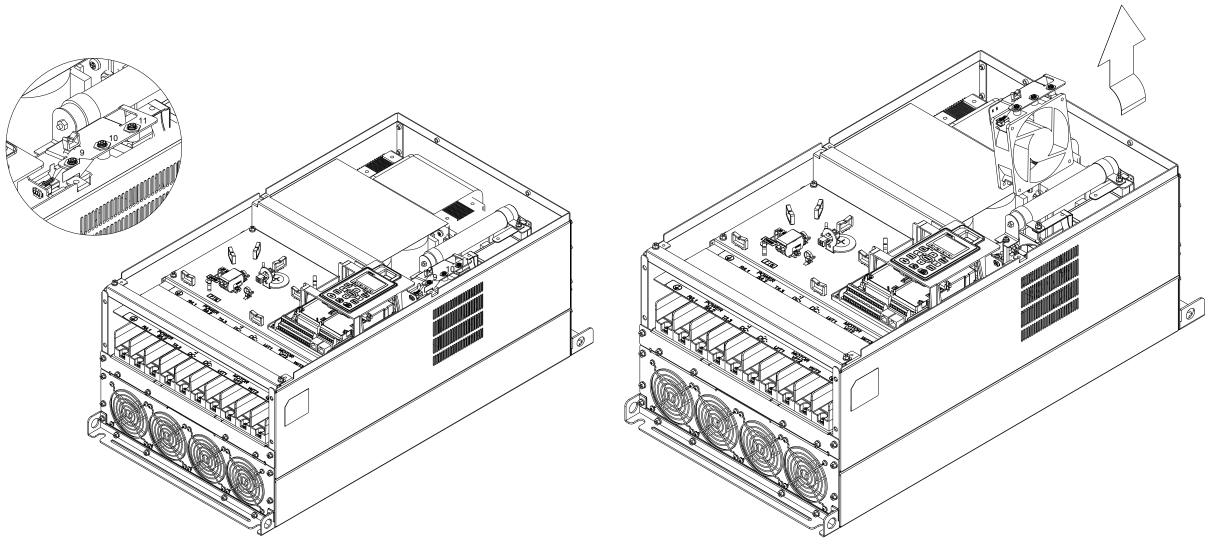
(1) Loosen the screw (as shown in figure below) and removes the cover. Screw torque: 14~16kg-cm (12.2~13.9Ib-in).



(2) Loosen the screw (as shown in figure below) and removes the cover. Screw torque: 24~26kg-cm (20.8~22.6Ib-in).



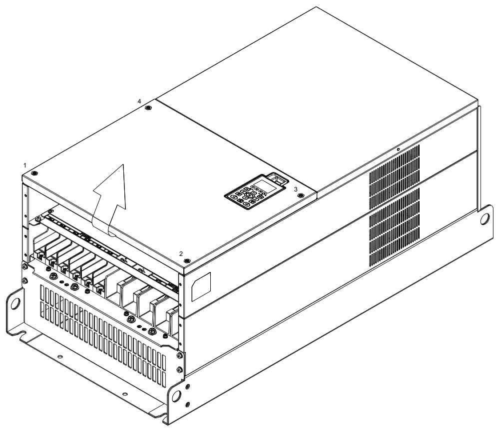
(3) Loosen the screws and remove the fan. (As shown in the figure below) Screw torque: 24~26kg-cm (20.8~22.6lb-in).



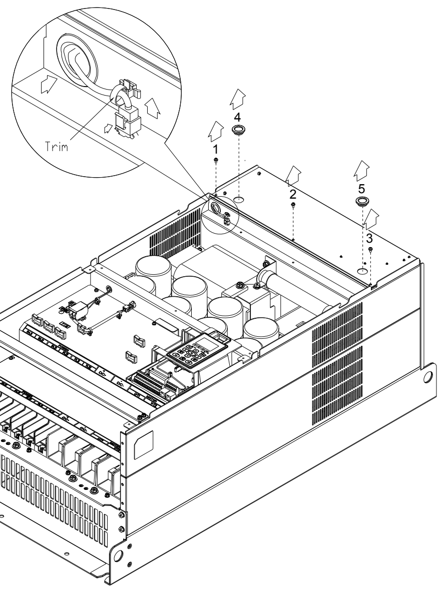
Frame G
Applicable model
VFD1800C43A/43E; VFD2200C43A/43E;

Fan model『MKC-GFKM』

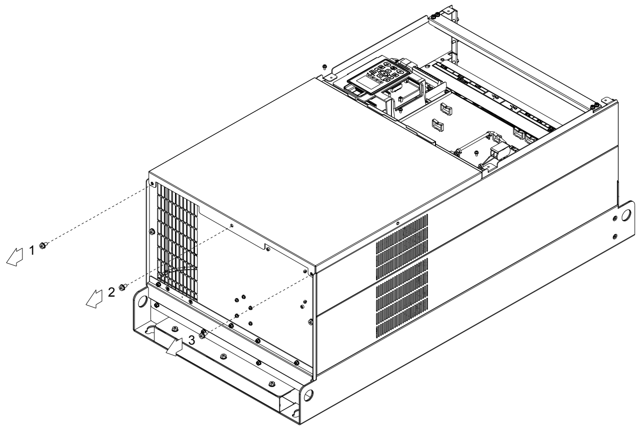
(1) Loosen the screw (as shown in figure below) and remove the cover. Screw torque: 24~26kg-cm (20.8~22.6lb-in).



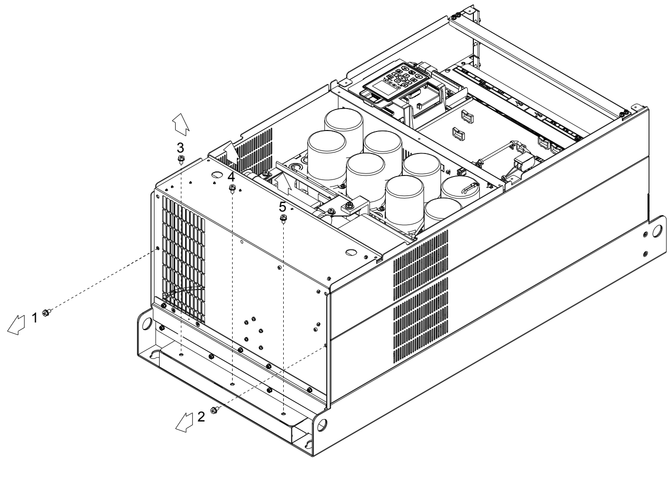
(2) Loosen the screw (as shown in figure below) and remove the cover. Screw torque: 15~20kg-cm (12.2~13.9lb-in).



(3) Loosen the screw (as shown in the figure below) and remove the bottom cover.
Screw torque: 24~26kg-cm (20.8~22.6lb-in).



(4) Screw torque: 35~40kg-cm (30.4~34.7lb-in).



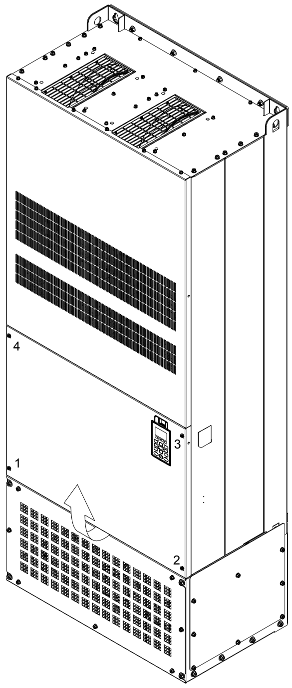
Frame H

Applicable model

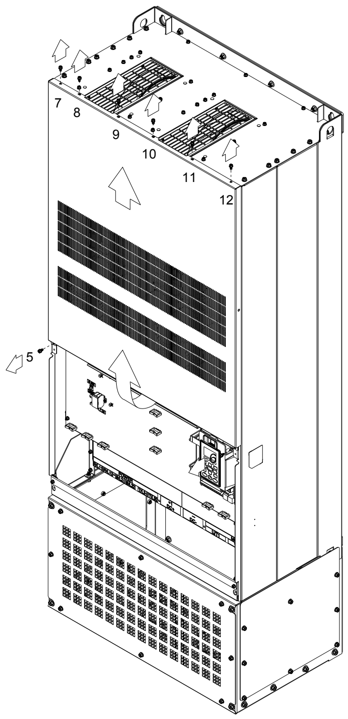
VFD2800C43A/43E; VFD3150C43A/43E; VFD3550C43A/43E;

Fan model 『MKC-HFKM』

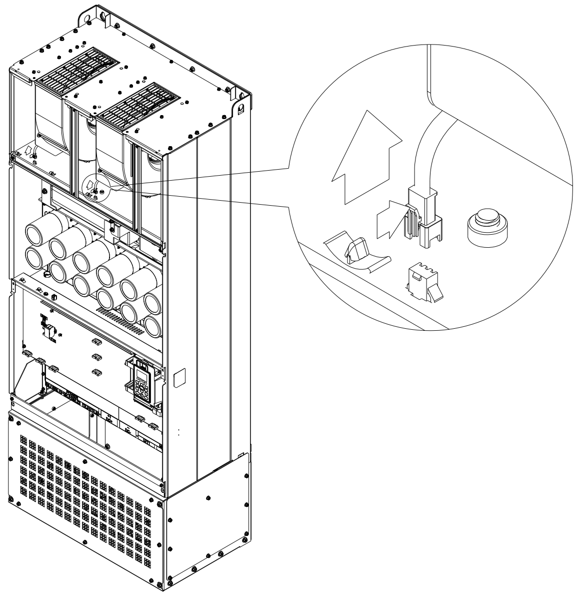
(1) Loosen the screw and remove the top cover.
Screw torque: 14~16kg-cm (12.2~13.9lb-in)



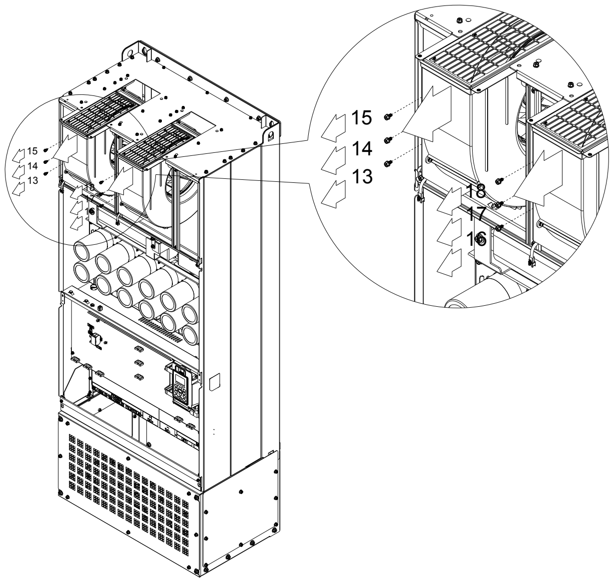
(2) Loosen the screw and remove the top cover.
Screw torque: 24~26kg-cm (20.8~22.6lb-in).



(3) Disconnect the fan.



(4) Loosen the screw and remove the fan. Make sure fan power is properly disconnected before removal. Screw torque: 24~26kg-cm (20.8~22.6lb-in).



NOTE:

Model VFD007C43E; VFD015C43E; VFD022C43E; VFD037C43E; VFD040C43E; VFD055C43E; VFD075C43E; VFD110C43E; VFD150C43E; VFD185C43E; VFD220C43E; VFD300C43E will be available for ordering soon. Please contact your local distributor or Delta representative for detailed launch information.

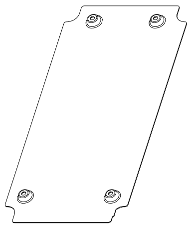
Flange Mounting Kit

Applicable Models, Frame A~F

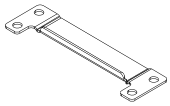
Frame A

『MKC-AFM1』

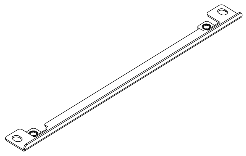
Applicable model
VFD015C23A; VFD022C23A; VFD022C43A/43E



Accessories 1*1



Accessories 2*2



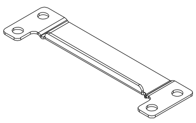
Accessories 3*2

Screw 1 *4
M3*P 0.5; L=6mm

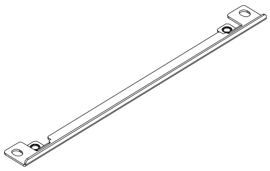
Screw 2*8
M6*P 1.0; L=16mm

『MKC-AFM』

Applicable model
VFD007C23A; VFD007C43A/43E; VFD015C43A/43E; VFD037C23A; VFD037C43A/43E; VFD040C43A/43E; VFD055C43A/43E



Accessories 2*2

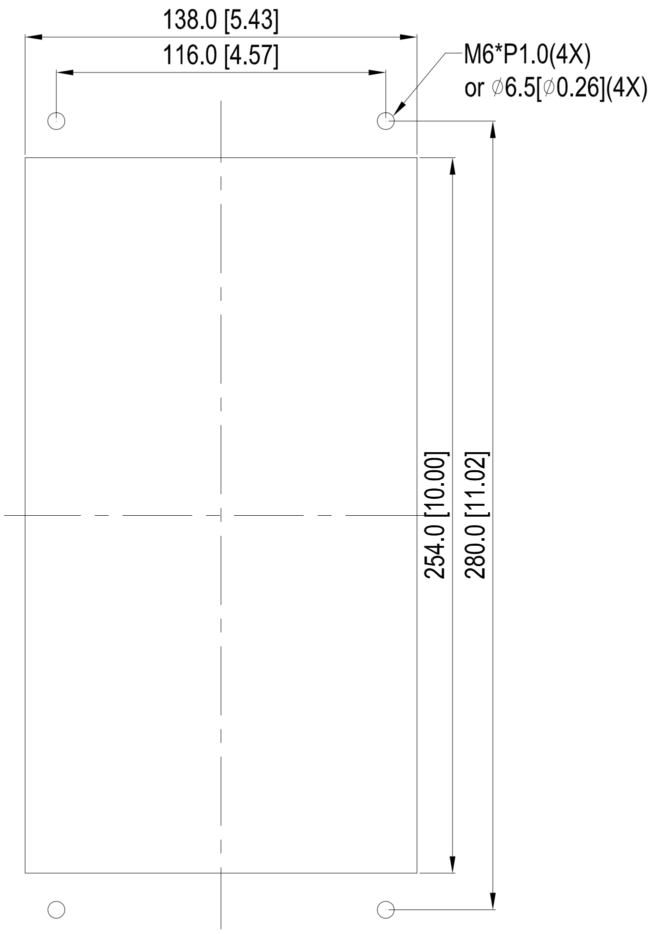


Accessories t 3*2

Screw *8
M6*P 1.0; L=16mm

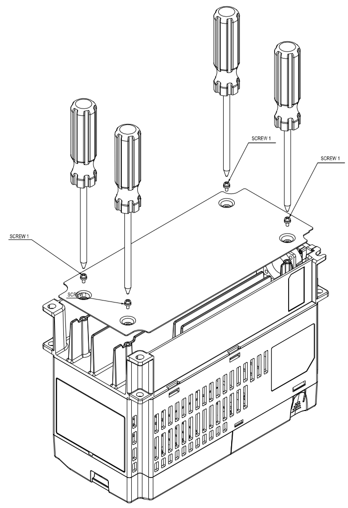
Cutout dimension

Unit: mm [inch]

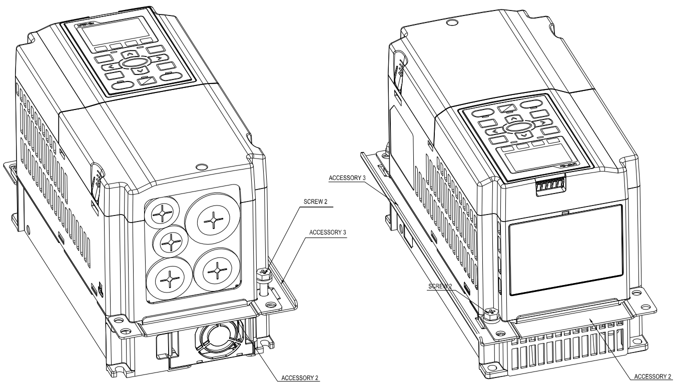


Installation『MKC-AFM1』

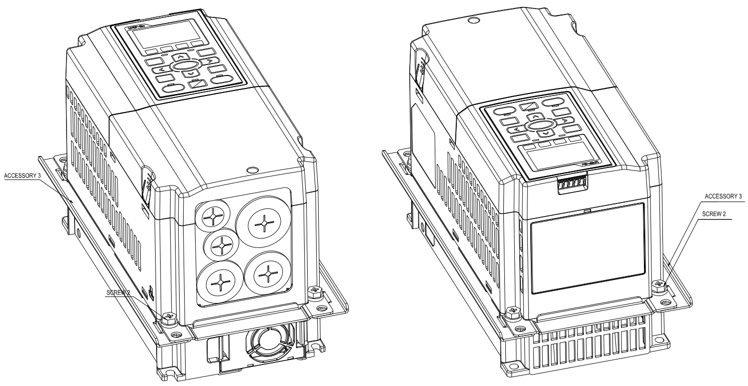
1. Install accessory 1 by fastening 4 of the screw 1(M3). Screw torque: 6~8kg-cm (5.21~6.94lb-in).



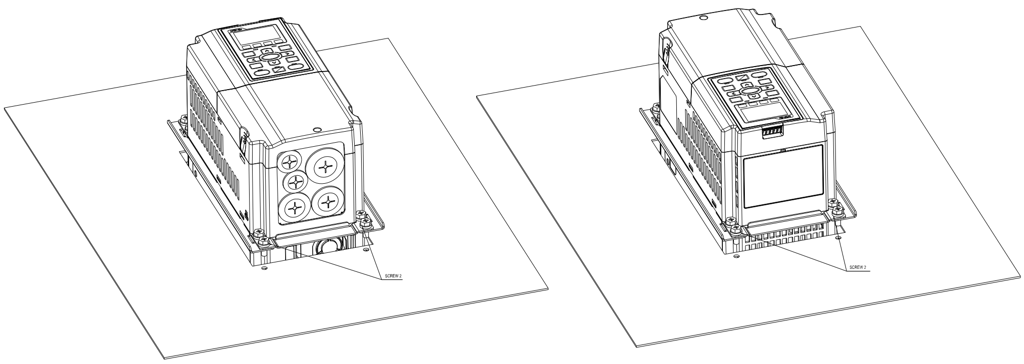
2. Install accessory 2&3 by fastening 2 of the screw 2(M6). Screw torque: 25~30kg-cm (5.21~6.94lb-in).



3. Install accessory 2&3 by fastening 2 of the screw 2(M6). Screw torque: 25~30kg-cm (5.21~6.94lb-in).

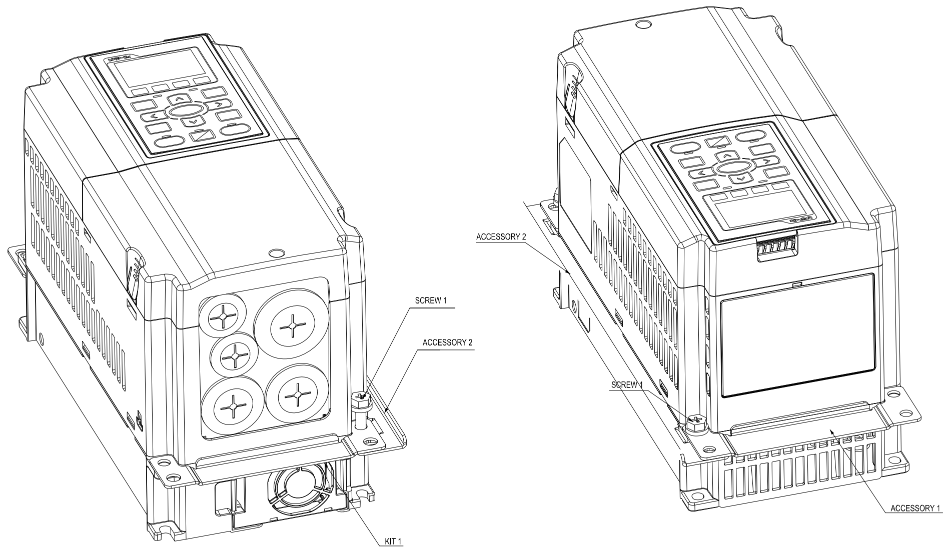


4. Plate installation, place 4 of the screw 2 (M6) through accessory 2&3 and the plate then fasten the screws. Screw torque: 25~30kg-cm (5.21~6.94lb-in).

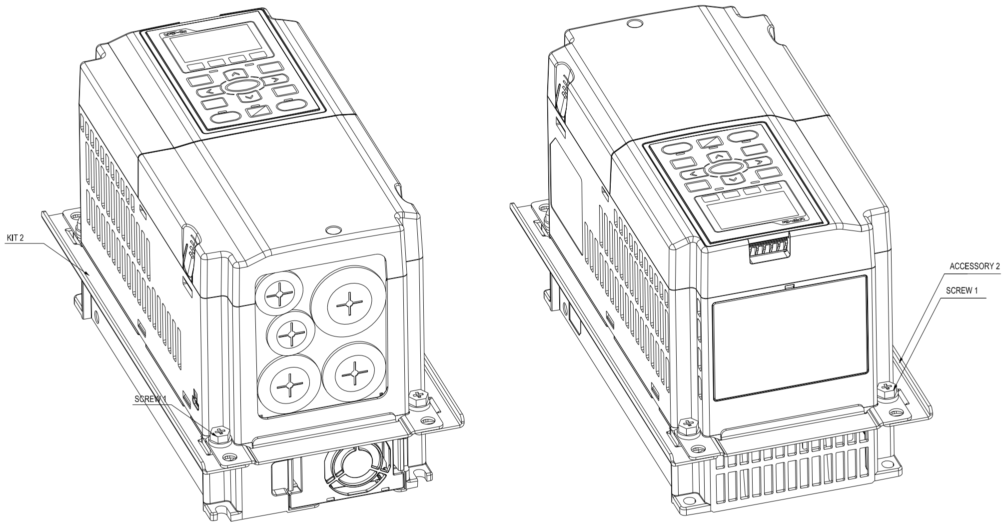


Installation『MKC-AFM』

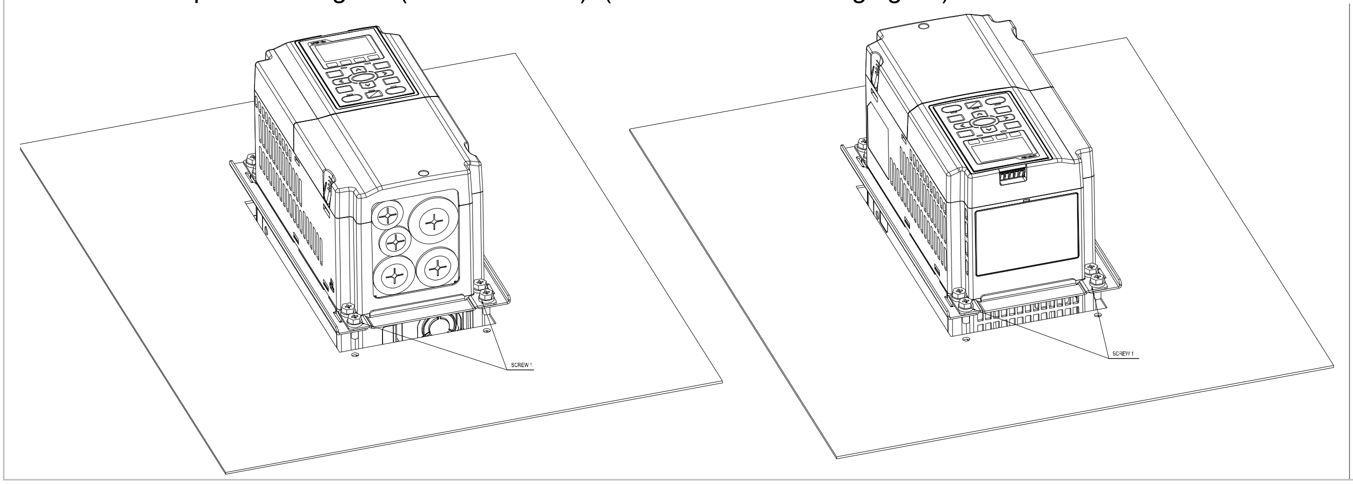
1. Install accessory 1& 2 by fastening 2 of the screw 1(M3). Screw torque: 25~30kg-cm (5.21~6.94Ib-in). (As shown in following figure)



2. Install accessory 1& 2 by fastening 2 of the screw 1(M3). Screw torque: 25~30kg-cm (5.21~6.94Ib-in). (As shown in following figure)



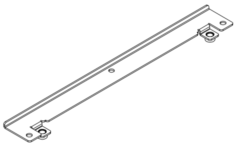
3. Plate installation, place 4 of the screw 2 (M6) through accessory 1&2 and the plate then fasten the screws. Screw torque: 25~30kg-cm (5.21~6.94Ib-in). (As shown in following figure)



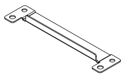
Frame B

『MKC-BFM』

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



Accessories 1*2

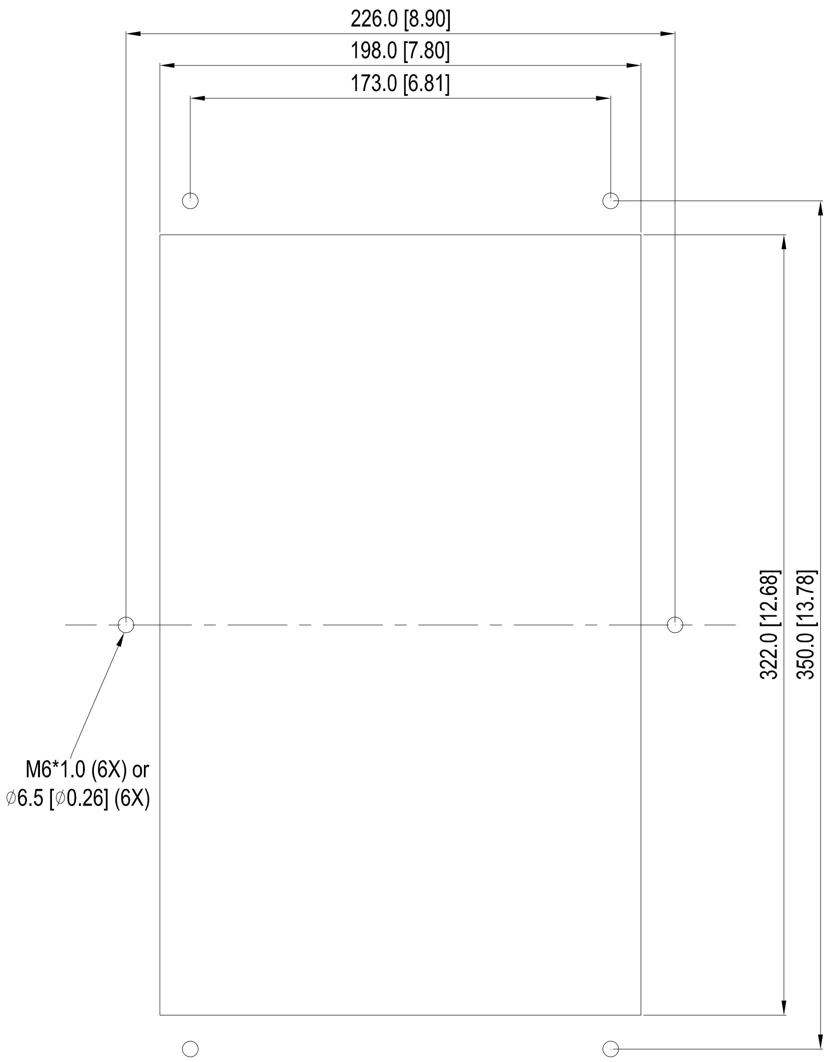


Accessories 2*2

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

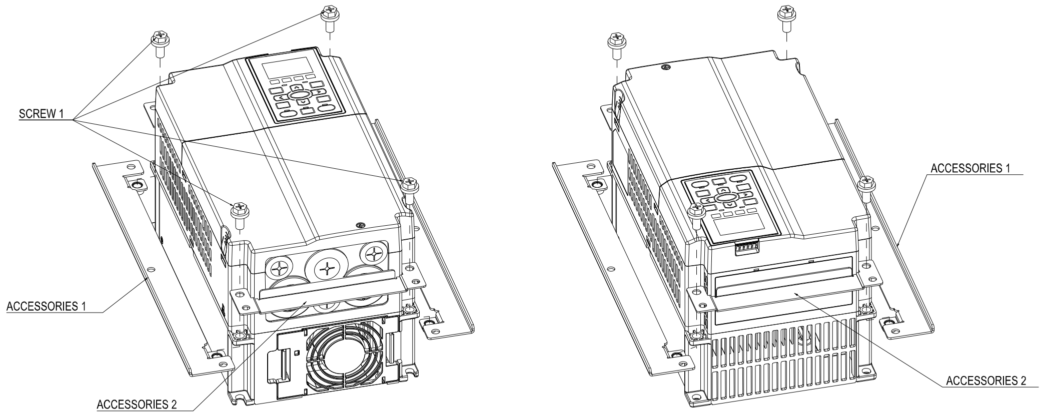
Cutout dimension

Unit: mm [inch]

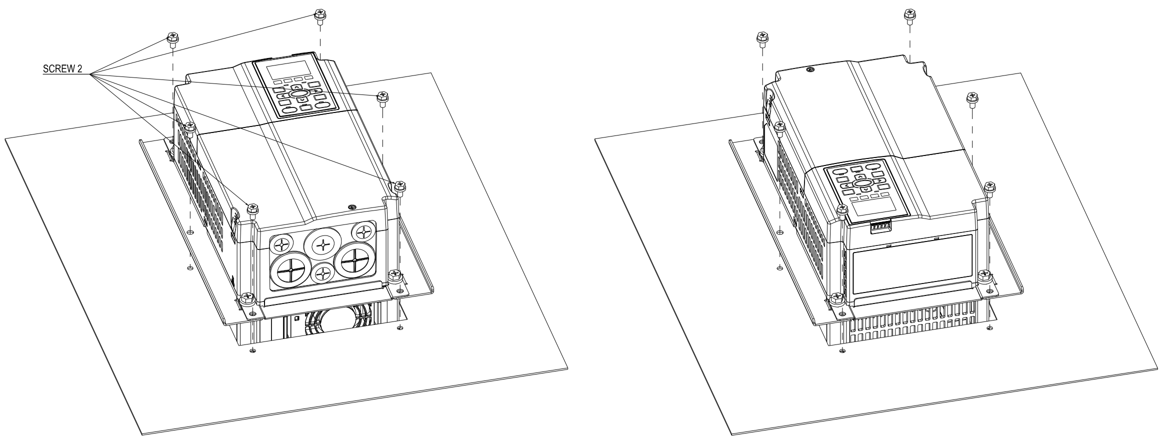


Installation『MKC-BFM』

1. Install accessory 1& 2 by fastening 4 of the screw 1(M8). Screw torque: 40~45kg-cm (34.7~39.0Ib-in). (As shown in the following figure)

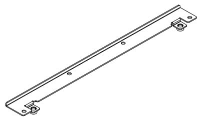


2. Plate installation, place 6 of the screw 2 (M6) through accessory 1&2 and the plate then fasten the screws. Screw torque: 25~30kg-cm (5.21~6.94Ib-in). (As shown in the following figure)

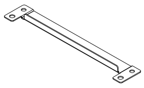


『MKC-CFM』

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



Accessories 1*2

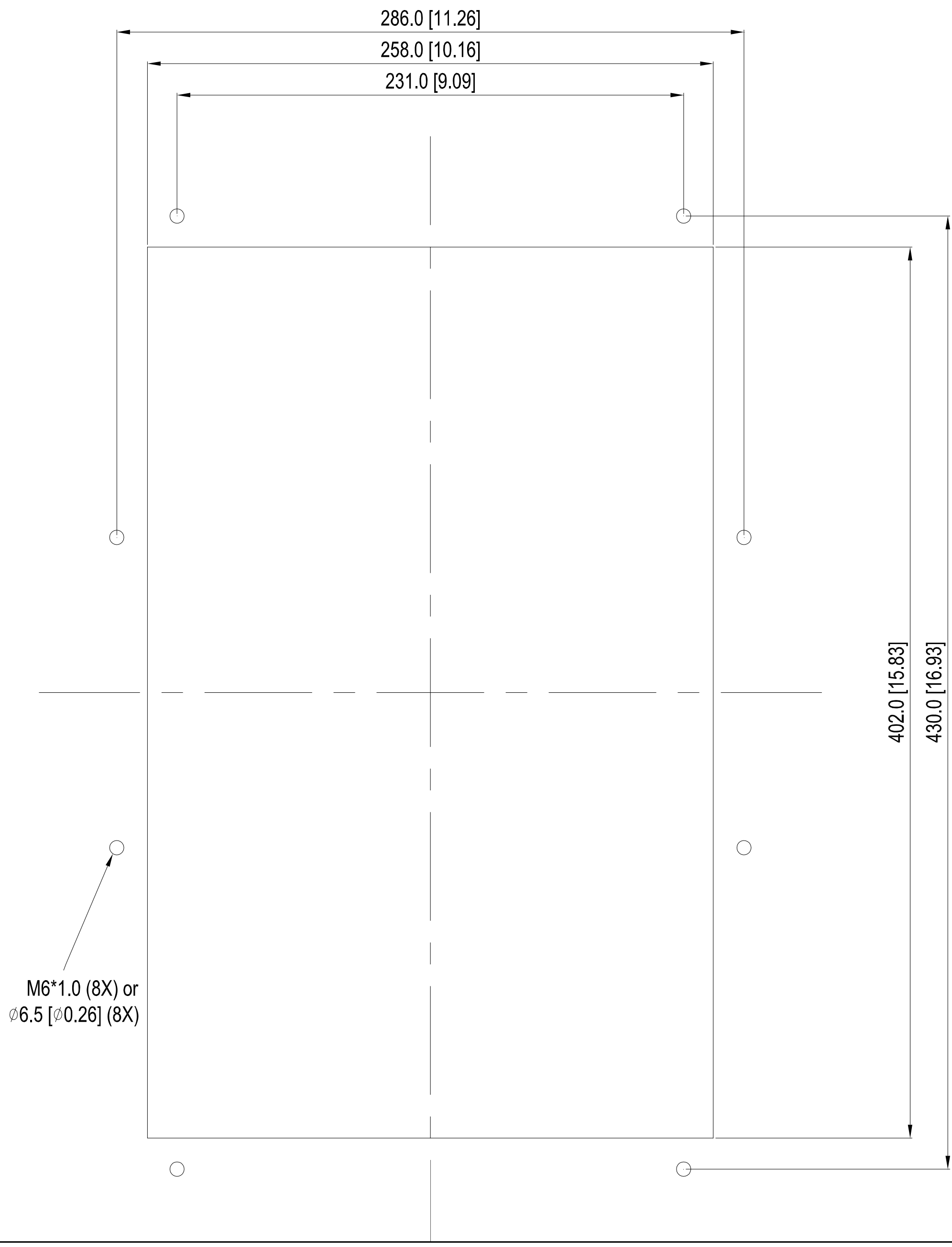


Accessories 2*2

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

Cutout dimension

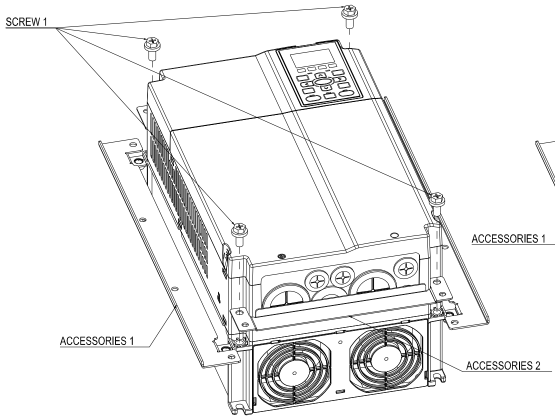
Unit: mm [inch]

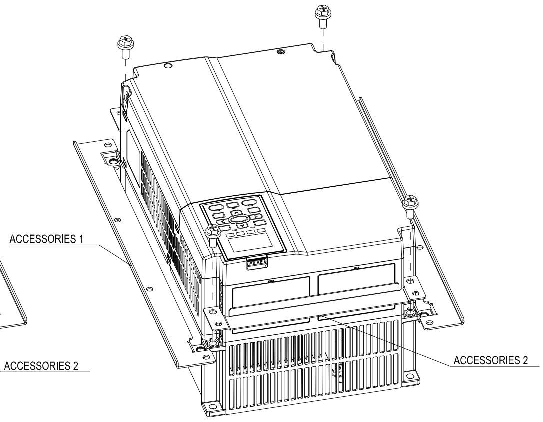


NOTE:
Model VFD007C43E; VFD015C43E; VFD022C43E; VFD037C43E; VFD040C43E; VFD055C43E; VFD075C43E; VFD110C43E; VFD150C43E; VFD185C43E; VFD220C43E; VFD300C43E will be available for ordering soon. Please contact your local distributor or Delta representative for detailed launch information.

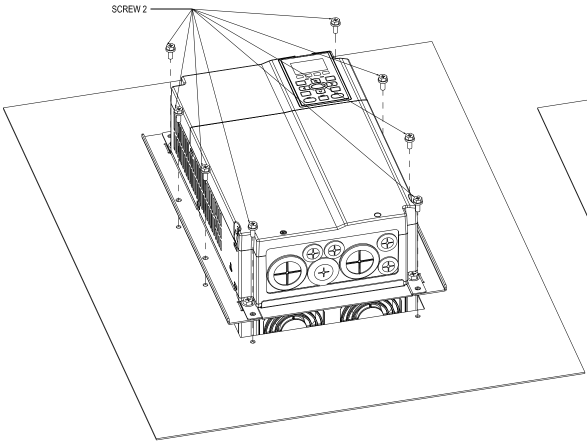
Installation『MKC-CFM』

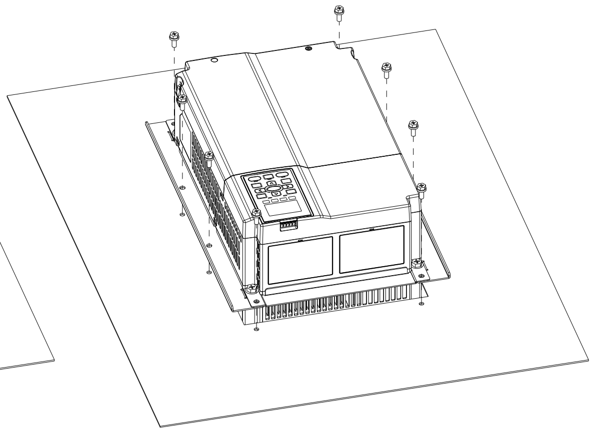
1. Install accessory 1& 2 by fastening 4 of the screw 1(M8). Screw torque: 50~55kg-cm (43.4~47.7lb-in). (As shown in the following figure)





2. Plate installation, place 8 of the screw 2 (M6) through accessories 1&2 and the plate then fasten the screws. Screw torque: 25~30kg-cm (5.21~6.94lb-in). (As shown in the following figure)





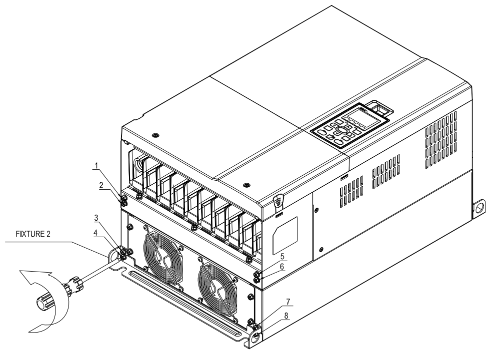
Frame D

Applicable model
VFD300C23A/23E; VFD370C23A/23E; VFD370C43A/43E; VFD450C43A/43E; VFD550C43A/43E; VFD750C43A/43E

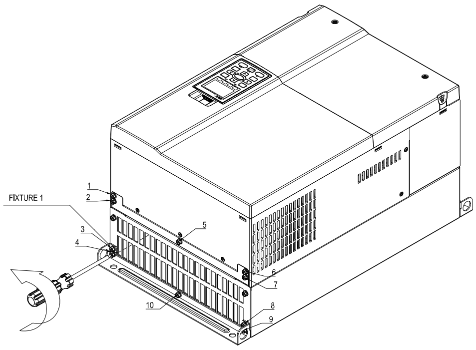
Cutout dimension Unit: mm [inch]

Frame D&E

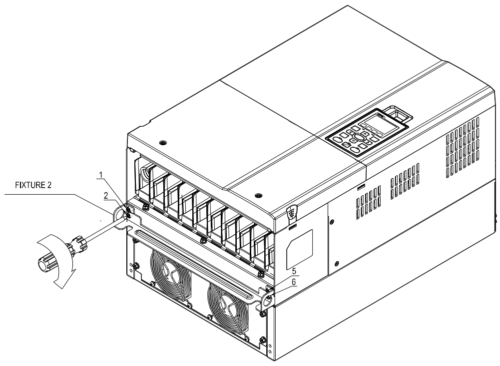
1. Loosen 8 screws and remove Fixture 2 (as shown in the following figure).



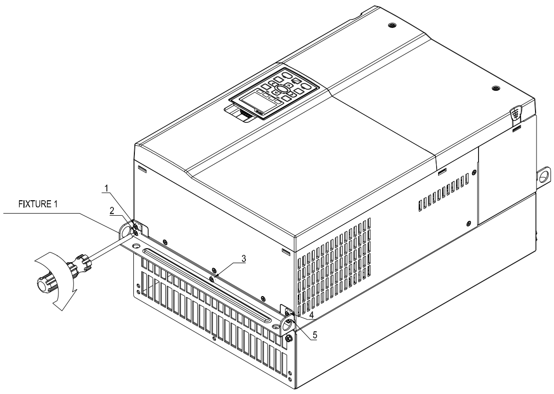
2. Loosen 10 screws and remove Fixture 1 (as shown in the following figure).



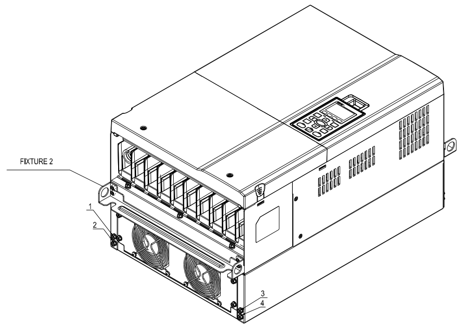
3. Fasten 4 screws (as shown in the following figure). Screw torque: 30~32kg-cm (26.0~27.8Ib-in).



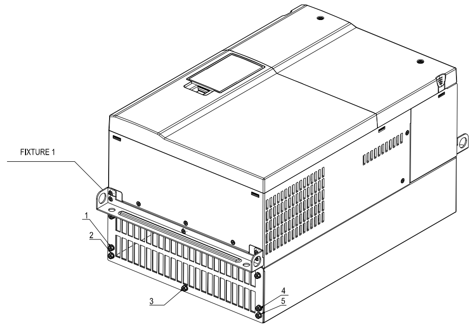
4. Fasten 5 screws (as shown in the following figure). Screw torque: 30~32kg-cm (26.0~27.8Ib-in).



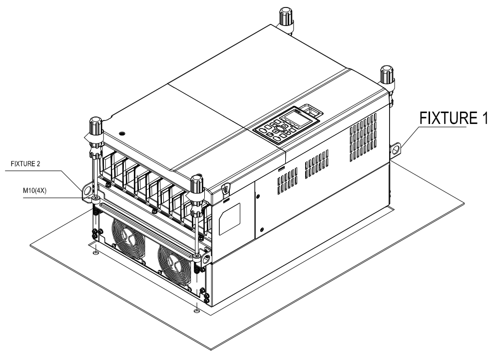
5. Fasten 4 screws (as shown in the following figure). Screw torque: 24~26kg-cm (20.8~22.6Ib-in).



6. Fasten 5 screws (as shown in the following figure). Screw torque: 24~26kg-cm (20.8~22.6Ib-in).



7. Place 4 screws (M10) through Fixture 1&2 and the plate then fasten the screws. (as shown in the following figure) Screw torque: 200~240kg-cm (173.6~208.3Ib-in).

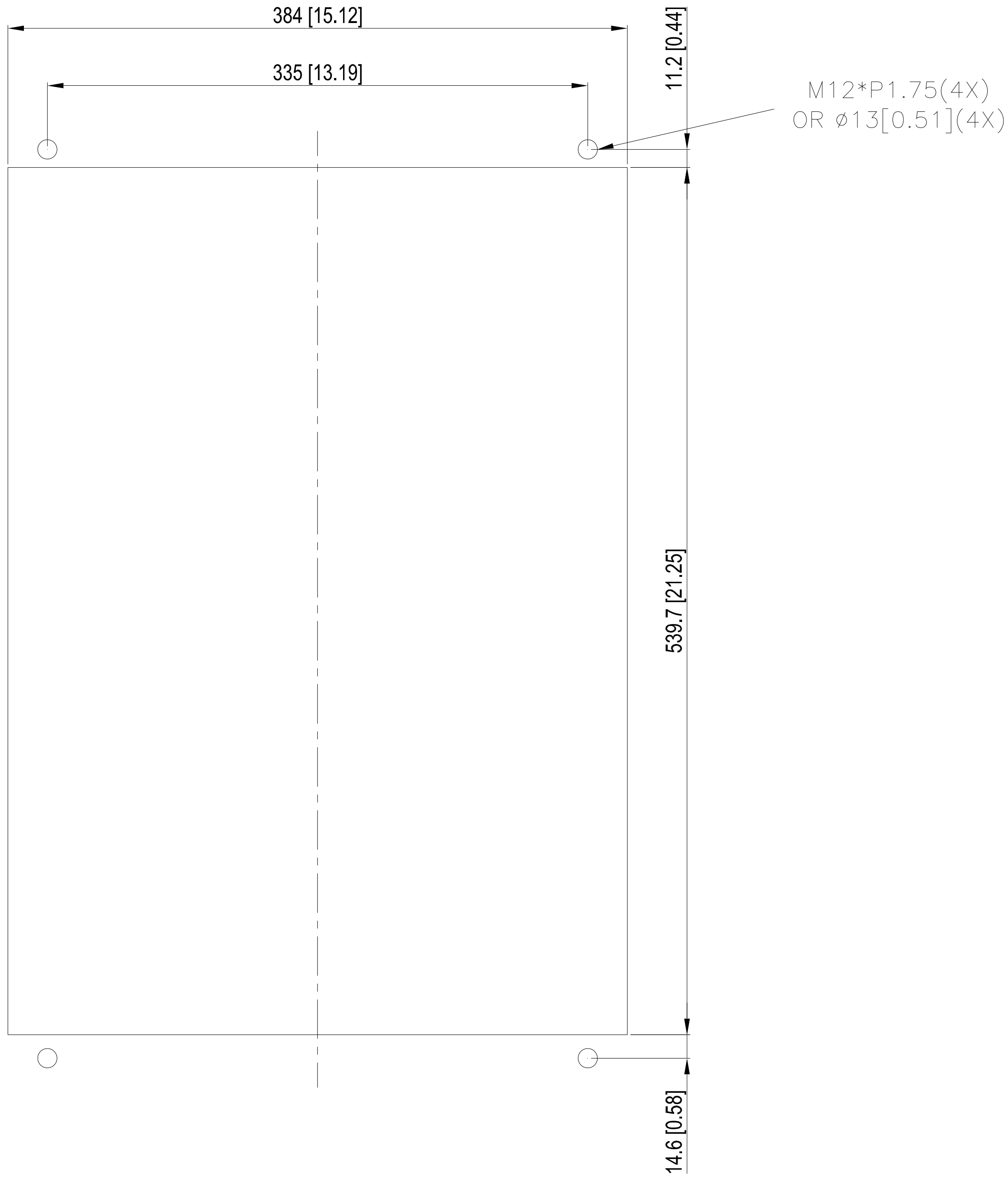


Frame E

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

Cutout dimension

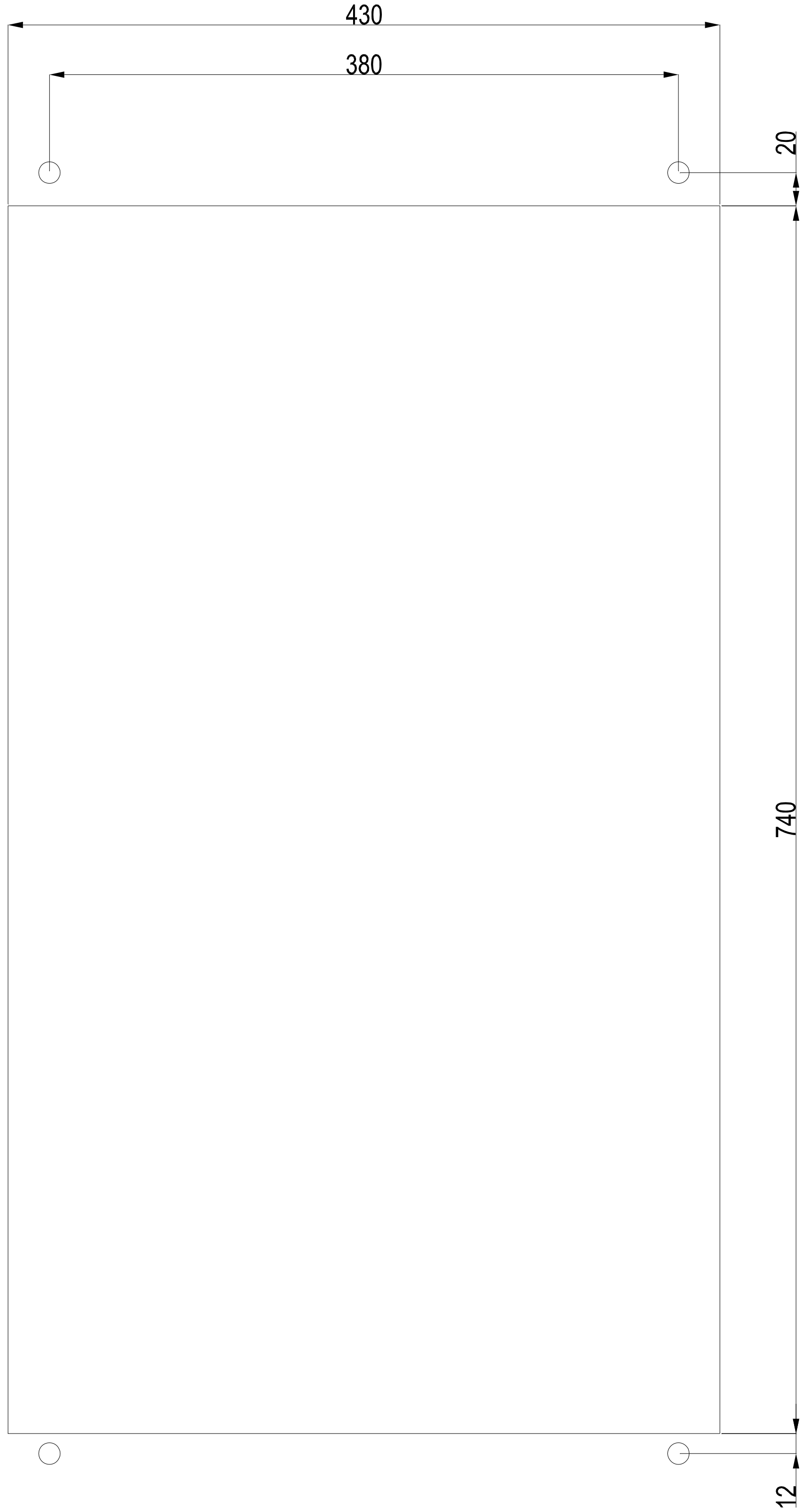
Unit: mm [inch]



Frame F

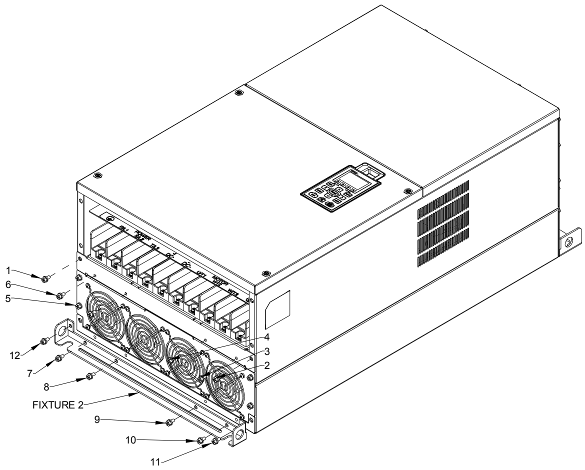
Applicable model
VFD900C23A/23E; VFD1320C43A/43E; VFD1600C43A/43E

Cutout dimension Unit: mm [inch]

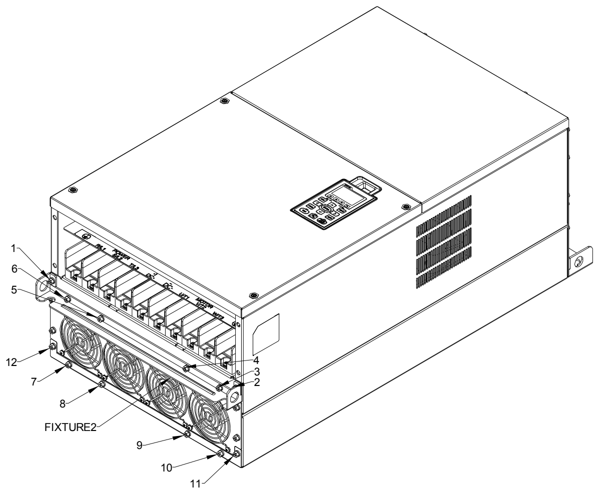


Frame F Installation

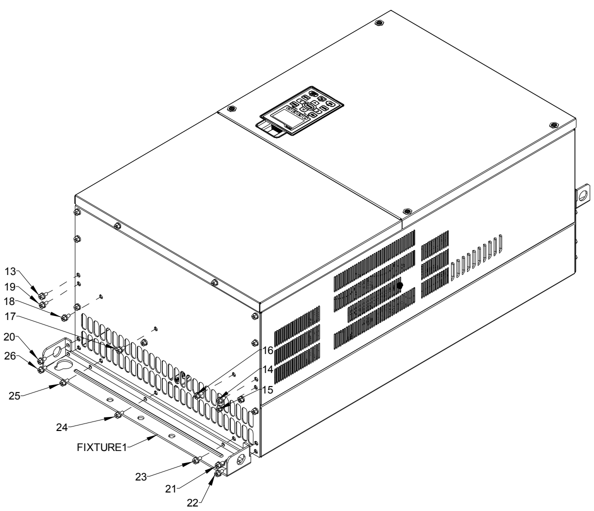
1. Loosen 12 screws and remove Fixture 2.



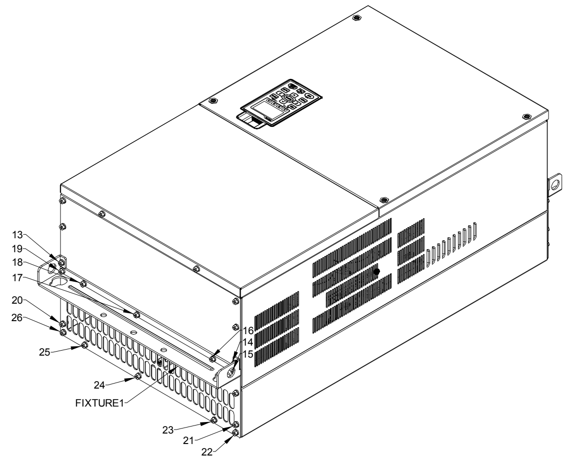
2. Loosen 12 screws and remove Fixture 2.
   Screw torque: 24~26kg-cm (20.8~22.6Ib-in).



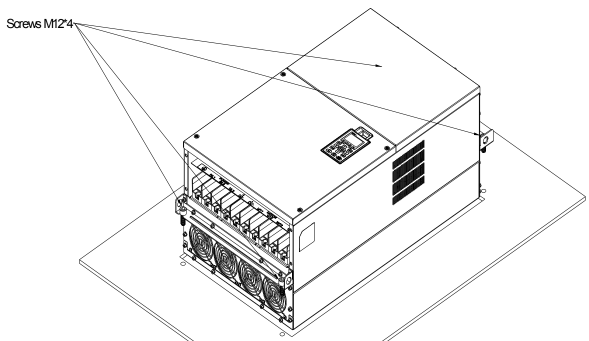
3. Loosen screw 13 ~26 and remove Fixture 1.



4. Install Fixture 1 by fasten screw 13 ~26
   Screw torque: 24~26kg-cm (20.8~22.6Ib-in).



5. Place 4 of the M12 screws through Fixture 1&2 and plate then fasten the screws.
   Screw torque: 300~400kg-cm (260~347Ib-in).



USB/RS-485 Communication Interface IFD6530

Warning

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

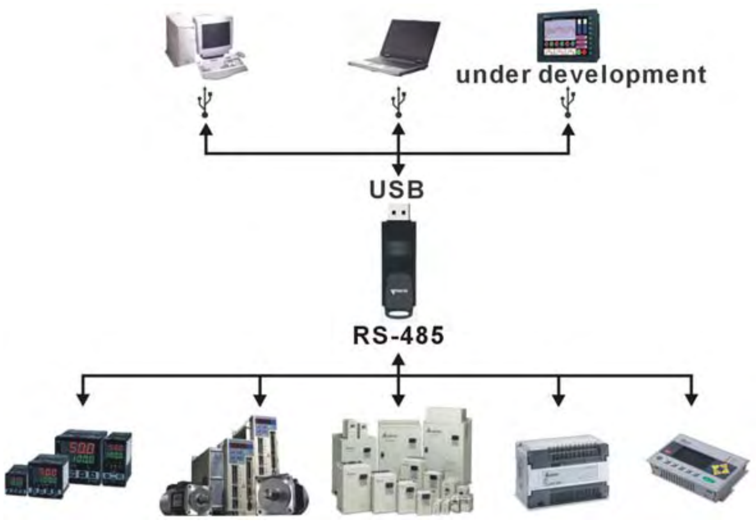
✓ *The content of this instruction sheet and the driver file may be revised without prior notice. Please consult our distributors or download the most updated instruction/driver version at http://www.delta.com.tw/product/em/control/cm/control_cm_main.asp*

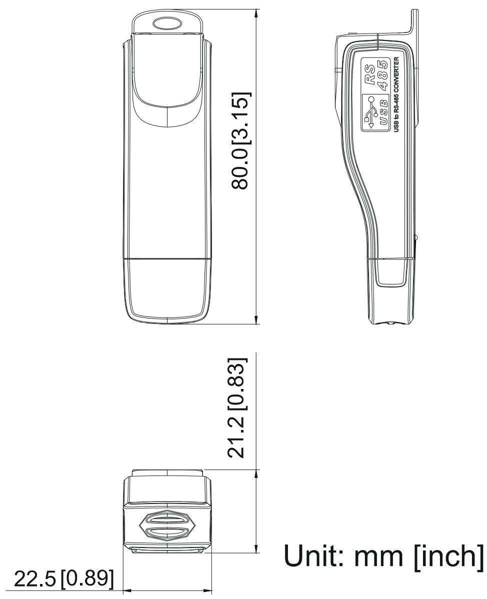
1. Introduction

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)

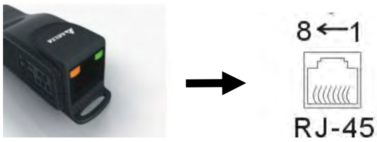




2. Specifications

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	Full compliance with USB V2.0 specification
Max. cable length	RS-485 Communication Port: 100 m
Support RS-485 half-duplex transmission	

■ **RJ-45**



PIN	Description
1	Reserved
2	Reserved
3	GND
4	SG-

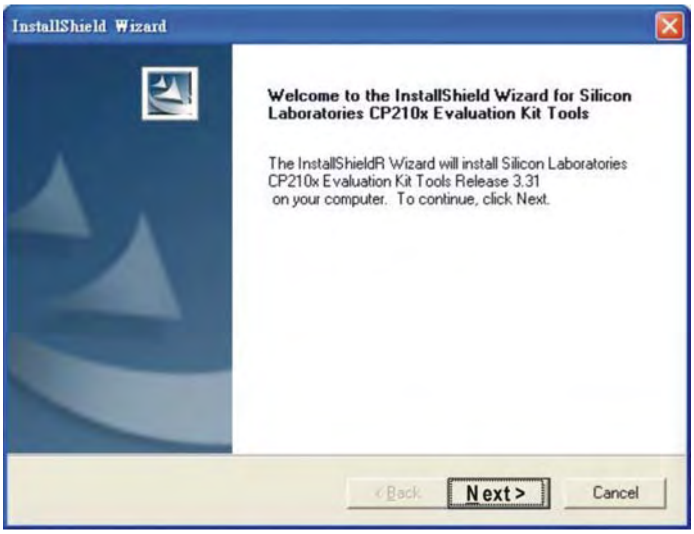
PIN	Description
5	SG+
6	GND
7	Reserved
8	+9V

3. Preparations before Driver Installation

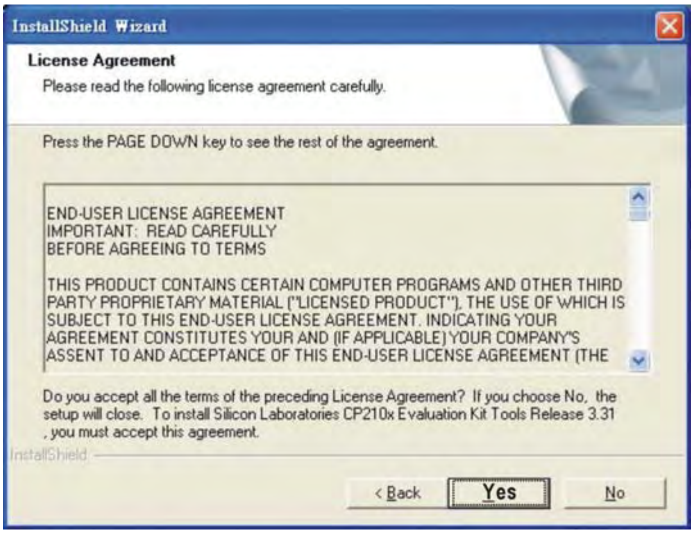
Please extract the driver file (IFD6530_Drivers.exe) by following steps. You could find driver file (IFD6530_Drivers.exe) in the CD supplied with IFD6530.

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

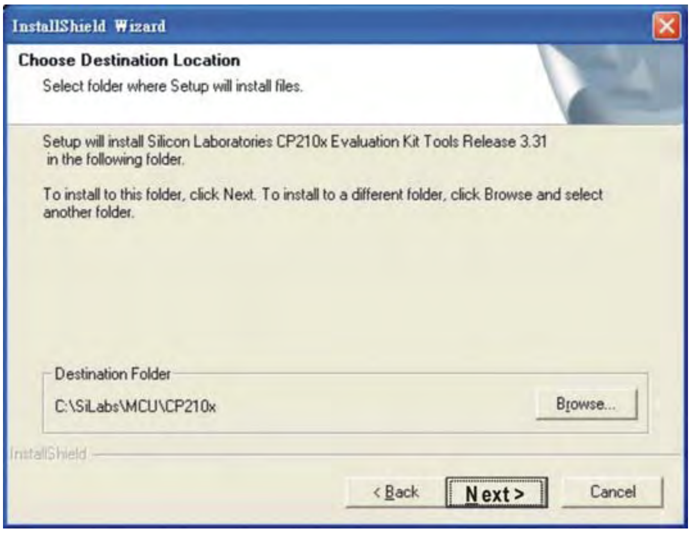
STEP 1



STEP 2



STEP 3



STEP 4

STEP 5

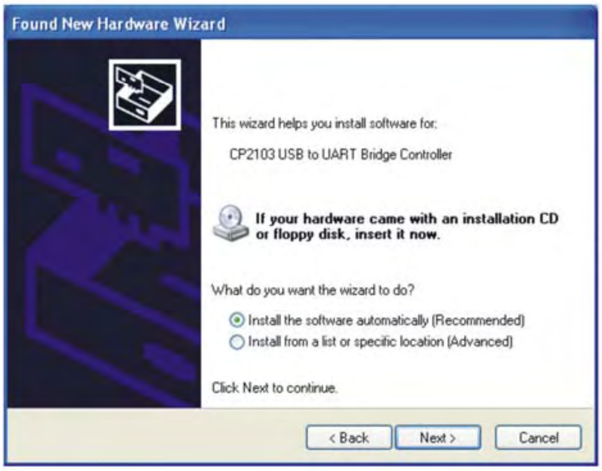
You should have a folder marked SiLabs under drive C.

4. Driver Installation

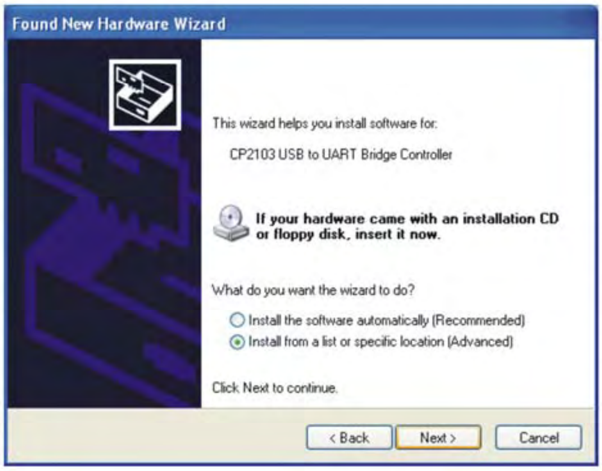
After connecting IFD6530 to PC, please install driver by following steps.

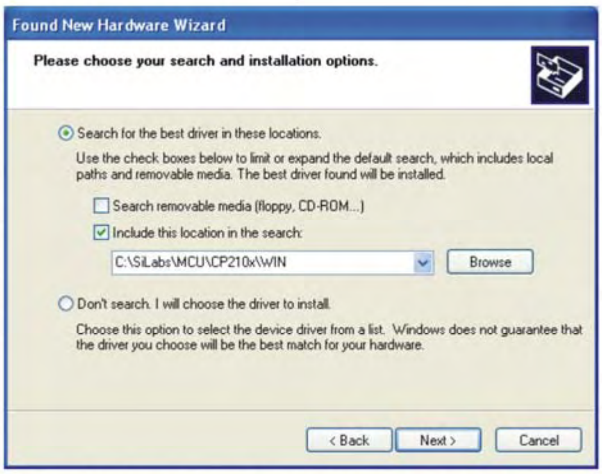
STEP 1

STEP 2

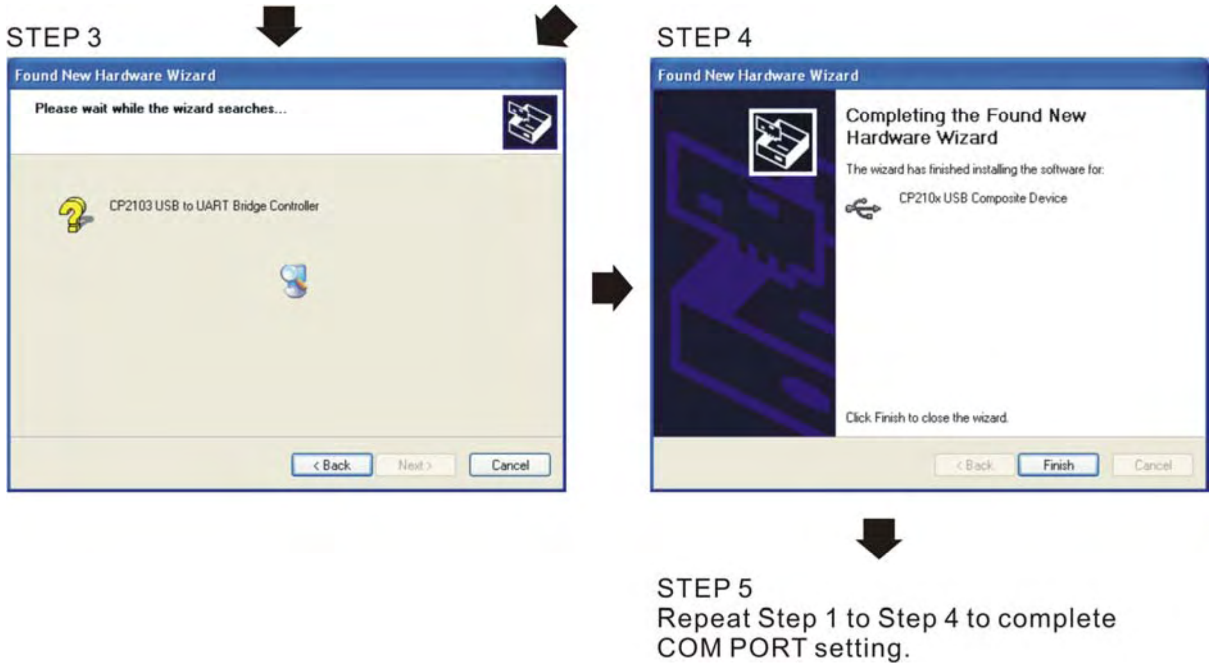


OR





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



5. LED Display

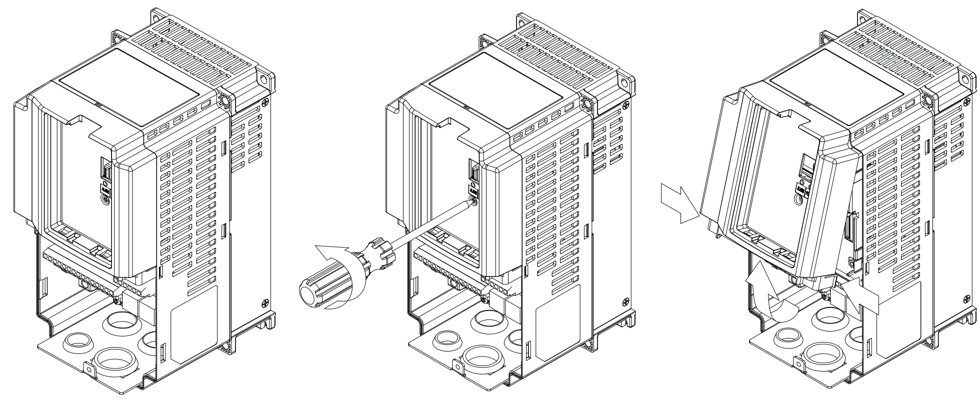
1. Steady Green LED ON: power is ON.
2. Blinking orange LED: data is transmitting.

Chapter 8 Option Cards

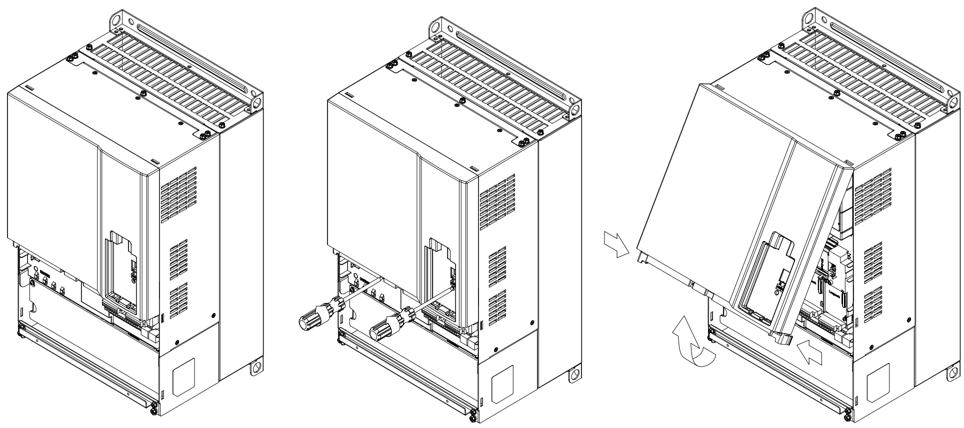
Please select applicable option cards for your drive or contact local distributor for suggestion.
To prevent drive damage during installation, please removes the digital keypad and the cover before wiring. Refer to the following instruction.

Removed key cover

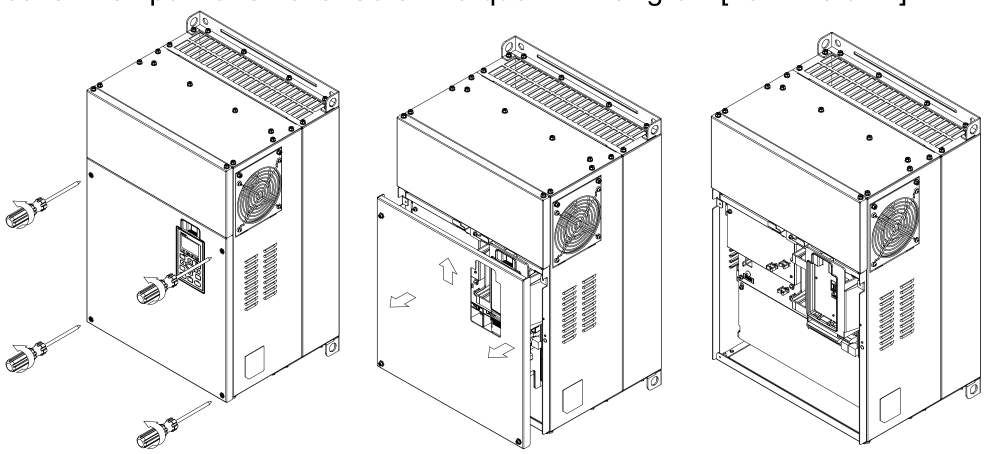
Frame A&B&C
Screw Torque: 8~10Kg-cm [6.9~8.7lb-in.]



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

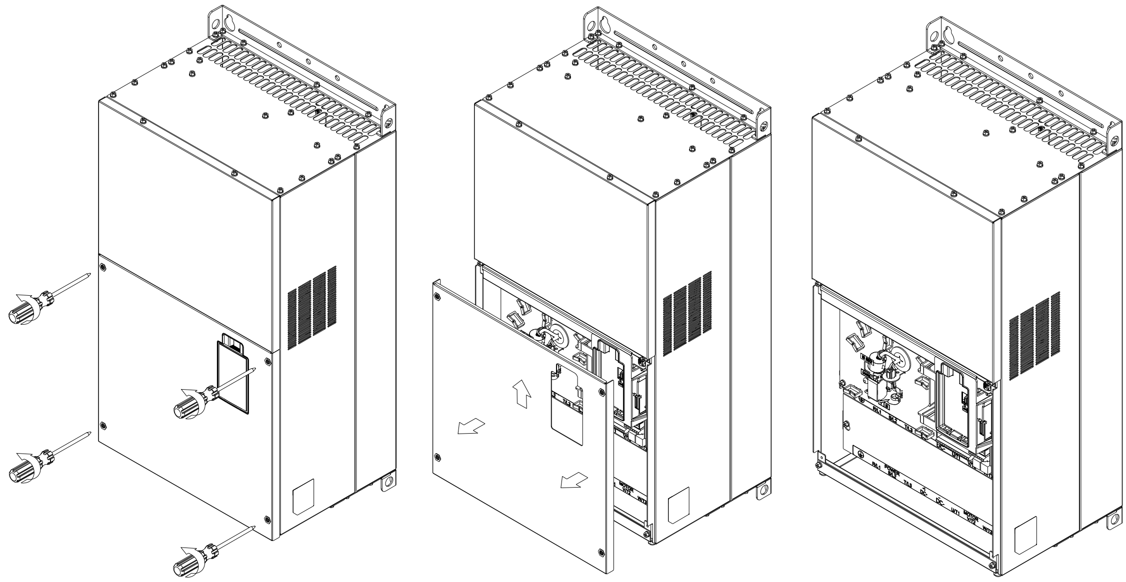


Frame E
Slightly lift the cover then pull to remove. Screw Torque: 12~15Kg-cm [10.4~13lb-in.]



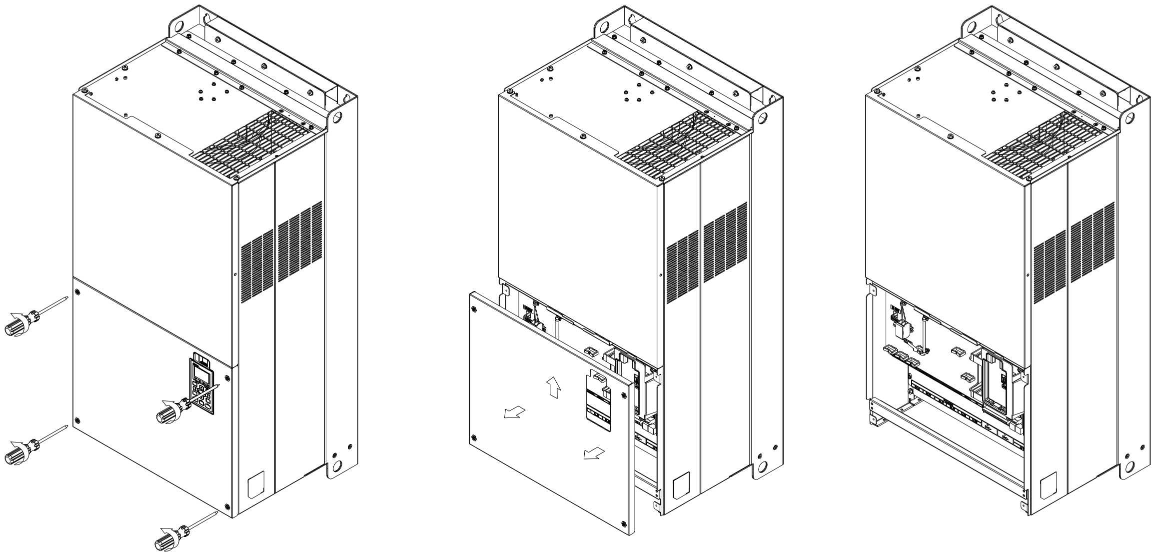
Frame F

Screw Torque: 12~ 15 Kg-cm [10.4~13lb-in.]



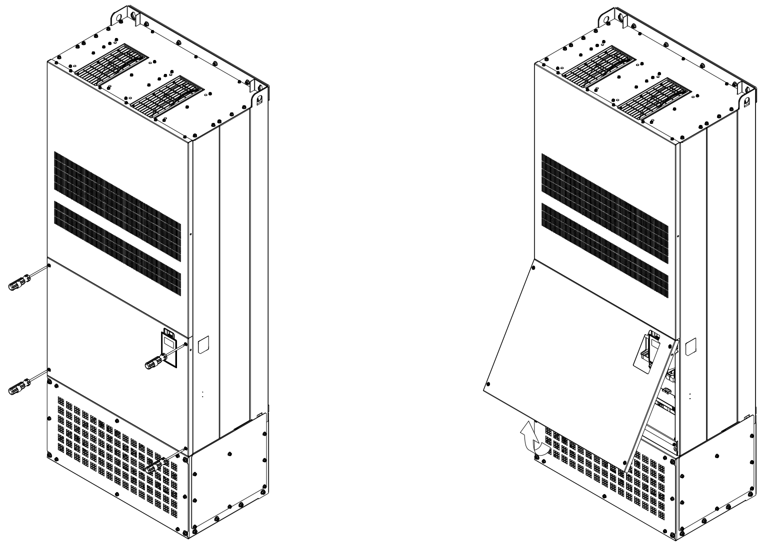
Frame G

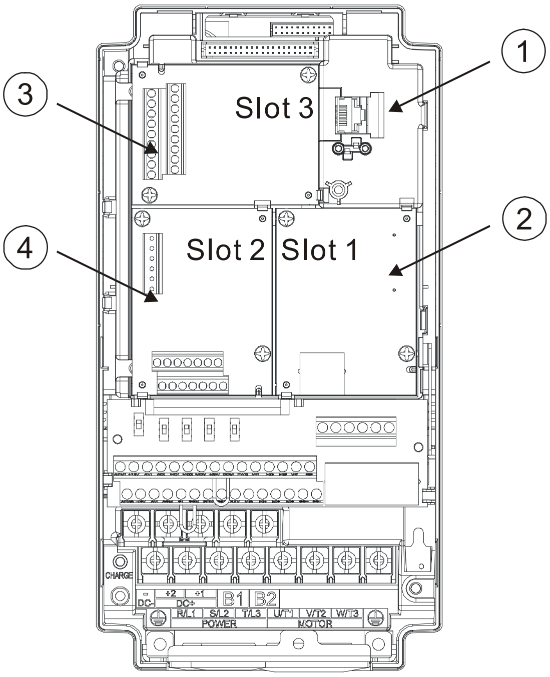
Screw Torque: 12~15Kg-cm [10.4~13lb-in.]



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. Please refer to CH10 Digital Keypad for more details on optional accessory RJ45 extension cable.
2	Communication extension card (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;
4	PG Card (Slot 2) EMC-PG01L; EMC-PG01O; EMC-PG01U; EMC-PG01R;

EMC-D42A

	Terminals	Descriptions
I/O Extension Card	COM	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) Duty-cycle: 50% Max. output frequency: 100Hz Max. current: 50mA Max. voltage: 48Vdc
	MXM	Common for multi-function output terminals MO10, MO11(photocoupler) Max 48VDC 50mA

EMC-D611A

	Terminals	Descriptions
I/O Extension Card	AC	AC power Common for multi-function input terminal (Neutral)
	MI10~ MI15	Refer to Pr. 02.26~ Pr. 02.31 for multi-function input selection Input voltage: 100~130VAC Input frequency: 57~63Hz Input impedance: 27Kohm Terminal response time: ON: 10ms OFF: 20ms

EMC-R6AA

	Terminals	Descriptions
Relay Extension Card	R10A~R15A R10C~R15C	Refer to Pr. 02.36~ Pr. 02.41 for multi-function input selection Resistive load: 5A(N.O.)/3A(N.C.) 250VAC 5A(N.O.)/3A(N.C.) 30VDC Inductive load (COS 0.4) 2.0A(N.O.)/1.2A(N.C.) 250VAC 2.0A(N.O.)/1.2A(N.C.) 30VDC It is used to output each monitor signal, such as drive is in operation, frequency attained or overload indication.

EMC-PG01L

■ Terminal description

Set by Pr.10-00~10-02

Terminals		Descriptions
PG1	VP	Output voltage for power: +5V/+12V±5% (use FSW3 to switch +5V/+12V) Max. output current: 200mA
	DCM	Common for power and signal
	A1, /A1, B1, /B1, Z1, /Z1	Encoder input signal It can be 1-phase or 2-phase input. Max. output frequency: 300kP/sec
PG2	A2, /A2, B2, /B2	Pulse Input signal It can be 1-phase or 2-phase input. Max. output frequency: 300kP/sec.
PG OUT	AO, /AO, BO, /BO, ZO, /ZO	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

■ Wiring Diagram

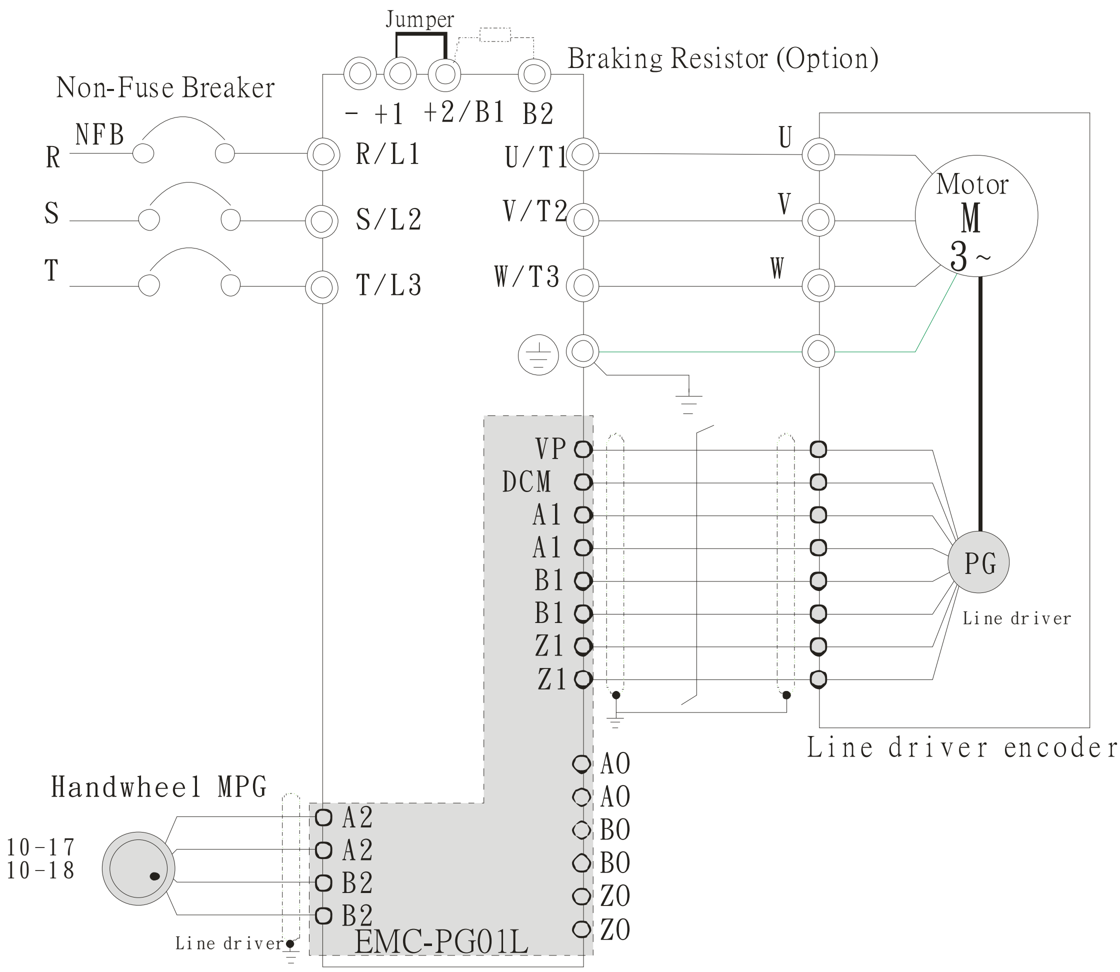


Figure 1

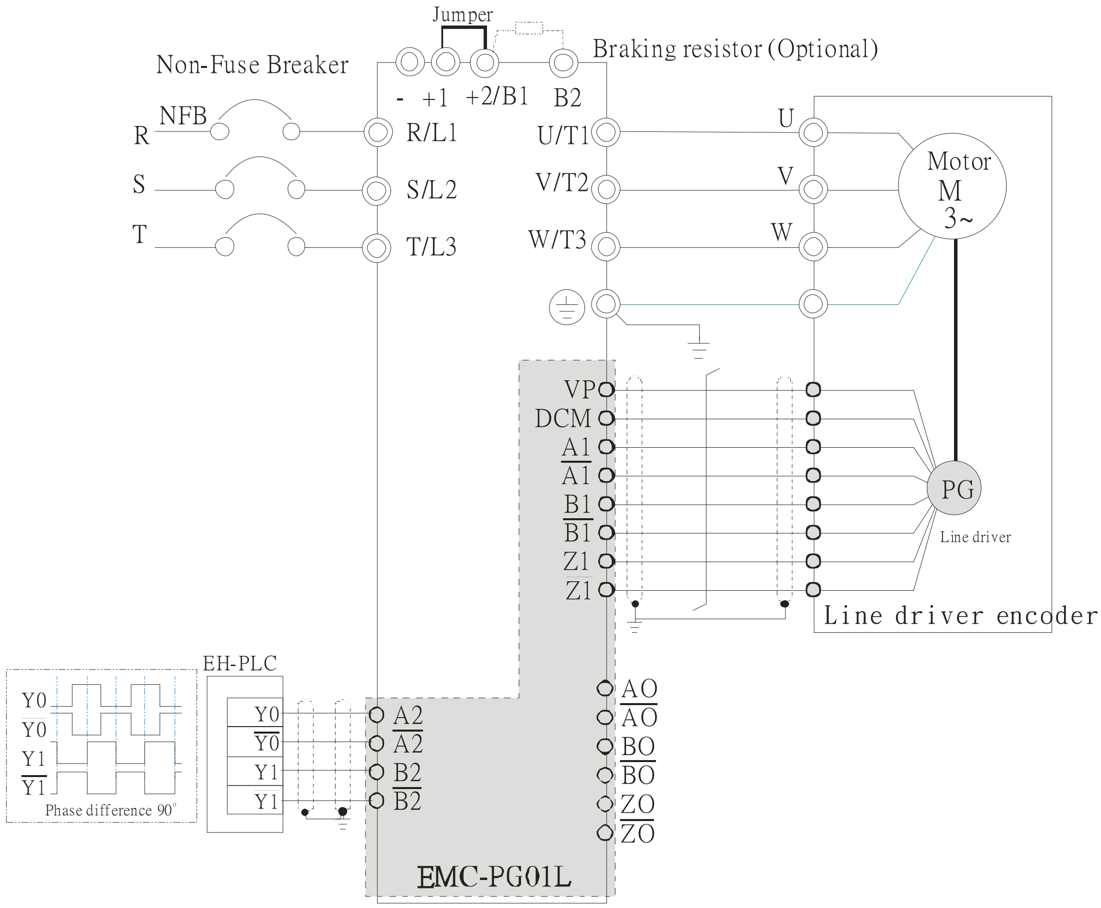

Jumper
Non-Fuse Breaker
Braking resistor (Optional)
- +1 +2/B1 B2
NFB
R
S
T
R/L1
S/L2
T/L3
U/T1
V/T2
W/T3
U
V
W
Motor
M
3~
VP
DCM
A1
A1
B1
B1
Z1
Z1
PG
Line driver
Line driver encoder
EH-PLC
Y0
Y0
Y1
Y1
Phase difference 90°
A2
A2
B2
B2
AO
AO
BO
BO
ZO
ZO
EMC-PG01L

Figure 2

EMC-PG01O

■ Terminal descriptions

Set by Pr.10-00~10-02

Terminals		Descriptions
PG1	VP	Output voltage for power: +5V/+12V±5% (use FSW3 to switch +5V/+12V) Max. output current: 200mA
	DCM	Common for power and signal
	A1, /A1, B1, /B1, Z1, /Z1	Encoder Input signal It can be 1-phase or 2-phase input. Max. output frequency: 300kP/sec
PG2	A2, /A2, B2, /B2	Pulse Input Signal It can be 1-phase or 2-phase input. Max. output frequency: 300kP/sec.
PG OUT	V+ V-	Needs external power source for PG OUT circuit. Input voltage of power:+12V ~ +24V
	A/O, B/O, Z/O	PG Card Output signals has division frequency function: 1~255 times. On the open collector's output signal, add a high-pull resistor on the external power V+ ~ V- (e.g. power of PLC) to prevent the interference of the receiving signal. Max. Output current: 20mA.Max output frequency: 300KP/Sec

■ Wiring Diagram

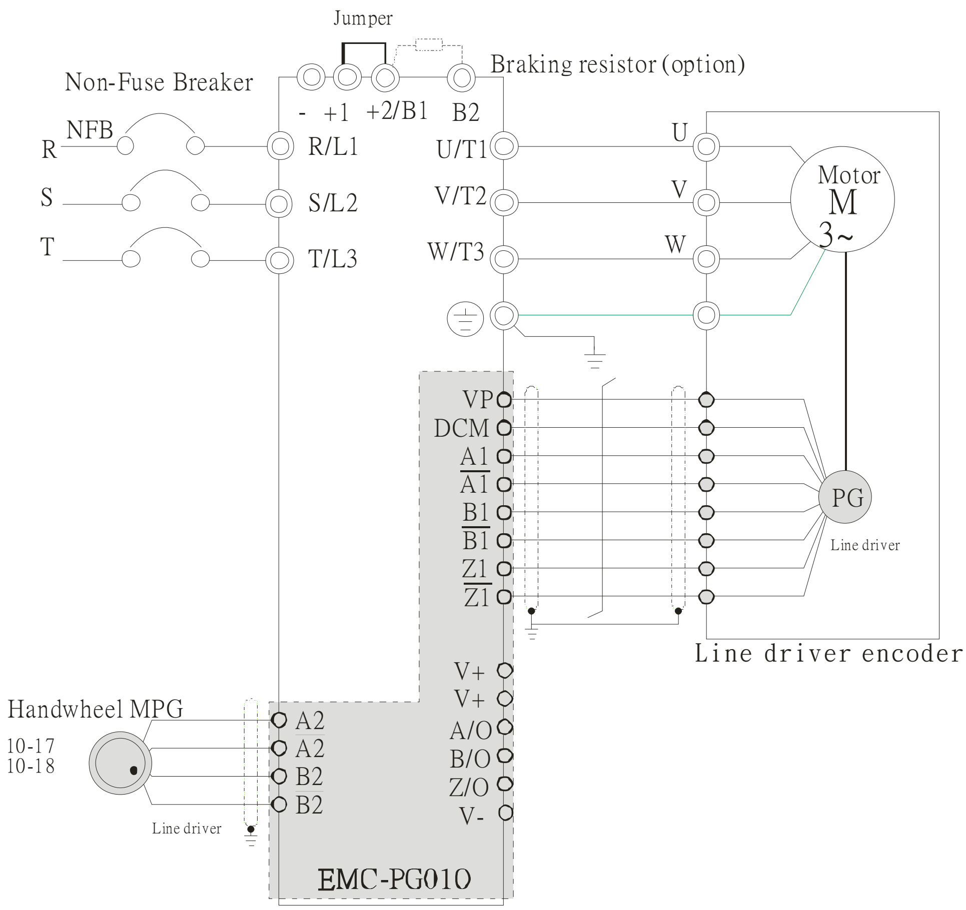


Figure 1

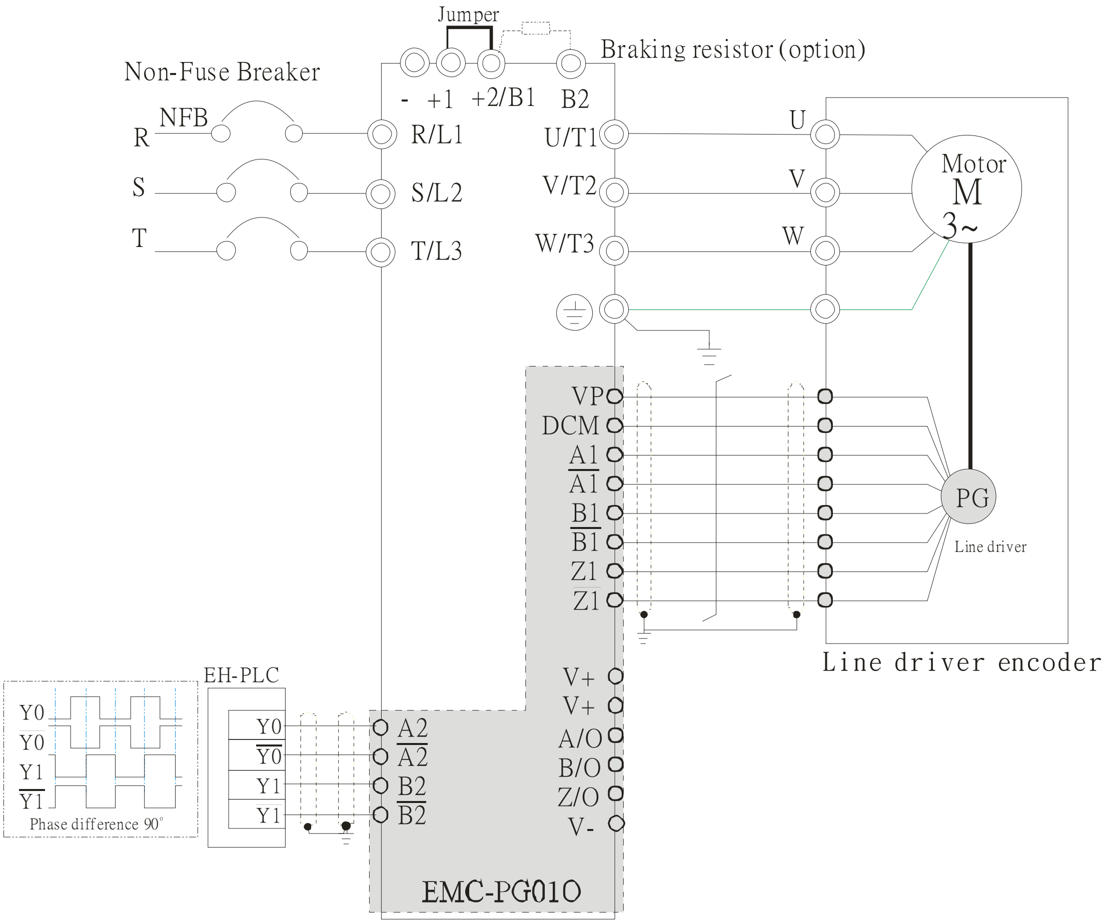

Jumper
Braking resistor (option)
Non-Fuse Breaker
NFB
R
S
T
- +1 +2/B1 B2
R/L1
S/L2
T/L3
U/T1
V/T2
W/T3
U
V
W
Motor
M
3~
VP
DCM
A1
A1
B1
B1
Z1
Z1
PG
Line driver
Line driver encoder
EH-PLC
Y0
Y0
Y1
Y1
Phase difference 90°
A2
A2
B2
B2
V+
V+
A/O
B/O
Z/O
V-
EMC-PG01O

Figure 2

EMC-PG01U

- FJMP1 $\boxed{S}$: Standard UVW Output Encoder; $\boxed{D}$: Delta Encoder
- Set by Pr.10-00~10-02

Terminals		Descriptions
PG1	VP	Output voltage for power: +5V/+12V±5% (use FSW3 to switch +5V/+12V) Max. output current: 200mA
	DCM	Common for power and signal
	A1, /A1, B1, /B1, Z1, /Z1	Encoder input signal 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 It can be 1-phase or 2-phase input. Max. output frequency: 300kP/sec.
PG OUT	AO, /AO, BO, /BO, ZO, /ZO	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

- **Wiring Diagram**

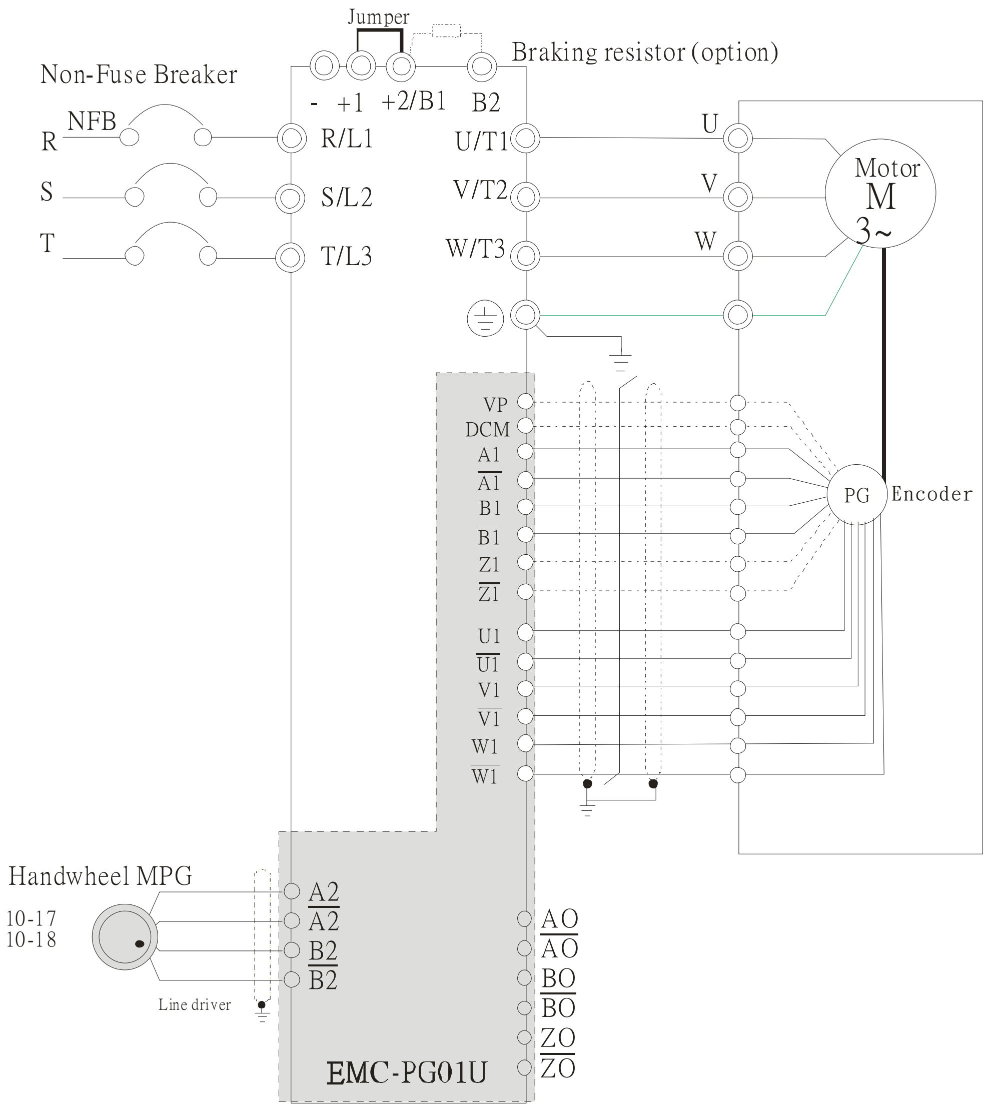


Figure 1

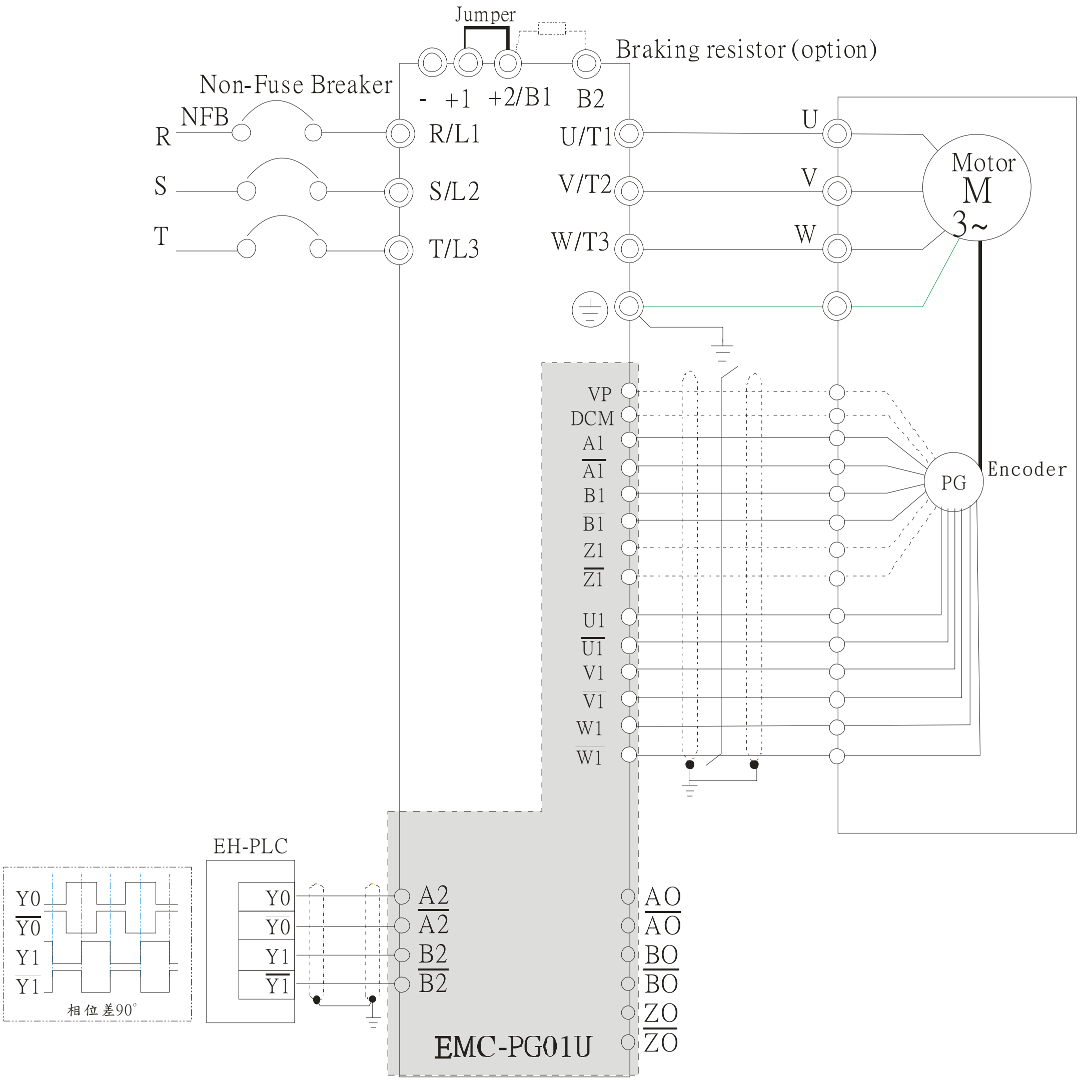

Jumper
Braking resistor (option)
Non-Fuse Breaker
NFB
R
S
T
- +1 +2/B1 B2
R/L1
S/L2
T/L3
U/T1
V/T2
W/T3
U
V
W
Motor
M
3~
VP
DCM
A1
A1
B1
B1
Z1
Z1
U1
U1
V1
V1
W1
W1
PG
Encoder
EH-PLC
Y0
Y0
Y1
Y1
相位差90°
A2
A2
B2
B2
AO
AO
BO
BO
ZO
ZO
EMC-PG01U

Figure 2

EMC-PG01R

■ Terminal Descriptions

Set by Pr.10-00~10-02

Terminals		Descriptions
PG1	R1- R2	Resolver Output Power 7Vrms, 10kHz
	S1,S2, S3, S4,	Resolver Input Signal 3.5±0.175Vrms, 10kHz
PG2	A2, /A2, B2, /B2	Pulse Input Signal It can be 1-phase or 2-phase input. Max. output frequency: 300kP/sec.
PG OUT	AO, /AO, BO, /BO, ZO, /ZO	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

■ Wiring Diagram

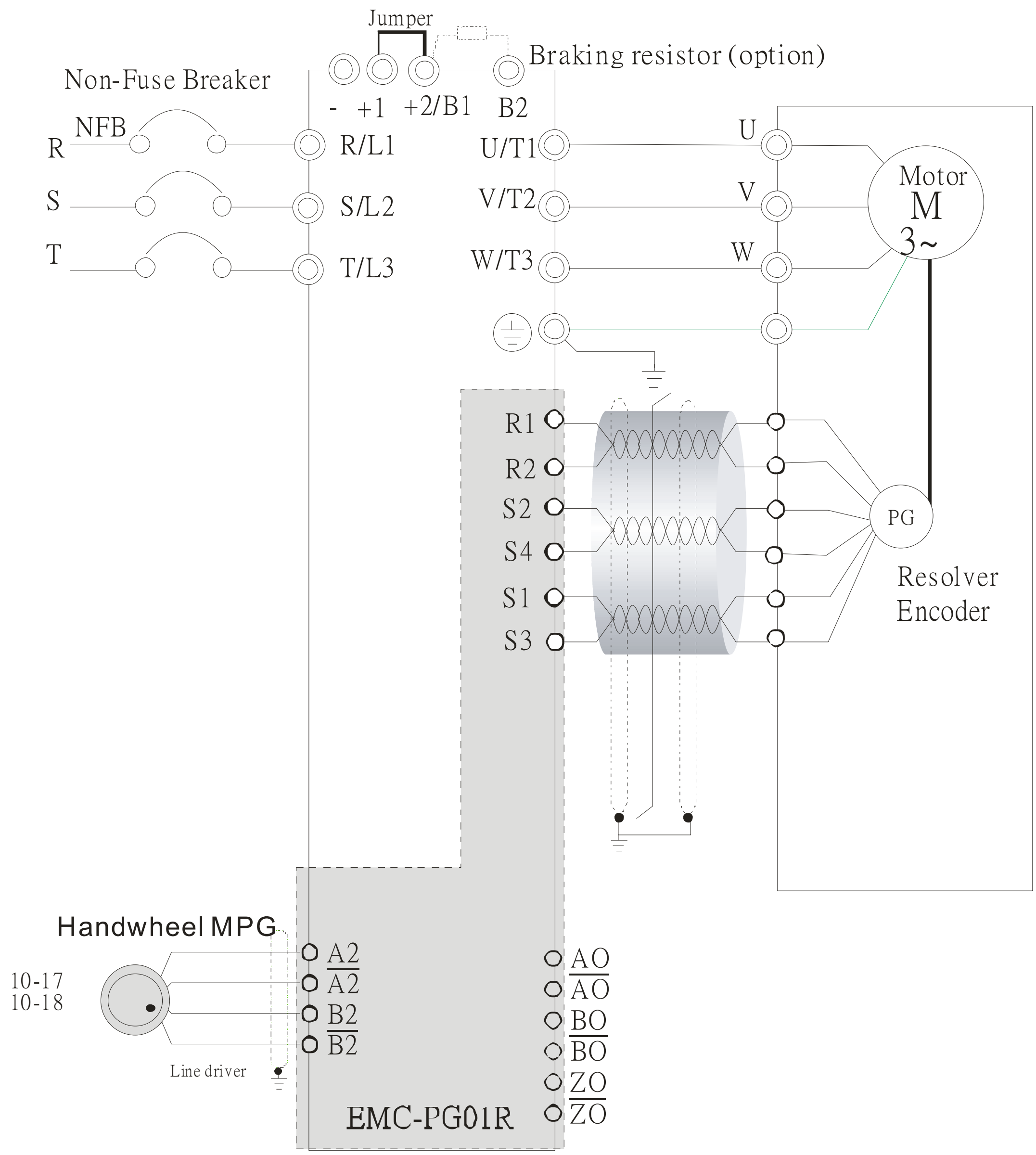


Figure 1

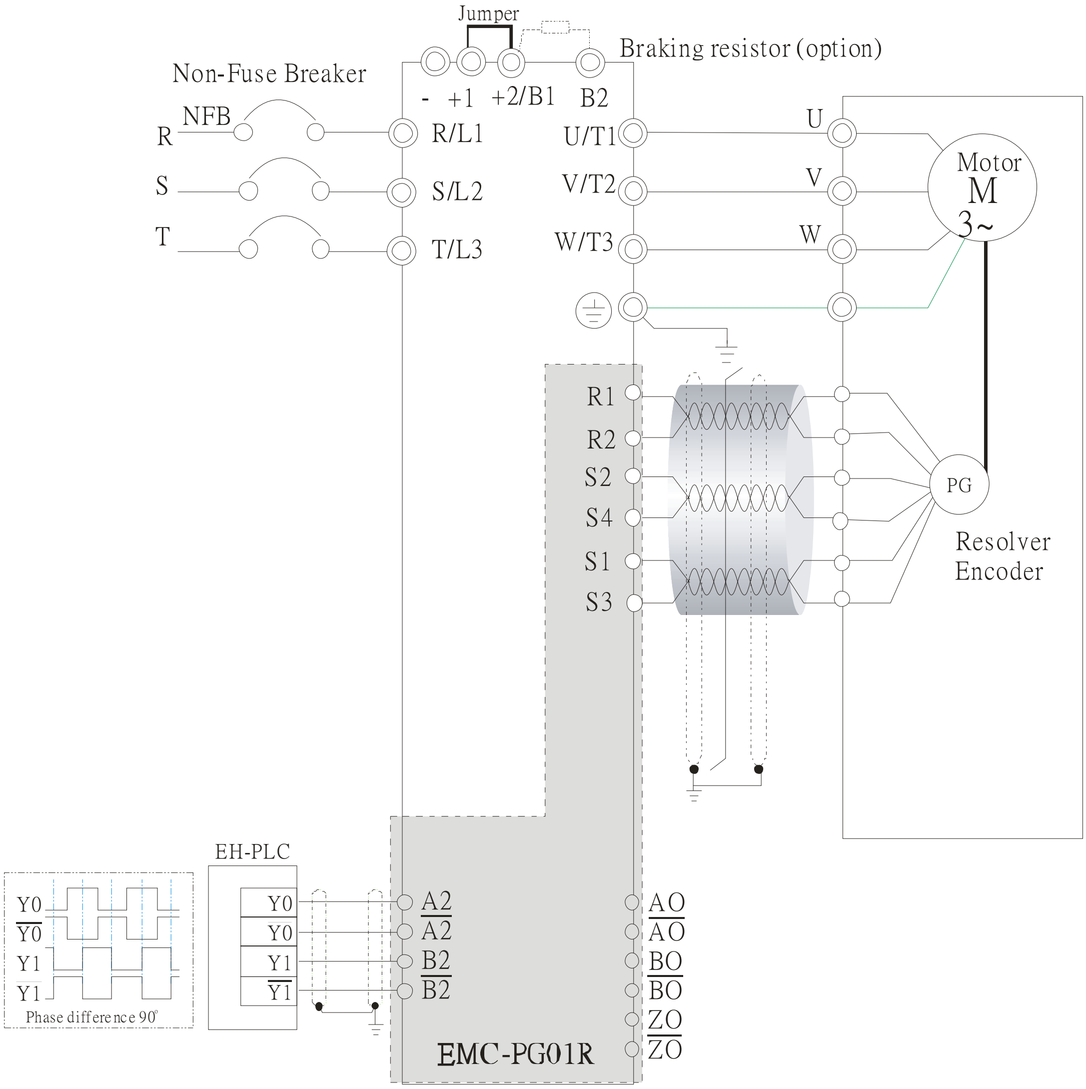


Figure 2

Screws Speciation for option card terminals:

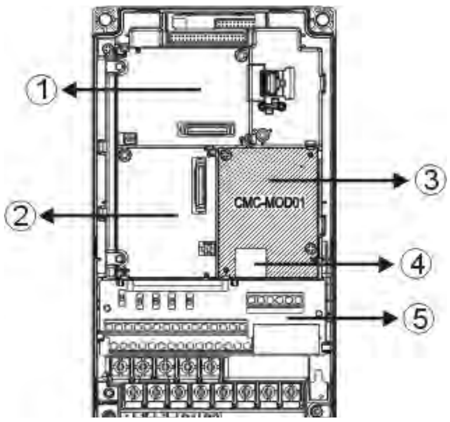
EMC-D42A	Wire gauge	24~12AWG（0.205~3.31mm^2）
	Torque	4Kg-cm [3.47Ib-in]
EMC-R6AA	Wire gauge	24~16AWG（0.205~1.31mm^2）
	Torque	6Kg-cm [5.21Ib-in]
EMC-PG01L EMC-PG01O EMC-PG01R EMC-PG01U	Wire gauge Torque	30~16AWG（0.0509~1.31mm^2） 2Kg-cm [1.74Ib-in]

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
②	PG Card
③	Comm. Card
④	RJ-45 connection port
⑤	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
Network protocol	ICMP, IP, TCP, UDP, DHCP, HTTP, SMTP, MODBUS OVER TCP/IP, Delta Configuration

Electrical Specification

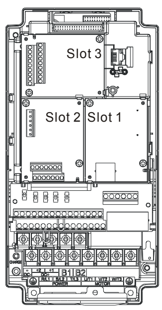
Weight	25g
Insulation voltage	500VDC
Power consumption	0.8W
Power supply voltage	5VDC

Environment

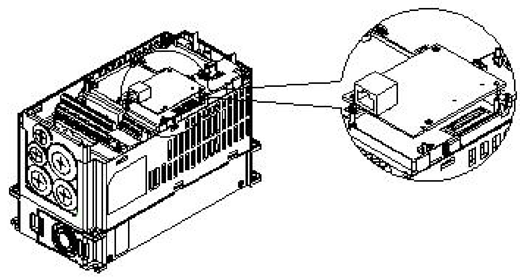
Noise immunity	ESD (IEC 61800-5-1, IEC 61000-4-2) EFT (IEC 61800-5-1, IEC 61000-4-4) Surge Test (IEC 61800-5-1, IEC 61000-4-5) Conducted Susceptibility Test (IEC 61800-5-1, IEC 61000-4-6)
Operation/storage	Operation: -10°C ~ 50°C (temperature), 90% (humidity) Storage: -25°C ~ 70°C (temperature), 95%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

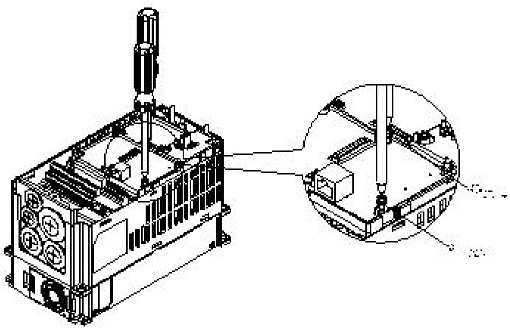
1. Switch off the power supply of VFD-C2000.
2. Open the front cover of VFD-C2000.
3. Place the insulation spacer into the positioning pin at Slot 1 (shown in Figure 3), and aim the two holes on the PCB at the positioning pin. Press the pin to clip the holes with the PCB (see Figure 4).
4. Screw up at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



[Figure 3]



[Figure 4]



[Figure 5]

■ **Communication Parameters for VFD-C2000 Connected to Ethernet**

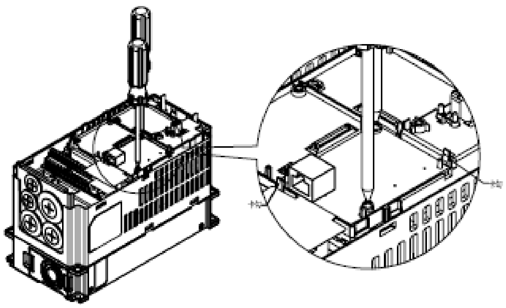
When VFD-C2000 is link to Ethernet, please set up the communication parameters base on the table below. Ethernet master will be able to read/write the frequency word and control word of VFD-C2000 after communication parameters setup.

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

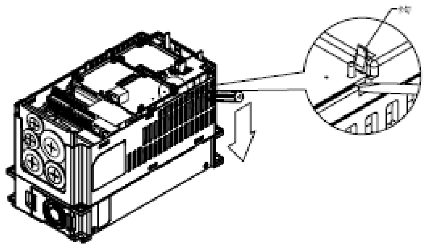
P09-30	Decoding method for communication	0	The decoding method for Delta AC motor drive
P09-75	IP setting	0	Static IP(0) / Dynamic distribution IP(1)
P09-76	IP address -1	192	IP address 192.168.1.5
P09-77	IP address -2	168	IP address 192.168.1.5
P09-78	IP address -3	1	IP address 192.168.1.5
P09-79	IP 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

- **Disconnecting CMC- MOD01 from VFD-C2000**

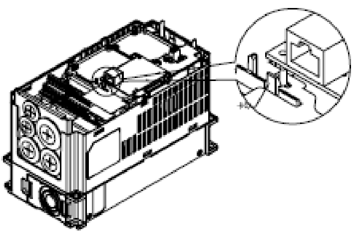
1. Switch off the power supply of VFD-C2000.
2. Remove the two screws (see Figure 6).
3. Twist opens the card clip and inserts the slot type screwdriver to the hollow to prize the PCB off the card clip (see Figure 7).
4. Twist opens the other card clip to remove the PCB (see Figure 8).



[Figure 6]



[Figure 7]



[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
POWER	Green	On	Power supply in normal status	--
		Off	No power supply	Check the power supply
LINK	Green	On	Network connection in normal status	--
		Flashes	Network in operation	--
		Off	Network not connected	Check if the network cable is connected

Troubleshooting

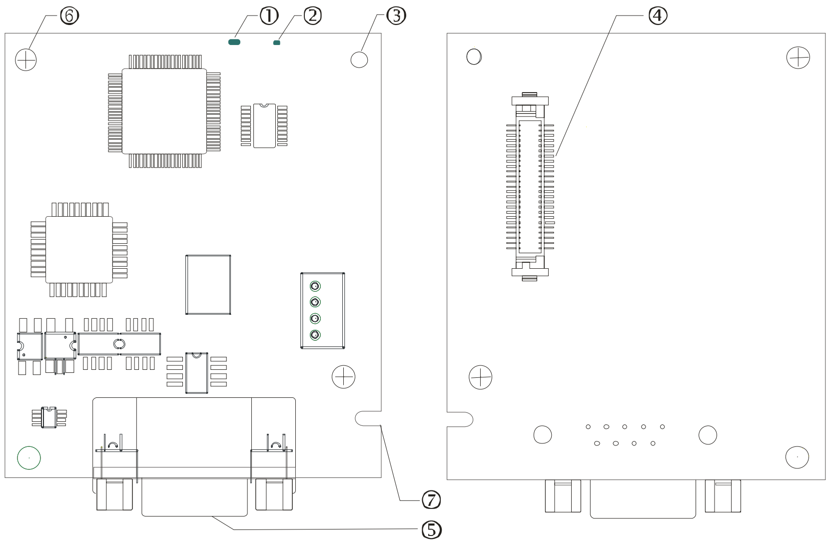
Abnormality	Cause	How to correct
POWER LED off	AC motor drive not powered	Check if AC motor drive is powered, and if the power supply is normal.
	CMC-MOD01 not connected to AC motor drive	Make sure CMC-MOD01 is connected to AC motor drive.
LINK LED off	CMC-MOD01 not connected to network	Make sure the network cable is correctly connected to network.
	Poor contact to RJ-45 connector	Make sure RJ-45 connector is connected to Ethernet port.
No module found	CMC-MOD01 not connected to network	Make sure CMC-MOD01 is connected to network.
	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.
Fail to open CMC-MOD01 setup page	CMC-MOD01 not connected to network	Make sure CMC-MOD01 is connected to the network.
	Incorrect communication setting in DCISoft	Make sure the communication setting in DCISoft is set to Ethernet.
	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.
	Incorrect mail server setting	Please confirm the IP address for SMTP-Server.

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



1. NET indicator
2. POWER indicator
3. Positioning hole
4. AC motor drive connection port
5. PROFIBUS DP connection port
6. Screw fixing hole
7. Fool-proof groove

■ 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 (bits per second)

Electrical Specification

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

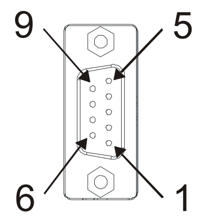
Environment

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: -10ºC ~ 50ºC (temperature), 90% (humidity), pollution degree 2 Storage: -25ºC ~ 70ºC (temperature), 95% (humidity, non-condensing)
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
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

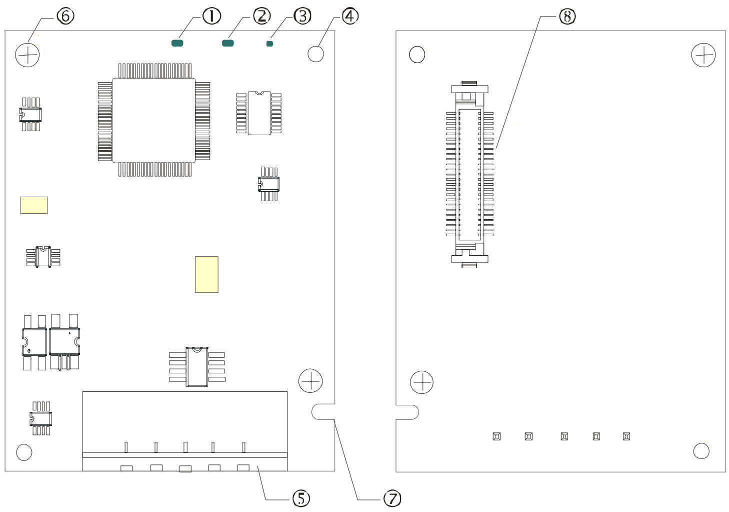
LED status	Indication	How to correct
Green light on	Normal status	--
Red light on	CMC-PD01 is not connected to PROFIBUS DP bus.	Connect CMC-PD01 to PROFIBUS DP bus.
Red light flashes	Invalid PROFIBUS communication address	Set the PROFIBUS address of CMC-PD01 between 1 ~ 125 (decimal)
Orange light flashes	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.

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	1. Communicating with AC motor drive 2. Transmitting power supply from AC motor drive
Communication	Delta HSSP protocol

Electrical Specification

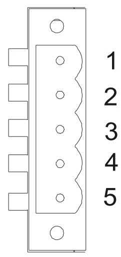
Power supply voltage	5VDC (supplied by AC motor drive)
Insulation voltage	500VDC
Communication wire power consumption	0.85W
Power consumption	1W
Weight	23g

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: -10ºC ~ 50ºC (temperature), 90% (humidity), pollution degree 2 Storage: -25ºC ~ 70ºC (temperature), 95% (humidity, non-condensing)
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	H	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
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
Off	No power supply or CMC-DN01 has not completed MAC ID test yet.	1. Check the power of CMC-DN01 and see if the connection is normal. 2. Make sure at least one or more nodes are on the bus. 3. Check if the serial transmission speed of CMC-DN01 is the same as that of other nodes.
Green light flashes	CMC-DN01 is on-line but has not established connection to the master.	1. Configure CMC-DN01 to the scan list of the master. 2. Re-download the configured data to the master.
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.	1. Check if the network connection is normal. 2. Check if the master operates normally.
Red light on	1. The communication is down. 2. MAC ID test failure. 3. No network power supply. 4. CMC-DN01 is off-line.	1. Make sure all the MAC IDs on the network are not repeated. 2. Check if the network installation is normal. 3. Check if the baud rate of CMC-DN01 is consistent with that of other nodes. 4. Check if the node address of CMC-DN01 is illegal. 5. Check if the network power supply is normal.

MS LED

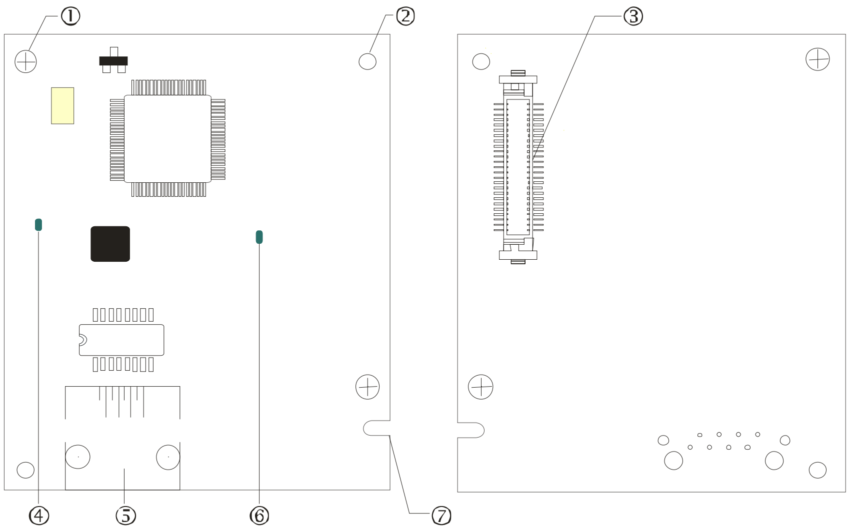
LED status	Indication	How to correct
Off	No power supply or being off-line	Check the power supply of CMC-DN01 and see of the connection is normal.
Green light flashes	Waiting for I/O data	Switch the master PLC to RUN status
Green light on	I/O data are normal	--
Red light flashes	Mapping error	1. Reconfigure CMC-DN01 2. Re-power AC motor drive
Red light on	Hardware error	1. See the error code displayed on AC motor drive. 2. Send back to the factory for repair if necessary.
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.

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



[Figure1]

1. Screw fixing hole
2. Positioning hole
3. AC motor drive connection port
4. LINK indicator
5. RJ-45 connection port
6. POWER indicator
7. Fool-proof groove

■ 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

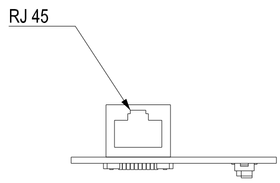
Environment

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

- **Installation**

Connecting CMC-EIP01 to Network

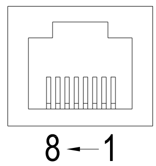
1. Turn off the power of AC motor drive.
2. Open the cover of AC motor drive.
3. Connect CAT-5e network cable to RJ-45 port on CMC-EIP01 (See Figure 2).



[Figure 2]

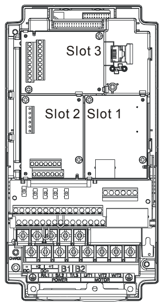
RJ-45 PIN Definition

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
4	--	N/C	8	--	N/C

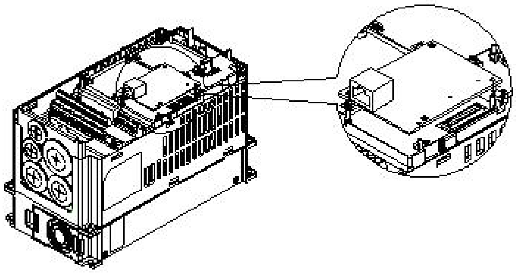


- **Connecting CMC-EIP01 to VFD-C2000**

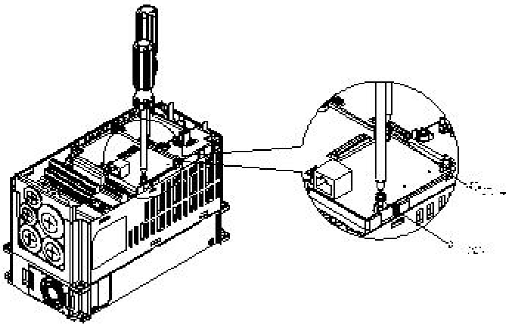
1. Switch off the power of AC motor drive.
2. Open the front cover of AC motor drive.
3. Place the insulation spacer into the positioning pin at Slot 1 (shown in Figure 3), and aim the two holes on the PCB at the positioning pin. Press the pin to clip the holes with the PCB (see Figure 4).
4. Screw up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



[Figure 3]



[Figure 4]



[Figure 5]

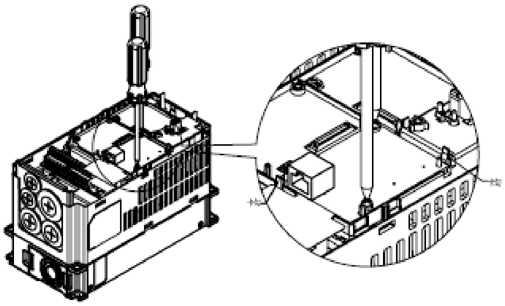
- **Communication Parameters for VFD-C2000 Connected to Ethernet**

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.

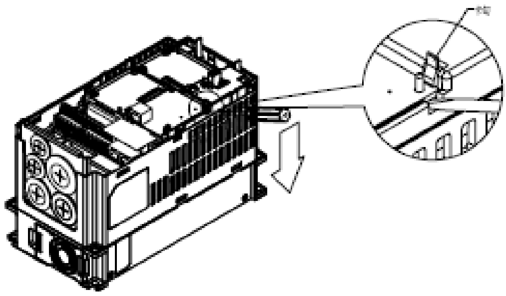
Parameter (Dec)	Function	Set value (Dec)	Explanation
P00-20	Setting up source of frequency command	8	The frequency command is controlled by communication card.
P00-21	Setting up source of operation command	5	The operation command is controlled by communication card.
P09-30	Decoding method for communication	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

■ Disconnecting CMC- EIP01 from VFD-C2000

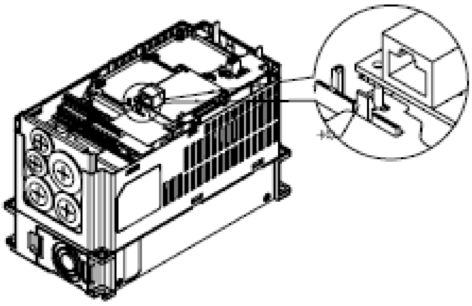
1. Switch off the power supply of VFD-C2000.
2. Remove the two screws (see Figure 6).
3. Twist opens the card clip and inserts the slot type screwdriver to the hollow to prize the PCB off the card clip (see Figure 7).
4. Twist opens the other card clip to remove the PCB (see Figure 8).



[Figure 6]



[Figure 7]



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

Troubleshooting

Abnormality	Cause	How to correct
POWER LED off	AC motor drive not powered	Check if AC motor drive is powered, and if the power supply is normal.
	CMC-EIP01 not connected to AC motor drive	Make sure CMC-EIP01 is connected to AC motor drive.
LINK LED off	CMC-EIP01 not connected to network	Make sure the network cable is correctly connected to network.

Abnormality	Cause	How to correct
	Poor contact to RJ-45 connector	Make sure RJ-45 connector is connected to Ethernet port.
No communication card found	CMC-EIP01 not connected to network	Make sure CMC-EIP01 is connected to network.
	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.
Fail to open CMC-EIP01 setup page	CMC-EIP01 not connected to network	Make sure CMC-EIP01 is connected to the network.
	Incorrect communication setting in DCISoft	Make sure the communication setting in DCISoft is set to Ethernet.
	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.
Fail to send e-mail	Incorrect network setting in CMC-EIP01	Check if the network setting for CMC-EIP01 is correct.
	Incorrect mail server setting	Please confirm the IP address for SMTP-Server.

EMC-COP01

■ **RJ-45 Pin definition**

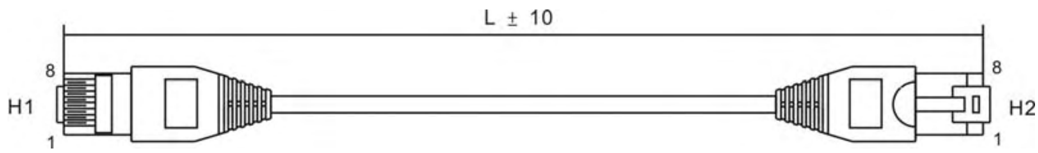
Pin	Pin name	Definition
1	CAN_H	CAN_H bus line (dominant high)
2	CAN_L	CAN_L bus line (dominant low)
3	CAN_GND	Ground/0V/V-
7	CAN_GND	Ground/0V/V-

■ **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**

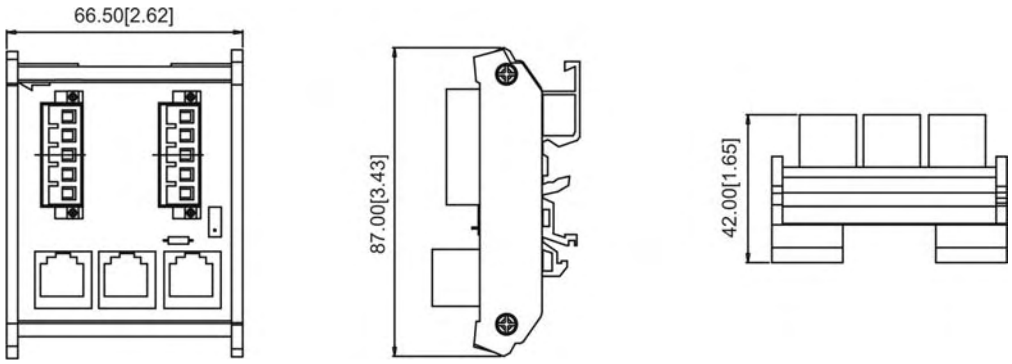
Model: TAP-CB03, TAP-CB04



Title	Part No.	L	
		mm	inch
1	TAP-CB03	500 ± 10	19 ± 0.4
2	TAP-CB04	1000± 10	39 ± 0.4

■ **CANopen Dimension**

Model: TAP-CN03



NOTE

Please refer to CANopen user manual for more details on CANopen operation. CANopen user manual can also be downloaded on Delta website: http://www.delta.com.tw/industrialautomation/.

Chapter 9 Specification

230V Series

Frame Size			A				B			C		
Model VFD-_ _ _C_ _			007	015	022	037	055	075	110	150	185	220
Applicable Motor Output (kW)			0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22
Applicable Motor Output (hp)			1	2	3	5	7.5	10	15	20	25	30
Output Rating	HEAVY DUTY	Rated Output Capacity (kVA)	1.9	2.8	4.0	6.4	9.6	12	19	25	28	34
		Rated Output Current (A)	4.8	7.1	10	16	24	31	47	62	71	86
		Carrier Frequency (kHz)	2~6kHz									
	NORMAL DUTY	Rate Output Capacity (kVA)	2.0	3.2	4.4	6.8	10	13	20	26	30	36
		Rated Output Current (A)	5	8	11	17	25	33	49	65	75	90
		Carrier Frequency (kHz)	2~15kHz							2~10kHz		
Input Rating	Input Current (A) Heavy Duty		6.1	11	15	18.5	26	34	50	68	78	95
	Input Current (A) Normal Duty		6.4	12	16	20	28	36	52	72	83	99
	Rated Voltage/Frequency		3-phase AC 200V~240V (-15% ~ +10%), 50/60Hz									
	Operating Voltage Range		170~265Vac									
	Frequency Tolerance		47~63Hz									
Cooling method			Natural cooling			Fan cooling						
Braking Chopper			Built-in									
DC reactor			Option									
EMC Filter			Option									

Frame Size			D		E			F
Model VFD-_ _ _C_ _			300	370	450	550	750	900
Applicable Motor Output (kW)			30	37	45	55	75	90
Applicable Motor Output (hp)			40	50	60	75	100	125
Output Rating	HEAVY DUTY	Rated Output Capacity (kVA)	45	55	68	81	96	131
		Rated Output Current (A)	114	139	171	204	242	329
		Carrier Frequency (kHz)	2~6kHz					
	NORMAL DUTY	Rate Output Capacity (kVA)	48	58	72	86	102	138
		Rated Output Current (A)	120	146	180	215	255	346
		Carrier Frequency (kHz)	2~10kHz		2~9 kHz			
Input Rating	Input Current (A) Heavy Duty		118	136	162	196	233	315
	Input Current (A) Normal Duty		124	143	171	206	245	331
	Rated Voltage/Frequency		3-phase AC 200V~240V (-15% ~ +10%), 50/60Hz					
	Operating Voltage Range		170~265Vac					
	Frequency Tolerance		47~63Hz					
Cooling method			Fan Cooling					
Braking Chopper			Option					
DC reactor			Built-in					
EMI Filter			Option					

460V Series

Frame Size			A						B			C		
Model VFD-_ _ _C_ _			007	015	022	037	040	055	075	110	150	185	220	300
Applicable Motor Output (kW)			0.75	1.5	2.2	3.7	4.0	5.5	7.5	11	15	18.5	22	30
Applicable Motor Output (hp)			1	2	3	5	5	7.5	10	15	20	25	30	40
Output Rating	HEAVY DUTY	Rated Output Capacity (kVA)	2.3	3.0	4.5	6.5	7.6	9.6	14	18	24	29	34	45
		Rated Output Current (A)	2.9	3.8	5.7	8.1	9.5	11	17	23	30	36	43	57
		Carrier Frequency (kHz)	2~6kHz											
	NORMAL DUTY	Rate Output Capacity (kVA)	2.4	3.2	4.8	7.2	8.4	10	14	19	25	30	36	48
		Rated Output Current (A)	3.0	4.0	6.0	9.0	10.5	12	18	24	32	38	45	60
		Carrier Frequency (kHz)	2~15kHz									2~10kHz		
Input Rating	Input Current (A) Heavy Duty		4.1	5.6	8.3	13	14.5	16	19	25	33	38	45	60
	Input Current (A) Normal Duty		4.3	5.9	8.7	14	15.5	17	20	26	35	40	47	63
	Rated Voltage/Frequency		3-Phase AC 380V~480V (-15%~+10%), 50/60Hz											
	Operating Voltage Range		323~528Vac											
	Frequency Tolerance		47~63Hz											
Cooling method			Natural cooling					Fan cooling						
Braking Chopper			Built-in											
DC reactor			Option											
EMI Filter			VFDXXXC43A: No EMI Filter; VFDXXXC43E: Built-in EMI Filter											

Frame Size			D				E		*F		*G		*H		
Model VFD-_ _ _C_ _			370	450	550	750	900	1100	1320	1600	1850	2200	2800	3150	3550
Applicable Motor Output (kW)			37	45	55	75	90	110	132	160	185	220	280	315	355
Applicable Motor Output (hp)			50	60	75	100	125	150	175	215	250	300	375	425	475
Output Rating	HEAVY DUTY	Rated Output Capacity (kVA)	55	69	84	114	136	167	197	235	280	348	417	466	517
		Rated Output Current (A)	69	86	105	143	171	209	247	295	352	437	523	585	649
		Carrier Frequency (kHz)	2~6kHz												
	NORMAL DUTY	Rate Output Capacity (kVA)	58	73	88	120	143	175	207	247	295	367	438	491	544
		Rated Output Current (A)	73	91	110	150	180	220	260	310	370	460	550	616	683
		Carrier Frequency (kHz)	2~10kHz				2~9kHz								
Input Rating	Input Current (A) Heavy Duty		70	96	108	149	159	197	228	285	361	380	469	527	594
	Input Current (A) Normal Duty		74	101	114	157	167	207	240	300	380	400	494	555	625
	Rated Voltage/Frequency		3-Phase AC 380V~480V (-15%~+10%), 50/60Hz												
	Operating Voltage Range		323~528Vac												
	Frequency Tolerance		47~63Hz												
Cooling method			Fan cooling												
Braking Chopper			Option												
DC reactor			Built-in												
EMI Filter			VFDXXXC43A: No EMI Filter; VFDXXXC43E: Built-in EMI Filter												

NOTE

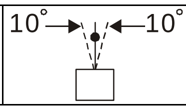
- *Frame F~H is under development.
- For FRAME A, B and C, Model VFDXXXC43A is under IP20/NEMA1/UL TYPE1 protection level.
- For FRAME D and above, if the last character of the model is A then it is under IP20 protection level but the wiring terminal is under IP00 protection level; if the last character of the model is E, it is under IP20/NEMA1/UL TYPE1 protection level.

General Specifications

Control Characteristics	Control Method	1: V/F, 2: SVC, 3: VF+PG, 4: FOC+PG, 5: TQC+PG,
	Starting Torque	Reach up to 150% or above at 0.5Hz. Under FOC+PG mode, starting torque can reach 150% at 0Hz.
	V/F Curve	4 point adjustable V/F curve and square curve
	Speed Response Ability	5Hz (vector control can reach up to 40Hz)
	Torque Limit	Max. 200% torque current
	Torque Accuracy	±5%
	Max. Output Frequency (Hz)	Normal duty: 0.01~600.00Hz; Heavy duty: 0.00 ~ 300.00 Hz
	Frequency Output Accuracy	Digital command:±0.01%, -10℃~+40℃, Analog command: ±0.1%, 25±10℃
	Output Frequency Resolution	Digital command:0.01Hz, Analog command: 0.03 X max. output frequency/60 Hz (±11 bit)
	Overload Tolerance	Normal duty: rated output current is 120% for 60 seconds Heavy duty: rated output current is 150% for 60 seconds
	Frequency Setting Signal	+10V~-10, 0~+10V, 4~20mA, 0~20mA, Pulse input
	Accel./decel. Time	0.00~600.00/0.0~6000.0 seconds
	Main control 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), Dwell, Cooling fan on/off switch, Slip compensation, Torque compensation, JOG frequency, Frequency upper/lower limit settings, DC injection braking at start/stop, High slip braking, PID control (with sleep function),Energy saving control, MODOBUS communication (RS-485 RJ45, max. 115.2 kbps), Fault restart, Parameter copy
	Fan Control	230V model VFD150C23A(include) and series above: PMW control; VFD150C23A and series below: on/off switch control 460V model VFD150C23A(include) and series above: PMW control; VFD150C23A and series below: on/off switch control
Protection Characteristics	Motor Protection	Electronic thermal relay protection
	Over-current Protection	Over-current protection for 220% rated current current clamp『Normal duty: 170~175%』;『Heavy duty: 180~185%』
	Over-voltage Protection	230: drive will stop when DC-BUS voltage exceeds 410V 460: drive will stop when DC-BUS voltage exceeds 820V
	Over-temperature Protection	Built-in temperature sensor
	Stall Prevention	Stall prevention during acceleration, deceleration and running independently
	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, cULus, GB/T12668-2, (certification in progress)

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^2 every year.

Environment	Installation location	IEC60364-1/IEC60664-1 Pollution degree 2, Indoor use only	
	Surrounding Temperature	Storage	-25 ^{o}C ~ +70 ^{o}C
		Transportation	-25 ^{o}C ~ +70 ^{o}C
		Non-condensation, non-frozen	
	Rated Humidity	Operation	Max. 90%
		Storage/ Transportation	Max. 95%
		No condense water	
	Air Pressure	Operation/ Storage	86 to 106 kPa
		Transportation	70 to 106 kPa
	Pollution Level	IEC721-3-3	
		Operation	Class 3C2; Class 3S2
		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 1000~3000m, decrease 2% of rated current or lower 0.5℃ of temeperature for every 100m increase in altitude. Maximum altitude for Corner Grounded is 2000m.
Package Drop	Storage	ISTA procedure 1A(according to weight) IEC60068-2-31	
	Transportation		
Vibration	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 from 55Hz to 512 Hz. Comply with IEC 60068-2-6		
Impact	IEC/EN 60068-2-27		
Operation Position	Max. allowed offset angle ±10^o (under normal installation position)		

Specification for Operation Temperature and Protection Level

Model	Frame	Top cover	Conduit Box	Protection Level	Operation Temperature
VFDxxxCxxA	Frame A~C 230V: 0.75~22kW 460V: 0.75~30kW	Remove top cover	Standard conduit plate	IP20/UL Open Type	-10~50℃
		Standard with top cover		IP20/UL Type1/NEMA1	-10~40℃
	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 	-10~50℃
VFDxxxCxxE	Frame A~C 460V: 0.75~30kW	Remove top cover	Standard conduit plate	IP20/UL Open Type	-10~50℃
		Standard with top cover		IP20/UL Type1/NEMA1	-10~40℃
	Frame D~H 230V: >22kW 460V: >30kW	N/A	Standard conduit box	IP20/UL Type1/NEMA1	-10~40℃

Chapter 10 Digital Keypad

KPC-CC01

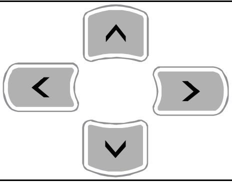
KPC-CE01(Option)

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

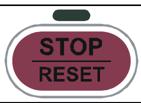
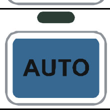
Installation Method
Embedded type and can be put flat on the surface of the control box. The front cover is water proof.

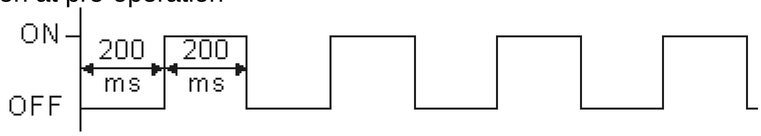
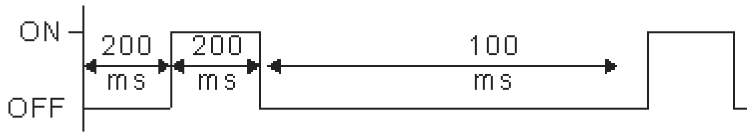
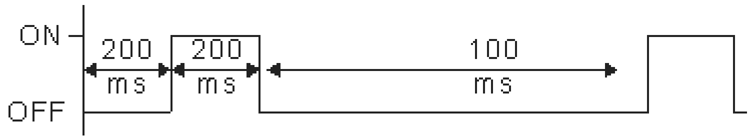
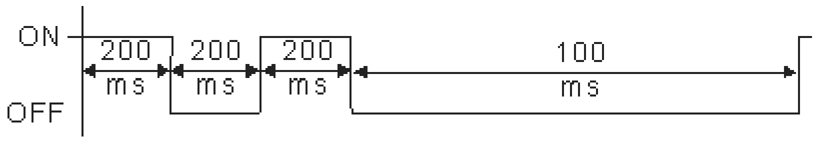
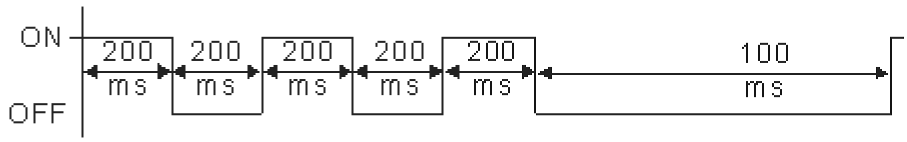
Descriptions of Keypad Functions

Key	Descriptions
RUN	Start Operation Key 1. It is only valid when the source of operation command is from the keypad. 2. It can operate the AC motor drive by the function setting and the RUN LED will be ON. 3. It can be pressed again and again at stop process. 4. When enabling "HAND" mode, it is only valid when the source of operation command is from the keypad.
STOP RESET	Stop Command Key. This key has the highest processing priority in any situation. 1. 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. 2. 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.
FWD REV	Operation Direction Key 1. This key is only control the operation direction NOT for activate the drive. FWD: forward, REV: reverse. 2. Refer to the LED descriptions for more details.
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. Detail Parameter 7. Quick/Simple Setup 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

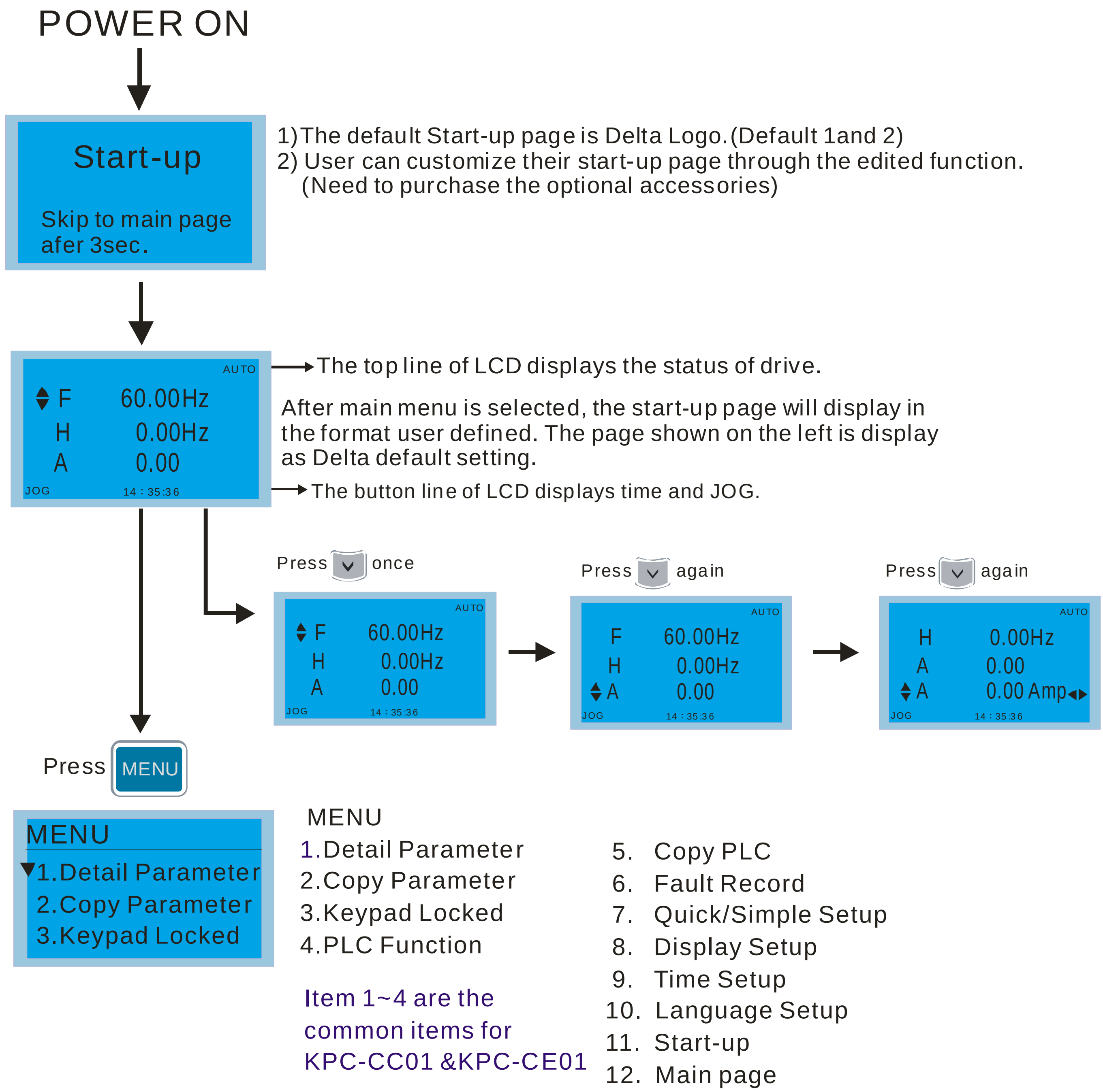
	Direction: Left/Right/Up/Down 1. In the numeric value setting mode, it is used to move the cursor and change the numeric value. 2. In the menu/text selection mode, it is used for item selection.
	Function Key 1. It has the factory setting function and the function can be set by the user. The present factory setting: F1 is JOG function. 2. Other functions must be defined by TPEditor first. TPEditor software V1.03 is available for download at: http://www.delta.com.tw/product/em/download/download_main.asp?act=3&pid=3&cid=3&tpid=3 3. Installation Instruction for TPEditor is on page 10-16 of this chapter.
	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.
	1. 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). 2. 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 hand frequency source and hand operation source. 3. Successful mode switching for KPC-CE01, “H/A” LED will be off; for KPC-CC01, it will display HAND mode/ AUTO mode on the screen

Descriptions of LED Functions

LED	Descriptions
	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
	Steady ON: stop indicator of the AC motor drive. Blinking: drive is in the standby status. Steady OFF: drive doesn’t execute “STOP” command.
	Operation Direction LED (green: forward running, red: reverse running) Steady ON: drive is in forward running status. Blinking: drive is changing the operation direction. Steady OFF: drive is in reverse running status.
	(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).
	(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).

<table>
<tr>
<td>CANopen ~”RUN”</td>
<td>
RUN LED:
<table>
<tr><th>LED status</th><th>Condition/State</th></tr>
<tr><td>OFF</td><td>CANopen at initial
No LED</td></tr>
<tr><td>Blinking</td><td>CANopen at pre-operation

</td></tr>
<tr><td>Single flash</td><td>CANopen at stopped

</td></tr>
<tr><td>ON</td><td>CANopen at operation status
No LED</td></tr>
</table>
</td>
</tr>
<tr>
<td>CANopen ~”ERR”</td>
<td>
ERR LED:
<table>
<tr><th>LED status</th><th>Condition/ State</th></tr>
<tr><td>OFF</td><td>No Error</td></tr>
<tr><td>Single flash</td><td>One message fail

</td></tr>
<tr><td>Double flash</td><td>Guarding fail or heartbeat fail

</td></tr>
<tr><td>Triple flash</td><td>SYNC fail

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

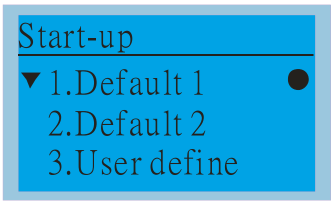
Digital Keypad: KPC-CC01 Function

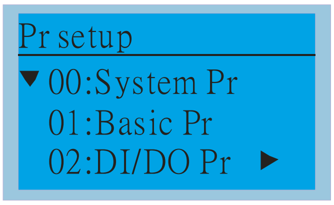


NOTE

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).

Display Icon





● : present setting

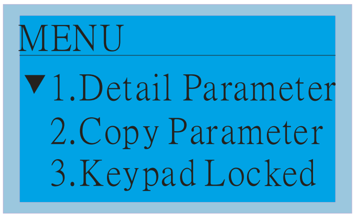
▼ : roll down the page for more options

Press  for more options.

▶ : show complete sentence

Press  for complete information

Display item

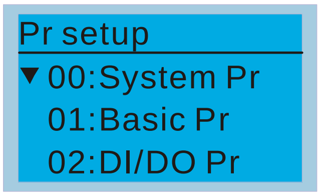
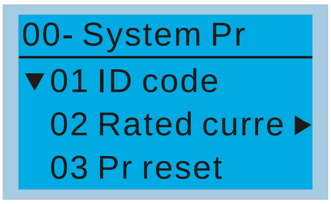
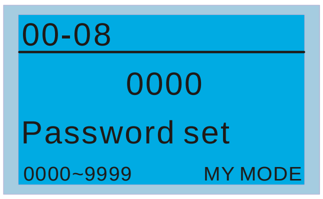
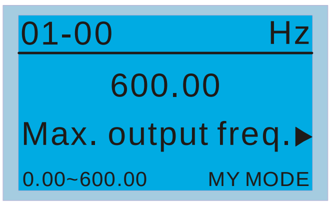


MENU
1.Detail Parameter
2.Copy Parameter
3.Keypad Locked
4.PLC Function

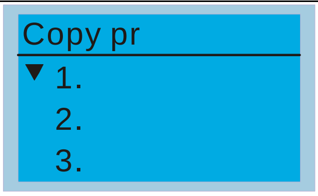
5. Copy PLC
6. Fault Record
7. Quick/Simple Setup
8. Display Setup
9. Time Setup
10. Language Setup
11. Start-up
12. Main page
13. PC Link

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

1. Detail Parameter

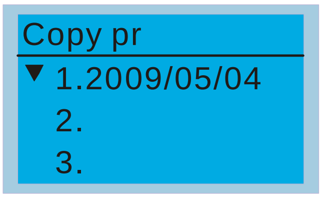
 Press  to select.	00 System Pr Content  00-08 Password Set  01-00 The maximum output freq. 

2. Copy Parameter

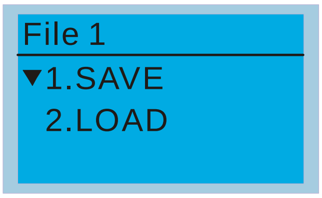


Copy parameters (Pr)

1. 4 sets of parameters duplication.
2. When the setting is complete, the date will be written to the copy parameters (Pr) page.



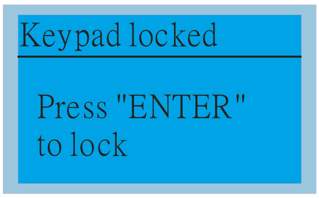
Press ENTER



Press  to save or load

After selecting save and pressing "ENTER", the parameter setting will be saved in the keypad.

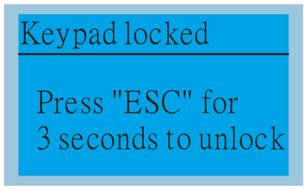
3. Keypad locked



Press ENTER to lock

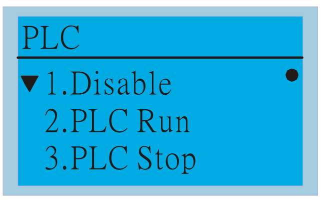
Keypad Locked

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 any key.

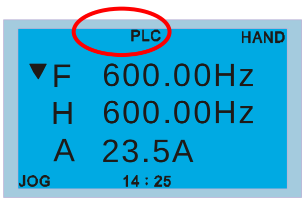
4. PLC Function



PLC function

1. Disable
2. PLC run
3. PLC stop

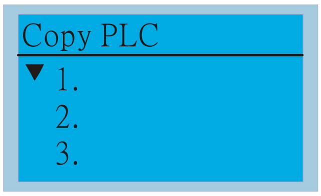
When activate and stop PLC function, the PLC status will be displayed on main page of Delta default setting.



The PLC function of KPC-CE01 can only displays:

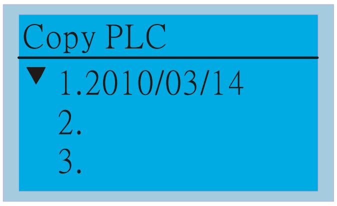
1. PLC0
2. PLC1
3. PLC2

5. Copy PLC

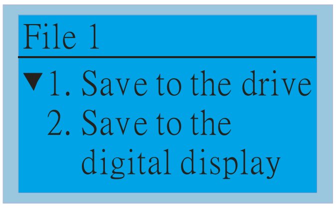


Copy PLC

1. Duplicate 4 sets of parameters.
2. When the setting is complete, the date will be written to the Copy PLC page.



Press ENTER to setting menu.



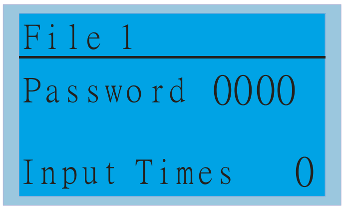
Press ∧ ∨ to select where to save the file

Press ENTER execute filesaving process.

If select save to the drive and press enter, the file will be saved to the drive.

NOTE

If password protection for WPLSoft editor was set, it is required to enter the password before the file can successfully be saved onto the digital display.



6. Fault record

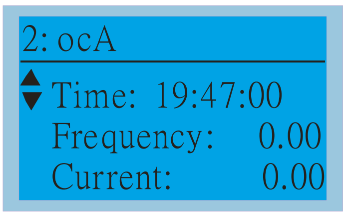
Press ENTER to select.

KPC-CE01 does not support this function.

Fault Record

It can accumulate 6 sets of recent fault records.
The first fault code displays in the record is the latest fault. Select the fault code for details on time, date, frequency, current, voltage and DC BUS Volt..

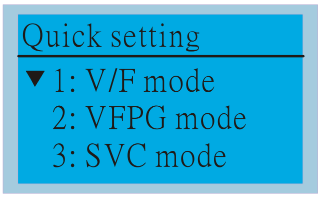
Press ENTER to view the current and voltage of the fault



NOTE

Fault actions of AC motor drive are record and save to KPC-CC01. When KPC-CC01 is removed and apply to another AC motor drive, the previous fault records will not be deleted. The new fault records of the present AC motor drive will accumulate to KPC-CC01.

7. Quick/Simple Setting



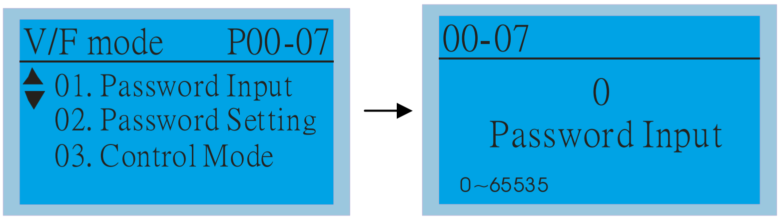
Press ENTER to select.

Quick Setting:
1. VF Mode
2. VFPG Mode
3. SVC Mode
4. FOCPG Mode
5. TQCPG Mode
6. My Mode

Quick Setting:

1. V/F Mode

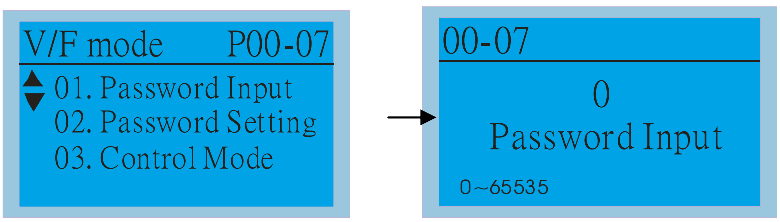
01: Password Input (Decode)



Items
1. Parameter Protection Password Input (P00-07)
2. Parameter Protection Password Setting (P00-08)
3. Control Mode (P00-10)
4. Control of Speed Mode (P00-11)
5. Load Selection (P00-16)
6. Carrier Frequency (P00-17)
7. Source of the Master Frequency Command (AUTO) (P00-20)
8. Source of the Operation Command (AUTO) (P00-21)
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. Mid-point Frequency 1 of Motor 1 (P01-03)
15. Mid-point Voltage 1 of Motor 1 (P01-04)
16. Mid-point Frequency 2 of Motor 1 (P01-05)
17. Mid-point Voltage 2 of Motor 1 (P01-06)
18. Min. Output Frequency of Motor 1 (P01-07)
19. Min. Output Voltage of Motor 1 (P01-08)
20. Output Frequency Upper Limit (P01-10)
21. Output Frequency Lower Limit (P01-11)
22. Accel. Time 1 (P01-12)
23. Decel Time 1 (P01-13)
24. Over-voltage Stall Prevention (P06-01)
25. Derating Protection (P06-55)
26. Software Brake Level (P07-00)
27. Speed Search during Start-up (P07-12)
28. Emergency Stop (EF) & Force to Stop Selection (P07-20)
29. Filter Time of Torque Command (P07-24)
30. Filter Time of Slip Compensation (P07-25)
31. Torque Compensation Gain (P07-26)
32. Slip Compensation Gain (P07-27)

2. VFPG Mode

01: Password Input (Decode)

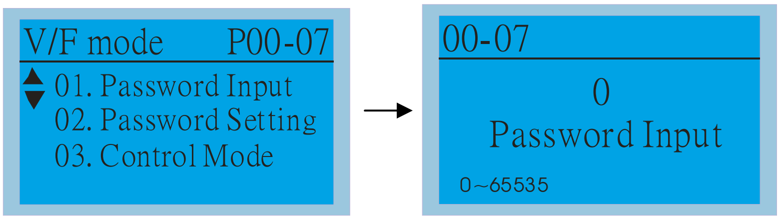


Items
1. Parameter Protection Password Input (P00-07)
2. Parameter Protection Password Setting (P00-08)
3. Control Mode (P00-10)
4. Control of Speed Mode (P00-11)
5. Load Selection (P00-16)
6. Source of the Master Frequency Command (AUTO) (P00-20)
7. Source of the Operation Command (AUTO) (P00-21)

8. Stop Method (P00-22)
9. Digital Keypad STOP function (P00-32)
10. Max. Operation Frequency (P01-00)
11. Base Frequency of Motor 1 (P01-01)
12. Max. Output Voltage Setting of Motor 1 (P01-02)
13. Min. Output Frequency of Motor 1 (P01-07)
14. Min. Output Voltage of Motor 1 (P01-08)
15. Output Frequency Upper Limit (P01-10)
16. Output Frequency Lower Limit (P01-11)
17. Accel. Time 1 (P01-12)
18. Decel Time 1 (P01-13)
19. Over-voltage Stall Prevention (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. Encoder Type Selection (P10-00)
25. Encoder Pulse (P10-01)
26. Encoder Input Type Setting (P10-02)
27. ASR Control (P) 1 (P11-06)
28. ASR Control (I) 1 (P11-07)
29. ASR Control (P) 2 (P11-08)
30. ASR Control (I) 2 (P11-09)
31. P Gain of Zero Speed (P11-10)
32. I Gain of Zero Speed (P11-11)

3. SVCPG Mode

01: Password Input (Decode)



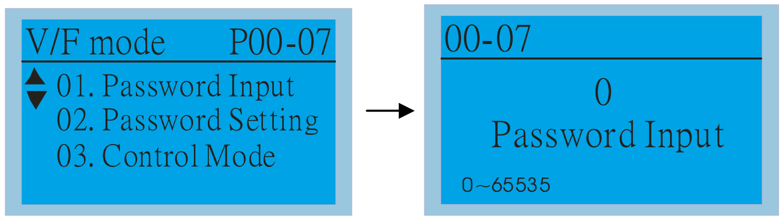
Items

1. Parameter Protection Password Input (P00-07)
2. Parameter Protection Password Setting (P00-08)
3. Control Mode (P00-10)
4. Control of Speed Mode (P00-11)
5. Load Selection (P00-16)
6. Carrier Frequency (P00-17)
7. Source of the Master Frequency Command (AUTO) (P00-20)
8. Source of the Operation Command (AUTO) (P00-21)
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 (P01-10)
17. Output Frequency Lower Limit (P01-11)
18. Accel. Time 1 (P01-12)
19. Decel Time 1 (P01-13)
20. Full-load Current of Induction Motor 1 (P05-01)
21. Rated Power of Induction Motor 1 (P05-02)
22. Rated Speed of Induction Motor 1 (P05-03)
23. Pole Number of Induction Motor 1 (P05-04)
24. No-load Current of Induction Motor 1 (P05-05)
25. Over-voltage Stall Prevention (P06-01)
26. Over-current Stall Prevention during Acceleration (P06-03)
27. Derating Protection (P06-55)
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

01: Password Input (Decode)

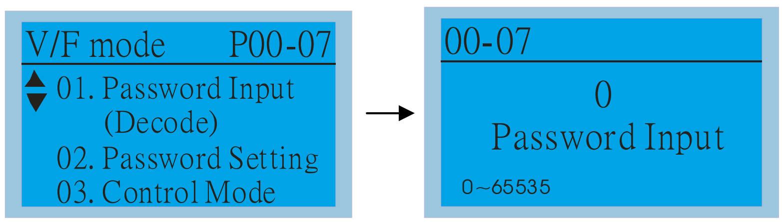


Items

1. Parameter Protection Password Input (P00-07)
2. Parameter Protection Password Setting (P00-08)
3. Control Mode (P00-10)
4. Control of Speed Mode (P00-11)
5. Source of the Master Frequency Command (AUTO) (P00-20)
6. Source of the Operation Command (AUTO) (P00-21)
7. Stop Method (P00-22)
8. Max. Operation Frequency (P01-00)
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)
12. Output Frequency Lower Limit (P01-11)
13. Accel. Time 1 (P01-12)
14. Decel Time 1 (P01-13)
15. Full-load Current of Induction Motor 1 (P05-01)
16. Rated Power of Induction Motor 1 (P05-02)
17. Rated Speed of Induction Motor 1 (P05-03)
18. Pole Number of Induction Motor 1 (P05-04)
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)
26. Encoder Pulse (P10-01)
27. Encoder Input Type Setting (P10-02)
28. System Control (P11-00)
29. Per Unit of System Inertia (P11-01)
30. ASR1 Low-speed Bandwidth (P11-03)
31. ASR2 High-speed Bandwidth (P11-04)
32. Zero-speed Bandwidth (P11-05)

5. TQCPG Mode

01: Password Input (Decode)

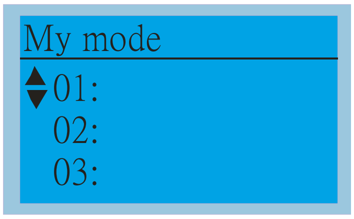


Items

1. Password Input (Decode) (P00-07)
2. Password Setting (P00-08)
3. Control Mode (P00-10)
4. Control of Speed Mode (P00-11)
5. Source of the Master Frequency Command (P00-20)

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

6.My Mode

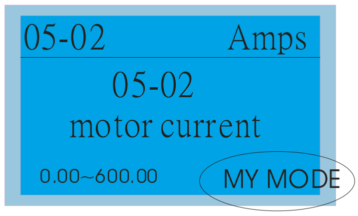


My mode:

It can save 01~32 sets of parameters (Pr).

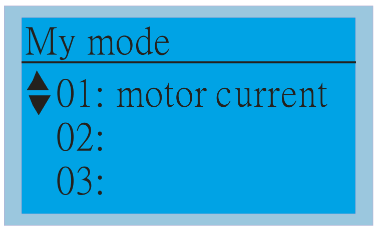
Click F4 in parameter setting page, the parameter will save to My Mode. To delete or correct the parameter, enter this parameter and click the “DEL” on the bottom right corner.

1

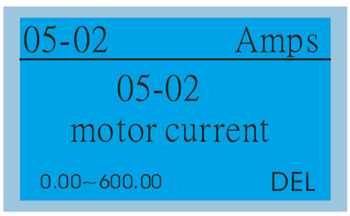


Press F4 and save to my mode.

2



The parameter (Pr) will be displayed in My mode if it is properly saved. To correct or to delete this Pr. clicks DEL.

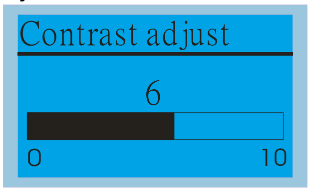


Press F4 to delete this Pr. setting in My Mode.

8. Display setup

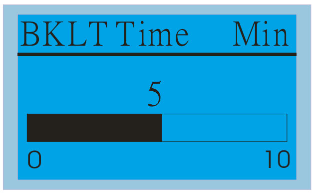
Press ENTER to enter the setting menu.

1. Contrast Adjustment



Adjust setting value

2. Back-lighted Time



Adjust setting value

9. Time setting

Enter time setup page, "9" will continue to blink

move to left / right

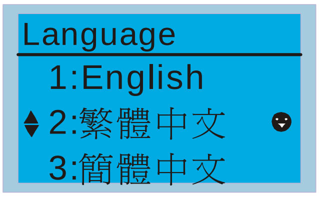
increase / decrease the value

Press ENTER to confirm.

NOTE

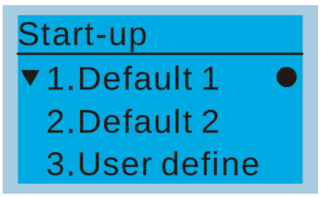
When the digital keypad is removed, the time setting will be in standby status for 7 days. After this period, the time needs to be reset.

10. Language setup



Language selection.

11. Startup Page Setting



1. Default picture 1
   DELTA LOGO
2. Default picture 2
   DELTA Text
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.

<u>USB/RS-485 Communication Interface-IFD6530</u>

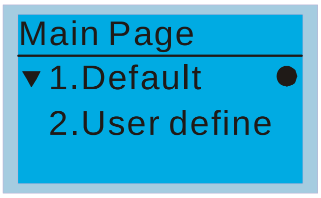
Please refer to Chapter 07 Optional Acessories for more detail.

<u>TPEditor</u>

TPEditor Installation Instruction is on page 10-16 and TPEditor V1.03 is available for download at:

http://www.delta.com.tw/product/em/download/download_main.asp?act=3&pid=3&cid=3&tpid=3

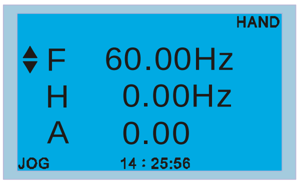
12. Main page



Press ENTER to select.

1. Default page

Default picture and editable picture are available upon selection.



F 600.00Hz >>> H >>> A >>> U (circulate)

2. 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.

<u>USB/RS-485 Communication Interface-IFD6530</u>

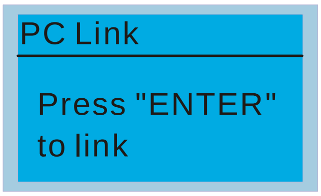
Please refer to Chapter 07 Optional Acessories for more detail.

<u>TPEditor</u>

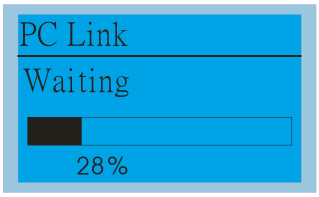
TPEditor Installation Instruction is on page 10-16 and TPEditor V1.03 is available for download at:

http://www.delta.com.tw/product/em/download/download_main.asp?act=3&pid=3&cid=3&tpid=3

13. PC Link

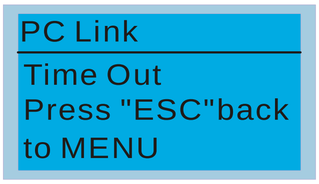


Press ENTER

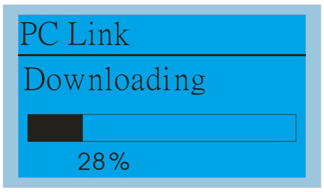


The function of PC Link is to establish a connection with computer to download the page for user defined editing. After enter to PC Link page, check if the connection of KPC-CC01 and computer is successfully establish, then press enter to go to next page and wait for communication response.

1. If the connection failed, the screen will show “Time Out”.



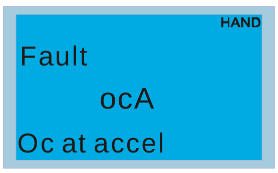
2. If the connection succeeds, the screen page will show “Downloading”. When the download is done, it returns to MENU page.

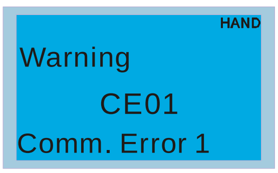


3. In order to set the start-up page and main page in the format user defined, user must check the user define option for start-up page and main page. If the user define page for editing has not yet downloaded to KPC-CC01, the start-up page and main page will display as blank.

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 for digital keypad: RJ45 Extension Lead

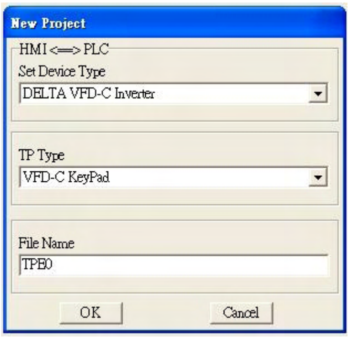
Part No.	Description
CBC-K3FT	RJ45 Extension Lead 3 feet
CBC-K5FT	RJ45 Extension Lead 5 feet
CBC-K7FT	RJ45 Extension Lead 7 feet
CBC-K10FT	RJ45 Extension Lead 10 feet
CBC-K16FT	RJ45 Extension Lead 16 feet

TPEditor Installation Instruction

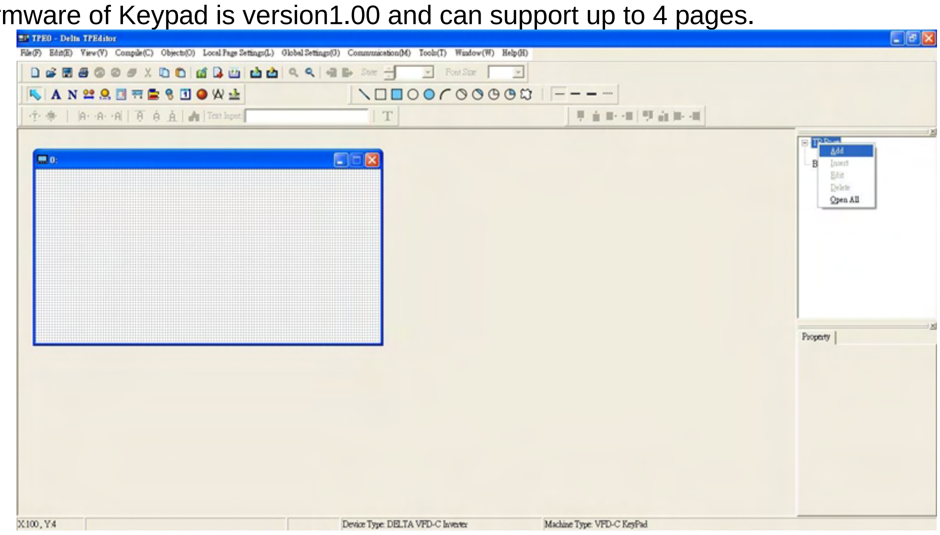
1) TPEditor: Setup & Basic Functions

1. Run TPEditor version 1.30

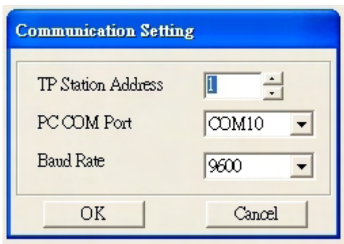
2. Go to File(F)→Click on New. The Window below will pop up. At the device type, click on the drop down menu and choose DELTA VFD-C Inverter. At the TP type, click on the drop down menu and choose VFD-C KeyPad. As for File Name, enter TPE0. Now click on OK.



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.

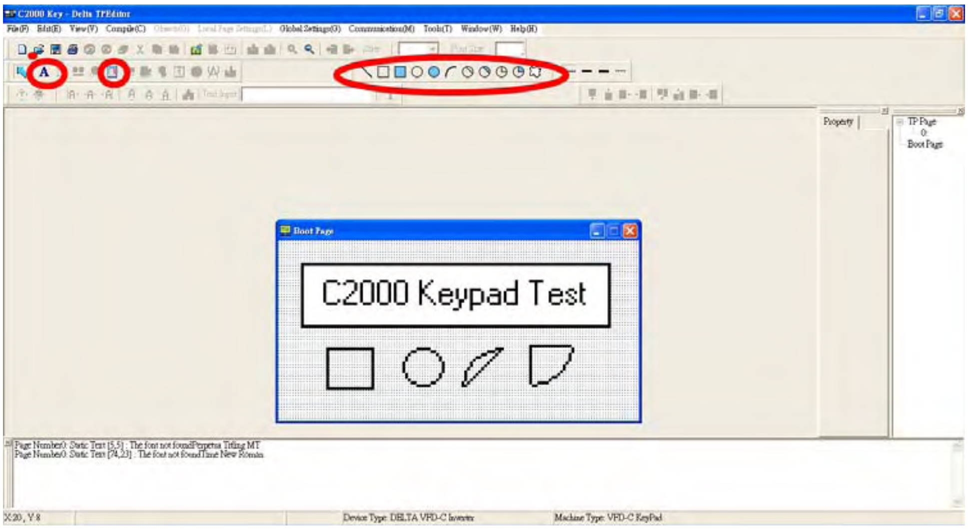


4. Download setting, Go to Tool →Communication settings (C) to set up the PC Com Port and Baud Rate. The supporting speeds of Baud rate are 9600bps, 19200bps and 38400bps. The default setting of TP address is 1, please do not modify.

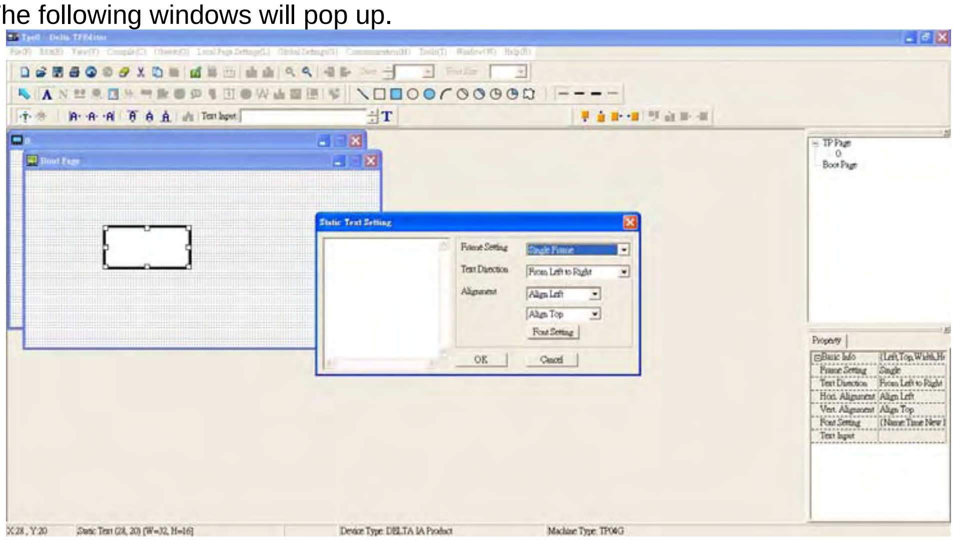


2) Edit Startup Page

1. Click once on the Boot Page on the right hand side of your computer screen or click on View (V) →click on Boot Page (B). Then a blank Boot Page window will pop up. Use the circled items to design your Startup page.

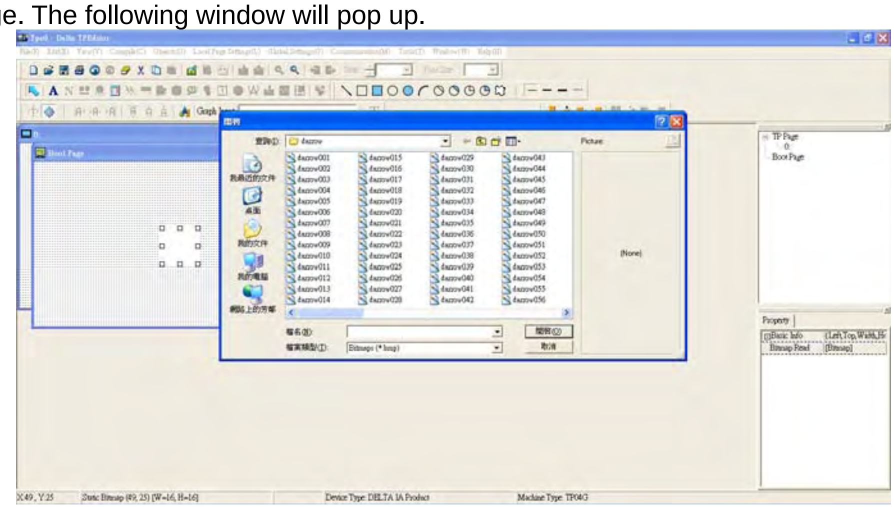


2. Static Text . Open a blank page, click once on this button , and then double click on that blank page. The following windows will pop up.

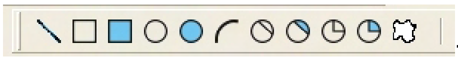


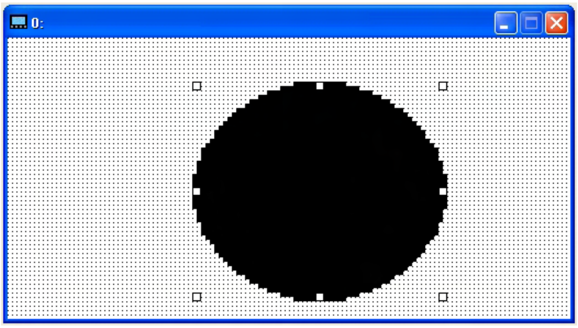
On the right hand side of the Static Text Setting, you can adjust the frame setting, the text direction, the alignment and the font setting. Once you finish all the adjustments that you need.
You can continue to input your text in the blank space of Static Text Setting window. When you finish inputting your text, click on OK to continue your next step or click cancel to abort the current step.

3. Static Bitmap →Open a blank page, then click once on this button and then double click on that blank page. The following window will pop up.

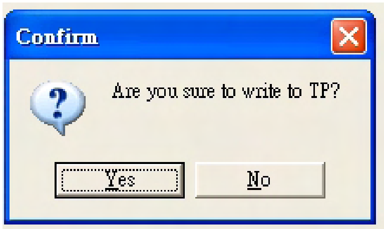


Please note that Static Bitmap setting support only images in BMP format. Now choose a image that you need and click open, then that image will appear in the Static Bitmap window.

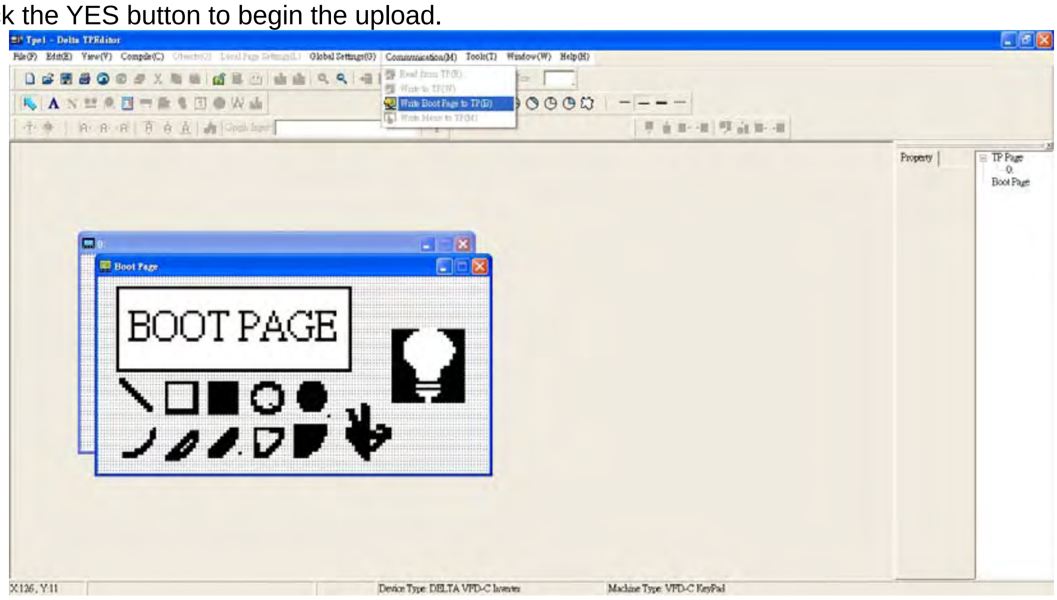
4. Geometric Bitmap  → As shown in the picture on the left side, there are 11 kinds of geometric bitmap to choose. Open a new blank page then click once on a geometric bitmap icon that you need. Then drag that icon and enlarge it to the size that you need on that blank page. For example, if you drag this icon  to a blank page, you will see the following window.



5. Download---Take the image below as an example. The sentence "Boot page" is static text, the 11 images below are geometric bitmaps. The image on the right hand side is a Static Bitmap. To upload a start up page, double click to activate "Boot page. Make sure that you have followed the instruction on page 3 to choose the right com port. Then go to "Communication (M)" →Click on "Write Boot Page TP (B)." When you see the pop up message below

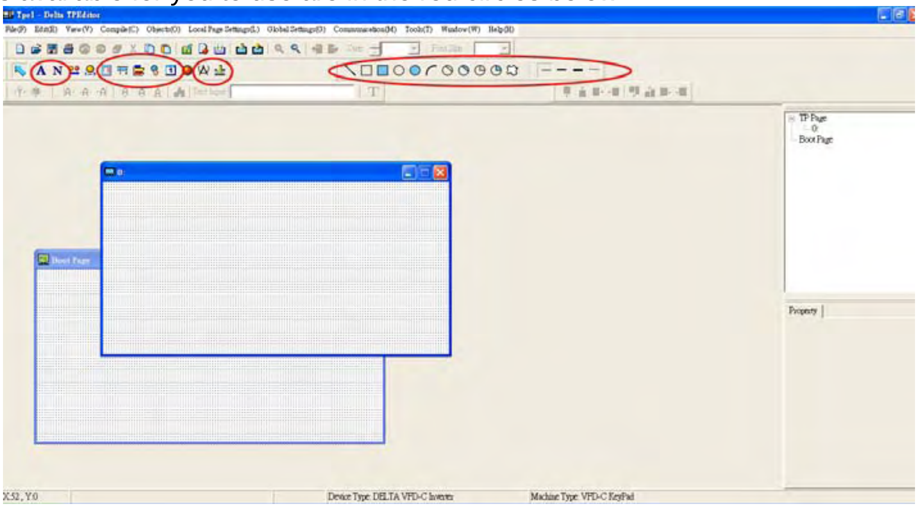


Go to the C2000 Keypad, press Menu then keep on pressing the Upward key until you see "PC Link," then press ENTER once, when you see "Press Enter to PC Link" on the keypad, press the ENTER again. Then click the YES button to begin the upload.



3) Edit Main Page

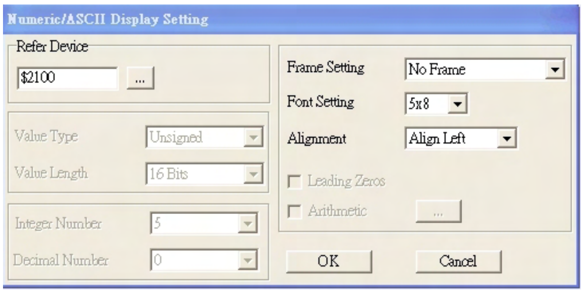
1. Click on a page under the TP Page to edit or go to View → click on Boot Page to begin to edit main page. The objects available for you to use are in the red circles below.



From left to right: Static Text, ASCII Display, Static Bitmap, Scale, Bar Graph, Button, Clock Display, Units, Numeric Input, 11 geometric bitmaps and different width of lines. The application of Static Text, Static Bitmap, and geometric bitmap is the same as the editing startup page.

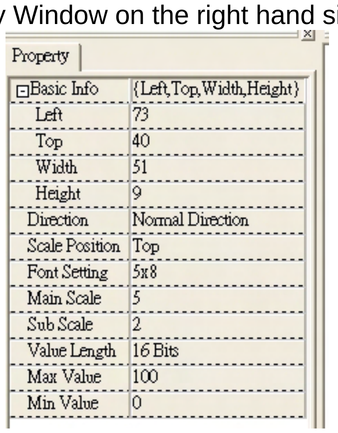
2. Numeric/ASCII Display A): Go to Objects (O)→Click once on the Numeric/ASCII Display(A) 

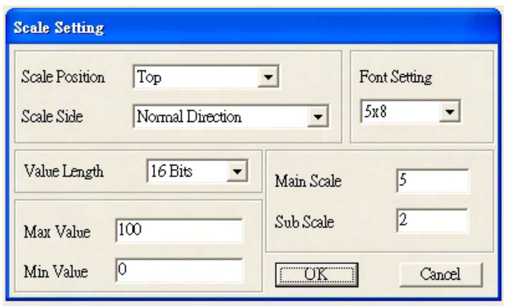
→Drag to enlarge to reach the size that you need to add objects in the screen where you want to create an object →Double click on the object to set up Related Devices, Frame Setting , Fonts and Alignment.



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.

3. 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.



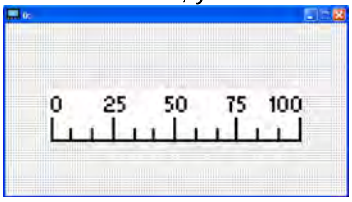


a. Scale Position: Click on the drop down list to choose which position that you need to place a scale.

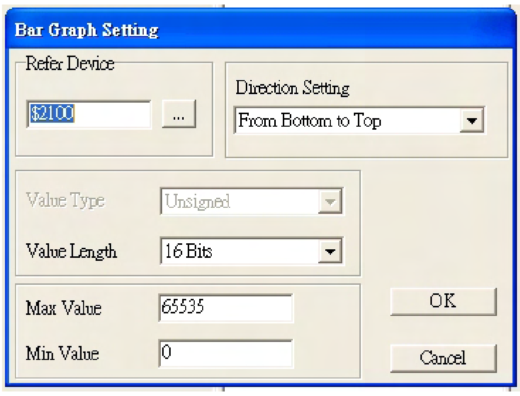
b. Scale Side: Click on the drop down list to choose if you want to number your scale from smaller number to bigger number or from big to small. Click OK to accept this setting or click Cancel to abort.

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 input numbers are limited by value.
g. Follow the Scale setting mentioned above; you will have a scale as shown below.



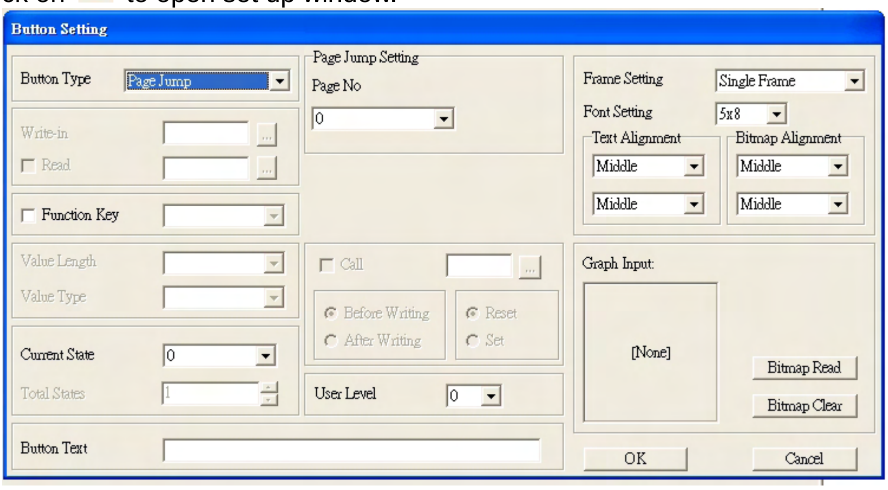
4. Bar Graph setting  :



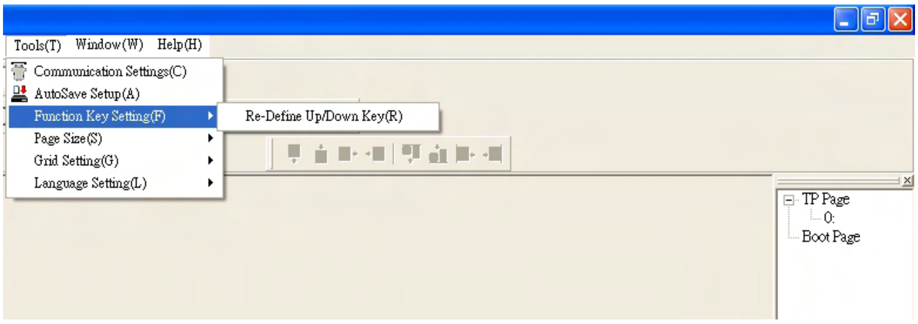
a. Related Device: Choose the VFD Communication Port that you need.
b. Direction Setting: Click on the drop down menu to choose one of the following directions: From Bottom to Top, From Top to Bottom, From Left to Right or From Right to Left.
c. Maximum Value & Minimum Value: They define the range covered 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.

5. Button  : 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  to open set up window.

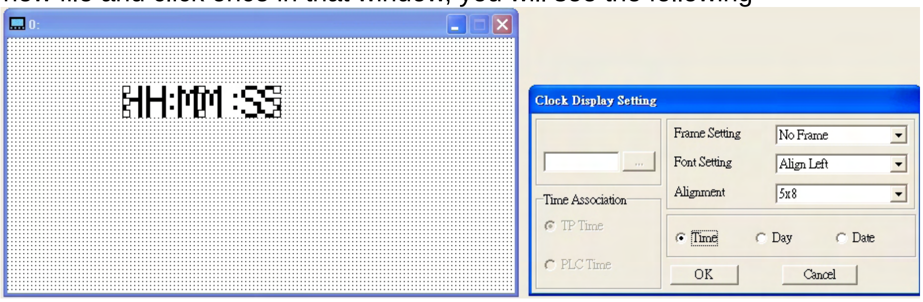


a. <Button Type> allows you set up buttons' functions. But Page Jump is the only supported function currently.
b. Page Jump setting: After you choose the Page Jump function in the drop down list, you will see this Page Jump Setting Menu
c. <Function Key> allows you to assign functions to the following 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).



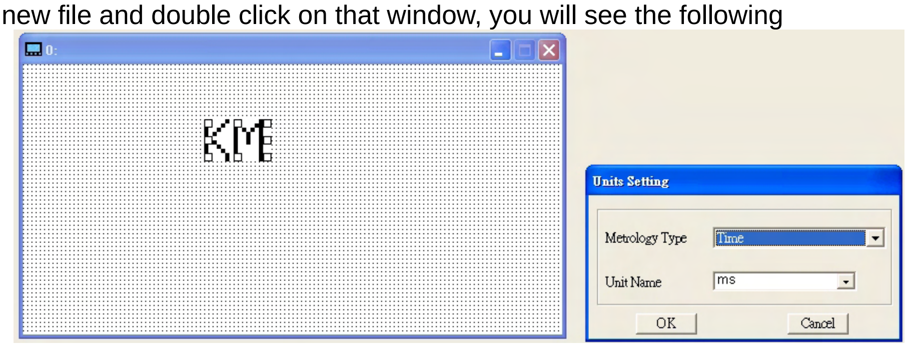
d. There are no supported functions other than the setting mentioned above.

6. Clock Display Setting : Click once on this button .
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.

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

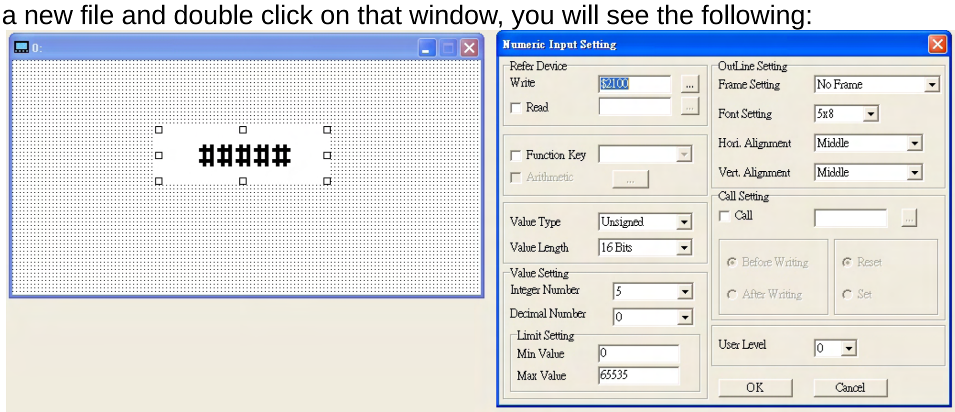


Choose from the drop down list the Metrology and the Unity Name that you need.
As for Metrology, you have the following choices Length, Square Measure, Volume/Solid Measure, Weight, Speed, Time and Temperature. The unit name changes automatically when you change metrology type.

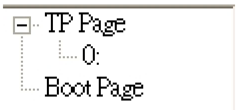
8. Numeric Input Setting :

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

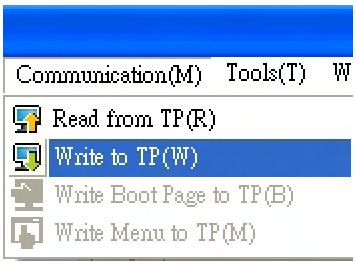
Click once on this button .
Open a new file and double click on that window, you will see the following:



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.

9. 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



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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.

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.

NOTE

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

NOTE IM: Induction Motor; PM: Permanent Magnet Motor

Parameter	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 19: 460V, 20HP 20: 230V, 25HP 21: 460V, 25HP 22: 230V, 30HP 23: 460V, 30HP 24: 230V, 40HP 25: 460V, 40HP 26: 230V, 50HP 27: 460V, 50HP 28: 230V, 60HP 29: 460V, 60HP 30: 230V, 75HP 31: 460V, 75HP 32: 230V, 100HP 33: 460V, 100HP 34: 230V, 125HP 35: 460V, 125HP 37: 460V, 150HP 39: 460V, 175HP 41: 460V, 215HP 43: 460V, 250HP 45: 460V, 300HP 47: 460V, 375HP 49: 460V, 425HP 51: 460V, 475HP 93: 460V, 5HP（4kW）	Read only
00-01	Display AC Motor Drive Rated Current	Display by models	Read only

Parameter	Explanation	Settings	Factory Setting
00-02	Parameter Reset	0: No function 1: Read only 6: Reset PLC (including CANopen Master Index) 7: Reset CANopen Index (Slave) 8: keypad lock 9: All parameters are reset to factory settings(base frequency is 50Hz) 10: All parameters are reset to factory settings (base frequency is 60Hz)	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	0: Display output current (A) 1: Display counter value (c) 2: Display actual output frequency (H.) 3: Display DC-BUS voltage (v) 4: Display output voltage (E) 5: Display output power angle (n) 6: Display output power in kW (P) 7: Display actual motor speed rpm (r) 8: Display estimate output torque % (t) 9: Display PG feedback (G) (refer to Pr.10-00,10-01) 10: Display PID feedback in % (b) 11: Display AVI in % (1.) 12: Display ACI in % (2.) 13: Display AUI in % (3.) 14: Display the temperature of IGBT in oC (i.) 15: Display the temperature of capacitance in oC (c.) 16: The status of digital input (ON/OFF) (i) 17: The status of digital output (ON/OFF) (o) 18: Multi-step speed (S) 19: The corresponding CPU pin status of digital input (d.) 20: The corresponding CPU pin status of digital output (0.) 21: Actual motor position (PG1 of PG card) (P.) 22: Pulse input frequency (PG2 of PG card) (S.) 23: Pulse input position (PG2 of PG card) (q.) 24: Position command tracing error (E.) 25: Overload counting (0.00~100.00%) (h.) 26: Ground Fault GFF (Unit :%)(G.) 27: DC Bus voltage ripple (Unit: Vdc) (r.) 28: Display PLC data D1043 (C) 29: Display PM motor pole section (EMC-PG01U application) (4.) 30: Display output of user defined (U) 31: H page x Pr.00-05 Display user Gain(K) 32: Number of actual motor revolution during operation (PG card plug in and Z phase signal input) (Z.)	3
00-05	Coefficient Gain in Actual Output Frequency	0~160.00	0
00-06	Software Version	Read-only	#.#
00-07	Parameter Protection Password Input	0～65535 0~3: the times of password attempts	0

	Parameter	Explanation	Settings	Factory Setting
〆	00-08	Parameter Protection Password Setting	0 ~ 65535 0: No password protection / password is entered correctly (Pr00-07) 1: Parameter is locked	0
〆	00-09	Reserved		
	00-10	Control Mode	0: Speed mode 1: Point-to-Point position control 2: Torque mode 3: Home mode	0
	00-11	Control of Speed Mode	0: VF (IM V/f control) 1: VFPG (IM V/f control+ Encoder) 2: SVC(IM Sensorless vector control) 3: FOCPG (IM FOC vector control+ encoder) 4: FOCPG（PM FOC vector control + Encoder） 5: FOC Sensorless (IM field oriented sensorless vector control)	0
	00-12	Point-to-Point Position mode	0: Relative position 1: Absolute position	
	00-13	Torque Mode Control	0: TQCPG（IM Torque control + Encoder） 1: TQCPG (PM Torque control + Encoder) 2: TQC Sensorless (IM Sensorless torque control)	0
	00-14	Reserved		
	00-15	Reserved		
〆	00-16	Load Selection	0: Normal load 1: Heavy load	0
	00-17	Carrier Frequency	Normal load 230V (460V) 1-15HP [1-20HP] 2~15KHz 20-50HP [25-100HP] 2~10KHz 60-100HP [125-475HP] 2~09KHz Heavy load 1-475HP 2~6KHz	8 6 4 2
	00-18	Reserved		
	00-19	PLC Command Mask	Bit 0: Control command controls by PLC Bit 1: Frequency command controls by PLC Bit 2: Reserved Bit 3: Torque command controls by PLC	Read only
〆	00-20	Source of Master Frequency Command（AUTO）	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)	0
〆	00-21	Source of the Operation Command （AUTO）	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 (no CANopen card)	0

	Parameter	Explanation	Settings	Factory Setting
✎	00-22	Stop Method	0: Ramp to stop 1: Coast to stop	0
✎	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 define on decimal place 0000b: no decimal place 0001b: one decimal place 0010b: two decimal place 0011b: three decimal place Bit 4~15: user define on unit 000xh: Hz 001xh: rpm 002xh: % 003xh: kg	0
	00-26	Max. User Defined Value	0: Disable 0000B: 0~65535 (No decimal place in Pr.00-25 setting) 0001B: 0.0~6553.5 (One decimal place in Pr.00-25 setting) 0010B: 0.0~655.35(Two decimal place in Pr.00-25 setting) 0011B: 0.0~65.536 (Three decimal place in Pr.00-25 setting)	0
	00-27	User Defined Value	Read only	Read Only
	00-28 ~ 00-29	Reserved		
✎	00-30	Source of the Master Frequency Command （HAND）	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)	0
✎	00-31	Source of the Operation Command （HAND）	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)	0
✎	00-32	Digital Keypad STOP Function	0: STOP key disable 1: STOP key enable	0
	00-33 ~ 00-47	Reserved		
✎	00-48	Display Filter Time (Current)	0.001~65.535 sec	0.100
✎	00-49	Display Filter Time (Keypad)	0.001~65.535 sec	0.100
	00-50	Software Version (date)	Read only	#####

01 Basic Parameters

	Parameter	Explanation	Settings	Factory Setting
	01-00	Max. Operation Frequency	50.00~600.00Hz	60.00/ 50.00
	01-01	Base Frequency of Motor 1	0.00~600.00Hz	60.00/ 50.00
	01-02	Max. Output Voltage Setting 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	3.00
✔	01-04	Mid-point Voltage 1 of Motor 1	230V: 0.0V~240.0V 460V: 0.0V~480.0V	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
✔	01-10	Output Frequency Upper Limit	0.00~600.00Hz	600.00
✔	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	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	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	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	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	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	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	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	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	10.00 10.0
✔	01-21	JOG Deceleration Time	Pr.01-45=0: 0.00~600.00 second Pr.01-45=1: 0.00~6000.0 second	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 for Acceleration Departure Time 1	Pr.01-45=0: 0.00~25.00 second Pr.01-45=1: 0.0~250.0 second	0.20 0.2

Parameter	Explanation	Settings	Factory Setting
01-25	S-curve for 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
01-26	S-curve for Deceleration Departure Time 1	Pr.01-45=0: 0.00~25.00 second Pr.01-45=1: 0.0~250.0 second	0.20 0.2
01-27	S-curve for 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	Upper limit of Frequency 1 setting not allowed	0.00~600.00Hz	0.00
01-29	Lower limit of Frequency 1 setting not allowed	0.00~600.00Hz	0.00
01-30	Upper limit of Frequency 2 setting not allowed	0.00~600.00Hz	0.00
01-31	Lower limit of Frequency 2 setting not allowed	0.00~600.00Hz	0.00
01-32	Upper limit of Frequency 3 setting not allowed	0.00~600.00Hz	0.00
01-33	Lower limit of Frequency 3 setting not allowed	0.00~600.00Hz	0.00
01-34	Zero-speed Mode	0: Output waiting 1: Zero-speed operation 2: Fmin (the 4th output frequency)	0
01-35	Max. Output Frequency of Motor 2	0.00~600.00Hz	60.00/ 50.00
01-36	Max. 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	3.00
01-38	Mid-point Voltage 1 of Motor 2	230V: 0.0V~240.0V 460V: 0.0V~480.0V	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
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~Pr.01-08 1: Curve to the power of 1.5 2: Curve to the power of 2	0
01-44	Optimal Acceleration/Deceleration Setting	0: Linear accel. /decel. 1: Auto accel.; linear decel. 2: Linear accel.; auto decel. 3: Auto accel./decel. 4: Linear, stall prevention by auto accel./decel. (limit by Pr.01-21 to 01-22)	0
01-45	Time Unit for Accel. /Decel. and S Curve	0: Unit: 0.01 sec 1: Unit: 0.1sec	0
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

Parameter	Explanation	Settings	Factory Setting
02-00	2-wire/3-wire Operation Control	0: 2-wire mode, 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^{st}, 2^{nd} acceleration/deceleration time selection	0
02-27	Input terminal of I/O extension card (MI11)	9: The 3^{rd}, 4^{th} 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: TQCPG/FOCPG model selection	
		27: ASR1/ASR2 selection	
		28: Emergency stop (EF1)	
		29: Signal confirmation for Y-connection	
		30: Signal confirmation for Δ-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	

	Parameter	Explanation	Settings	Factory Setting
			39: Torque command direction	
			40: Force coast to stop	
			41: HAND switch	
			42: AUTO switch	
			43: Enable resolution selection (Pr.02-48)	
			44: Reversed direction homing	
			45: Forward direction homing	
			46: Homing (ORG)	
			47: Homing function enable	
			48: Mechanical gear ratio switch	
			49: Drive enable	
			50: Reserved	
			51: Selection for PLC mode bit0	
			52: Selection for PLC mode bit1	
			53: Trigger CANopen quick stop	
			54~70: Reserved	
✎	02-09	UP/DOWN key mode	0: up/down by the accel. /decel. time 1: up/down constant speed (Pr.02-10)	0
✎	02-10	Constant speed. The Accel. /Decel. Speed of the UP/DOWN Key	0.01~1.00Hz/ms	1
✎	02-11	Multi-function Input Response Time	0.000~30.000 second	0.005
✎	02-12	Multi-function Input Mode Selection	0000h~FFFFh (0: N.O.; 1: N.C.）	0
✎	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 the I/O extension card (MO11)	5: Zero speed (Frequency command)	0
✎	02-38	Output terminal of the I/O extension card (MO12)	6: Zero speed, include STOP(Frequency command)	0
✎	02-39	Output terminal of the I/O extension card (MO13)	7: Over torque 1(Pr.06-06~06-08)	0
✎	02-40	Output terminal of the I/O extension card (MO14)	8: Over torque 2(Pr.06-09~06-11)	0
✎	02-41	Output terminal of the I/O extension card (MO15)	9: Drive is ready	0
✎	02-42	Output terminal of the I/O extension card (MO16)	10: Low voltage warning（LV）(Pr.06-00)	0
✎	02-43	Output terminal of the I/O extension card (MO17)	11: Malfunction indication	0
✎	02-44	Output terminal of the I/O extension card (MO18)	12: Mechanical brake release(Pr.02-32)	0
✎	02-45	Output terminal of the I/O extension card (MO19)	13: Overheat warning (Pr.06-15)	0
✎	02-46	Output terminal of the I/O extension card (MO20)	14: Software brake signal indication(Pr.07-00)	0
			15: PID feedback error	
			16: Slip error (oSL)	
			17: Terminal count value attained, does not return to 0 (Pr.02-20)	

Parameter	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 (>= 02-33)	
		28: Output when current <=Pr.02-33 (<= 02-33)	
		29: Output when frequency >= Pr.02-34 (>= 02-34)	
		30: Output when frequency <= Pr.02-34 (<= 02-34)	
		31: Y-connection for the motor coil	
		32: △-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 output <=Pr.02-47	
		44: Low current output (use with Pr.06-71~06-73)	
		45: UVW Output Electromagnetic valve Switch	
		46：Reserved	
		47: Closed brake output	
		48~49: reserved	
		50: Output for CANopen control	
		51: Output for communication card	
		52: Output for RS485	
		53~62: Reserved	
02-18	Multi-function output direction	0000h~FFFFh (0: N.O.; 1: N.C.）	0
02-19	Terminal counting value attained (returns to 0)	0~65535	0
02-20	Preliminary counting value attained (not return to 0)	0~65535	0
02-21	Digital Output Gain (DFM)	1～166	1
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
02-34	Output frequency setting for multi-function output terminal	0.00~+-60.00Hz（Motor speed when using PG Card）	0.00
02-35	External Operation Control Selection after Reset and	0: Disable	0

	Parameter	Explanation	Settings	Factory Setting
		Activate	1: Drive runs if run command exists after reset	
✓	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 Saved Memory of the Frequency Command Executed by External Terminal	Read only	Read only

03 Analog Input/Output Parameters

Parameter	Explanation	Settings	Factory Setting
03-00	Analog Input 1 (AVI)	0: No function	1
03-01	Analog Input 2(ACI)	1: Frequency command (torque limit under torque control mode)	0
03-02	Analog Input 3 (AUI)	2: Torque command (torque limit under speed mode)	0
		3: Torque compensation 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	
		12~17: Reserved	
03-03	AVI Analog Input Bias	-100.0~100.0%	0
03-04	ACI Analog Input Bias	-100.0~100.0%	0
03-05	AUI Analog Positive Voltage Input Bias	-100.0~100.0%	0
03-06	AUI Analog Negative Voltage Input Bias	-100.0~100.0%	0
03-07	Positive/negative Bias Mode (AVI)	0: No bias 1: Lower than bias=bias 2: Greater than bias=bias 3: The absolute value of the bias voltage while serving as the center 4: Serve bias as the center	0
03-08	Positive/negative Bias Mode (ACI)		
03-09	Positive/negative Bias Mode (AUI)		
03-10	Reserved		
03-11	Analog Input Gain 1 (AVI)	-500.0~500.0%	100.0
03-12	Analog Input Gain 2 (ACI)	-500.0~500.0%	100.0
03-13	Analog Positive Input Gain 3 (AUI)	-500.0~500.0%	100.0
03-14	Analog Negative Input Gain 4 (AUI)	-500.0~500.0%	100.0
03-15	Analog Input Filter Time (AVI)	0.00~2.00 sec.	0.01
03-16	Analog Input Filter Time (ACI)	0.00~2.00 sec.	0.01
03-17	Analog Input Filter Time (AUI)	0.00~2.00 sec.	0.01
03-18	Addition Function of the Analog Input	0: Disable (AVI, ACI, AUI) 1: Enable	0
03-19	Loss of the ACI Signal	0: Disable 1: Continue operation at the last frequency 2: Decelerate to 0Hz 3: Stop immediately and display ACE	0
03-20	Multi-function Output 1 (AFM1)	0: Output frequency (Hz)	0

	Parameter	Explanation	Settings	Factory Setting
✔	03-23	Multi-function Output 2 (AFM2)	1: Frequency command (Hz) 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: Iq 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 output	0
✔	03-21	Gain for Analog Output 1 (AFM1)	0~500.0%	100.0
✔	03-22	Analog Output 1 Value in REV Direction (AFM1)	0: Absolute output voltage 1: Reverse output 0V; Positive output 0-10V 2: Reverse output 5-0V; Positive output 5-10V	0
✔	03-24	Gain for Analog Output 2 (AFM2)	0~500.0%	100.0
✔	03-25	Analog Output 2 Value in REV Direction (AFM2)	0: Absolute output voltage 1: Output 0V in REV direction; output 0-10V in FWD direction 2: Output 5-0V in REV direction; output 5-10V in FWD direction	0
✔	03-26	Reserved		
✔	03-27	Reserved		
✔	03-28	AVI Selection	0: 0-10V 1: 0-20mA 2: 4-20mA	0
✔	03-29	ACI Selection	0: 4-20mA 1: 0-10V 2: 0-20mA	0
✔	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

04 Multi-step Speed Parameters

	Parameter	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
✎	04-02	3rd Step Speed Frequency	0.00~600.00Hz	0
✎	04-03	4th Step Speed Frequency	0.00~600.00Hz	0
✎	04-04	5th Step Speed Frequency	0.00~600.00Hz	0
✎	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
✎	04-08	9th Step Speed Frequency	0.00~600.00Hz	0
✎	04-09	10th Step Speed Frequency	0.00~600.00Hz	0
✎	04-10	11th Step Speed Frequency	0.00~600.00Hz	0
✎	04-11	12th Step Speed Frequency	0.00~600.00Hz	0
✎	04-12	13th Step Speed Frequency	0.00~600.00Hz	0
✎	04-13	14th Step Speed Frequency	0.00~600.00Hz	0
✎	04-14	15th Step Speed Frequency	0.00~600.00Hz	0
	04-15	Position command 1 (revolution)	-30000~30000	0
	04-16	Position command 1 (pulse)	-32767~32767	0
	04-17	Position command 2 (revolution)	-30000~30000	0
	04-18	Position command 2 (pulse)	-32767~32767	0
	04-19	Position command 3 (revolution)	-30000~30000	0
	04-20	Position command 3 (pulse)	-32767~32767	0
	04-21	Position command 4 (revolution)	-30000~30000	0
	04-22	Position command 4 (pulse)	-32767~32767	0
	04-23	Position command 5 (revolution)	-30000~30000	0
	04-24	Position command 5 (pulse)	-32767~32767	0
	04-25	Position command 6 (revolution)	-30000~30000	0
	04-26	Position command 6 (pulse)	-32767~32767	0
	04-27	Position command 7 (revolution)	-30000~30000	0
	04-28	Position command 7 (pulse)	-32767~32767	0
	04-29	Position command 8 (revolution)	-30000~30000	0
	04-30	Position command 8 (pulse)	-32767~32767	0

Parameter	Explanation	Settings	Factory Setting
04-31	Position command 9 (revolution)	-30000~30000	0
04-32	Position command 9 (pulse)	-32767~32767	0
04-33	Position command 10 (revolution)	-30000~30000	0
04-34	Position command 10 (pulse)	-32767~32767	0
04-35	Position command 11 (revolution)	-30000~30000	0
04-36	Position command 11 (pulse)	-32767~32767	0
04-37	Position command 12 (revolution)	-30000~30000	0
04-38	Position command 12 (pulse)	-32767~32767	0
04-39	Position command 13 (revolution)	-30000~30000	0
04-40	Position command 13 (pulse)	-32767~32767	0
04-41	Position command 14 (revolution)	-30000~30000	0
04-42	Position command 14 (pulse)	-32767~32767	0
04-43	Position command 15 (revolution)	-30000~30000	0
04-44	Position command 15 (pulse)	-32767~32767	0

05 Motor Parameters

Parameter	Explanation	Settings	Factory Setting
05-00	Motor Auto Tuning	0: No function 1: Measure induction motor in dynamic status (motor spinning) (Rs, Rr, Lm, Lx, no-load current) 2: Measure induction motor in static status (motor not spinning) 3: No function 4: Measure PM motor magnetic pole and PG origin in static status (motor not spinning) 5: Measure PM motor parameter in dynamic status (motor spinning) 6: Measure IM motor flux curve in dynamic status 12: FOC Sensorless inertia estimation	0
05-01	Full-load Current of Induction Motor 1(A)	10~120% of drive's rated current	#.##
05-02	Rated Power of Induction Motor 1(kW)	0~655.35kW	#.##
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 1	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	0~65535mΩ	0
05-07	Rotor Resistance (Rr) of Induction Motor 1	0~65535mΩ	0
05-08	Magnetizing Inductance (Lm) of Induction Motor 1	0~65535mH	0
05-09	Stator Inductance (Lx) of Induction Motor 1	0~65535mH	0
05-10 ~ 05-12	Reserved		
05-13	Full-load Current of Induction Motor 2 (A)	10~120%	#.##
05-14	Rated Power of Induction Motor 2 (kW)	0~655.35kW	#.##
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	0~65535mΩ	0
05-19	Rotor Resistance (Rr) of Induction Motor 2	0~65535mΩ	0
05-20	Magnetizing Inductance (Lm) of Induction Motor 2	0~65535mH	0
05-21	Stator Inductance (Lx) of Induction Motor 2	0~65535mH	0
05-22	Induction Motor 1/ 2 Selection	1: motor 1 2: motor 2	1
05-23	Frequency for Y-connection/△-connection Switch of Induction Motor	0.00~600.00Hz	60.00

	Parameter	Explanation	Settings	Factory Setting
〆	05-24	Y-connection/△-connection Switch of Induction Motor	0: Disable 1: Enable	0
〆	05-25	Delay Time for Y-connection/△-connection Switch of Induction Motor	0.000~60.000 sec.	0.200
	05-26 ~ 05-30	Reserved		
	05-31	Accumulative Motor Operation Time (Min)	00~1439	0
	05-32	Accumulative Motor Operation Time (day)	00~65535	0
	05-33	Induction Motor and Permanent Magnet Motor Selection	0: Induction Motor 1: Permanent Magnet Motor	0
	05-34	Full-load current of Permanent Magnet Motor	0.00~655.35Amps	0.00
	05-35	Rated Power of Permanent Magnet Motor	0.00~655.35kW	0.00
	05-36	Rated speed of Permanent Magnet Motor	0~65535rpm	2000
	05-37	Pole number of Permanent Magnet Motor	0~65535	10
	05-38	Inertia of Permanent Magnet Motor	0.0~6553.5 kg.cm^2	0.0
	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	Offset angle of PM Motor pole	0.0~360.0°	0.0
	05-43	Ke parameter of PM Motor	0~65535 (Unit: V/1000rpm)	0

06 Protection Parameters

	Parameter	Explanation	Settings	Factory Setting
✔	06-00	Low Voltage Level	230V: 150.0~220.0Vdc For Frame E and the frames above E: 190.0~220.0V 460V: 300.0~440.0Vdc For frame E and the frames above E: 380.0~440.0V	200.0 400.0
✔	06-01	Over-voltage Stall Prevention	0: No function 230V: 0.0~450.0Vdc 460V: 0.0~900.0Vdc	380.0 760.0
✔	06-02	Reserved		
✔	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
✔	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)	0: No function 1: Over-torque detection during constant speed operation, continue to operate after detection 2: Over-torque detection during constant speed operation, stop operation after detection 3: Over-torque detection during operation, continue to operate after detection 4: Over-torque detection during operation, stop operation after detection	0
✔	06-07	Over-torque Detection Level (OT1)	10~250% (100%: drive's rated current)	120
✔	06-08	Over-torque Detection Time (OT1)	0.0~60.0 sec.	0.1
✔	06-09	Over-torque Detection Selection (OT2)	0: No function 1: Over-torque detection during constant speed operation, continue to operate after detection 2: Over-torque detection during constant speed operation, stop operation after detection 3: Over-torque detection during operation, continue to operation after detection 4: Over-torque detection during operation, stop operation after detection	0
✔	06-10	Over-torque Detection Level (OT2)	10~250% (100%: drive's rated current)	120
✔	06-11	Over-torque Detection Time (OT2)	0.0~60.0 sec.	0.1
✔	06-12	Current Limit	0~250% (100%: drive's rated current）	170
✔	06-13	Electronic Thermal Relay Selection (Motor 1)	0: Inverter motor 1: Standard motor 2: Disable	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℃	85.0
✔	06-16	Stall Prevention Limit	0～100% (Pr.06-03, Pr.06-04)	50

Parameter	Explanation	Settings	Factory Setting
	Level		
06-17	Present Fault Record	0: No fault record	0
06-18	Second Most Recent Fault Record	1: Over-current during acceleration (ocA)	0
06-19	Third Most Recent Fault Record	2: Over-current during deceleration (ocd)	0
06-20	Fourth Most Recent Fault Record	3: Over-current during constant speed(ocn)	0
06-21	Fifth Most Recent Fault Record	4: Ground fault (GFF)	0
06-22	Sixth Most Recent Fault Record	5: IGBT short-circuit (occ)	0
		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: 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 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: Ground current 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)	

	Parameter	Explanation	Settings	Factory Setting
			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)	
			66-72: Reserved	
			73: External safety gate S1	
			74~78: Reserved	
			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)	
			85~100: 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 (CIdE)	
			106: CANopen slave station number setting error (CAdE)	
			107: CANopen index setting exceed limit (CFrE)	
			111: Reserved	
✗	06-23	Fault Output Option 1	0~65535(refer to bit table for fault code)	0
✗	06-24	Fault Output Option 2	0~65535(refer to bit table for fault code)	0
✗	06-25	Fault Output Option 3	0~65535(refer to bit table for fault code)	0
✗	06-26	Fault Output Option 4	0~65535(refer to bit table for fault code)	0
✗	06-27	Electronic Thermal Relay Selection 2 (Motor 2)	0: Inverter motor 1: Standard motor 2: Disable	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 3: No warning	0
✗	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	0.00~655.35 Amp	Read

Parameter	Explanation	Settings	Factory Setting
	Malfunction		only
06-36	IGBT Temperature at Malfunction	0.0~6553.5 ℃	Read only
06-37	Capacitance Temperature at Malfunction	0.0~6553.5 ℃	Read only
06-38	Motor Speed in rpm at Malfunction	0~65535	Read only
06-39	Torque Command at Malfunction	0~65535	Read only
06-40	Status of Multi-function Input Terminal at Malfunction	0000h~FFFFh	Read only
06-41	Status of Multi-function Output Terminal at Malfunction	0000h~FFFFh	Read only
06-42	Drive Status at Malfunction	0000h~FFFFh	Read only
06-43	Reserved		
06-44	Reserved		
06-45	Treatment for 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
06-46	Deceleration Time of Output Phase Loss	0.000~65.535 sec	0.500
06-47	Current Bandwidth	0.00~655.35%	1.00
06-48	DC Brake Time of Output Phase Loss	0.000~65.535sec	0.000
06-49	Reserved		
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 model: 0.0~160.0 Vdc 460V model: 0.0~320.0 Vdc	30.0 /60.0
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	0: constant rated current and limit carrier wave by load current and 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	0
06-56	PT100 Detection Level 1	0.000~10.000V	5.000
06-57	PT100 Detection Level 2	0.000~10.000V	7.000
06-58	PT100 Level 1 Frequency Protect	0.00~600.00Hz	0.00
06-59	Reserved		
06-60	Software Detection GFF Current Level	0.0~6553.5 %	60.0
06-61	Software Detection GFF Filter Time	0.0~6553.5 %	0.10
06-62	Disable Level of dEb	230V series: 0.0~220.0 Vdc 460V series: 0.0~440.0 Vdc	180.0 /360.0

Parameter	Explanation	Settings	Factory Setting
06-63	Fault Record 1 (Min)	0~64799 min	Read only
06-64	Fault Record 2 (Min)	0~64799 min	Read only
06-65	Fault Record 3 (Min)	0~64799 min	Read only
06-66	Fault Record 4 (Min)	0~64799 min	Read only
06-67	Fault Record 5 (Min)	0~64799 min	Read only
06-68	Fault Record 6 (Min)	0~64799 min	Read only
06-69	Days of operation	Read only	Read only
06-70	Minutes of operation	Read only	Read only
06-71	Low Current Setting Level	0.0 ~ 6553.5 %	0.0
06-72	Low Current Detection Time	0.00 ~ 655.35sec	0.00
06-73	Treatment for low current	0 : No function 1 : Warn and coast to stop 2 : Warn and ramp to stop by 2nd deceleration time 3 : Warn and operation continue	0

07 Special Parameters

Parameter	Explanation	Settings	Factory Setting
07-00	Software Brake Level	230V: 350.0~450.0Vdc 460V: 700.0~900.0Vdc	380.0 760.0
07-01	DC Brake Current Level	0~100%	0
07-02	DC Brake Time at Start-up	0.0~60.0 sec.	0.0
07-03	DC Brake Time at Stop	0.0~60.0 sec.	0.0
07-04	Startup Frequency for DC Brake	0.00~600.00Hz	0.00
07-05	Reserved		
07-06	Restart after Momentary Power Loss	0: Stop operation 1: Speed search for last frequency command 2: Speed search for minimum output frequency	0
07-07	Maximum Power Loss Duration	0.1~20.0 sec.	2.0
07-08	Base Block Time	0.1~5.0 sec.	0.5
07-09	Current Limit for Speed Search	20~200%	50
07-10	Treatment to Reboots After Fault	0: Stop operation 1: Speed search starts with current speed 2: Speed search starts with minimum output frequency	0
07-11	# of Automatic Reboots After Fault	0~10	0
07-12	Speed Search during Start-up	0: Disable 1: Speed search for maximum output frequency 2: Speed search for start-up motor frequency 3: Speed search for minimum output frequency	0
07-13	Decel. Time to Momentary Power Loss	0: Disable 1: 1st decel. time 2: 2nd decel. time 3: 3rd decel. time 4: 4th decel. time 5: current decel. time 6: Auto decel. time	0
07-14	DEB Return Time	0.0~25.0sec	0.0
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
07-18	Dwell Frequency at Decel.	0.00 ~ 600.00Hz	0.00
07-19	Fan Cooling Control	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 heat sink temperature (around 60^{o}C) is attained. 4: Fan always OFF	0

	Parameter	Explanation	Settings	Factory Setting
✎	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
✎	07-21	Auto Energy-saving Operation	0: Disable 1: Enable	0
✎	07-22	Energy-saving Gain	10～1000%	100
✎	07-23	Auto Voltage Regulation(AVR) Function	0: Enable AVR 1: Disable AVR 2: Disable AVR during deceleration	0
✎	07-24	Filter Time of Torque Command (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	0
✎	07-27	Slip Compensation Gain (V/F and SVC control mode)	0.00~10.00	0.00
✎	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	Recovery Time to Pr.07-11 (# of automatic reboots after fault)	0.0~6000.0 sec	60.0

08 High-function PID Parameters

	Parameter	Explanation	Settings	Factory Setting
✓	08-00	Input Terminal for PID Feedback	0: No function 1: Negative PID feedback: input from external terminal AVI (Pr.03-00) 2: Negative PID feedback from PG card (Pr.10-15, skip direction) 3: Negative PID feedback from PG card (Pr.10-15) 4: Positive PID feedback from external terminal AVI (Pr.03-00) 5: Positive PID feedback from PG card (Pr.10-15, skip direction) 6: Positive PID feedback from PG card (Pr.10-15)	0
✓	08-01	Proportional Gain (P)	0.0~500.0%	80.0
✓	08-02	Integral Time (I)	0.00~100.00sec	1.00
✓	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	Reserved		
✓	08-07	PID Delay Time	0.0~ 35sec	0.0
✓	08-08	Feedback Signal Detection Time	0.0~3600.0sec	0.0
✓	08-09	Feedback 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
✓	08-12	Sleep Time	0.0 ~ 6000.0sec	0.0
✓	08-13	PID Deviation Level	1.0 ~ 50.0%	10.0
✓	08-14	PID Deviation Time	0.1~300.0sec	5.0
✓	08-15	Filter Time for PID Feedback	0.1~300.0sec	5.0
✓	08-16	PID Compensation Selection	0: Parameter setting 1: Analog input	0
✓	08-17	PID Compensation	-100.0~+100.0%	0
	08-18	Reserved		
	08-19	Reserved		
	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

09 Communication Parameters

Parameter	Explanation	Settings	Factory Setting
09-00	COM1 Communication Address	1~254	1
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
09-04	COM1 Communication Protocol	0: 7N1 (ASCII) 1: 7N2 (ASCII) 2: 7E1 (ASCII) 3: 7O1 (ASCII) 4: 7E2 (ASCII) 5: 7O2 (ASCII) 6: 8N1 (ASCII) 7: 8N2 (ASCII) 8: 8E1 (ASCII) 9: 8O1 (ASCII) 10: 8E2 (ASCII) 11: 8O2 (ASCII) 12: 8N1 (RTU) 13: 8N2 (RTU) 14: 8E1 (RTU) 15: 8O1 (RTU) 16: 8E2 (RTU) 17: 8O2 (RTU)	1
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
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
09-23	Block Transfer 13	0~65535	0
09-24	Block Transfer 14	0~65535	0
09-25	Block Transfer 15	0~65535	0

Parameter	Explanation	Settings	Factory Setting
✓ 09-26	Block Transfer 16	0~65535	0
09-27 ~ 09-29	Reserved		
09-30	Communication Decoding Method	0: by 20XX 1: by 60XX	1
09-31 ~ 09-34	Reserved		
09-35	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	0
09-40	CANopen Decoding Method	0: Communication definition of C2000 series 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	0
09-42	CANopen Control Status	0: Not ready for use state 1: Inhibit start state 2: Ready to switch on state 3: Switched on state 4: Enable operation state 7: Quick Stop Active state 13: Err Reaction Activation state 14: Error state	0
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	0
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	##

Parameter	Explanation	Settings	Factory Setting
		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: 100Kbps 1: 125Kbps 2: 250Kbps 3: 1Mbps (Delta Only) Non standard DeviceNet: (Delta Only) 0: 10Kbps 1: 20Kbps 2: 50Kbps 3: 100Kbps 4: 125Kbps 5: 250Kbps 6: 500Kbps 7: 800Kbps 8: 1Mbps	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
09-78	IP Address 3 of the Communication Card	0~255	0
09-79	IP Address 4 of the Communication Card	0~255	0
09-80	Address Mask 1 of the Communication Card	0~255	0
09-81	Address Mask 2 of the Communication Card	0~255	0
09-82	Address Mask 3 of the Communication Card	0~255	0
09-83	Address Mask 4 of the Communication Card	0~255	0
09-84	Getway Address 1 of the Communication Card	0~255	0
09-85	Getway Address 2 of the Communication Card	0~255	0

Parameter	Explanation	Settings	Factory Setting
09-86	Getway Address 3 of the Communication Card	0~255	0
09-87	Getway Address 4 of the Communication Card	0~255	0
09-88	Password for Communication Card (Low word)	0~255	0
09-89	Password for Communication Card (High word)	0~255	0
09-90	Reset Communication Card	0: No function 1: Reset, return to factory setting	0
09-91	Additional Setting for Communication Card	Bit0: Enable IP filter Bit1: Enable to write internet parameters (1bit). Bit 1: Enable to write internet parameters (1bit). This bit will change to disable when it finishes saving the internet parameter updates. Bit 2: Enable login password (1bit). This bit will be changed to disable when it finishes saving the internet parameter updates.	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

NOTE IM: Induction Motor; PM: Permanent Magnet Motor

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

Parameter	Explanation	Settings	Factory Setting
10-17	Electrical Gear A	1~5000	100
10-18	Electrical Gear B	1~5000	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	0.0~2.0%fN	10.0
10-27	FOC Low-pass Filter Time Constant	1~1000ms	50
10-28	FOC Excitation Current Rise Time	33~100%Tr	100

11 Advanced Parameters

NOTE IM: Induction Motor; PM: Permanent Magnet Motor

Parameter	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	0
11-01	Per Unit of System Inertia	1~65535（256=1PU）	400
11-02	ASR1/ASR2 Switch Frequency	0.00~600.00Hz (0: Disable)	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	0~100%	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
11-17	Forward Motor Torque Limit	0~500%	200
11-18	Forward Regenerative Torque Limit	0~500%	200
11-19	Reverse Motor Torque Limit	0~500%	200
11-20	Reverse Regenerative Torque Limit	0~500%	200
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)	0

Parameter	Explanation	Settings	Factory Setting
		2: RS485 communication (Pr.11-29) 3: Control by external terminal (Pr.11-30~11-32)	
11-29	Torque Offset Setting	0~100%	0.0
11-30	High Torque Offset	0~100%	30.0
11-31	Middle Torque Offset	0~100%	20.0
11-32	Low Torque Offset	0~100%	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	0: Pr.11-37~11-38 1: By frequency command (Pr.00-20)	0
11-37	Forward Speed Limit (torque mode)	0~120%	10
11-38	Reverse Speed Limit (torque mode)	0~120%	10
11-39	Reserved		
11-40	Command Source of Point-to-Point Position Control	0: External terminal 1: Reserved 2: Reserved 3: CAN 4: PLC 5: Communication card	0
11-41	Reserved		
11-42	Reserved		
11-43	Max. Frequency of Point-to-Point Position Control	0.00~327.67Hz	0.00
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

✓ The parameter can be set during operation.

00-00 Identity Code of the AC Motor Drive

Factory Setting: #.#

Settings Read Only

00-01 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.00-01.
- 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				B			C		
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	D		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						B			C		
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	10	15	20	25	30	40
Pr.00-00	5	7	9	11	93	13	15	17	19	21	23	25
Rated Current for Heavy Duty (A)	2.9	3.8	5.7	8.1	9.5	11	17	23	30	36	43	57
Rated Current for Normal Duty (A)	3.0	4.0	6.0	9.0	10.5	12	18	24	32	38	45	60

Frame	D				E		F		G		H		
kW	37	45	55	75	90	110	132	160	185	220	280	315	355
HP	50	60	75	100	125	150	175	215	250	300	375	425	475
Pr.00-00	27	29	31	33	35	37	39	41	43	45	47	49	51
Rated Current for Heavy Duty (A)	69	86	105	143	171	209	247	295	352	437	523	585	649
Rated Current for Normal Duty (A)	73	91	110	150	180	220	260	310	370	460	550	616	683

00-02 Parameter Reset

Factory Setting: 0

Settings
- 0: No Function
- 1: Write protection for parameters
- 6: Reset PLC (including CANopen Master Index)
- 7: Reset CANopen Index (Slave)
- 8: keypad lock
- 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 the password is set in Pr.00-08, it needs to input the password set in Pr.00-07 to reset to factory settings.

📖 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.

00-03 Start-up Display Selection

Factory setting: 0

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.

00-04 Content of Multi-function Display

Factory setting: 3

Settings
- 0: Display output current (A)
- 1: Display counter value (c)
- 2: Display actual output frequency (H.)
- 3: Display DC-BUS voltage (v)
- 4: Display output voltage (E)
- 5: Display output power angle (n)
- 6: Display output power in kW (P)
- 7: Display actual motor speed rpm (r = 00: positive speed; -00 negative speed)
- 8: Display estimate output torque % (t = 00: positive torque; -00 negative torque) (t)
- 9: Display PG feedback (G) (refer to Note 1)
- 10: Display PID feedback in % (b)

11: Display AVI in % (1.), 0~10V/4-20mA/0-20mA corresponds to 0~100% (Refer to Note 2)

12: Display ACI in % (2.), 4~20mA/0~10V/0-20mA corresponds to 0~100%（Refer to Note 2）

13: Display AUI in % (3.), -10V~10V corresponds to -100~100%(Refer to Note 2)

14: Display the temperature of IGBT in oC (i.)

15: Display the temperature of capacitance in oC (c.)

16: The status of digital input (ON/OFF) refer to Pr.02-20 (i) (Refer to Note3)

17: Display digital output status ON/OFF (Pr.02-15) (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 NOTE 4)

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%) (h.)

26: GFF Ground Fault (Unit :%)(G.)

27:DC Bus voltage ripple (Unit: Vdc)(r.)

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.)

NOTE

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. 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	Reserved				Reserved				Reserved				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 x60/2π)/motor rated speed

00-05 Coefficient Gain in Actual Output Frequency

Factory Setting: 0

Settings 0~160.00

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).

00-06 Software Version

Factory Setting: #.#

Settings Read only

00-07 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 misoperation.

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.

00-08 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

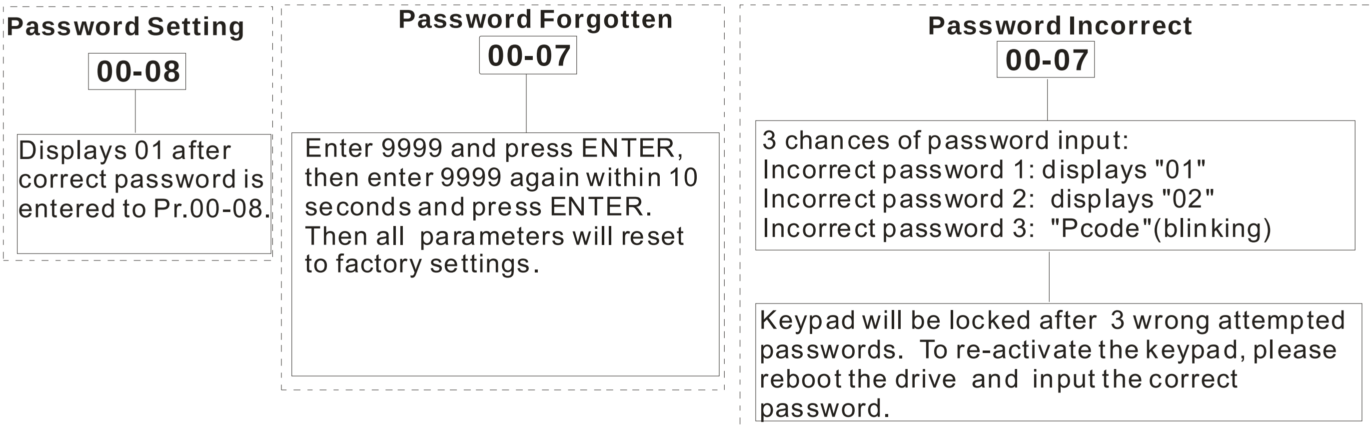
To set a password to protect your parameter settings.
If the display shows 0, no password is set nor password has been correctly entered in Pr.00-07. All parameters can then be changed, including Pr.00-08.

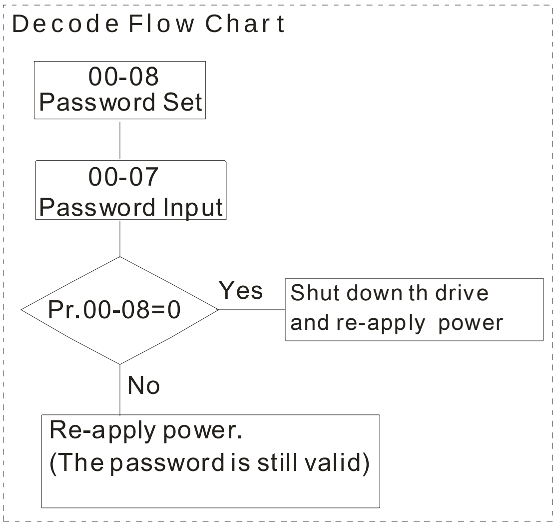
The first time you can set a password directly. After successful setting of password the display will show 1.
Be sure to write down the password for later use.
To cancel the parameter lock, set the parameter to 0 after inputting correct password into Pr. 00-07.

📖 How to retrieve parameter protection after decoding by Pr.00-07:

Method 1: Re-enter the password to Pr.00-08 (input the password once).
Method 2: After reboots, password function will be recovered.
Method 3: Input any value into Pr.00-07 (Do not enter the password).
.

Password Decode Flow Chart





00-09	Reserved

00-10	Control Mode

Factory Setting: 0

Settings 0: Speed mode
1: Point-to-Point position control
2: Torque mode
3: Home mode

📖 This parameter determines the control mode of C2000 series AC motor drive.

00-11 Control of Speed Mode

Factory Setting: 0

Settings
0: VF (IM V/f control)
1: VFPG (IM V/f control+ Encoder)
2: SVC(IM Sensorless vector control)
3: FOCPG (IM FOC vector control+ encoder)
4: FOCPG（PM FOC vector control + Encoder）
5: FOC Sensorless (IM field oriented sensorless vector control)

- 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.

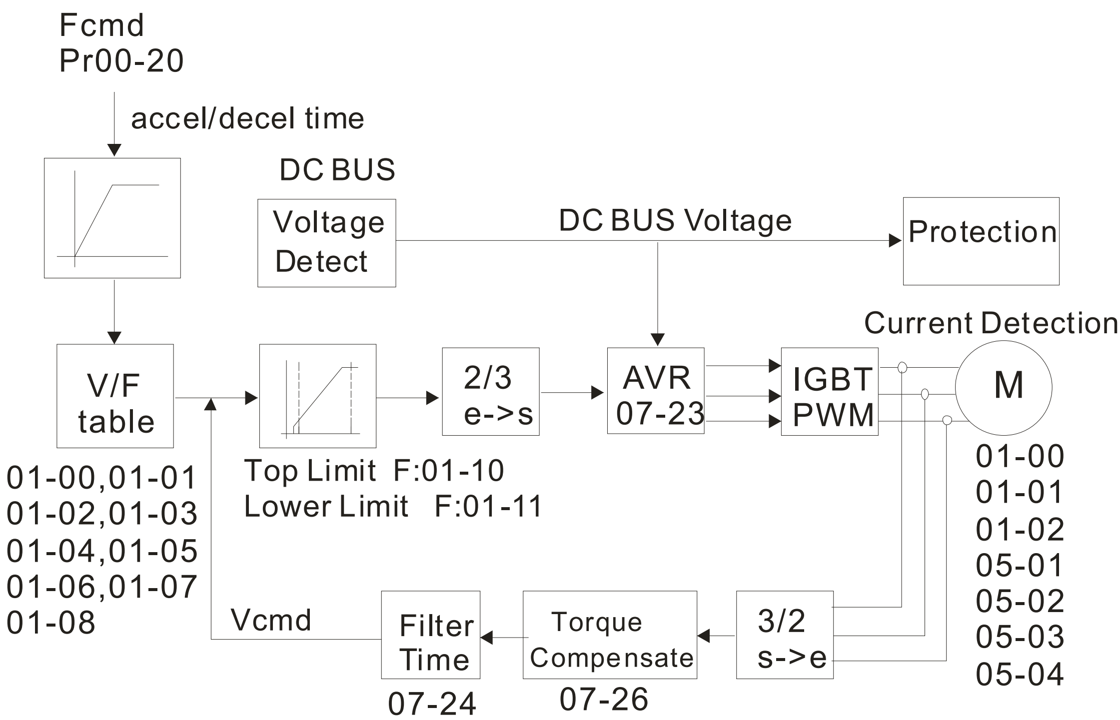
  2: (IM Sensorless vector control): get the optimal control by the auto-tuning of motor parameters.

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

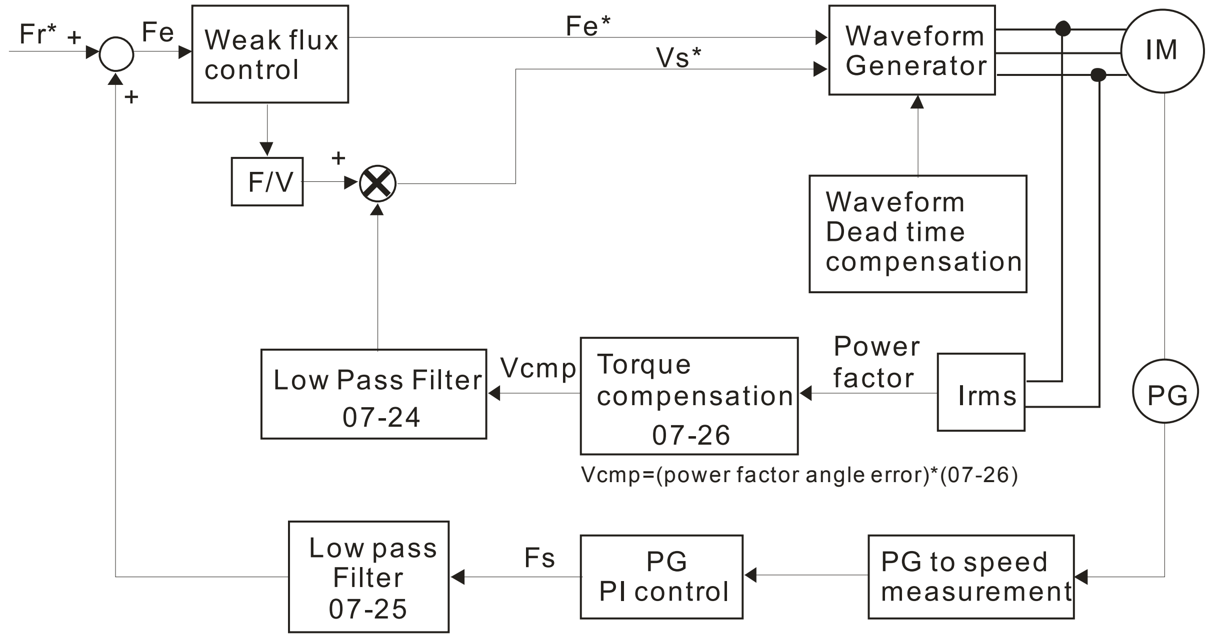
  4: (PM FOC vector control + Encoder): besides torque increases, the speed control will be more accurate (1:1000).

  5: FOC Sensorless: IM field oriented sensorless vector control

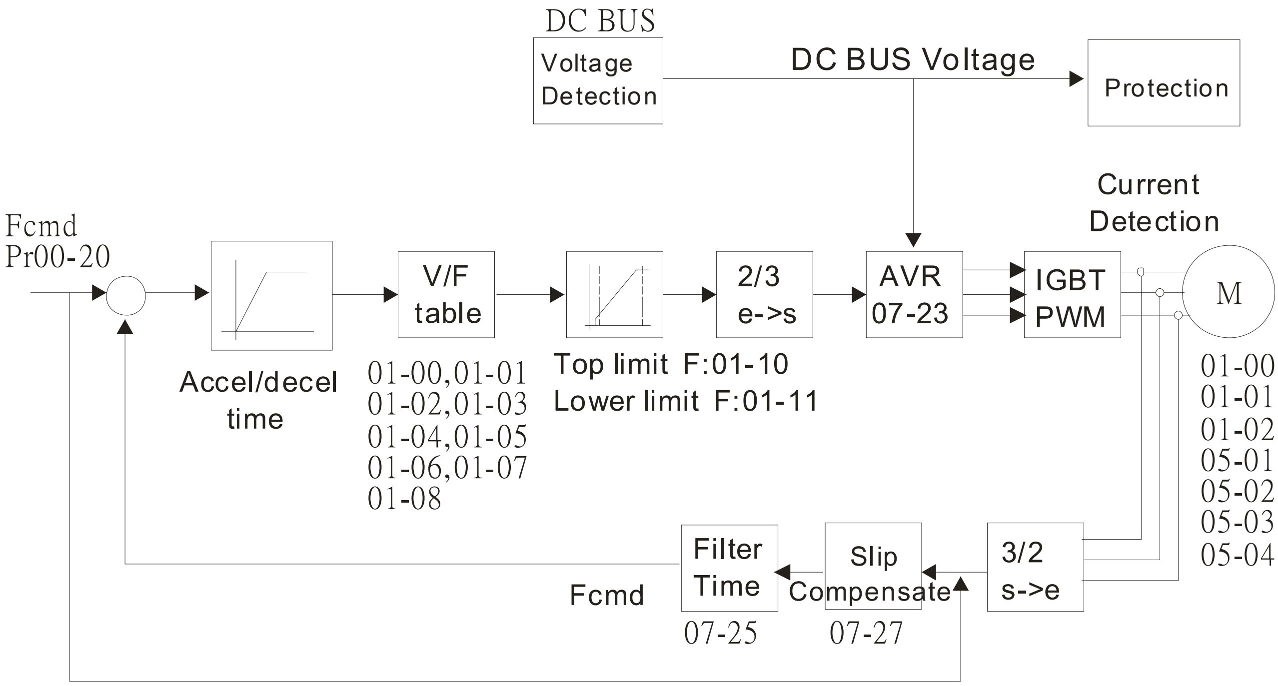
- When setting Pr.00-11 to 0, the V/F control diagram is shown as follows.



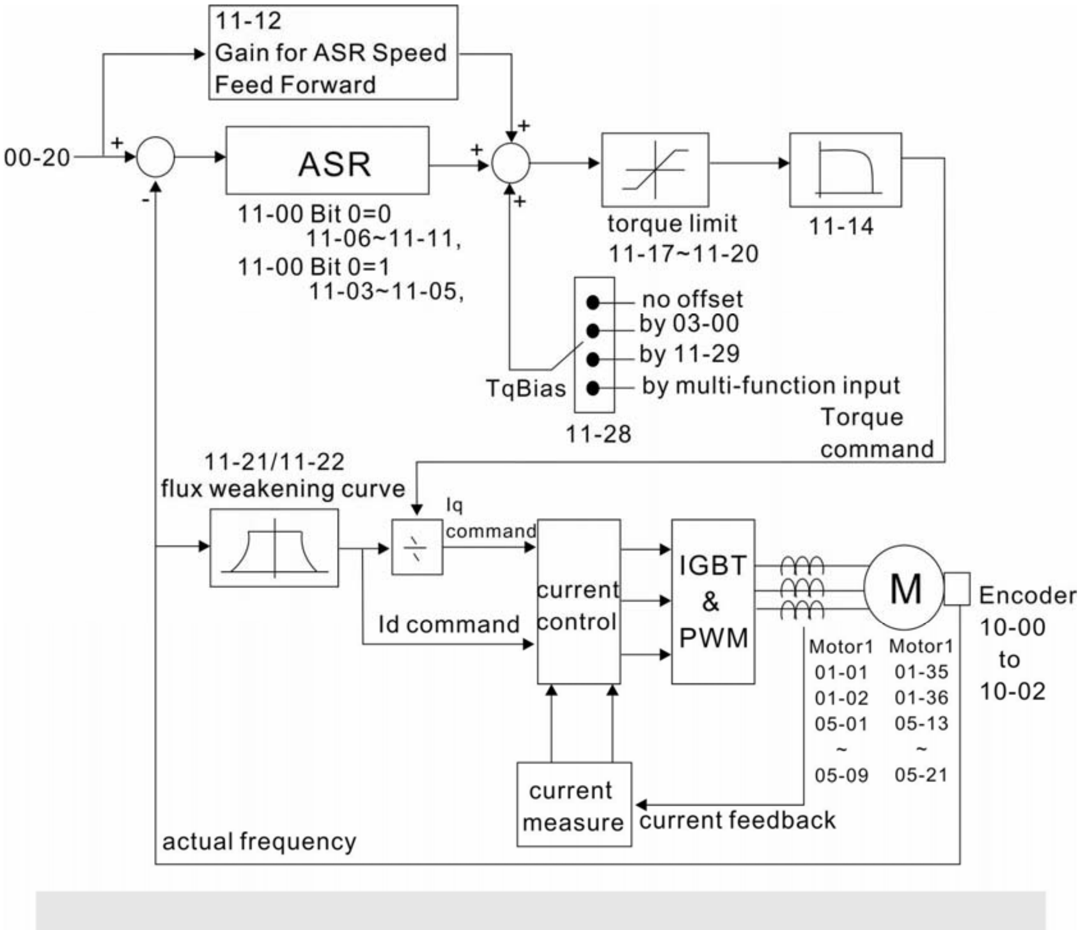
📖 When setting Pr.00-11 to 1, the V/F control + encoder diagram is shown as follows.



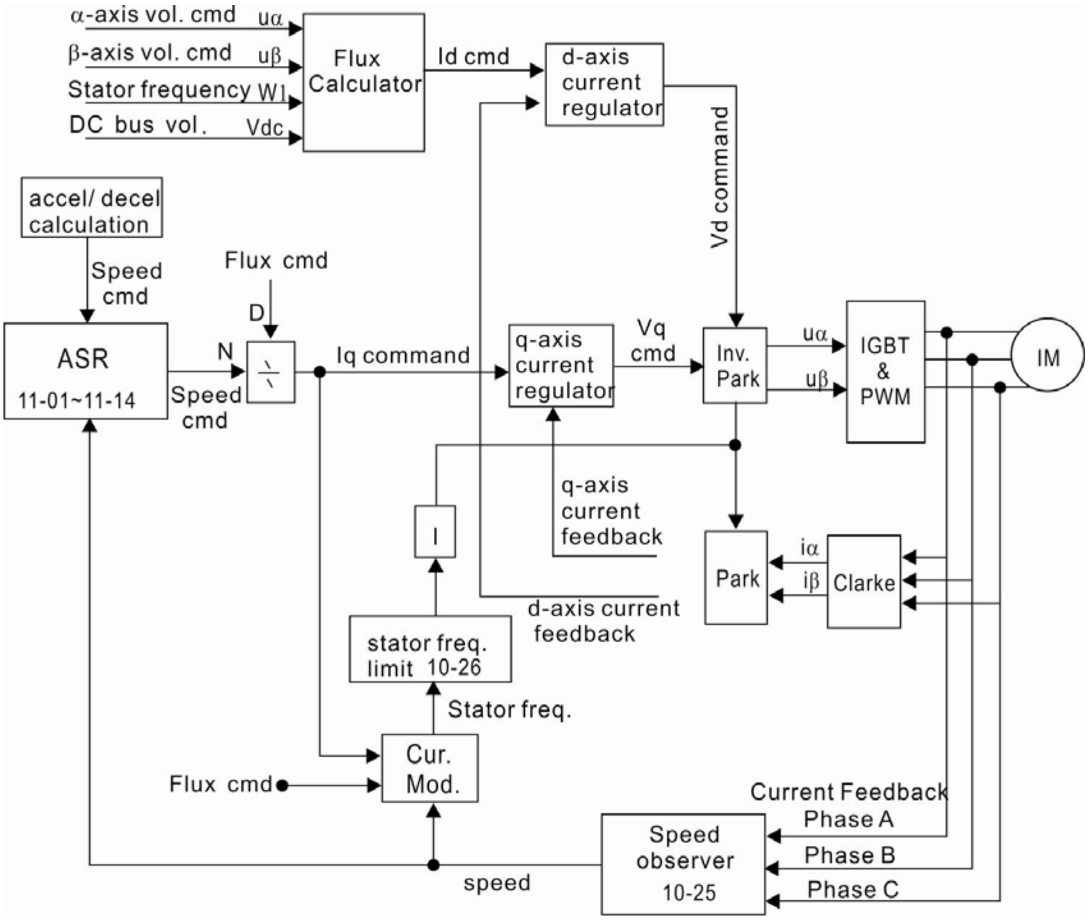
📖 When setting Pr.00-11 to 2, the sensorless vector control diagram is shown as follows.



📖 When setting Pr.00-11 to 3, the FOCPG control diagram is shown as follows.



📖 When setting Pr.00-11 to 5, FOC sensorless control diagram is shown as follows.



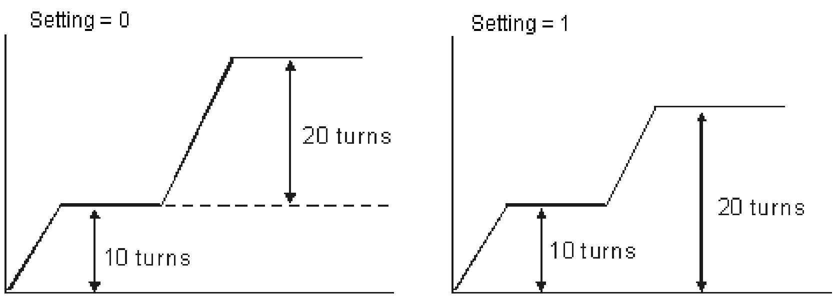
00-12 Point to Point Position control

Factory Settings: 0

Settings: 0: Incremental Type

1: Absolute Type

Pr. 00-12 = 0 is incremental type P2P; Pr.00-12 = 1 is absolute type P2P



00-13 Control of Torque Mode

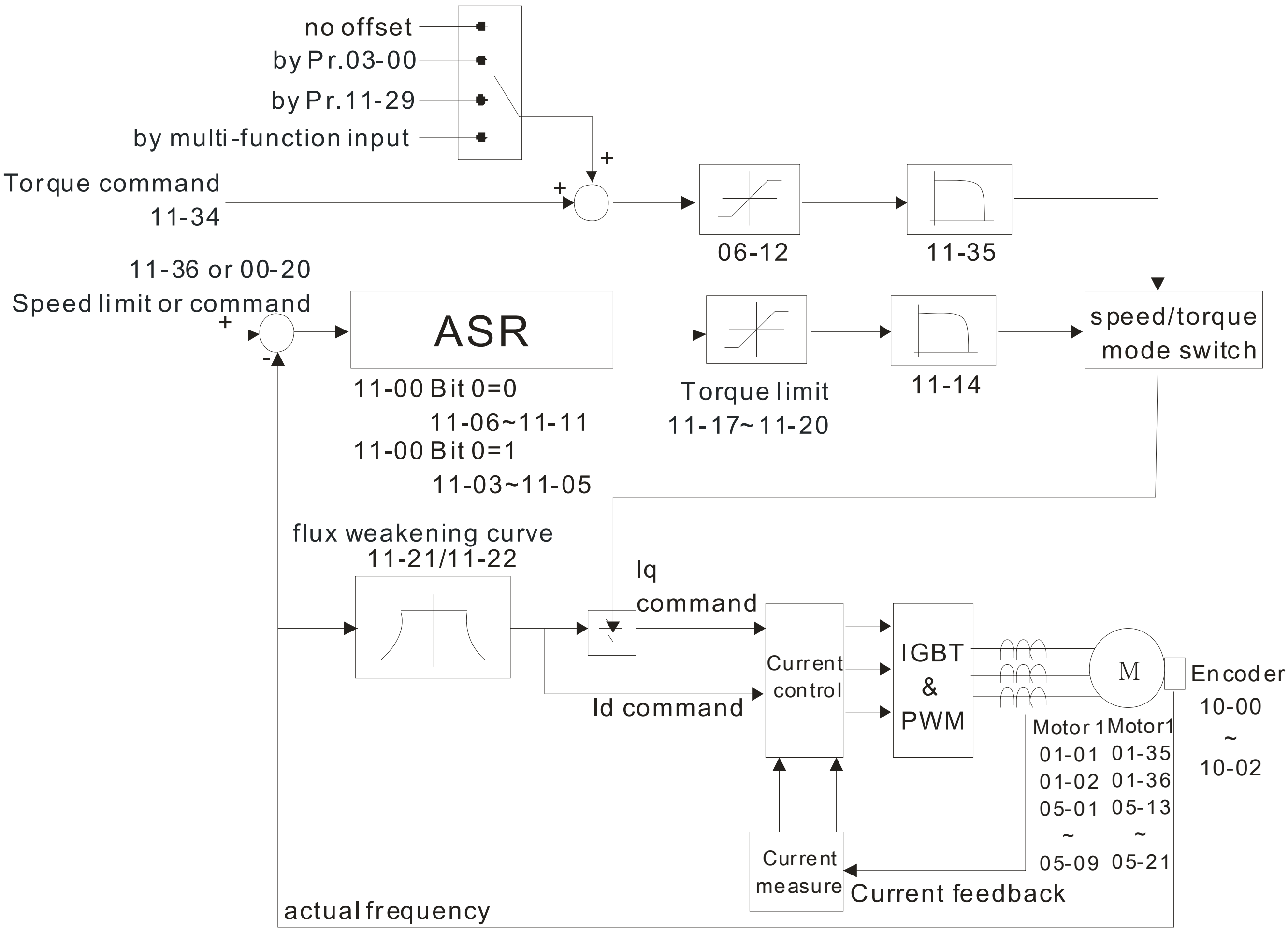
Factory Setting: 0

Settings 0: 0: TQCPG（IM Torque control + Encoder）

1: TQCPG (PM Torque control + Encoder)

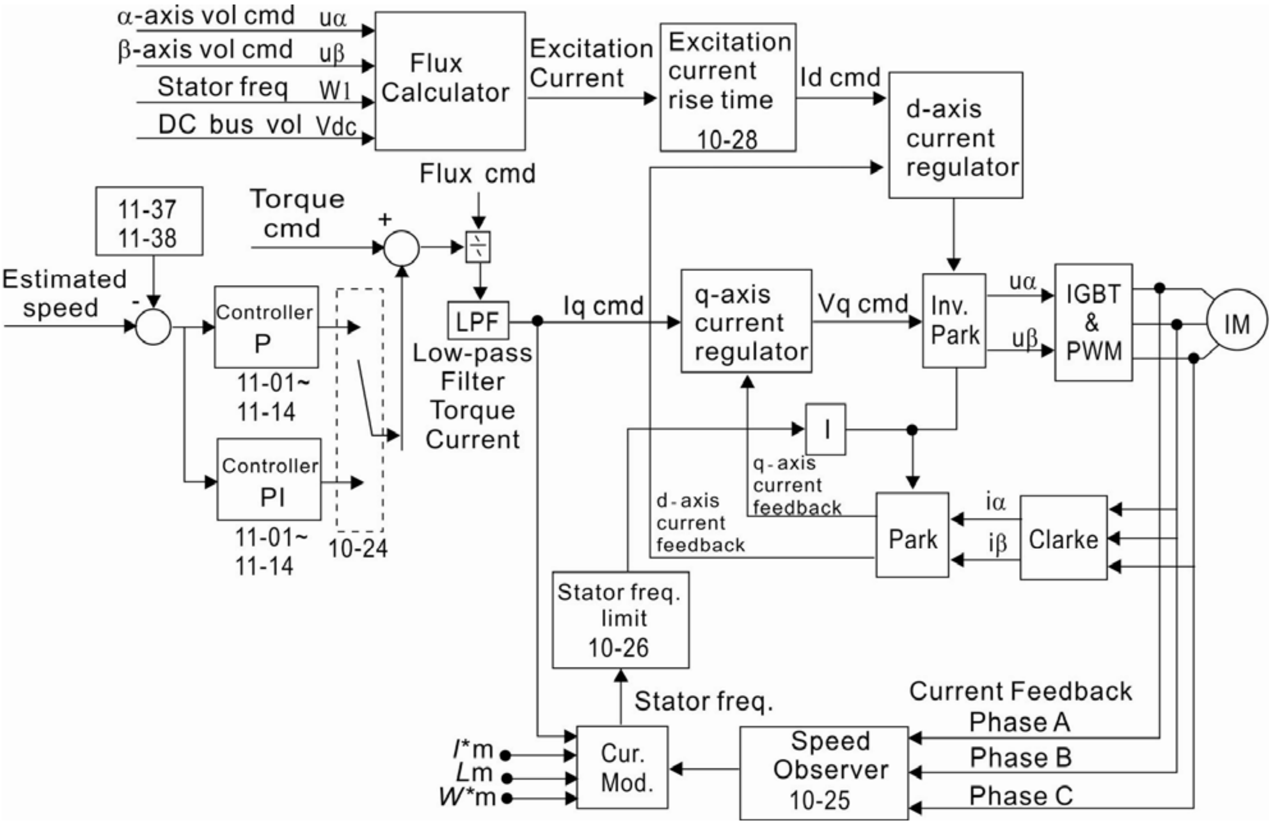
2: TQC Sensorless (IM Sensorless torque control)

TQCPG control diagram is shown in the following:



Control Diagram for the Torque + Encoder

📖 TQC Sensorless control diagram is shown in the following:



00-14 Reserved

00-15 Reserved

00-16 Load Selection

Factory Setting: 0

Settings 0: Normal load

1: Heavy load

📖 Normal duty: over load, rated output current 160% in 3 second. Please refer to Pr.00-17 for the setting of carrier wave. Refer to chapter specifications or Pr.00-01 for the rated current.

📖 Heavy duty: over load, rated output current 180% in 3 second. Please refer to Pr.00-17 for the setting of carrier wave. Refer to chapter specifications or Pr.00-01 for the rated current.

00-17 Carrier Frequency

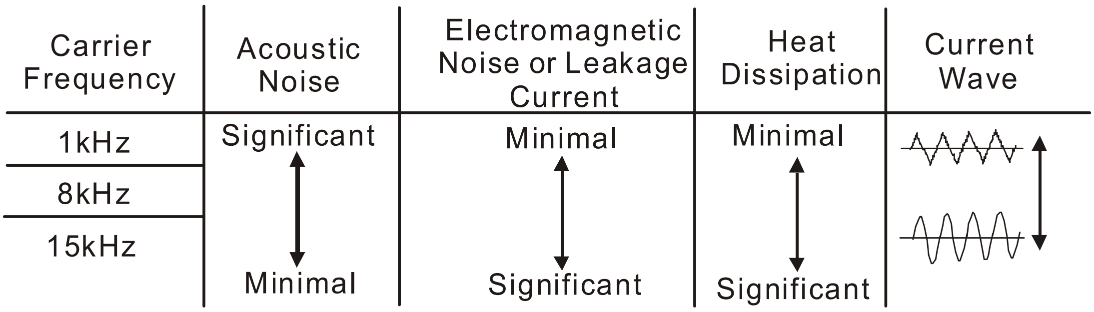
Factory setting: Table below

Settings 2～15kHz

📖 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 Setting	8kHz	6kHz	4kHz
Heavy Duty Factory Setting	2kHz		

460V Series			
Models	1-20HP [0.75-15kW]	25-75HP [18.5-55kW]	100-475HP [75-355kW]
Setting Range	02~15kHz	02~10kHz	02~09kHz
Normal Duty Factory Setting	8kHz	6kHz	4kHz
Heavy Duty Factory Setting	2kHz		



- 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.

00-18 Reserved

00-19 PLC Command Mask

Factory Setting: Read Only

Settings
- Bit 0: Control command controls by PLC
- Bit 1: Frequency command controls by PLC
- Bit 2: Reserved
- Bit 3: Torque command controls by PLC

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

00-20 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)

- 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 mutli-function input terminal. When the external terminal is OFF, the drive won't receive any operation signal and can't execute JOG.

00-21 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)

- 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.

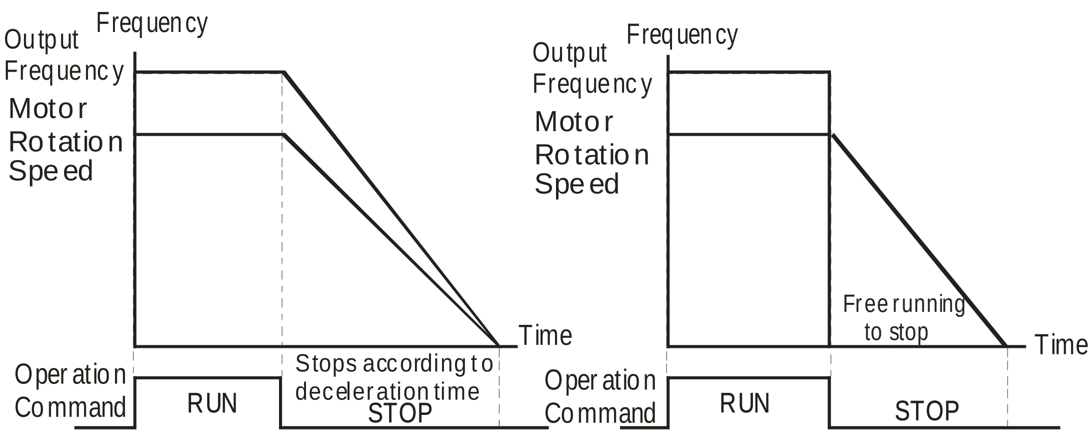
00-22 Stop Method

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.



Ramp to 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

📖 The stop method of the torque control is also set by Pr.00-22.

00-23 Control of Motor Direction

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.

00-24 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.

00-25 User Defined Characteristics

Factory Setting: 0

Settings Bit 0~3: user define on decimal place
0000b: no decimal place
0001b: one decimal place
0010b: two decimal place
0011b: three decimal place

Bit 4~15: user define on unit
000xh: Hz
001xh: rpm
002xh: %
003xh: kg

📖 Bit 0~3: F & H page unit and Pr.00-26 decimal display is supported up to 3 decimal places.

📖 Bit 4~15: F & H page unit and Pr.00-26 unit display is supported up to 4 types of unit display.

00-26 Max. User Defined Value

Factory Setting: 0

Settings 0: Disable
0~65535 (No decimal place in Pr.00-25 setting)
0.0~6553.5 (One decimal place in Pr.00-25 setting)
0.0~655.35(Two decimal place in Pr.00-25 setting)
0.0~65.536 (Three decimal place in Pr.00-25 setting)

📖 User define is enabled when Pr.00-26 is not 0. The setting of Pr.00-26 corresponds to Pr.01.00 (Max. output frequency of the drive).

Example: User define: 100.0%, Pr.01.00 = 60.00Hz

Pr.00.25 setting is 0021h; Pr.0026 setting is 100.0%

NOTE

In order to display as the setting in Pr.0025, please set up Pr.00.25 first and ensure Pr.00.26 is not set to 0.

00-27 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 Pr.00-20 is set to digital keypad control or RS-285 communication input control.

00-28 Reserved

00-29 Reserved

00-30 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.

00-31 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.

00-32 Digital Keypad STOP Function

Factory Setting: 0

Settings 0: STOP key disable

1: STOP key enable

00-33 ~ 00-47 Reserved

00-48 Display Filter Time (Current)

Factory Settings: 0.100

Settings: 0.001~65.535 sec

📖 Set this parameter to minimize the current fluctuation displayed by digital keypad.

00-49 Display Filter Time (Keypad)

Factory Settings: 0.100

Settings: 0.001~65.535 sec

📖 Set this parameter to minimize the display value fluctuation displayed by digital keypad.

00-50 Software Version (date)

Factory Settings: ####

Settings: Read only

📖 This parameter displays the drive's software version by date.

Group 1 Basic Parameters

✓ The parameter can be set during operation.

01-00 Maximum Output Frequency

Factory Setting: 60.00/50.00

Settings 50.00~600.00Hz

- 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.

01-01 1st Output Frequency Setting 1 (base frequency and motor rated frequency)

01-35 1st Output Frequency Setting 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.
- Pr.01-35 is used for the application occasion that uses double base motor.

01-02 1st Output Voltage Setting 1 (base frequency and motor rated frequency)

01-36 1st Output Voltage Setting 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.

01-03 Mid-point Frequency 1 of Motor 1

Factory Setting: 3.00

Settings 0.00~600.00Hz

✓ **01-04** Mid-point Voltage 1 of Motor 1

Factory Setting: 11.0/22.0

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

01-37 Mid-point Frequency 1 of Motor 2

Factory Setting: 3.00

Settings 0.00~600.00Hz

✓ **01-38** Mid-point Voltage 1 of Motor 2

Factory Setting: 11.0/22.0

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

01-05 Mid-point Frequency 2 of Motor 1

Factory Setting: 0.50

Settings 0.00~600.00Hz

✓ **01-06** Mid-point Voltage 2 of Motor 1

Factory Setting: 2.0/4.0

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

01-39 Mid-point Frequency 2 of Motor 2

Factory Setting: 0.50

Settings 0.00~600.00Hz

✓ **01-40** Mid-point Voltage 2 of Motor 2

Factory Setting: 2.0/4.0

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

01-07 Min. Output Frequency of Motor 1

Factory Setting: 0.00

Settings 0.00~600.00Hz

✓ **01-08** Min. Output Voltage of Motor 1

Factory Setting: 0.0/0.0

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

01-41 Min. Output Frequency of Motor 2

Factory Setting: 0.00

Settings 0.00~600.00Hz

✓ **01-42** Min. Output Voltage of Motor 2

Factory Setting: 0.0/0.0

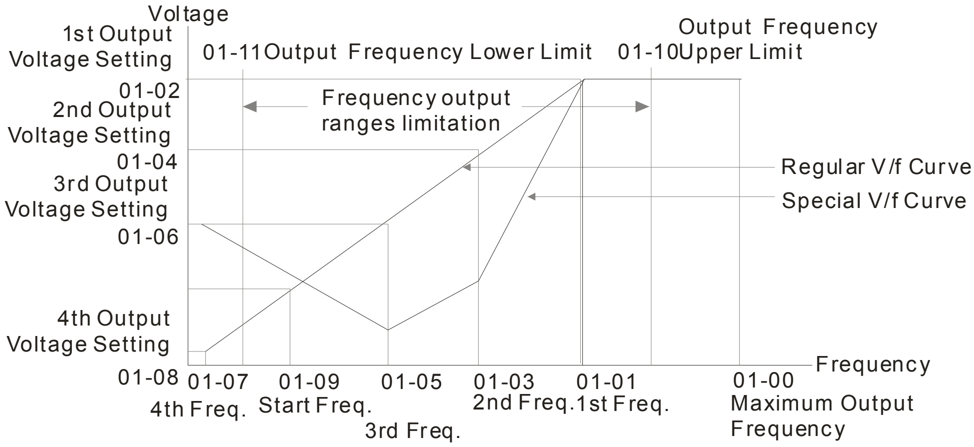
Settings 230V series: 0.0~240.0V
460V series: 0.0~480.0V

📖 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.

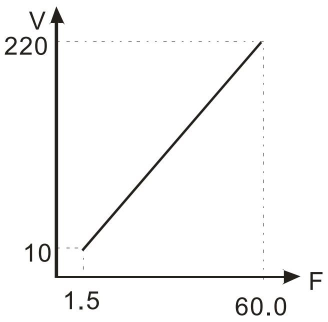


V/f Curve

Common settings of V/f curve:

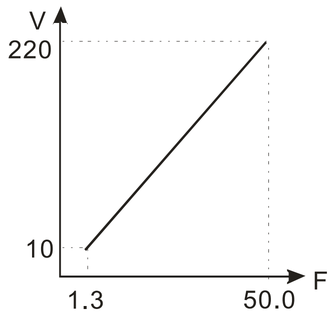
(1) General purpose

Motor spec. 60Hz



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

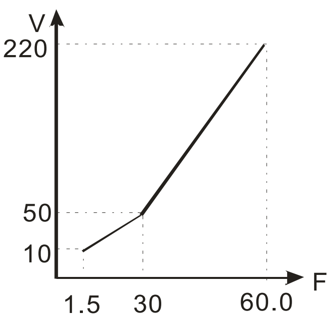
Motor spec. 50Hz



Pr.	Setting
01-00	50.0
01-01	50.0
01-02	220.0
01-03 01-05	1.30
01-04 01-06	12.0
01-07	1.30
01-08	12.0

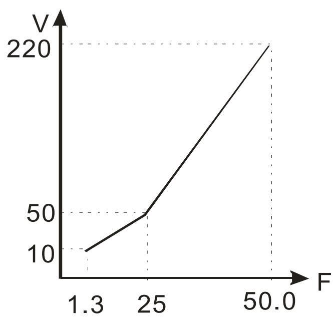
(2) Fan and hydraulic machinery

Motor spec. 60Hz



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

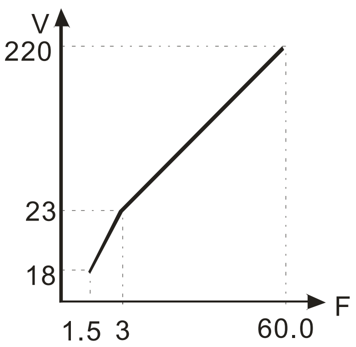
Motor spec. 50Hz



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

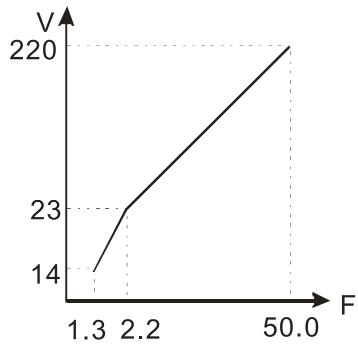
(3) High starting torque

Motor spec. 60Hz



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

Motor spec. 50Hz



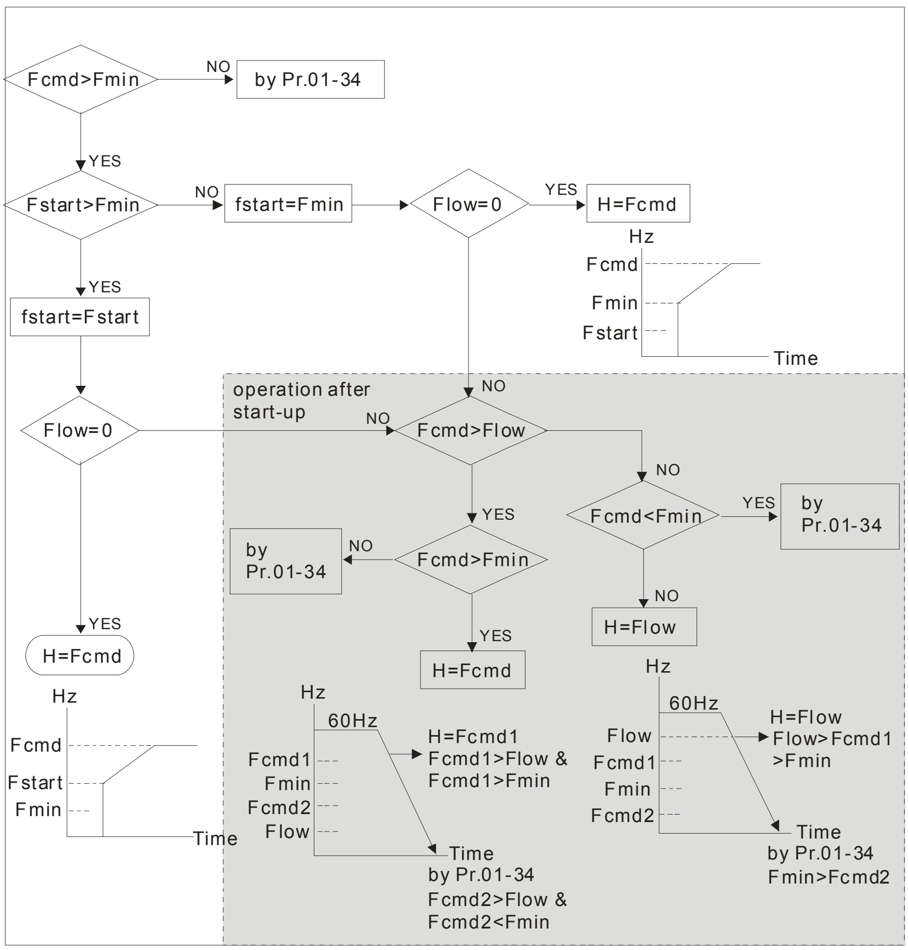
Pr.	Setting
01-00	50.0
01-01	50.0
01-02	220.0
01-03 01-05	2.20
01-04 01-06	23.0
01-07	1.30
01-08	14.0

01-09 Start-Up Frequency

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.
- 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)



01-10 Output Frequency Upper Limit

Factory Setting: 600.00

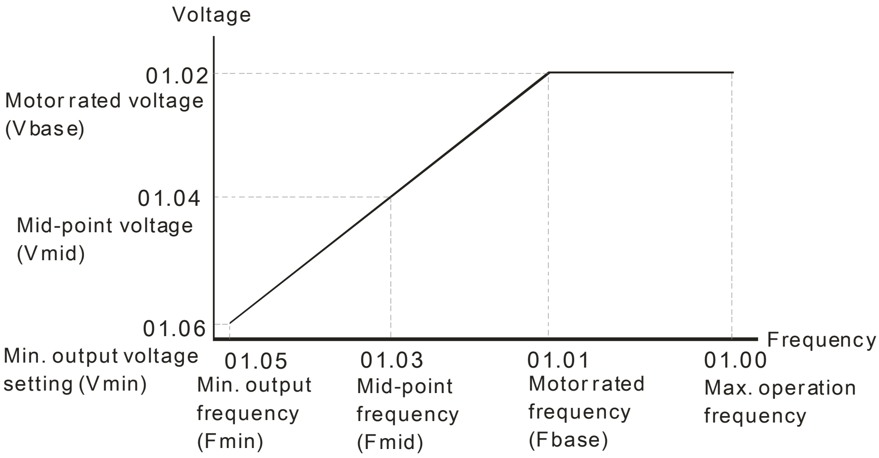
Settings 0.0~600.00Hz

01-11 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, it will run with the upper limit frequency. If output frequency lower than output frequency lower limit and frequency setting is higher than min. frequency, 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. Pr.01-00 setting is regarded as 100.0%.
- Output frequency upper limit = (Pr.01-00×Pr.01-10) /100
- This setting 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



V/f curve

- This setting 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.01-05) and accelerate to the setting frequency. It won't limit by this parameter 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.01-05) is 1.5Hz, it will operate by 10Hz when the frequency command is greater than Pr.01-05 and less than

10Hz. If the frequency command is less than Pr.01-05, the drive will be in ready status and no output.

- If the frequency output upper limit is 60Hz and frequency setting is also 60Hz, it won't exceed 60Hz even after slip compensation. If the output frequency needs to exceed 60Hz, it can increase output frequency upper limit or max. operation frequency.

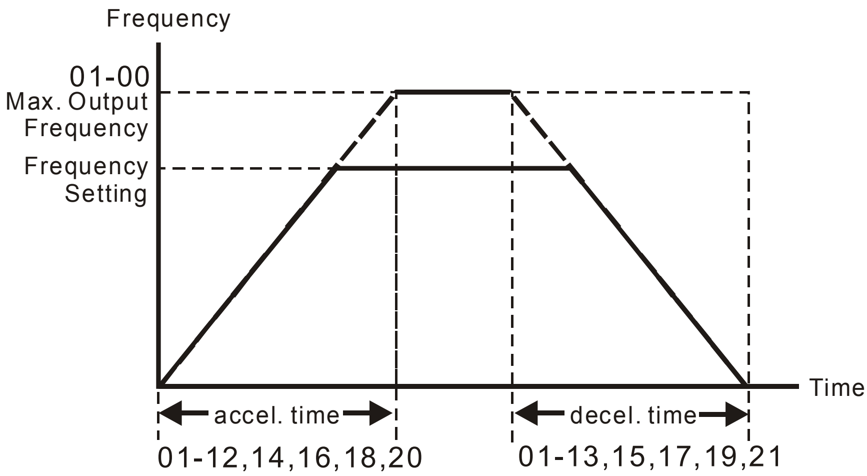
01-12	Accel. Time 1
01-13	Decel. Time 1
01-14	Accel. Time 2
01-15	Decel. Time 2
01-16	Accel. Time 3
01-17	Decel. Time 3
01-18	Accel. Time 4
01-19	Decel. Time 4
01-20	JOG Acceleration Time
01-21	JOG Deceleration Time

Factory Setting: 10.00/10.0

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 the 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.



Accel./Decel. Time

01-22 JOG Frequency

Factory Setting: 6.00

Settings 0.00~600.00Hz

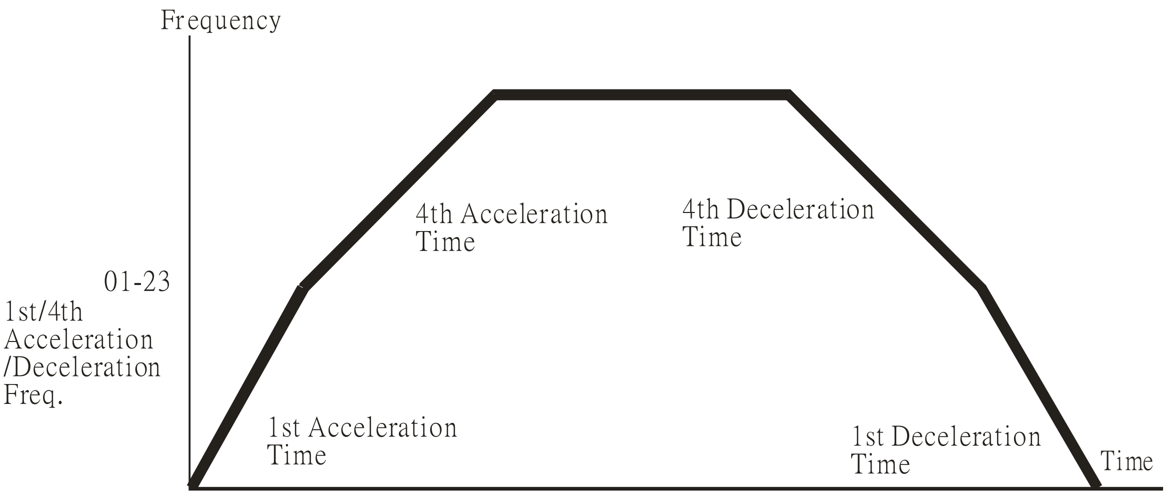
- Both external terminal JOG and key “F1” on the keypad KPC-CC01 can be used. When the jog command is ON, the AC motor drive will accelerate from 0Hz to jog frequency (Pr.01-22). When the jog command is OFF, the AC motor drive will decelerate from Jog Frequency to zero. The Jog Accel./Decel. time (Pr.01-20, 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 except forward/reverse commands and STOP key on the digital keypad.
- It does not support JOG function in the optional keypad KPC-CE01.

01-23 1st/4th Accel./decel. Frequency

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.



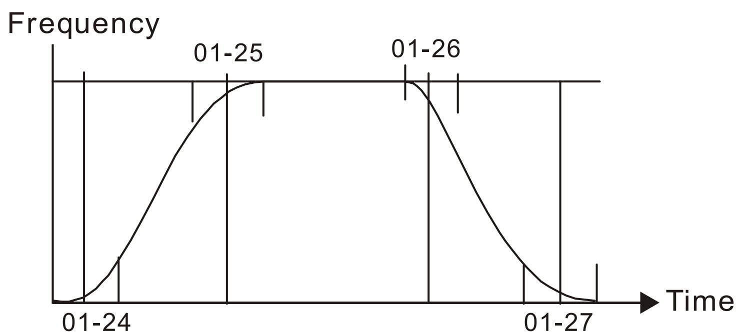
1st/4th Acceleration/Deceleration Switching

✔ 01-24	S-curve for Acceleration Departure Time 1
✔ 01-25	S-curve for Acceleration Arrival Time 2
✔ 01-26	S-curve for Deceleration Departure Time 1
✔ 01-27	S-curve for Deceleration Arrival Time 2

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.
- When Pr.01-12, 01-14, 01-16, 01-18 ≥ 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
- When Pr.01-13, 01-15, 01-17, 01-19 ≥ 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



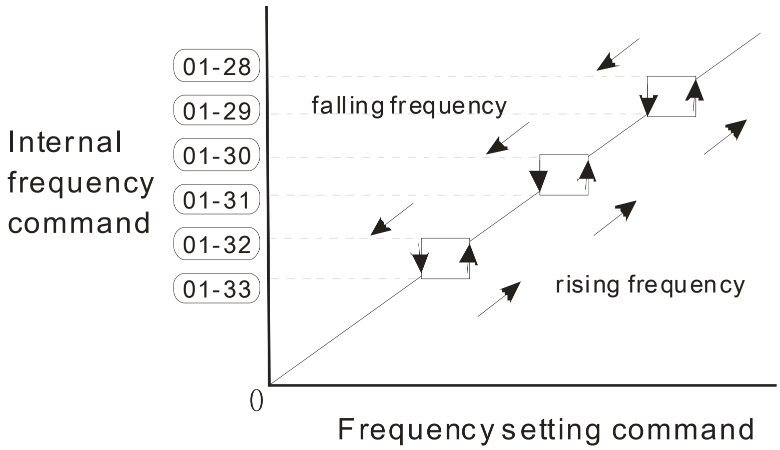
01-28	Skip Frequency 1 (upper limit)
01-29	Skip Frequency 1 (lower limit)
01-30	Skip Frequency 2 (upper limit)
01-31	Skip Frequency 2 (lower limit)
01-32	Skip Frequency 3 (upper limit)
01-33	Skip Frequency 3 (lower limit)

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.

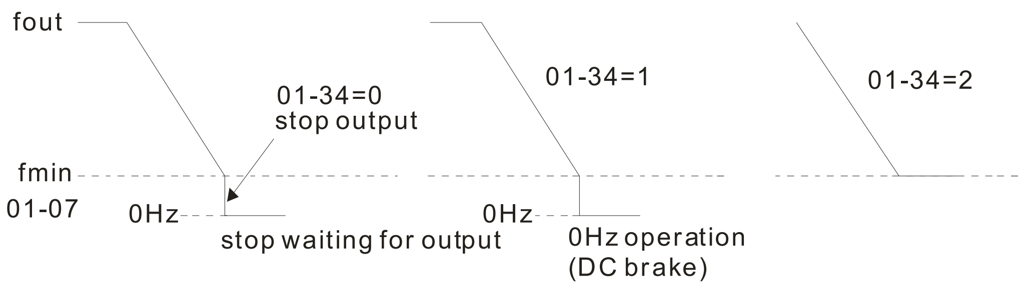


01-34 Zero-speed Mode

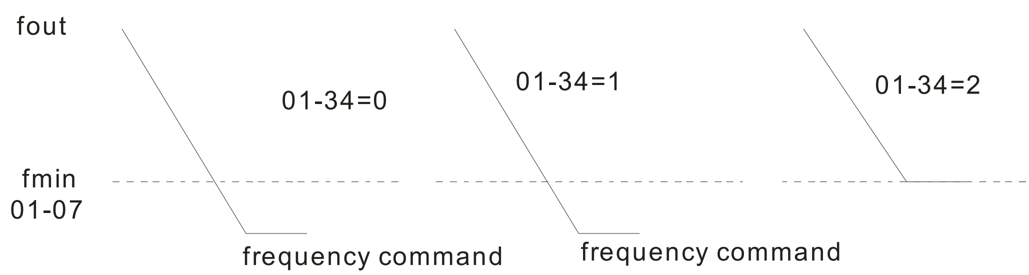
Factory Setting: 0

Settings
0: Output waiting
1: Zero-speed operation
2: Fmin (4th output frequency setting)

- When the frequency is less than Fmin (Pr.01-07 or Pr.01-41), it will operate by this parameter.
- When it is set to 0, the AC motor drive will be in waiting mode without voltage output from terminals U/V/W.
- When setting 1, it will execute DC brake by Vmin(Pr.01-08 and Pr.01-42) in V/f, VFPG and SVC modes. It executes zero-speed operation in VFPG and FOCPG mode.
- When it is set to 2, the AC motor drive will run by Fmin (Pr.01-07, Pr.01-41) and Vmin (Pr.01-08, Pr.01-42) in V/f, VFPG, SVC and FOCPG modes.
- In V/f, VFPG and SVC modes



- In FOCPG mode, when Pr.01-34 is set to 2, it will act according Pr.01-34 setting.



01-43 V/f Curve Selection

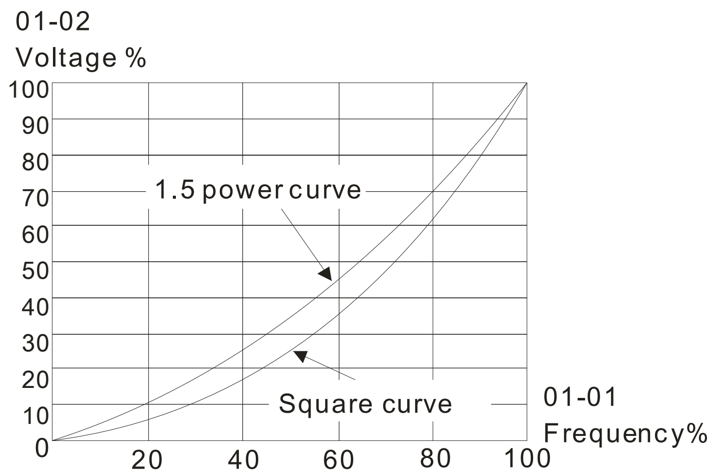
Factory Setting: 0

Settings 0: V/f curve determined by group 01

1: 1.5 power curve

2: Square curve

- When setting to 0, refer to Pr.01-01~01-08 for motor 1 V/f curve. For motor 2, please refer to Pr.01-35~01-42.
- When setting to 1 or 2, 2nd and 3rd voltage frequency setting are invalid.
- If motor load is variable torque load (torque is in direct proportion to speed, such as the load of fan or pump), it can decrease input voltage to reduce flux loss and iron loss of the motor at low speed with 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.



01-44 Optimal Acceleration/Deceleration Setting

Factory Setting: 0

Settings 0: Linear accel./decel.

1: Auto accel., linear decel.

2: Linear accel., auto decel.

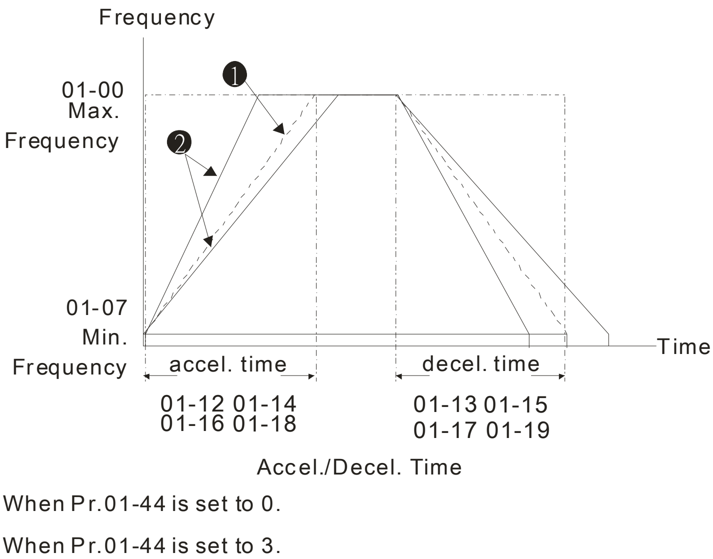
3: Auto accel./decel. (auto calculate the accel./decel. time by actual load)

4: Stall prevention by auto accel./decel. (limited by 01-12 to 01-21)

- t can decrease the drive's vibration during load starts and stops by setting this parameter. Also it will speed up to the setting frequency with the fastest and smoothest start-up current when it detects small torque. At deceleration, it will auto stop the drive with the fastest and the smoothest deceleration time when the regenerated voltage of the load is detected.
- 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.



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

Factory Setting: 0

Settings 0: Unit 0.01 sec

1: Unit 0.1 sec

01-46 Time for CANopen Quick Stop

Factory Setting: 0.00

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

Pr. 01-45=1: 0.0~6000.0 sec

📖 It is used to set the time that decelerates from the max. operation frequency (Pr.01-00) to 0.00Hz in CANopen control

02 Digital Input/Output Parameter

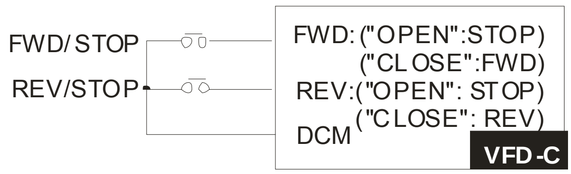
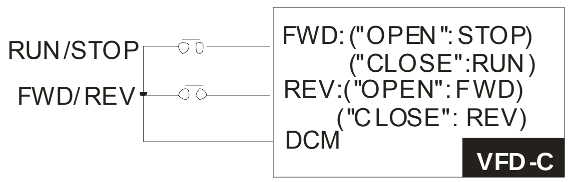
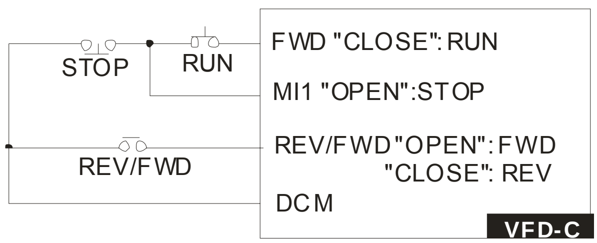
✓ The parameter can be set during operation.

02-00	2-wire/3-wire Operation Control

Factory Setting: 0

Settings 0: 2 wire mode 1
1: 2 wire mode 2
2: 3 wire mode

📖 It is used to set the operation control method:

<table>
<tr><th>Pr.02-00</th><th>Control Circuits of the External Terminal</th></tr>
<tr><td>0
2-wire mode 1
FWD/STOP
REV/STOP</td><td>
</td></tr>
<tr><td>1
2-wire mode 2
RUN/STOP
REV/FWD</td><td>
</td></tr>
<tr><td>3
3-wire operation control</td><td>
</td></tr>
</table>

02-01	Multi-function Input Command 1 (MI1)

Factory Setting: 1

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

Factory Setting: 2

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

Factory Setting: 3

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

Factory Setting: 4

02-05	Multi-function Input Command 5 (MI5)
02-06	Multi-function Input Command 6 (MI6)
02-07	Multi-function Input Command 7 (MI7)
02-08	Multi-function Input Command 8 (MI8)
02-26	Input terminal of I/O extension card (MI10)
02-27	Input terminal of I/O extension card (MI11)
02-28	Input terminal of I/O extension card (MI12)
02-29	Input terminal of I/O extension card (MI13)

02-30 Input terminal of I/O extension card (MI14)

02-31 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 1st, 2nd acceleration/deceleration time selection
9: the 3rd, 4th 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: FOCPG/TQCPG model selection
27: ASR1/ASR2 selection
28: Emergency stop (EF1)
29: Signal confirmation for Y-connection
30: Signal confirmation for Δ-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: Reserved
51: Selection for PLC mode bit0
52: Selection for PLC mode bit1
53: Trigger CANopen quick stop
54~70: Reserved

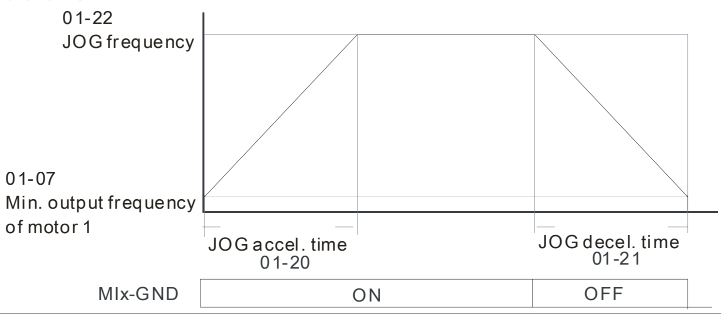
📖 This parameter selects the functions for each multi-function terminal.

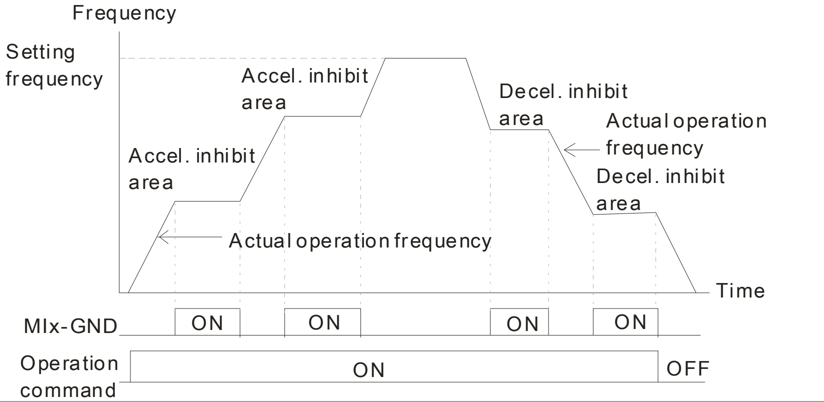
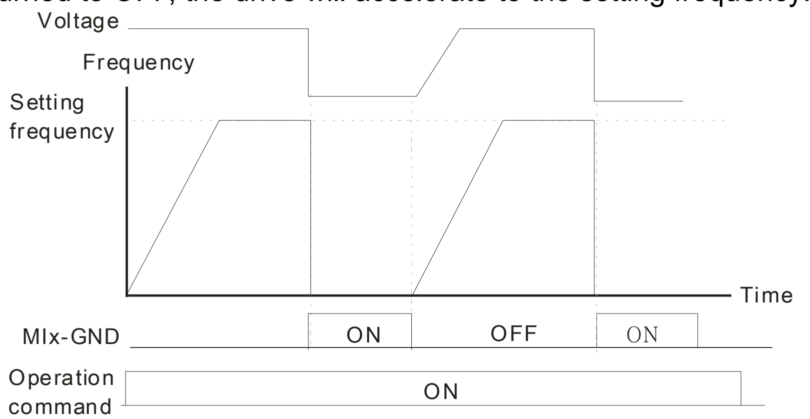
📖 The terminals of Pr.02-26~Pr.02-29 are virtual and set as MI10~MI13 when using with optional card EMC-D42A. Pr.02-30~02-31 are virtual terminals.

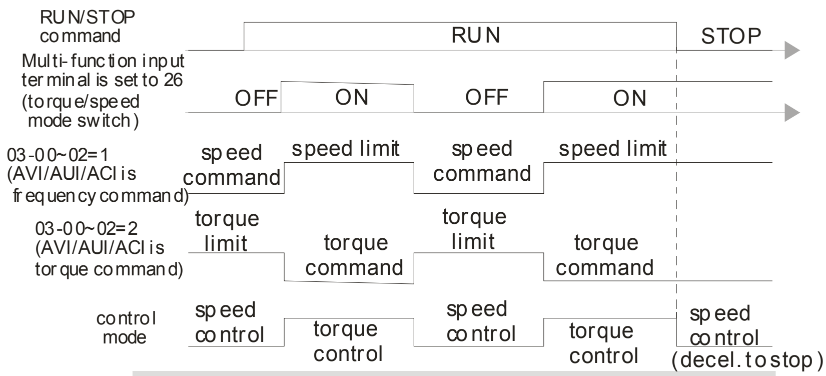
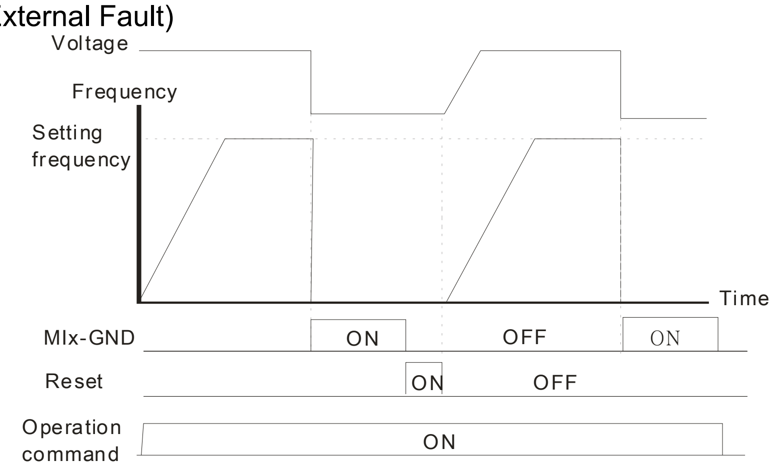
📖 When being used as a virtual terminal, it needs to change the status (0/1: ON/OFF) of bit 8-15 of Pr.02-12 by digital keypad KPC-CC01 or communication.

📖 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.

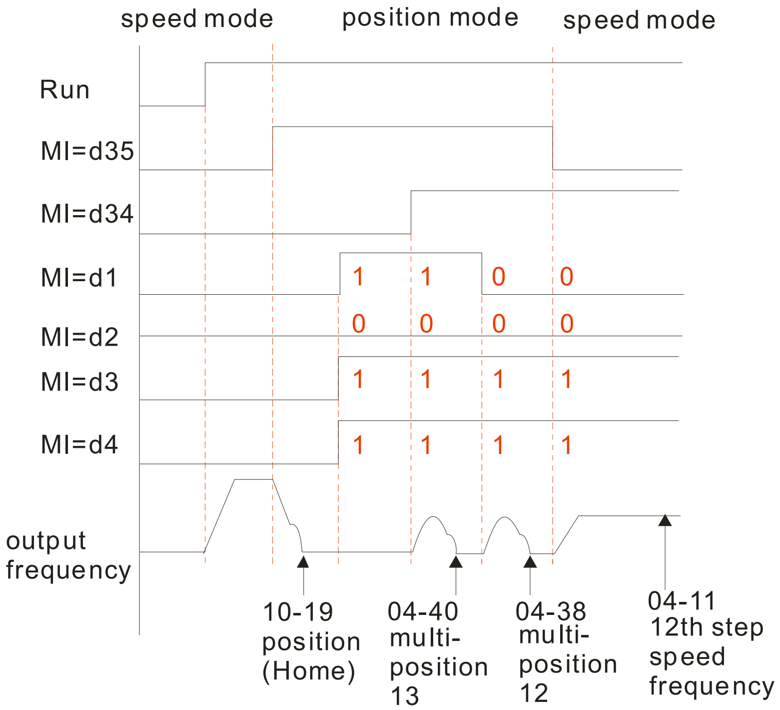
📖 Summary of function settings (Take the normally open contact for example, ON: contact is closed, OFF: contact is open)

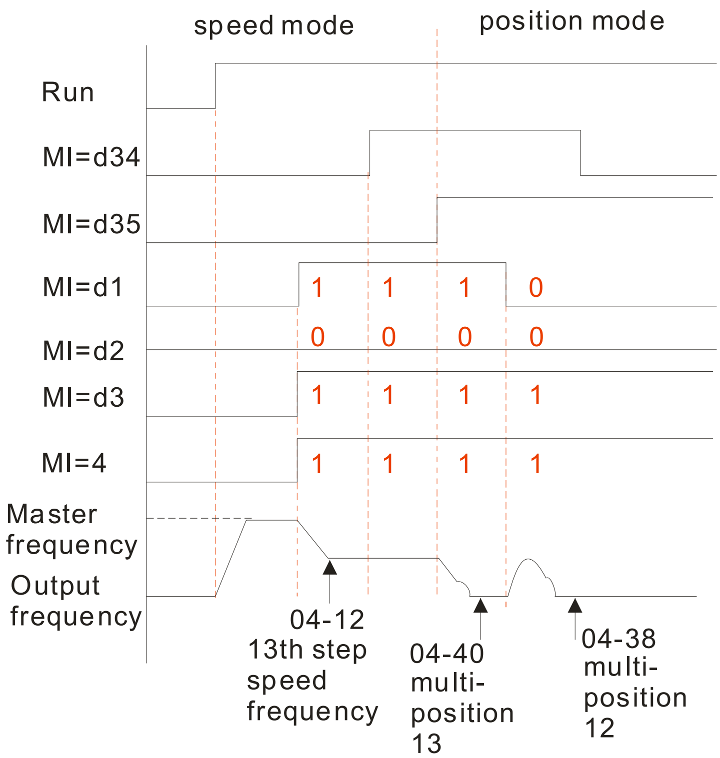
<table>
<tr><th>Settings</th><th>Functions</th><th>Descriptions</th></tr>
<tr><td>0</td><td>No Function</td><td></td></tr>
<tr><td>1</td><td>Multi-step speed command 1/multi-step position command 1</td><td rowspan="4">15 step speeds could be conducted through the digital status of the 4 terminals, and 16 in total if the master speed is included. (Refer to Parameter set 4)</td></tr>
<tr><td>2</td><td>Multi-step speed command 2/ multi-step position command 2</td></tr>
<tr><td>3</td><td>Multi-step speed command 3/ multi-step position command 3</td></tr>
<tr><td>4</td><td>Multi-step speed command 4/ multi-step position command 4</td></tr>
<tr><td>5</td><td>Reset</td><td>After the error of the drive is eliminated, use this terminal to reset the drive.</td></tr>
<tr><td>6</td><td>JOG Command</td><td>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.

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

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. 
8	The 1st, 2nd acceleration or deceleration time selection	The acceleration/deceleration time of the drive could be selected from this function or the digital status of the terminals; there are 4 acceleration/deceleration speeds in total for selection.
9	The 3rd, 4th acceleration or deceleration time selection	
10	EF Input (EF: External fault)	External fault input terminal. It will decelerate by Pr.07-20 setting (it will have fault record when external fault occurs)
11	External B.B. Input (Base Block)	When this contact is ON, output of the drive will be cut off immediately, and the motor will be free run and display B.B. signal. Refer to Pr.07-08 for details.
12	Output Stop	If this contact 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 is ON: use motor 2 parameters. OFF: use motor 1 parameters.
15	Operation speed command form AVI	When the contact 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 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 this function is enabled, 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 is ON, the drive will ramp to stop by Pr.07-20 setting.

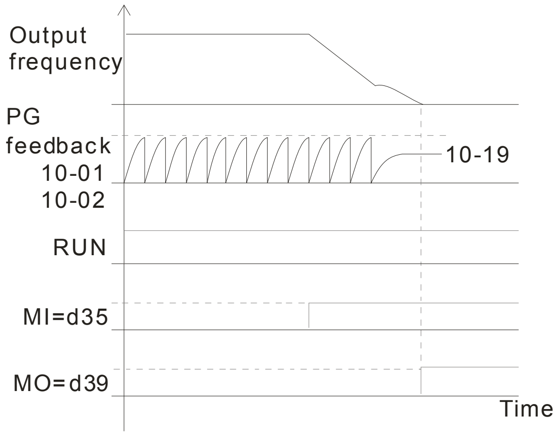
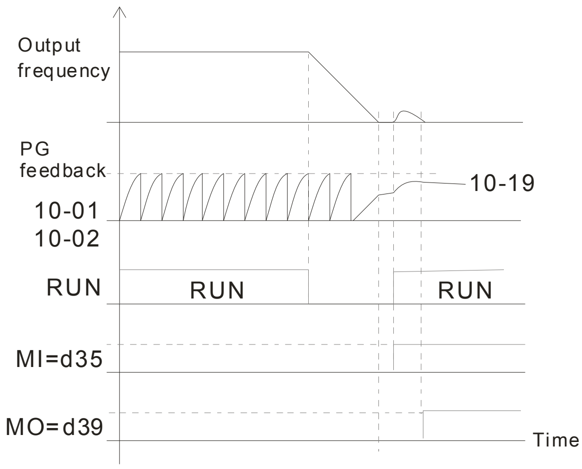
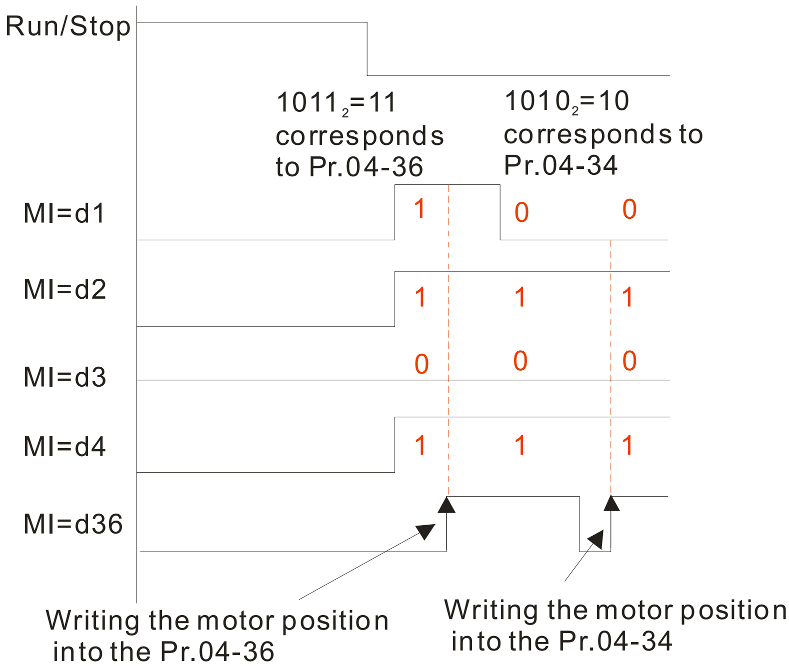
19	Digital Up command	When the contact is ON, the frequency will be increased and decreased. If this function is constantly ON, the frequency will be increased/decreased by Pr.02-09/Pr.02-10.
20	Digital Down command	
21	PID function disabled	When the contact is ON, the PID function is disabled.
22	Clear counter	When the contact 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 is ON. It needs to be used with Pr.02-19.
24	FWD JOG command	When the contact 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.
25	REV JOG command	When the contact 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.
26	FOCPG/TQCPG mode selection	When the contact is ON: TQCPG mode. When the contact is OFF: FOCPG mode.  Switch timing for torque/speed control (00-10=0/4, multi-function input terminal is set to 26)
27	ASR1/ASR2 selection	When the contact 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.
28	Emergency stop (EF1)	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) 

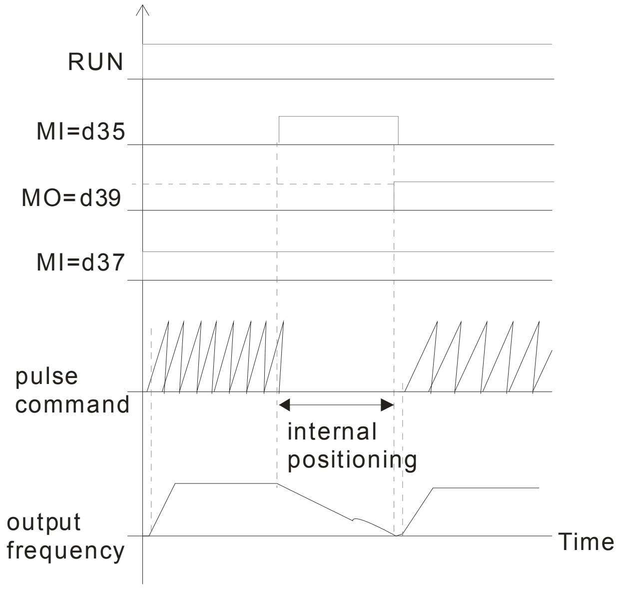
<table>
<tr><td>29</td><td>Signal confirmation for Y-connection</td><td>When is the contact is ON, the drive will operate by 1st V/f.</td></tr>
<tr><td>30</td><td>Signal confirmation for ˜connection</td><td>When the contact is ON, the drive will operate by 2nd V/f.</td></tr>
<tr><td>31</td><td>High torque bias</td><td rowspan="3">Refer to Pr.11-30~11-32 for details.</td></tr>
<tr><td>32</td><td>Middle torque bias</td></tr>
<tr><td>33</td><td>Low torque bias</td></tr>
<tr><td>34</td><td>Switch between multi-step position and multi-speed control</td><td>When the contact 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)





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

35	Enable single-point position control	When the contact 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.  
36	Enable multi-step position learning function (valid at stop)	When the contact is ON/OFF, the drive will base the multi-function inputs 1-4 ON/OFF status to find the corresponding multi-step positions and write current motor position into such corresponding multi-step position. 
37	Full position control pulse command input enable	When Pr.00-20 is set to 4 or 5 and this contact 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

<table>
<tr><td></td><td></td><td>faction with MI=d35 return to home position,.
</td></tr>
<tr><td>38</td><td>Disable EEPROM write function</td><td>When this contact is ON, write to EEPROM is disabled.</td></tr>
<tr><td>39</td><td>Torque command direction</td><td>For torque control (Pr.00-10=2), when torque command is AVI or ACI, the contact is ON and it is negative torque.</td></tr>
<tr><td>40</td><td>Force coast to stop</td><td>When this contact is ON during the operation, the drive will free run to stop.</td></tr>
<tr><td>41</td><td>HAND switch</td><td rowspan="2">1. When multi-function input terminal switched OFF, it executes a STOP command. , When switching to off during the operation, the drive will stop.
2. When switching during operation by the keypad KPC-CC01, the drive will be switched to the status after stop.
3. It will display HAND/OFF/AUTO on the keypad KPC-CC01.
<table><tr><td></td><td>Bit 1</td><td>Bit 0</td></tr><tr><td>OFF</td><td>0</td><td>0</td></tr><tr><td>AUTO</td><td>0</td><td>1</td></tr><tr><td>HAND</td><td>1</td><td>0</td></tr><tr><td>OFF</td><td>1</td><td>1</td></tr></table></td></tr>
<tr><td>42</td><td>AUTO switch</td></tr>
<tr><td>43</td><td>Enable resolution selection</td><td>Refer to Pr.02-48 for details.</td></tr>
<tr><td>44</td><td>Reverse direction homing</td><td>Reverse direction limit switch signal input. When this terminal is ON, the drive will refer to the setting in Pr.00-40, 00-41, 00-42 accordingly to execute homing in a counter clockwise (reverse) direction (counter clockwise).</td></tr>
<tr><td>45</td><td>Forward direction homing</td><td>Forward direction limit switch signal input. When this terminal is ON, the drive will refer to the setting in Pr.00-40, 00-41, 00-42 accordingly to execute homing in a clockwise (forward) direction.</td></tr>
<tr><td>46</td><td>Homing ORG</td><td>ORG point input. When this terminal is ON, the drive will refer to the setting in Pr.00-40, 00-41, 00-42 accordingly to execute homing.</td></tr>
<tr><td>47</td><td>Homing function enable</td><td>Pr00-10 = 3 (homing mode), if the external terminal MIx=47 is OFF, the drive will ignore the home command and execute Point to Point position control.</td></tr>
<tr><td>48</td><td>Mechanical gear ratio switch</td><td>When this contact is ON, the mechanical gear ratio switch will be the second group A2/B2 (refer to Pr.10-08 and Pr.10-09).</td></tr>
<tr><td>49</td><td>Drive enable</td><td>When drive=enable, RUN command is valid.
When drive= disable, RUN command is invalid.
When drive is in operation, motor coast to stop.</td></tr>
</table>

<table>
<tr><td>50</td><td colspan="2">Reserved</td></tr>
<tr><td>51</td><td>Selection for PLC mode bit0</td><td rowspan="2"><table><tr><td>PLC status</td><td>Bit 1</td><td>Bit 0</td></tr><tr><td>Disable PLC function (PLC 0)</td><td>0</td><td>0</td></tr><tr><td>Trigger PLC to operation (PLC 1)</td><td>0</td><td>1</td></tr><tr><td>Trigger PLC to stop (PLC 2)</td><td>1</td><td>0</td></tr><tr><td>No function</td><td>1</td><td>1</td></tr></table></td></tr>
<tr><td>52</td><td>Selection for PLC mode bit1</td></tr>
<tr><td>53</td><td>Enable CANopen quick stop</td><td>When this function is enabled under CANopen control, it will change to quick stop. Refer to Chapter 15 for more details.</td></tr>
<tr><td>54~70</td><td colspan="2">Reserved</td></tr>
</table>

02-09 UP/DOWN Key Mode

Factory Setting: 0

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

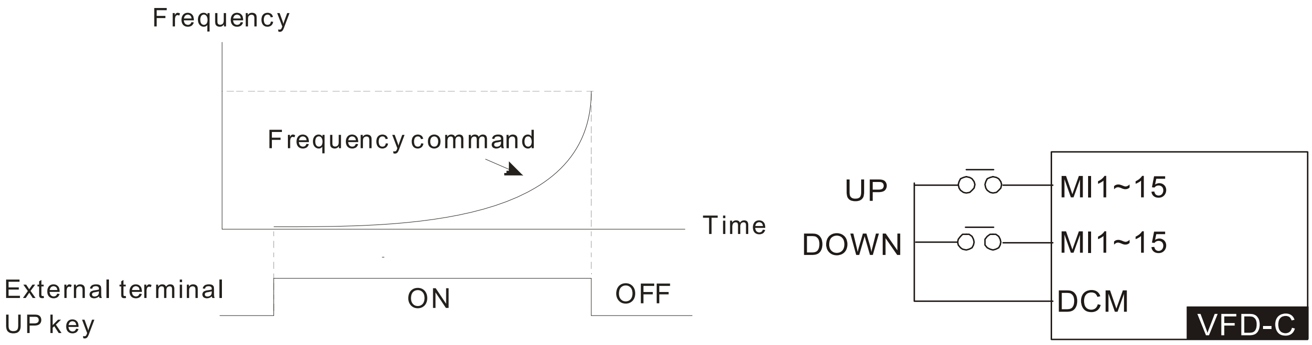
1: Up/down constant speed (Pr.02-10)

02-10 The Acceleration/Deceleration Speed of the UP/DOWN Key with Constant Speed

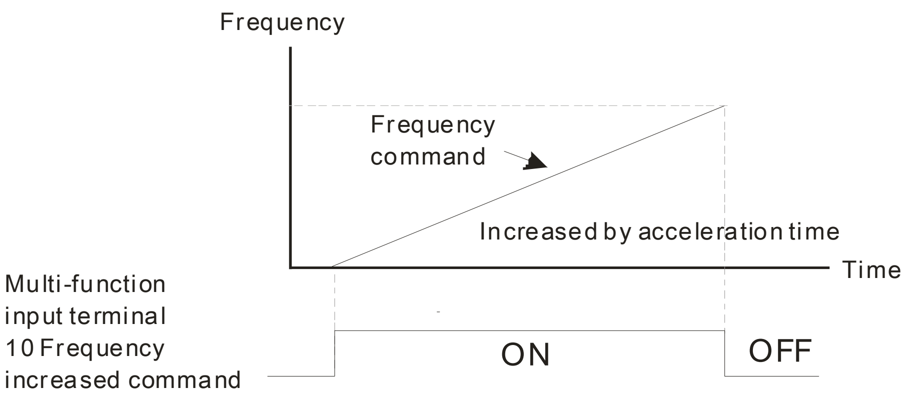
Factory Setting: 1

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.
- Pr.02-09 set to 0: it will increase/decrease frequency command (F) by the external terminal UP/DOWN key as shown in the following diagram. In this mode, it also can be controlled by UP/DOWN key on the digital keypad.



- Pr.02-09 set to 1: it will increase/decrease frequency command (F) by the setting of acceleration/deceleration (Pr.01-12~01-19) and only be valid during operation.



02-11 Digital Input Response Time

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.

02-12 Digital Input Operation Direction

Factory Setting: 0000h

Settings 0000h~FFFFh（0:N.O. ; 1:N.C.）

- The setting of this parameter is In hexadecimal.
- This parameter is used to set the input signal level and it won't be 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 + 2nd step speed command=1001(binary)=9 (Decimal). Only need to set Pr.02-12=9 by communication and it can forward with 2nd step speed. It doesn't 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	REV	FWD

02-13 Multi-function Output 1 (Relay1)

Factory Setting: 11

02-14 Multi-function Output 2 (Relay2)

Factory Setting: 1

02-16 Multi-function Output 3 (MO1)

02-17 Multi-function Output 4 (MO2)

02-36 Output terminal of the I/O extension card (MO10)

02-37 Output terminal of the I/O extension card (MO11)

02-38 Output terminal of the I/O extension card (MO12)

02-39 Output terminal of the I/O extension card (MO13)

02-40 Output terminal of the I/O extension card (MO14)

02-41 Output terminal of the I/O extension card (MO15)

02-42 Output terminal of the I/O extension card (MO16)

02-43 Output terminal of the I/O extension card (MO17)

02-44 Output terminal of the I/O extension card (MO18)

02-45 Output terminal of the I/O extension card (MO19)

02-46 Output terminal of the I/O extension card (MO20)

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 >= Pr.02-34 (>= 02-34) 30: Output when frequency <= Pr.02-34 (<= 02-34) 31: Y-connection for the motor coil 32: △-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: Motor actual speed output <=Pr.02-47
44: Low current output (Pr.06-71 to Pr.06-73)
45: UVW Output Electromagnetic valve On/Off Switch
46: Reserved
47: Closed brake output
48~49: reserved
50: Output for CANopen control
51: Output for communication card
52: Output for RS485
53~62: Reserved

- This parameter selects the functions for each multi-function terminal.
- The terminals of Pr.02-36~Pr.02-41 will only be displayed after using with optional card EMC-D42A and EMC-R6AA.
- The optional card EMC-D42A offers 2 output terminals and can be used with Pr.02-36~02-37.
- The optional card EMC-R6AA offers 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)

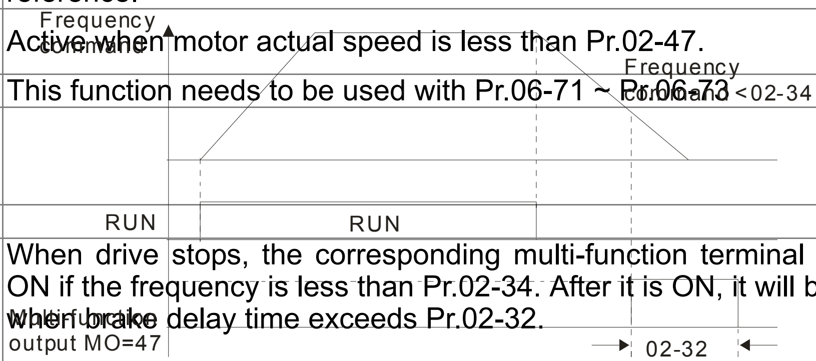
Settings	Functions	Descriptions
0	No Function	
1	Operation Indication	Active when the drive is not at STOP.
2	Master Frequency Attained	Active when the AC motor drive reaches the output frequency setting.
3	Desired Frequency Attained 1 (Pr.02-22)	Active when the desired frequency (Pr.02-22) is attained.
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)
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.00-20≠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.
31	Y-connection for the Motor Coil	Active when PR.05-24 is less than Pr.05-23 and time is more than Pr.05-25.
32	. -connection for the Motor Coil	Active when PR.05-24 is higher than Pr.05-23 and time is more than Pr.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.

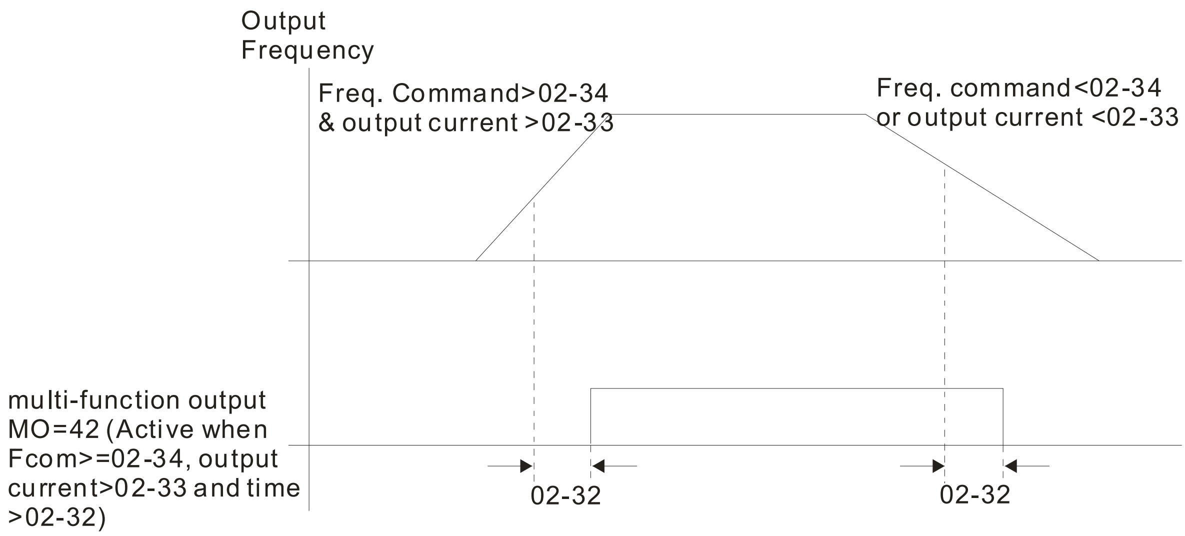
39	Position Attained (Pr.10-19)	Active when the PG position control point reaches Pr.10-19.
40	Speed Attained (including zero speed)	Active when the output frequency reaches frequency setting or stop.
41	Multi-position Attained	User can set any three multi-function input terminals to 41. The current 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 Pr.02-17=41	MO1 Pr.02-16=41	RY2 Pr.02-14=41	RY1 Pr.02-13=41
Pr.04-16	0	0	0	1
Pr.04-18	0	0	1	0
Pr.04-20	0	0	1	1
Pr.04-22	0	1	0	0
Pr.04-24	0	1	0	1
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

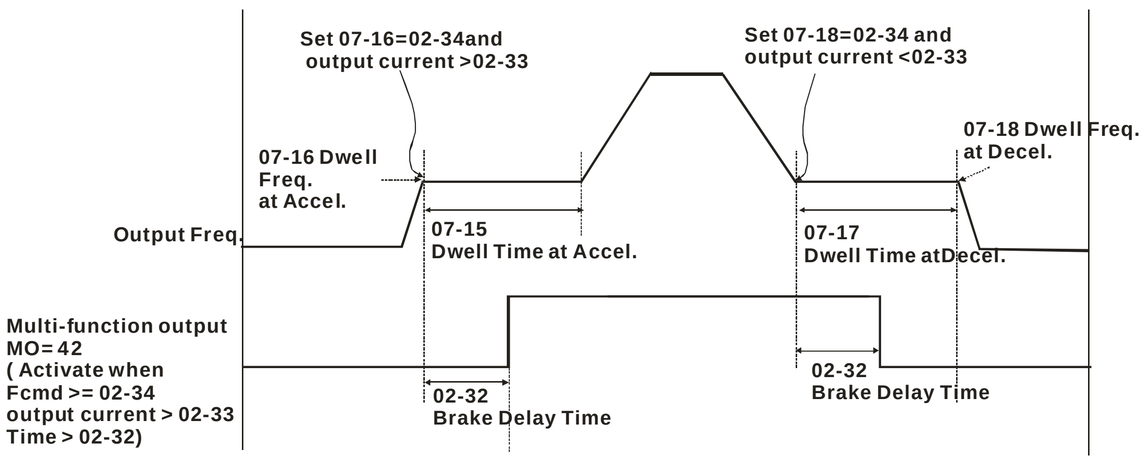
42	Crane Function	This function should be used with Pr.02-32, Pr.02-33 and Pr.02-34. Active when setting Pr.07-16=Pr.02-34 and Fcmd > Pr.02-34 and output current > Pr.02-33 and Time > Pr.02-32. The example of the crane application is in the following for your reference.
43	Motor Zero-speed Output (Pr.02-47)	Active when motor actual speed is less than Pr.02-47.
44	Low Current Output	This function needs to be used with Pr.06-71 ~ Pr.06-73
45	UVW Output Electromagnetic valve Switch	
46	Reserved	
47	Brake Release at Stop	When drive stops, the corresponding multi-function terminal will be ON if the frequency is less than Pr.02-34. After it is ON, it will be OFF when brake delay time exceeds Pr.02-32.
48-49	Reserved	
50	Output for CANopen control	For CANopen communication output
51	Output for communication card	For communication output of communication cards (CMC-MOD01, CMC-EIP01, CMC-PN01 and CMC-DN01)
52	Output for RS-485	For RS-485 output
53~62	Reserved	



Example of crane function



It is recommended to be used with Dwell function as shown in the following:



02-18 Multi-output Direction

Factory Setting: 0000h

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

- The setting of this parameter is in hexadecimal.
- This parameter is set via bit setting. If a bit is 1, the corresponding 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

02-19 Terminal count value attained (returns to 0)

Factory Setting: 0

Settings 0~65535

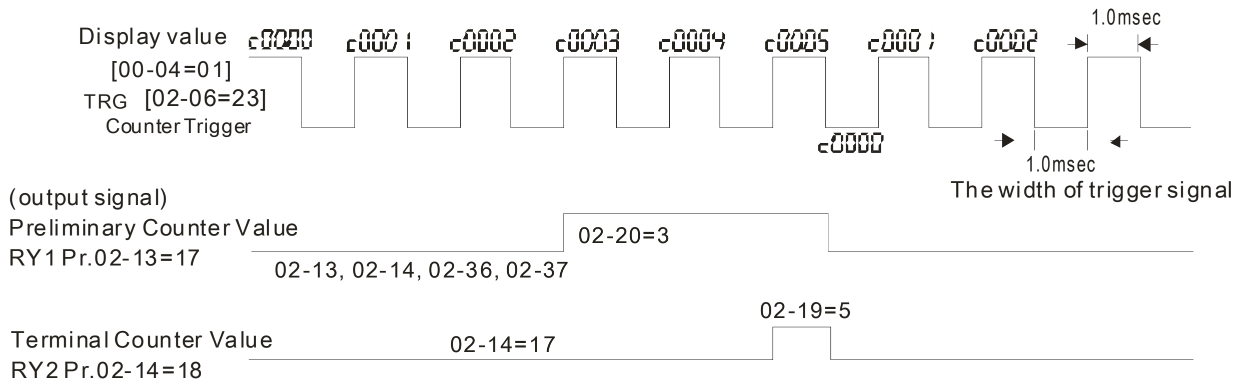
- The counter trigger can be set by the multi-function terminal MI6 (set Pr.02-06 to 23). Upon completion of counting, the specified output terminal will be activated (Pr.02-13~02-14, Pr.02-36, 02-37 is set to 18). Pr.02-19 can't be set to 0.
- When the display shows c5555, the drive has counted 5,555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

02-20 Preliminary count value attained (not return to 0)

Factory Setting: 0

Settings 0~65535

- 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.



02-21 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.

02-22 Desired Frequency Attained 1

Factory Setting: 60.00/50.00

Settings 0.00~600.00Hz

02-23 The Width of the Desired Frequency Attained 1

Factory Setting: 2.00

Settings 0.00~600.00Hz

02-24 Desired Frequency Attained 2

Factory Setting: 60.00/50.00

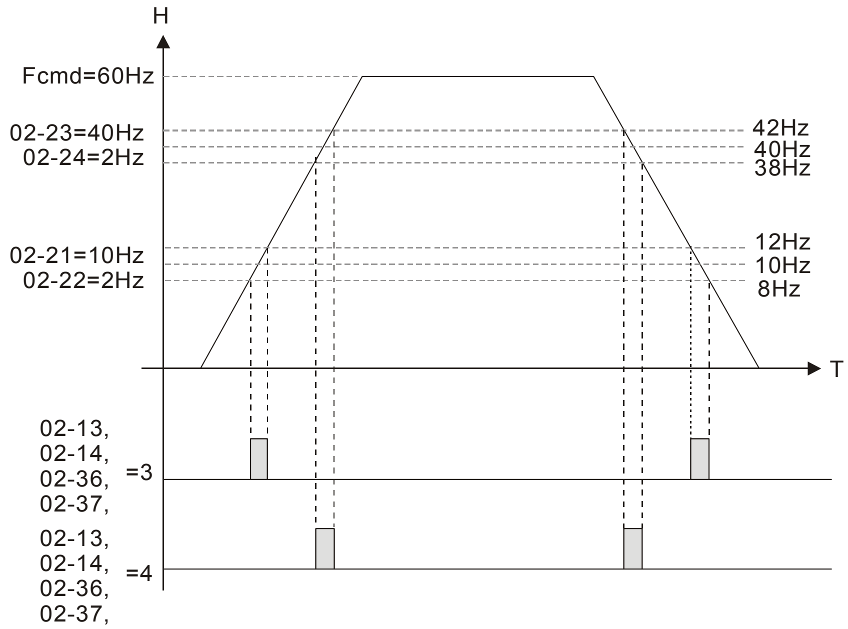
Settings 0.00~600.00Hz

02-25 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.

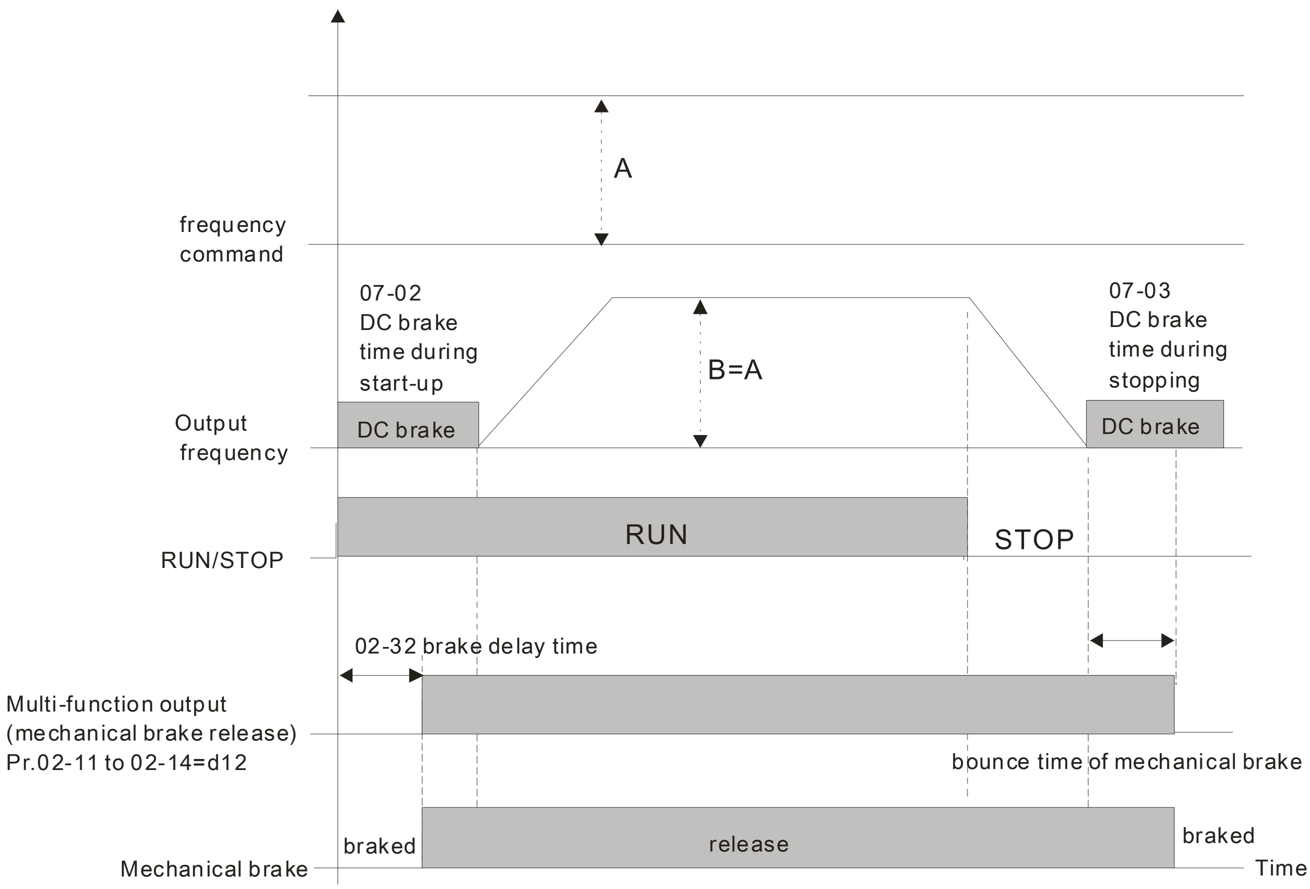


02-32 Brake Delay Time

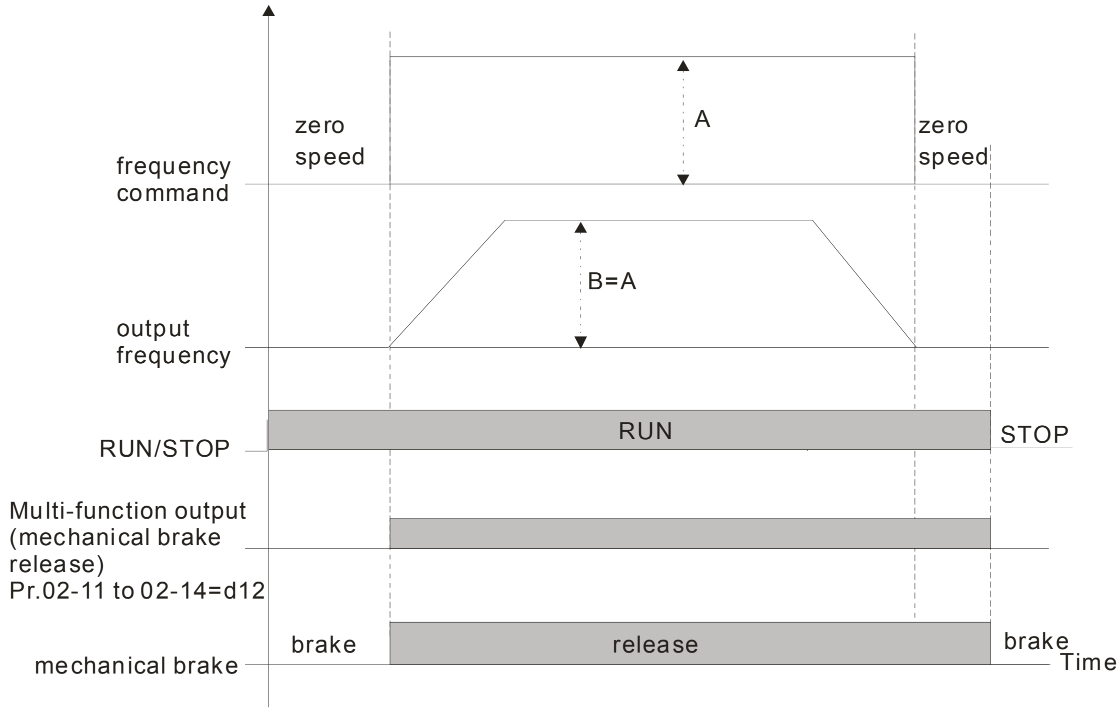
Factory Setting: 0.000

Settings 0.000~65.000 sec

📖 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 is recommended 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.



02-33 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 than Pr.02-33, it will activate multi-function output terminal (Pr.02-13, 02-14, 02-16, 02-17 is set to 28).

02-34 Output Boundary for Multi-function Output Terminals

Factory Setting: 0.00

Settings 0.00~±60.00Hz

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

02-35 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.

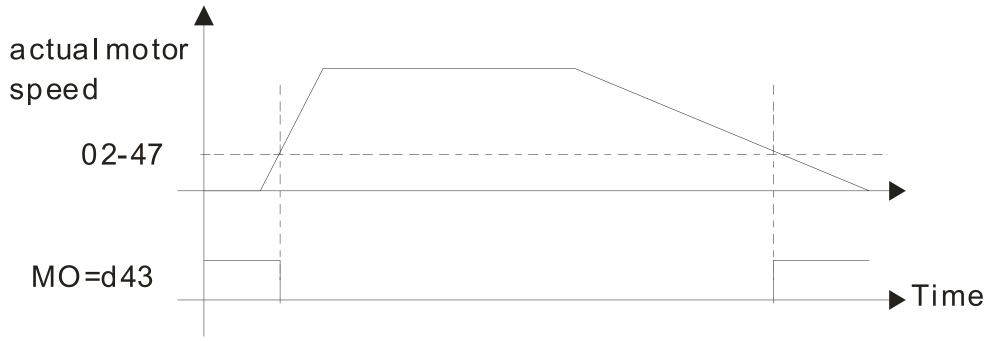
Status 2: After clearing fault once a fault is detected and the external terminal for RUN keeps ON, the drive can run after pressing RESET key.

02-47 Zero-speed Level of Motor

Factory Setting: 0

Settings 0~65535 rpm

- This parameter should be used with the multi-function output terminals (set to 43). It needs to be used with PG cared and motor with encoder feedback.
- This parameter is used to set the level of motor zero-speed. When the actual speed is lower than this setting, the corresponding multi-function output terminal 43 will be ON as shown as follows.



02-48 Max. Frequency of Resolution Switch

Factory Setting: 60.00

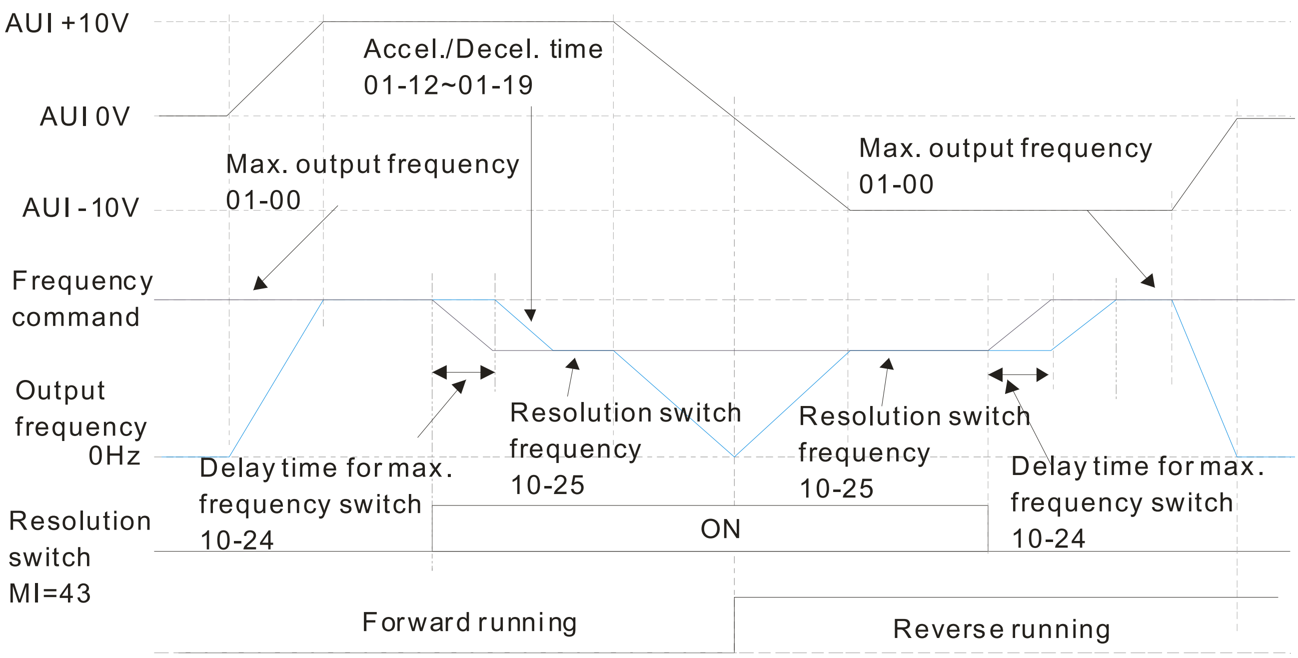
Settings 0.01~600.00Hz

02-49 Switch the delay time of Max. output frequency

Factory Setting: 0.000

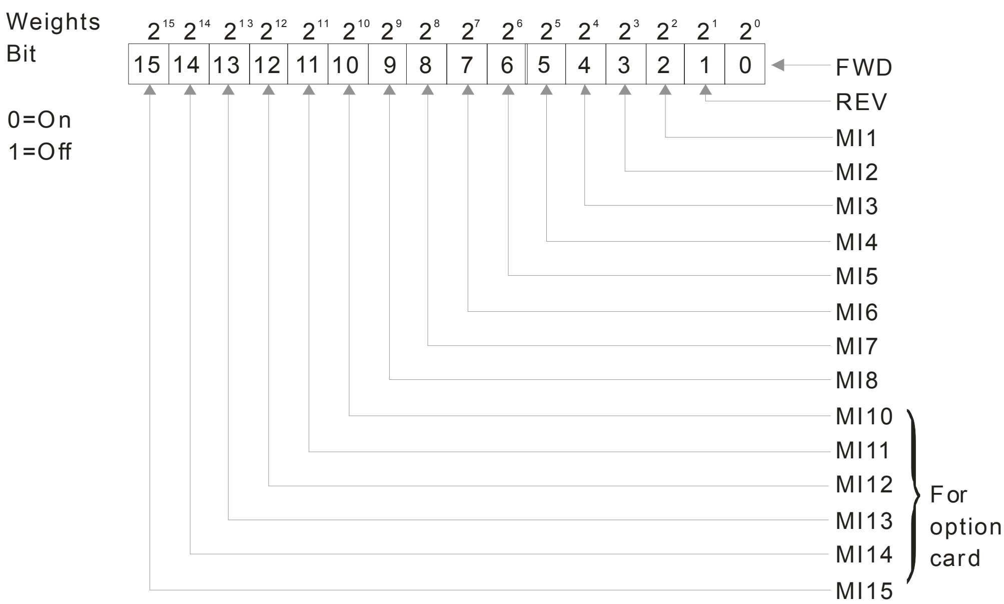
Settings 0.000~65.000 sec

- It is used to improve the unstable speed or unstable position due to the insufficient of analog resolution. It needs to be used with external terminal (set to 43). After setting this parameter, it needs to adjust the analog output resolution of controller simultaneously by this setting.

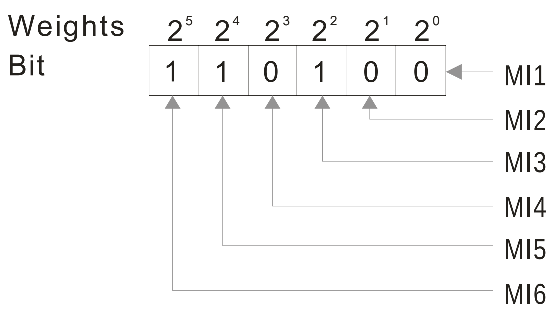


02-50 Display the Status of Multi-function Input Terminal

Factory Setting: Read only



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.



0=ON
1=OFF

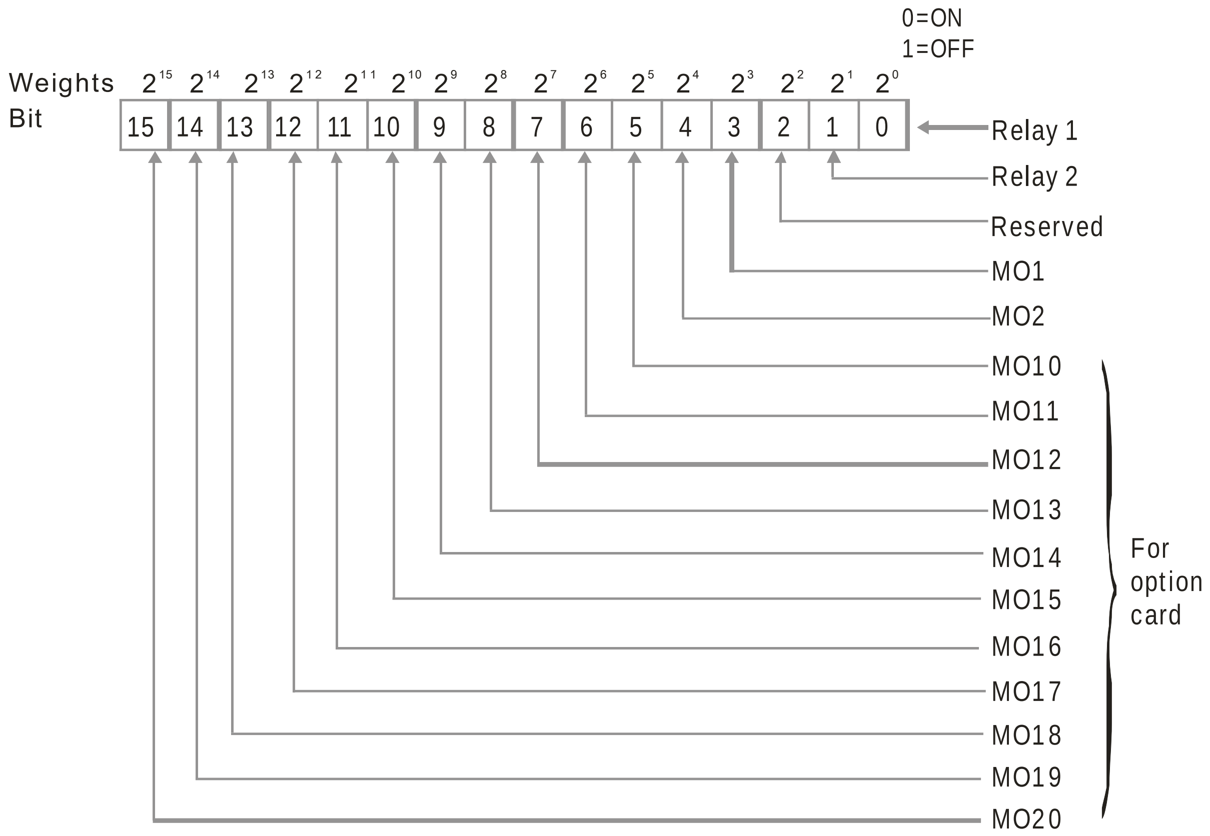
Settings
$= \text{bit5}\times 2^5 + \text{bit4}\times 2^4 + \text{bit2}\times 2^2$
$= 1\times 2^5 + 1\times 2^4 + 1\times 2^2$
$= 32+16+4 = 52$

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

02-51	Status of Multi-function Output Terminal

Factory Setting: Read only

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.



NOTE

2^7=128 2^6=64

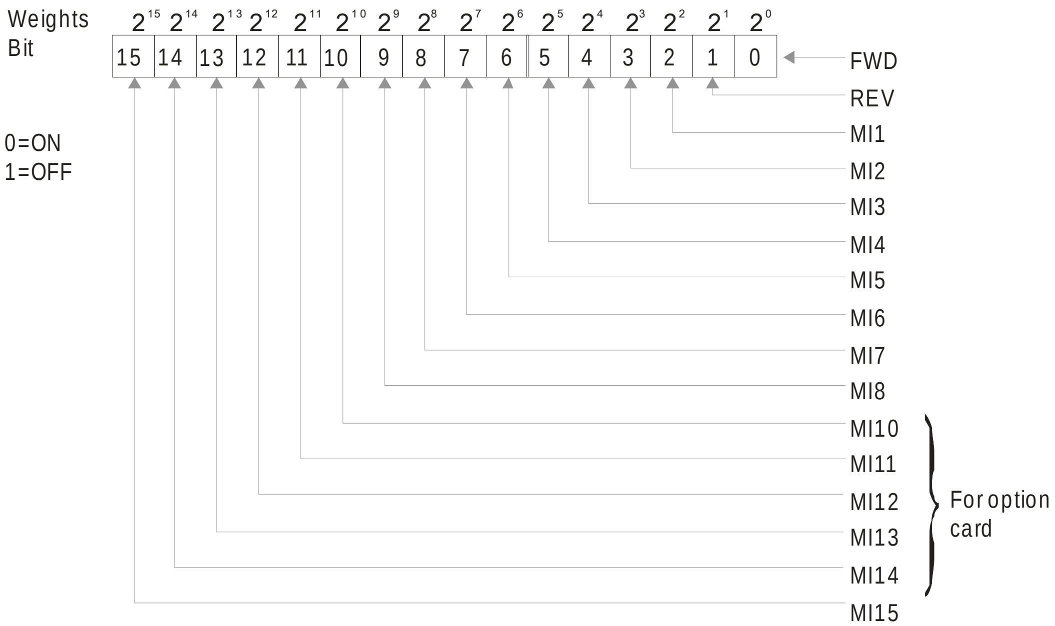
2^5=32 2^4=16 2^3=8

2^2=4 2^1=2 2^0=1

02-52 Display External Output terminal occupied by PLC

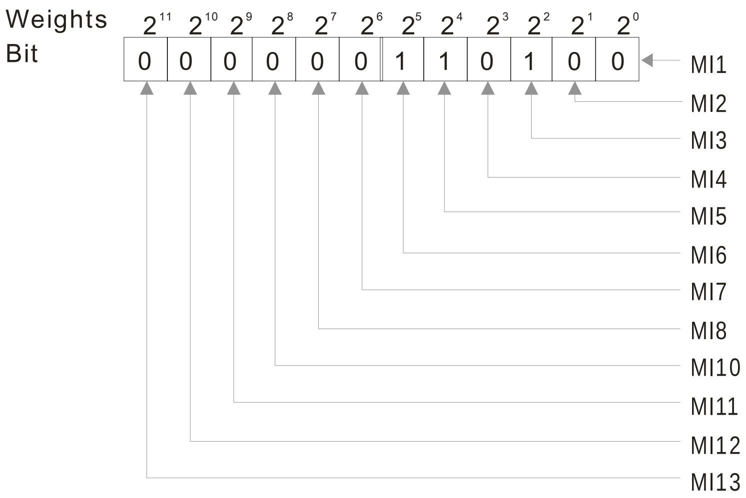
Factory Setting: Read only

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



For Example:

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



0: not used by PLC
1: used by PLC

Displays
$= bit5x2^5+bit4x2^4+bit2x2^2$
$= 1x2^5+1x2^4+1x2^2$
$=32+16+4 =52$

NOTE
$2^{14}=16384$ $2^{13}=8192$ $2^{12}=4096$
$2^{11}=2048$ $2^{10}=1024$ $2^9=512$
$2^8=256$ $2^7=128$ $2^6=64$
$2^5=32$ $2^4=16$ $2^3=8$ $2^2=4$
$2^1=2$ $2^0=1$

02-53 Display Analog Input Terminal occupied by PLC

Factory Setting: Read only

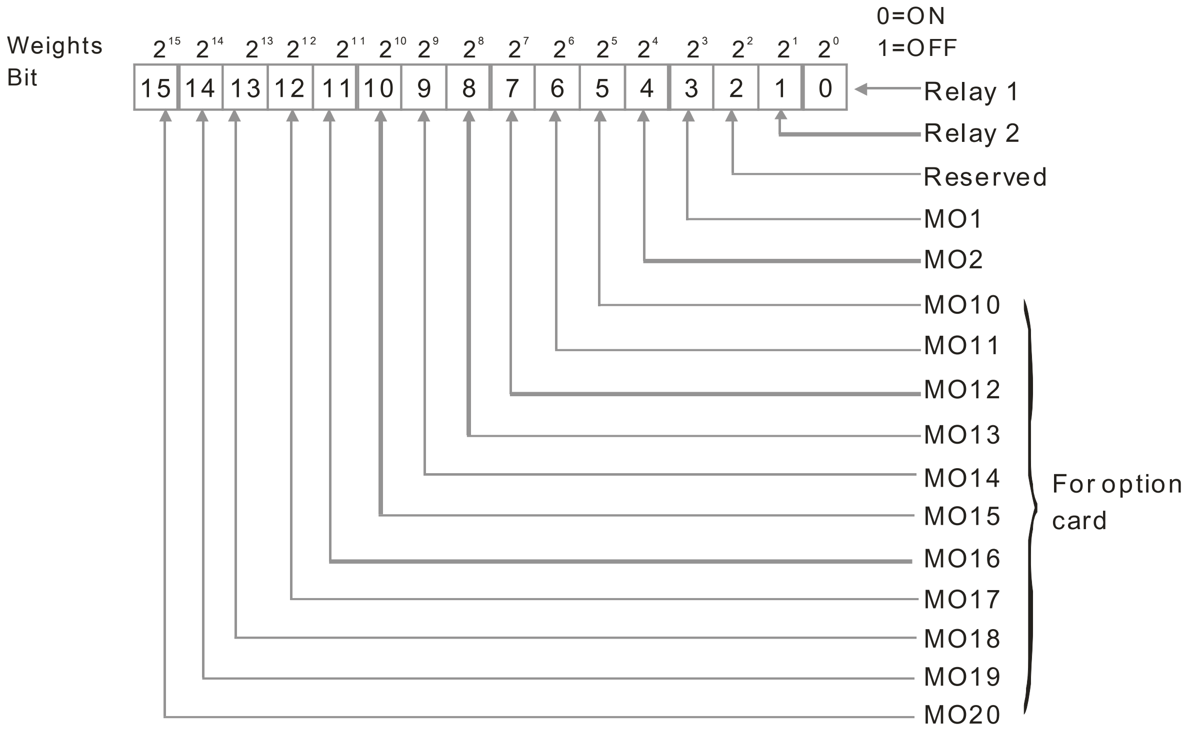
📖 P.02-53 shows the external multi-function output terminal that used by PLC.

02-54 Display the saved memory of the frequency command executed by external terminal

Factory Setting: Read only

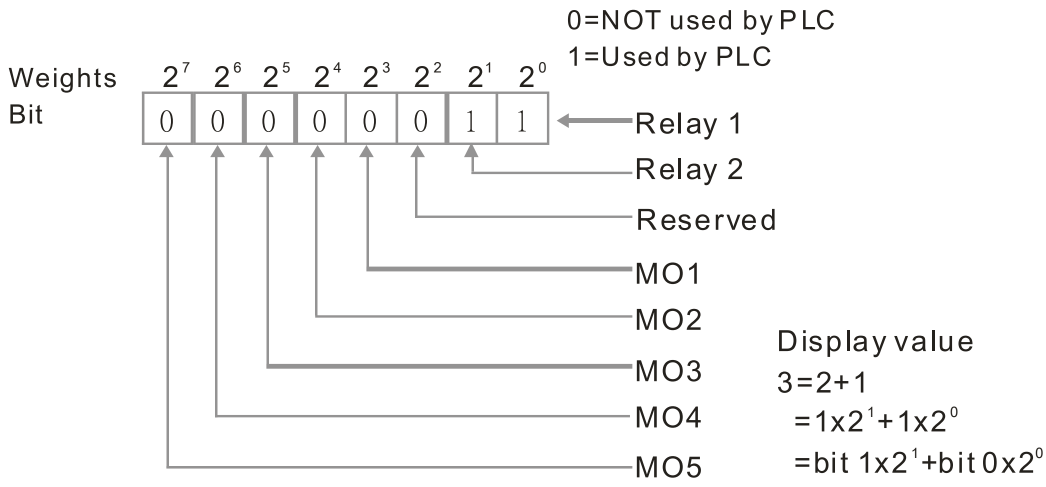
Settings Read only

📖 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.



NOTE
$2^7=128$ $2^6=64$
$2^5=32$ $2^4=16$ $2^3=8$
$2^2=4$ $2^1=2$ $2^0=1$

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



03 Analog Input/Output Parameter

✓ The parameter can be set during operation.

✓ **03-00** Analog Input 1 (AVI)

Factory Setting: 1

✓ **03-01** Analog Input 2(ACI)

Factory Setting: 0

✓ **03-02** Analog Input 3 (AUI)

Factory Setting: 0

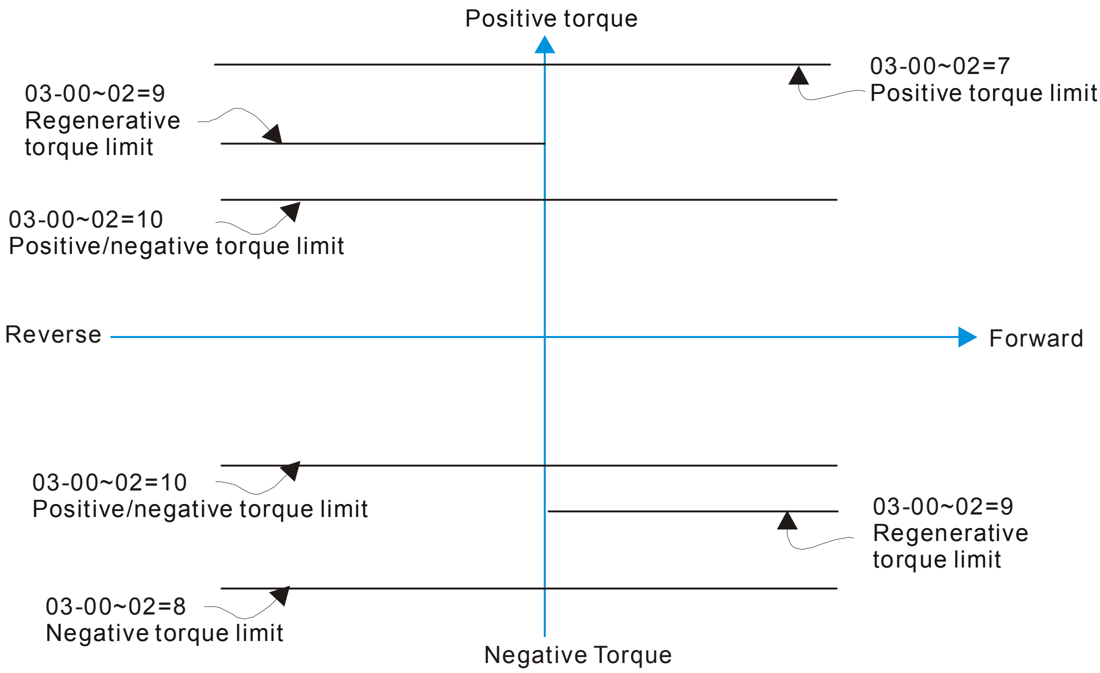
Settings

0: No function
1: Frequency command (torque limit under torque control mode)
2: Torque command (torque limit under speed mode)
3: Torque compensation 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
12~17: Reserved

- 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)

- When it is torque command or torque limit, the corresponding value for 0~±10V/4~20mA is 0 – max. output torque (Pr.11-27).

- When it is torque compensation, the corresponding value for 0~±10V/4~20mA is 0 – rated torque.



03-03 Analog Input Bias 1 (AVI)

Factory Setting: 0

Settings -100.0~100.0%

- It is used to set the corresponding AVI voltage of the external analog input 0.

03-04 Analog Input Bias 1 (ACI)

Factory Setting: 0

Settings -100.0~100.0%

- It is used to set the corresponding ACI voltage of the external analog input 0.

03-05 AUI Analog Positive Input Bias

Factory Setting: 0

Settings -100.0~100.0%

- It is used to set the corresponding AUI voltage of the external analog input 0.
- The relation between external input voltage/current and setting frequency: 0~10V (4-20mA) corresponds to 0-60Hz.

03-06 AUI Analog Negative Input Bias

Factory Setting: 0

Settings -100.0~100.0%

03-07 Positive/negative Bias Mode (AVI)
03-08 Positive/negative Bias Mode (ACI)
03-09 Positive/negative Bias Mode (AUI)
03-10 Reserved

Factory Setting: 0

Settings 0: Zero bias

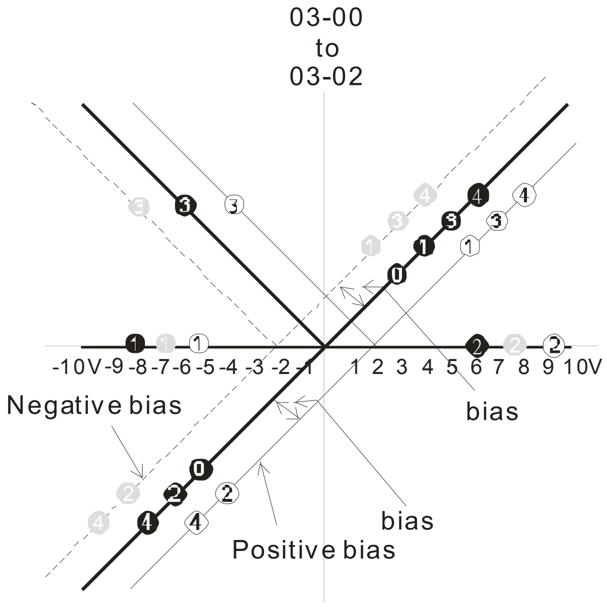
1: Lower than bias=bias

2: Greater than bias=bias

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

4: Serve bias as the center

- 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.



03-11~03-14 gain is positive

0 Zero bias

1 Lower than bias =bias

2 Greater than bias=bias

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

4 Serve bias as the center

03-11	Analog Input Gain 1 (AVI)
03-12	Analog Input Gain 2 (ACI)
03-13	Analog Positive Input Gain 3 (AUI)
03-14	Analog Negative Input Gain 4 (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.

03-15	Analog Input Filter Time (AVI)
03-16	Analog Input Filter Time (ACI)
03-17	Analog Input Filter Time (AUI)

Factory Setting: 0.01

Settings 0.00~2.00 sec

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.

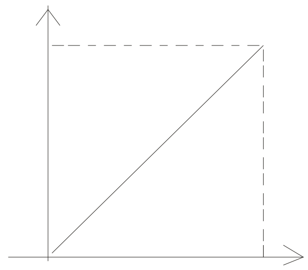
03-18	Addition Function of the Analog Input

Factory Setting: 0

Settings 0: Disable (AVI, ACI, AUI)

1: Enable

When Pr.03-18 is set to 0 and the analog input setting is the same, the priority for AVI, ACI and AUI are AVI>ACI>AUI.



$$F_{command}=[(ay-bias)*gain]*\frac{Fmax(01\text{-}00)}{10V \text{ or } 16mA}$$

Fcommand: the corresponding frequency for 10V or 20mA
ay : 10 or 16mA
bias : Pr.03-03,Pr.03-04, Pr.03-05
gain : Pr.03-11, Pr.03-12, Pr.03-13, Pr.03-14

03-19 Loss of the ACI Signal

Factory Setting: 0

Settings 0: Disable
1: Continue operation at the last frequency
2: Decelerate to stop
3: top immediately and display ACE

- This parameter determines the behavior when ACI is lost.
- When Pr.03-29 is set to 1, it means ACI terminal is for 0-10V voltage input. 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 or drive is stop.

03-20 Multi-function Output 1 (AFM1)

Factory Setting: 0

03-23 Multi-function Output 2 (AFM2)

Factory Setting: 0

Settings 0~23

Function Chart

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 communication card	For communication output (CMC-MOD01, CMC-EIP01, CMC-PN01, CMC-DN01)
23	Constant voltage output	Voltage output level can be controls by Pr.03-32 and Pr03-33. 0~100% of Pr.03-32 corresponds to 0~10V of AFM1.

03-21 Gain for Analog Output 1 (AFM1)

Factory Setting: 100.0

03-24 Gain for Analog Output 2 (AFM2)

Factory Setting: 100.0

Settings 0~500.0%

- It is used to adjust the analog voltage level (Pr.03-20) that terminal AFM outputs.
- This parameter is set the corresponding voltage of the analog output 0.

03-22 Analog Output 1 Value in REV Direction (AFM1)

Factory Setting: 0

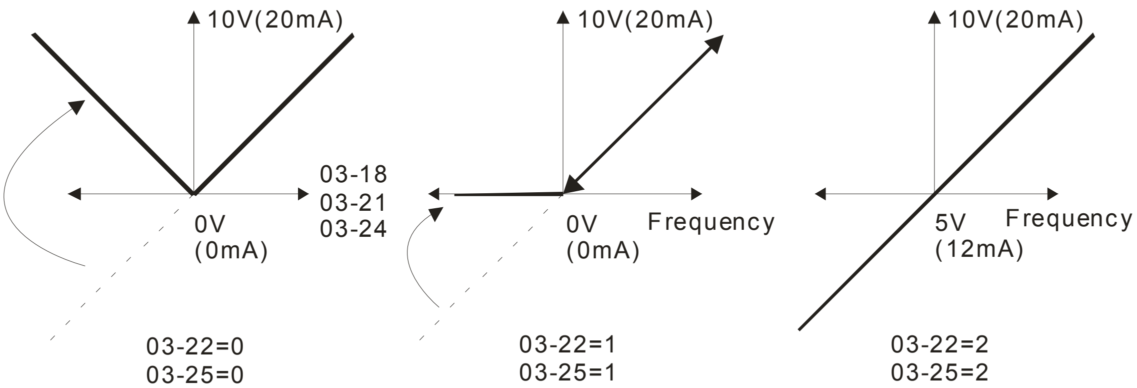
03-25 Analog Output 2 Value in REV Direction (AFM2)

Factory Setting: 0

Settings 0: Absolute value in REV direction

1: Output 0V in REV direction; output 0-10V in FWD direction

2: Output 5-0V in REV direction; output 5-10V in FWD direction



Selections for the analog output direction

03-26 Reserved

03-27 Reserved

03-28 AVI Selection

Factory Setting: 0

Settings 0: 0-10V

1: 0-20mA

2: 4-20mA

03-29 ACI Selection

Factory Setting: 0

Settings 0: 4-20mA

1: 0-10V

2: 0-20mA

When changing the input mode, please check if the switch of external terminal (SW3, SW4) corresponds to the setting of Pr.03-28~03-29.

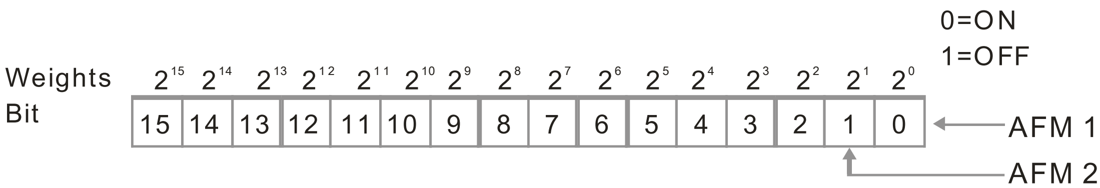
03-30 Status of PLC Output Terminal

Factory Setting: ##

Settings 0~65535

Monitor the status of PLC analog output terminals

P.03-30 shows the external multi-function output terminal that used by PLC.



NOTE

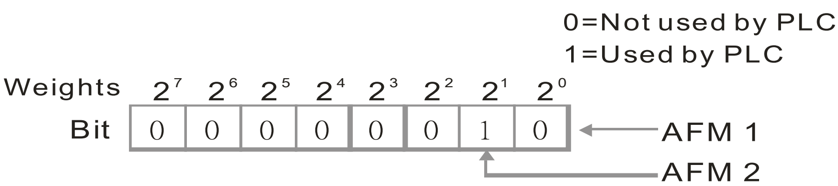
$2^7=128$ $2^6=64$

$2^5=32$ $2^4=16$ $2^3=8$

$2^2=4$ $2^1=2$ $2^0=1$

For Example:

If the value of Pr.02-30 displays 0002h(Hex), it means AFM1and AFM2 are used by PLC.



Display value

$2=1\times2^1+0\times2^0$

$=\text{bit } 1\times2^1+\text{bit } 0\times2^0$

03-31 AFM2 0-20mA Output Selection

Factory Setting: 0

Settings 0: 0-20mA output

1: 4-20mA output

03-32	AFM1 DC output setting level
03-33	AFM2 DC Output Setting Level

Factory Setting: 0.00

Settings 0.00~100.00%

04 Multi-Step Speed Parameters

✓ The parameter can be set during operation.

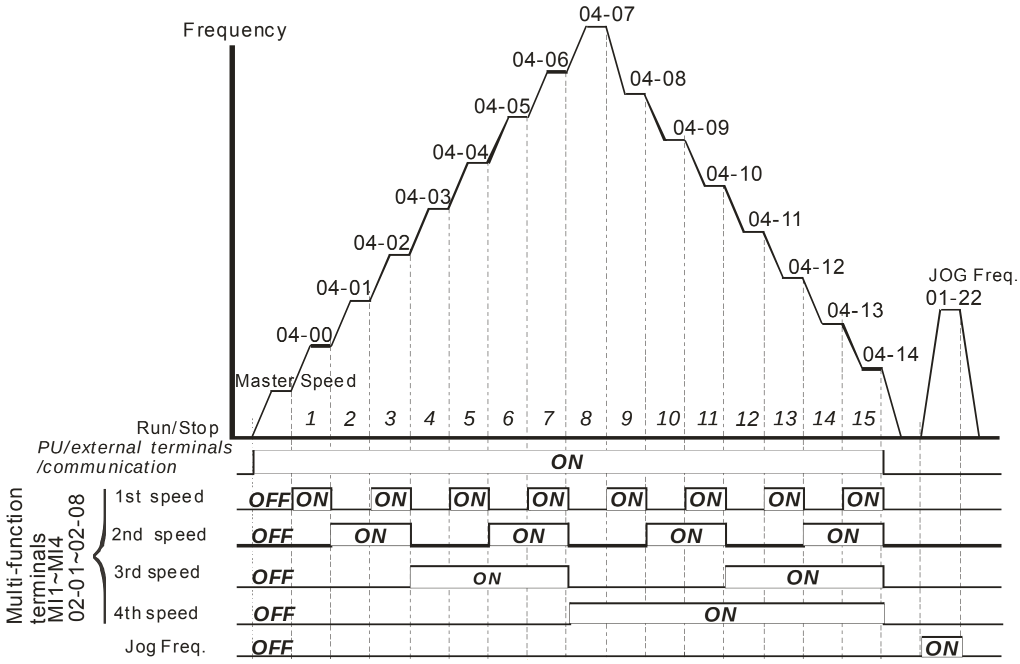
✓	04-00	1st Step Speed Frequency
✓	04-01	2nd Step Speed Frequency
✓	04-02	3rd Step Speed Frequency
✓	04-03	4th Step Speed Frequency
✓	04-04	5th Step Speed Frequency
✓	04-05	6th Step Speed Frequency
✓	04-06	7th Step Speed Frequency
✓	04-07	8th Step Speed Frequency
✓	04-08	9th Step Speed Frequency
✓	04-09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

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.
- Each one of multi-step speeds can be set within 0.0~600.0Hz 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)



Multi-speed via External Terminals

04-16	Position command 1 (pulse)
04-18	Position command 2 (pulse)
04-20	Position command 3 (pulse)
04-22	Position command 4 (pulse)
04-24	Position command 5 (pulse)
04-26	Position command 6 (pulse)
04-28	Position command 7 (pulse)
04-30	Position command 8 (pulse)
04-32	Position command 9 (pulse)
04-34	Position command 10 (pulse)
04-36	Position command 11 (pulse)
04-38	Position command 12 (pulse)
04-40	Position command 13 (pulse)
04-42	Position command 14 (pulse)
04-44	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 1st step speed frequency
04-18 Position command 1 (pulse)	0	0	1	0	04-01 2nd step speed frequency
04-20 Position command 1 (pulse)	0	0	1	1	04-02 3rd step speed frequency
04-22 Position command 1 (pulse)	0	1	0	0	04-03 4th step speed frequency

04-24 Position command 1 (pulse)	0	1	0	1	04-04 5th step speed frequency
04-26 Position command 1 (pulse)	0	1	1	0	04-05 6th step speed frequency
04-28 Position command 1 (pulse)	0	1	1	1	04-06 7th step speed frequency
04-30 Position command 1 (pulse)	1	0	0	0	04-07 8th step speed frequency
04-32 Position command 1 (pulse)	1	0	0	1	04-08 9th step speed frequency
04-34 Position command 1 (pulse)	1	0	1	0	04-09 10th step speed frequency
04-36 Position command 1 (pulse)	1	0	1	1	04-10 11th step speed frequency
04-38 Position command 1 (pulse)	1	1	0	0	04-11 12th step speed frequency
04-40 Position command 1 (pulse)	1	1	0	1	04-12 13th step speed frequency
04-42 Position command 1 (pulse)	1	1	1	0	04-13 14th step speed frequency
04-44 Position command 1 (pulse)	1	1	1	1	04-14 15th step speed frequency

04-15 Position command 1 (revolution)

04-17 Position command 2 (revolution)

04-19 Position command 3 (revolution)

04-21 Position command 4 (revolution)

04-23 Position command 5 (revolution)

04-25 Position command 6 (revolution)

04-27 Position command 7 (revolution)

04-29 Position command 8 (revolution)

04-31 Position command 9 (revolution)

04-33 Position command 10 (revolution)

04-35 Position command 11 (revolution)

04-37 Position command 12 (revolution)

04-39 Position command 13 (revolution)

04-41 Position command 14 (revolution)

04-43 Position command 15 (revolution)

📖 To switch the target position of the external terminal, set external terminal parameters to 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	P2P Target Position		
0000	0		
0001	Multi-position 1	04-15	04-16
0010	Multi-position 2	04-17	04-18
0011	Multi-position 3	04-19	04-20
0100	Multi-position 4	04-21	04-22
0101	Multi-position 5	04-23	04-24
0110	Multi-position 6	04-25	04-26
0111	Multi-position 7	04-27	04-28

1000	Multi-position 8	04-29	04-30
1001	Multi-position 9	04-31	04-32
1010	Multi-position 10	04-33	04-34
1011	Multi-position 11	04-35	04-36
1100	Multi-position 12	04-37	04-38
1101	Multi-position 13	04-39	04-40
1110	Multi-position 14	04-41	04-42
1111	Multi-position 15	04-43	04-44

05 Motor Parameters

〆 The parameter can be set during operation.

05-00 Motor Auto Tuning

Factory Setting: 0

Settings 0: No function

1: Measure induction motor in dynamic status (motor spinning)
(Rs, Rr, Lm, Lx, no-load current)

2: Measure induction motor in static status (motor not spinning)

3: No function

4: Measure PM motor magnetic pole and PG origin in static status (motor not spinning)

5: Measure PM motor parameter in dynamic status (motor spinning)

6: Measure IM motor flux curve in dynamic status

12: FOC Sensorless inertia estimation

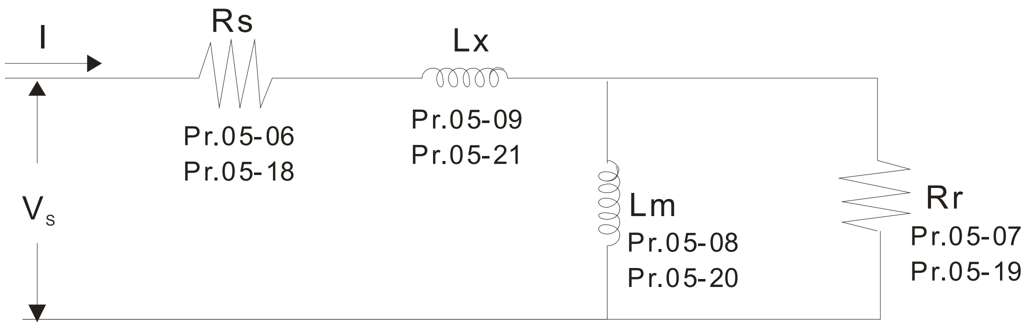
Induction Motor

- Start auto tuning by press the【Run】key and 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.
- AUTO-Tuning Process (dynamic motor):

1. Make sure that all the parameters are set to factory settings 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.

	Motor 1	Motor 2
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 the the【Run】key, the drive will begin auto-tuning. Please be aware motor starts spinning when the【Run】 key is pressed.
5. When auto-tuning is complete, 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, it needs to input Pr.05-05 for motor 1/Pr.05-17 for motor 2.

NOTE

☑ 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't be larger or equal to 120f/p (f: rated frequency 01-01/01-35; P: number of motor poles 05-04/05-16).

Permanent Magnetic Motor

🕮 Set Pr.05-00 =5 to start auto tuning for PM motor, press the【Run】 key and 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）.

🕮 AUTO-Tuning Process (dynamic motor):

1. Make sure that all the parameters are set to factory settings and the motor wiring is correct.
2. For PM motor, set Pr.05-33=1 and complete rest of the setting in Pr.05-34 rated current, Pr.05-35 rated power, Pr.05-36 rated speed and 05-37 pole number. The acceleration time and deceleration time should be set according to your motor capacity.
3. Set Pr.05-00=5 and press the【Run】key, the drive will begin auto-tuning for PM motor. Please be aware of the dynamic motor, it starts spinning as the 【Run】key 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 to begin auto-tuning for PM motor magnetic pole and PG origin, press【Run】key and 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.

Automatically measure the angle between magnetic pole and PG origin (dynamic motor)

1. Set Pr.05-00=5 and press RUN key, 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 auto-tuning begin.
3. Set Pr.05-00=4 and press and press the【Run】key to begin auto-tuning. Please be aware of the dynamic motor, it starts spinning as the 【Run】key is pressed.
4. When auto-tuning is completed, please check if the angle between magnetic pole and the PG origin is written into Pr.05-42 automatically.

Set Pr.05-00=6, to begin IM motor flux curve measure in dynamic status. This measure is only available for FOC/TQC Sensorless. Enter motor information into the parameters then the drive can now begin auto-tuning.

- ➢ Complete the setting in 01-01，01-02，05-01~05-04 according to the motor plate information
- ➢ Set 05-00=6 and press the 【Run】key to start auto-tuning. Please make sure the motor is removed before auto-tuning begin.

Set Pr.05-00=12, to begin IM motor inertia auto-tuning measure. This measure is only available for FOC/TQC Sensorless mode. Enter motor information into the parameters then the drive can now begin auto-tuning.

- ✧ Note: Before Pr.05-00=12 begin auto-tuning, motor parameters(no load current, Rs, Rr, Lm and Lx) must be inputted first.

- ➢ 00-10=2, torque mode
- ➢ 00-13=2, Sensorless torque mode
- ➢ 05-00=12, press 【Run】key to begin inertia estimation.
- ➢ When inertia estimation is completed, check if the outcome in Pr.11-01(unit PU Q8) is a reasonable value.

Sensorless FOC mode

- ➢ 00-10 = 0, speed mode
- ➢ 00-11 = 5, Sensorless FOC mode

11-00 bit0=1, use ASR gain to automatically adjust ASR bandwidth (Pr.11-03,11-04,11-05)

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

Unit: Amper

Factory Setting: #.##

Settings 10 to 120% of drive's rated current

📖 This value should be set according to the rated frequency of the motor as indicated on the motor nameplate. The factory setting is 90% X rated current.

Example: The rated current for 7.5HP (5.5kW) is 25 and factory setting is 22.5A. The range for setting will be 10~30A.(25*40%=10A and 25*120%=30A)

05-02 Rated Power of Induction Motor 1(kW)

Factory Setting: #.##

Settings 0~655.35 kW

It is used to set rated power of the motor 1. The factory setting is the power of the drive.

05-03 Rated Speed of Induction Motor 1 (rpm)

Factory Setting:
1710（60Hz 4 poles）
1410（50Hz 4 poles）

Settings 0~65535

It is used to set the rated speed of the motor and need to set according to the value indicated on the motor nameplate.

05-04 Pole Number of Induction Motor 1

Factory Setting: 4

Settings 2~20

It is used to set the number of motor poles (must be an even number).

05-05 No-load Current of Induction Motor 1 (A)

Unit: Amper
Factory Setting: #.##

Settings 0 to the factory setting in Pr.05-01

The factory setting is 40% X rated current.

05-06 Stator Resistance(Rs) of Induction Motor 1
05-07 Rotor Resistance(Rr) of Induction Motor 1

Factory Setting: #.###

Settings 0~65.535Ω

05-08 Magnetizing Inductance(Lm) of Induction Motor 1
05-09 Stator inductance(Lx) of Induction Motor 1

Factory Setting: #.#

Settings 0~6553.5mH

05-10 ~ **05-12** Reserved

05-13	Full-load Current of Induction Motor 2 (A)

Unit: Amper

Factory Setting:#.##

Settings 10~120%

📖 This value should be set according to the rated frequency of the motor as indicated on the motor nameplate. The factory setting is 90% X rated current.
Example: The rated current for 7.5HP (5.5kW) is 25A and factory setting is 22.5A. The range for setting will be 10~30A.(25*40%=10A and 25*120%=30A)

✓ 05-14	Rated Power of Induction Motor 2 (kW)

Factory Setting: #.##

Settings 0~655.35 kW

📖 It is used to set rated power of the motor 2. The factory setting is the power of the drive.

✓ 05-15	Rated Speed of Induction Motor 2 (rpm)

Factory Setting: 1710

Settings 0~65535

📖 It is used to set the rated speed of the motor and need to set according to the value indicated on the motor nameplate.

05-16	Pole Number of Induction Motor 2

Factory Setting: 4

Settings 2~20

📖 It is used to set the number of motor poles (must be an even number).

05-17	No-load Current of Induction Motor 2 (A)

Unit: Amper

Factory Setting: #.##

Settings 0 to the factory setting in Pr.05-01

📖 The factory setting is 40% X rated current.

05-18	Stator Resistance (Rs) of Induction Motor 2
05-19	Rotor Resistance (Rr) of Induction Motor 2

Factory Setting: #.###

Settings 0~65.535Ω

05-20	Magnetizing Inductance (Lm) of Induction Motor 2
05-21	Stator Inductance (Lx) of Induction Motor 2

Factory Setting: #.#

Settings 0~6553.5 mH

05-22 Induction Motor 1/ 2 Selection

Factory Setting: 1

Settings 1: Motor 1

2: Motor 2

It is used to set the motor that driven by the AC motor drive.

05-23 Frequency for Y-connection/△-connection Switch of Induction Motor

Factory Setting: 60.00

Settings 0.00~600.00Hz

05-24 Y-connection/△-connection Switch of Induction Motor IM

Factory Setting: 0

Settings 0: Disable

1: Enable

05-25 Delay Time for Y-connection/△-connection Switch of Induction Motor

Factory Setting: 0.200

Settings 0.000~60.000 sec

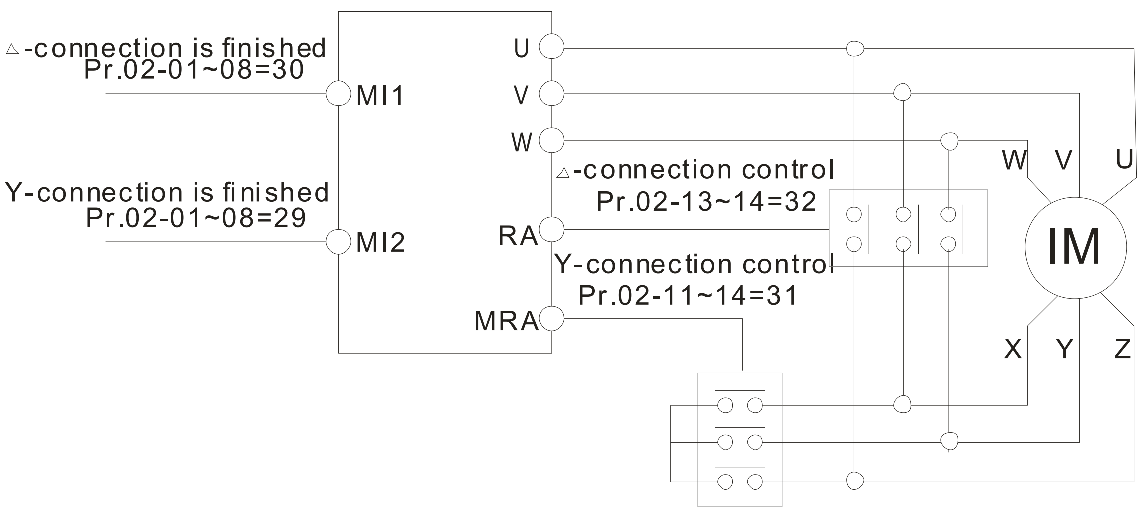
P.05-23 and Pr.05-25 are applied in the wide range motors and the motor coil will execute the switch of Y-connection/Δ-connection as required. (The wide range motors has relation with the motor design. In general, it has higher torque at low speed and Y-connection and it has higher speed at high speed and Δ connection.

Pr.05-24 is used to enable/disable Y-connection/Δ-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 Δ-connection. At the same time, it will also affect motor parameters.

Pr.05-25 is used to set the switch delay time of Y-connection/Δ-connection.

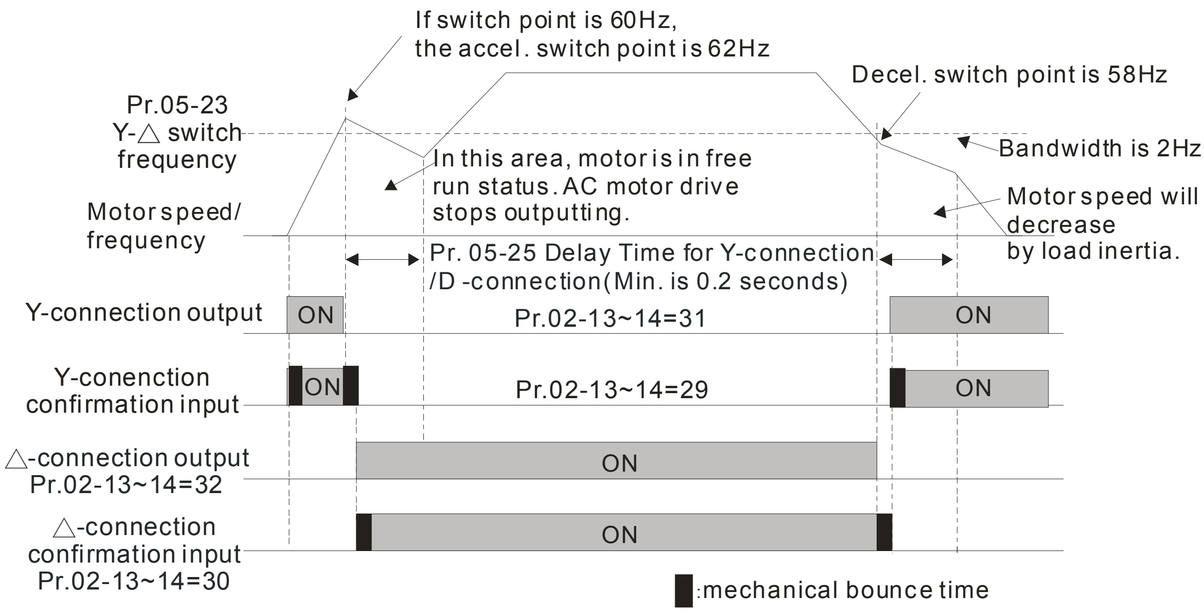
When output frequency reaches Y-connection/Δ-connection switch frequency, drive will delay by Pr.05-25 before multi-function output terminals are active.

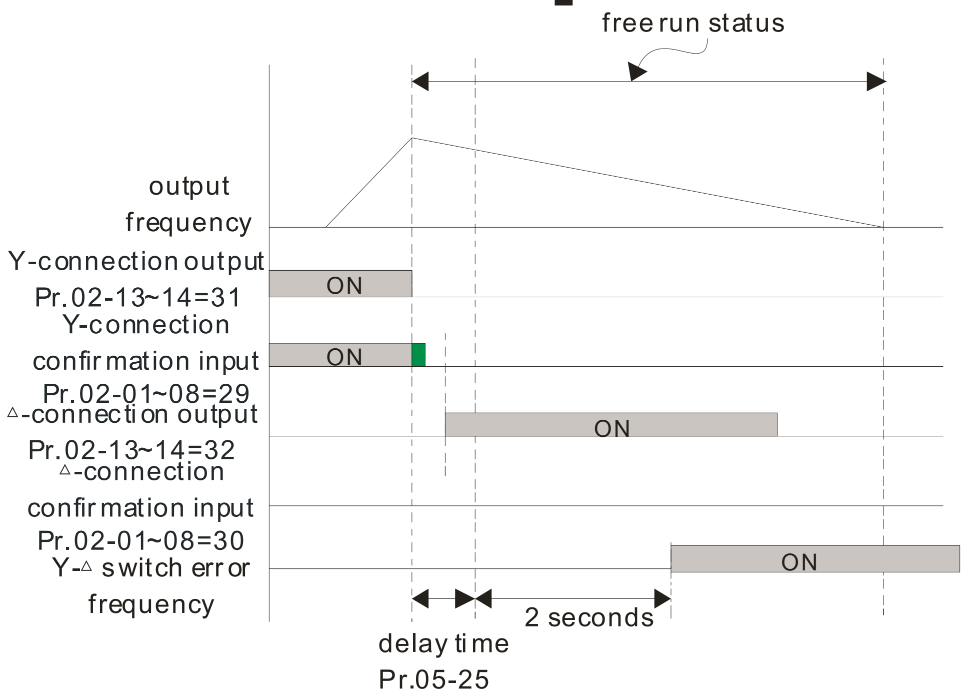


Y-△ connection switch: can be used for wide range motor

Y -connection for low speed: higher torque can be used for rigid tapping

△-connection for high speed: higher torque can be used for high-speed drilling





05-26 ~ 05-30	Reserved

05-31	Accumulative Motor Operation Time (Min)

Factory Setting: 0

Settings 00~1439

05-32	Accumulative Motor Operation Time (day)

Factory Setting: 0

Settings 00~65535

📖 Pr. 05-31 and Pr.05-32 are used to record the motor operation time. They can be cleared by setting to 00 and time won't be recorded when it is less than 60 seconds.

05-33 Induction Motor and Permanent Magnet Motor Selection

Factory Setting: 0

Settings 0: Induction Motor
1: Permanent Magnet Motor

05-34 Full-load current of Permanent Magnet Motor

Factory Setting: 0.00

Settings 0.00~655.35 Amps

05-35 Rated Power of Permanent Magnet Motor

Factory Setting: 0.00

Settings 0.00~655.35 kW

05-36 Rated speed of Permanent Magnet Motor

Factory Setting: 2000

Settings 0~65535 rpm

05-37 Pole number of Permanent Magnet Motor

Factory Setting: 10

Settings 0~65535

05-38 Inertia of Permanent Magnet Motor

Factory Setting: 0.0

Settings 0.0~6553.5 kg.cm^2

📖 This parameter setting is defined in **kg-cm2** . If this measure is not familiar, please refer to the chart below for a reference. (Delta's motor inertia chart is for reference purpose only.)

Delta Motor (Low inertia model)								
Rated Power(kW)	0.1	0.2	0.4	0.4	0.75	1	2	
Rotor inertia (kg.m^2)	3.70E-06	1.77E-05	2.77E-05	6.80E-05	1.13E-04	2.65E-04	4.45E-04	
Delta Motor (Mid to High Inertia model)								
Rated Power(kW)	0.5	1	1.5	2	2	0.3	0.6	0.9
Rotor inertia (kg.m^2)	8.17E-04	8.41E-04	1.12E-03	1.46E-03	3.47E-03	8.17E-04	8.41E-04	1.12E-03

05-39 Stator Resistance of PM Motor

Factory Setting: 0.000

Settings 0.000~65.535Ω

05-40 Permanent Magnet Motor Ld

Factory Setting: 0.00

Settings 0.00~655.35 mH

05-41 Permanent Magnet Motor Lq

Factory Setting: 0.00

Settings 0.00~655.35 mH

05-42 Offset angle of PM Motor pole

Factory Setting: 0

Settings 0.0~360.0°

Pr.05-42 can be detected by setting Pr.05-00=4

05-43 Ke parameter of PM Motor

Unit: V/1000rpm

Factory Setting: 0

Settings 0~65535

06 Protection Parameters

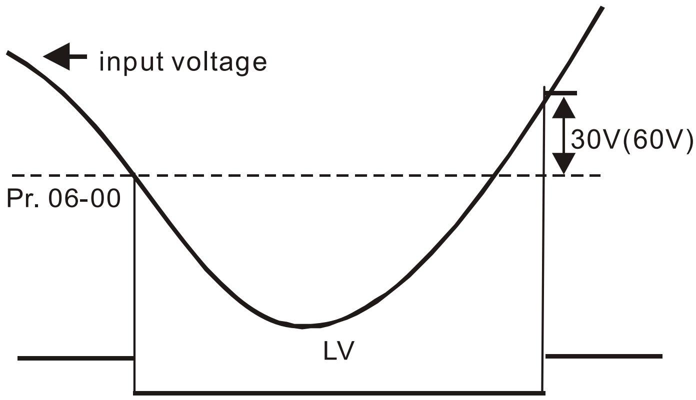
✓ The parameter can be set during operation.

✓ 06-00 Low Voltage Level

Factory Setting: 200.0/400.0

Settings 230V Series: 150.0~220.0V
Frame E~H: 190.0~220.0V
460V Series: 300.0~440.0V
Frame E~H: 380.0~440.0V

- It is used to set the Lv level. When the drive is in the low voltage, it will stop output and free to stop.



✓ 06-01 Over-voltage Stall Prevention

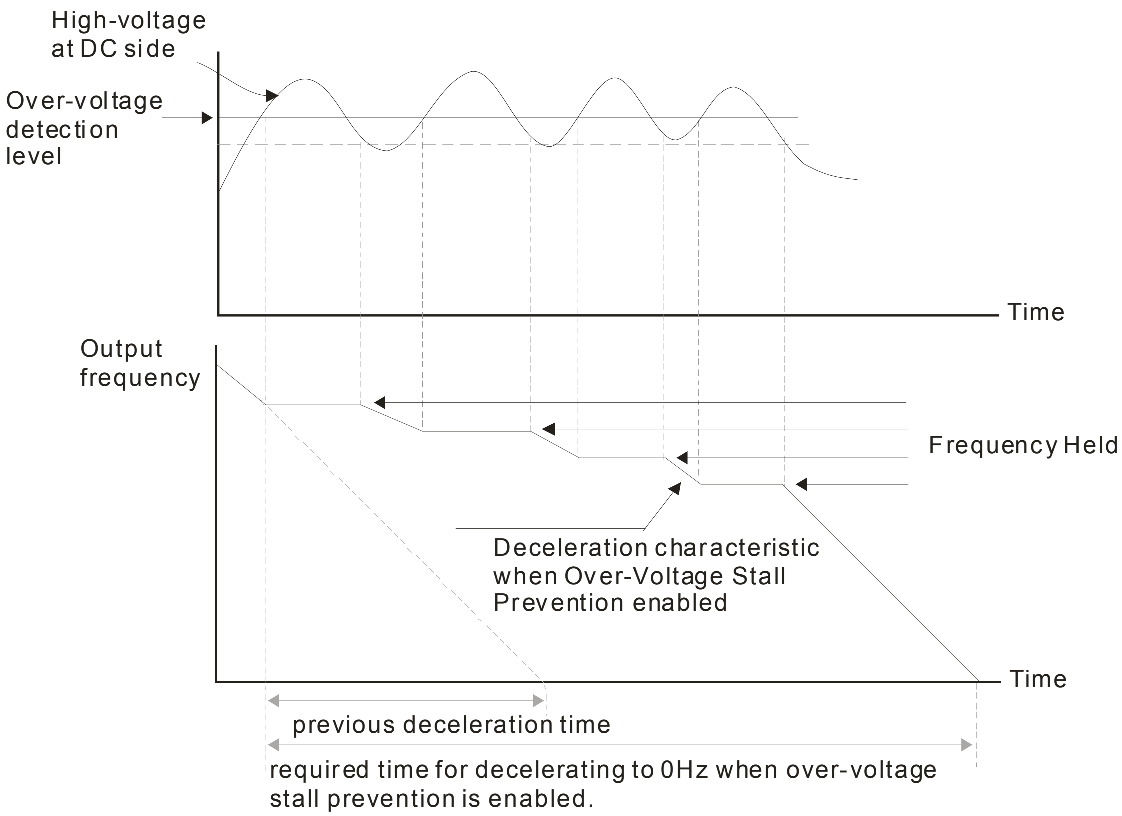
Factory Setting: 380.0/760.0

Settings 230V Series: 0.0~450.0V
460V Series:0.0~900.0V
0: No function

- During deceleration, the DC bus voltage may exceed its Maximum Allowable Value due to motor regeneration. When this function is enabled, the AC motor drive will not decelerate further and keep the output frequency constant until the voltage drops below the preset value again.
- 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.
- When the over-voltage stall prevention is enabled, drive deceleration time will be larger than the setting.
- 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 appendix B-1 for details) to consume the electrical energy that regenerated from the motor with heat type.

➢ Related parameters: Pr.01-13, 01-15, 01-17, 01-19 (settings of decel. time 1~4), Pr.02-13~02-14 (Multi-function Output 1 RY1, RY2), Pr. 02-16~02-17 Multi-function Output (MO1, 2)



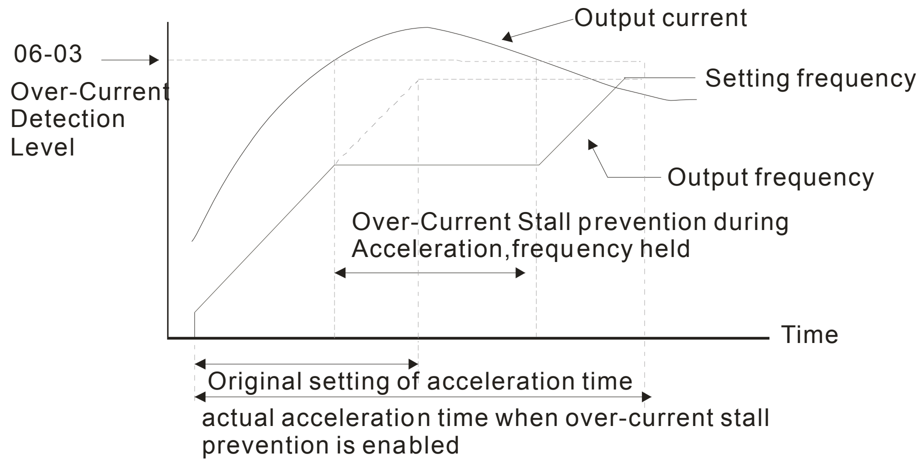
06-02 Reserved

06-03 Over-current Stall Prevention during Acceleration

Settings	Normal duty: 0~160% (100%: drive's rated current)	Factory Setting: 120
	Heavy duty: 0~180% (100%: drive's rated current)	Factory Setting: 150

- 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 deceleration 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

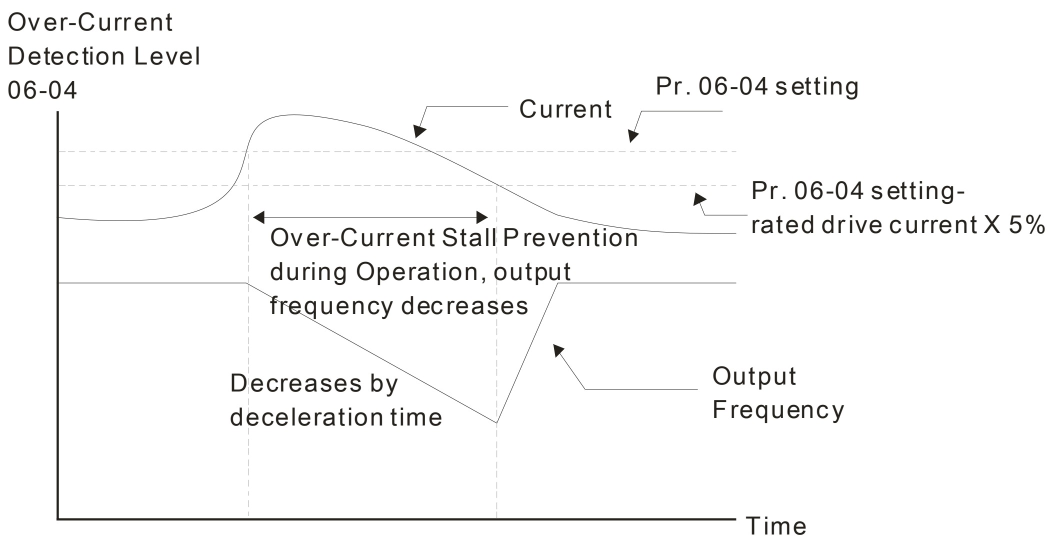
  1. dd the suitable acceleration time.
  2. Setting Pr.01-44 Optimal Acceleration/Deceleration Setting to 1, 3 or 4 (auto accel.)
- Optimal Acceleration/Deceleration Setting, Pr.02-13~02-14 (Multi-function Output 1 RY1, RY2), Pr. 02-16~02-17 Multi-function Output (MO1, 2)



06-04 Over-current Stall Prevention during Operation

Settings	Normal duty: 0~160% (100%: drive's rated current)	Factory Setting: 120%
	Heavy duty: 0~180% (100%: drive's rated current)	Factory Setting: 150%

- 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

06-05 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.

06-06 Over-torque Detection Selection (OT1)

Factory Setting: 0

Settings 0: Disable
1: Over-torque detection during constant speed operation, continue to operate after detection
2: Over-torque detection during constant speed operation, stop operation after detection
3: Over-torque detection during operation, continue to operate after detection
4: Over-torque detection during operation, stop operation after detection

06-09 Over-torque Detection Selection (OT2)

Factory Setting: 0

Settings 0: Disable
1: Over-torque detection during constant speed operation, continue to operate after detection
2: Over-torque detection during constant speed operation, stop operation after detection
3: Over-torque detection during operation, continue to operation after detection
4: Over-torque detection during operation, stop operation after detection

- When Pr.06-06 and Pr.06-09 are set to 1 or 3, it will display a warning message and won't have an abnormal record.
- When Pr.06-06 and Pr.06-09 are set to 2 or 4, it will display a warning message and will have an abnormal record.

06-07 Over-torque Detection Level (OT1)

Factory Setting: 120

Settings 10 to 250% (100%: drive's rated current)

06-08 Over-torque Detection Level (OT1)

Factory Setting: 0.1

Settings 0.0~60.0 sec

06-10 Over-torque Detection Level (OT2)

Factory Setting: 120

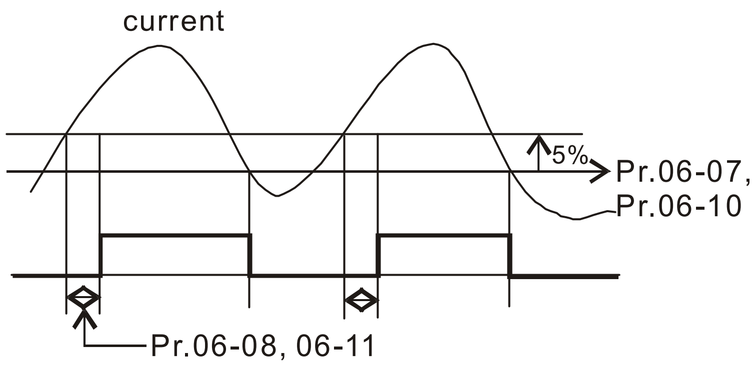
Settings 10 to 250% (100%: drive's rated current)

06-11 Over-torque Detection Time (OT2)

Factory Setting: 0.1

Settings 0.0~60.0 sec

- Over torque detection is determine by the following method: if the output current exceeds the over-torque detection level (Pr.06-07, factory setting: 150%) and also exceeds Pr.06-08 Over-Torque Detection Time, the fault code "ot1/ot2" will appear. If a Multi-Functional Output Terminal is to over-torque detection (setting 7 or 8), the output is on. Please refer to Pr.02-13~02-14 for details.



06-12 Current Limit

Factory Setting: 170

Settings 0~250% (100%: drive's rated current)

This parameter sets the max. current output of the drive.

06-13 Electronic Thermal Relay Selection (Motor 1)

06-27 Electronic Thermal Relay Selection (Motor 2)

Factory Setting: 2

Settings 0: Inverter motor

1: Standard motor

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.

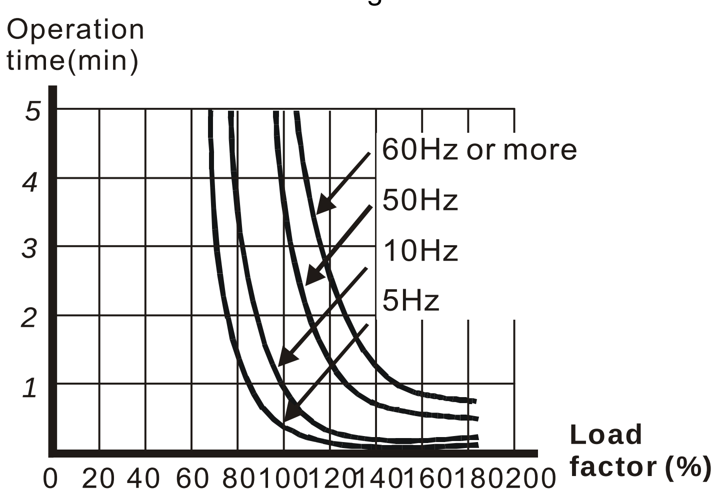
06-14 Electronic Thermal Characteristic for Motor 1

06-28 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.



06 - 15	Heat Sink Over-heat (OH) Warning

Factory Setting: 85.0

Settings 0.0~110.0℃

06 - 16	Stall Prevention Limit Level

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%:
Stall Prevention Level during acceleration = 06-03x06-16=150x80%=120%.
Stall Prevention Level at constant speed= 06-04x06-16=100x80%=80%.

06 - 17	Present Fault Record
06 - 18	Second Most Recent Fault Record
06 - 19	Third Most Recent Fault Record
06 - 20	Fourth Most Recent Fault Record
06 - 21	Fifth Most Recent Fault Record
06 - 22	Sixth Most Recent Fault Record

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)

66-72: Reserved

73: External safety gate S1

74~78: Reserved

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

85~100: 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

111: Reserved

- 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.

06-23	Fault Output Option 1
06-24	Fault Output Option 2
06-25	Fault Output Option 3
06-26	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 Code	Bit0	Bit1	Bit2	Bit3	Bit4	Bit5	Bit6
	current	Volt.	OL	SYS	FBK	EXI	CE
0: No fault							
1: Over-current during acceleration (ocA)	●						
2: Over-current during deceleration (ocd)	●						
3: Over-current during constant speed(ocn)	●						
4: Ground fault (GFF)	●						

5: IGBT short-circuit (occ)	●						
6: Over-current at stop (ocS)	●						
7: Over-voltage during acceleration (ovA)		●					
8: Over-voltage during deceleration (ovd)		●					
9: Over-voltage during constant speed (ovn)		●					
10: Over-voltage at stop (ovS)		●					
11: Low-voltage during acceleration (LvA)		●					
12: Low-voltage during deceleration (Lvd)		●					
13: Low-voltage during constant speed (Lvn)		●					
14: 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)			●				
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)						●	
66-72: Reserved							
73: External safety gate S1				●			
74~78: Reserved							
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	●						
85~100: 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							●

111: Reserved	

06-29 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

06-30 PTC Level

Factory Setting: 50.0

Settings 0.0~100.0%

- 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.

06-31 Frequency Command for Malfunction

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.

06-32 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.

06-33 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.

06-34 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.

06-35 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.

06-36 IGBT Temperature at Malfunction

Factory Setting: Read only

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.

06-37 Capacitance Temperature at Malfunction

Factory Setting: Read only

Settings 0.0~6553.5℃

📖 When malfunction occurs, user can check the current capacitance temperature. If it happens again, it will overwrite the previous record.

06-38 Motor Speed in rpm at Malfunction

Factory Setting: Read only

Settings 0.0~6553.5℃

📖 When malfunction occurs, user can check the current motor speed in rpm. If it happens again, it will overwrite the previous record.

06-39 Torque Command at Malfunction

Factory Setting: Read only

Settings 0~65535

📖 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

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

Factory Setting: Read only

Settings 0000h~FFFFh

📖 When malfunction occurs, user can check the status of multi-function input/output terminals. If it happens again, it will overwrite the previous record.

06-42 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.

06-43 Reserved

06-44 Reserved

06-45 Treatment for Output Phase Loss Detection (OPHL)

Factory Setting: 3

Settings 0: Warn and keep operating
1: Warn and ramp to stop
2: Warn and coast to stop
3: No warning

📖 Output phase loss

06-46 Deceleration Time of Output Phase Loss

Factory Setting:0.500

Settings 0.000~65.535 sec

06-47 Current Bandwidth

Factory Setting:1.00

Settings 0.00~655.35%

06-48 DC Brake Time of Output Phase Loss

Factory Setting:0.000

Settings 0.000~65.535 sec

06-49 Reserved

06-50 Time for Input Phase Loss Detection

Factory Setting:0.20

Settings 0.00~600.00 sec

06-51 Reserved

06-52 Ripple of Input Phase Loss

Factory Setting:30.0 / 60.0

Settings 230V Series: 0.0~160.0 Vdc
460V Series: 0.0~320.0 Vdc

06-53 Treatment for the detected Input Phase Loss （OrP）

Factory Setting: 0

Settings 0: warn, ramp to stop
1: warn, coast to stop

📖 Over ripple protection

06-54 Reserved

06-55 Derating Protection

Factory Setting: 0

Settings 0: constant rated current and limit carrier wave by load current and 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 50°C 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.

- Setting 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.

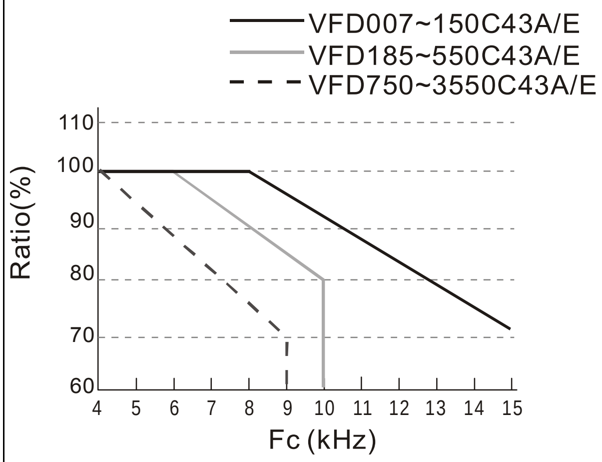
Derating curve diagram in the normal duty

Setting=1

Setting=0 or 2

(50℃: UL open-type)
(40℃:UL type1 or open type_size by size)

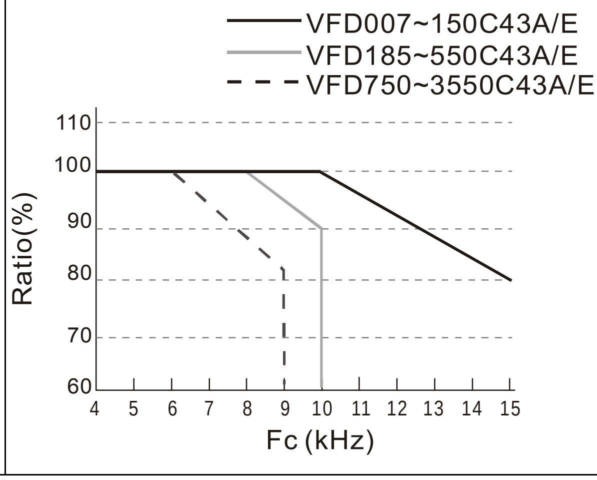
460V



Setting=0 or 2

(40℃: UL open-type)
(30℃: UL type1 or open type_size by size)

460V

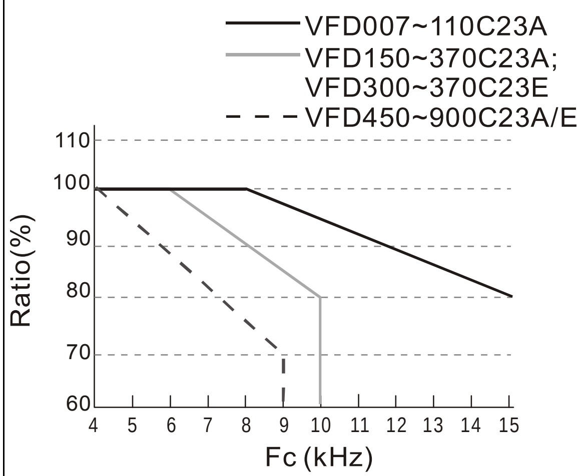


Setting=1

Setting=0 or 2

(50℃: UL open-type)
(40℃:UL type1 or open type_size by size)

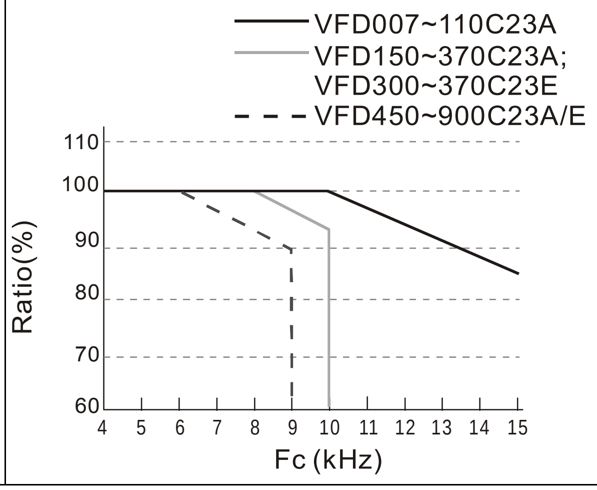
230V



Setting=0 or 2

(40℃: UL open-type)
(30℃: UL type1 or open type_size by size)

230V

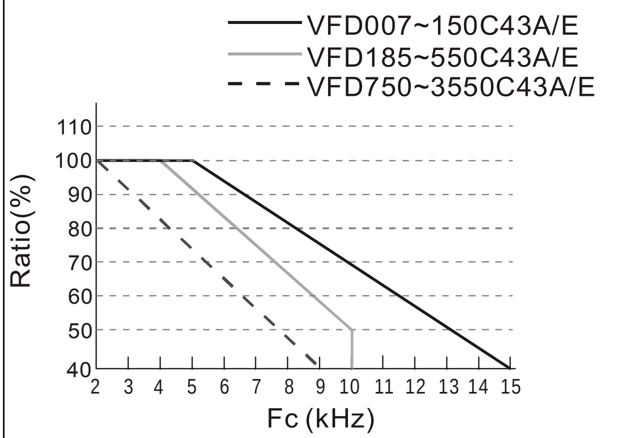


Derating curve diagram in the heavy duty

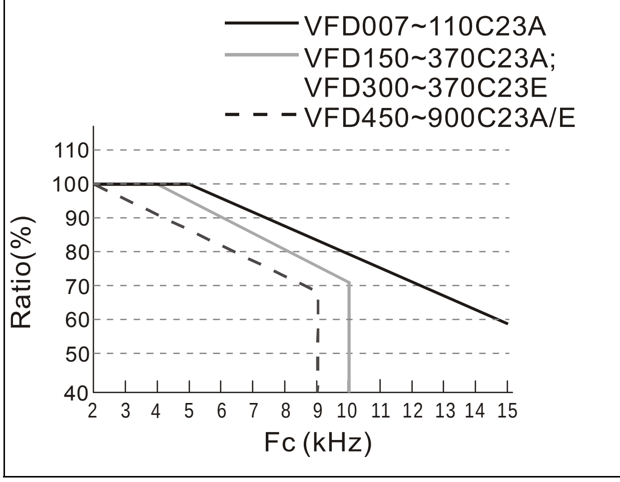
Setting=1
Setting=0 or 2

(50℃: UL open-type)
(40℃: UL type1 or open type_size by size)

460V



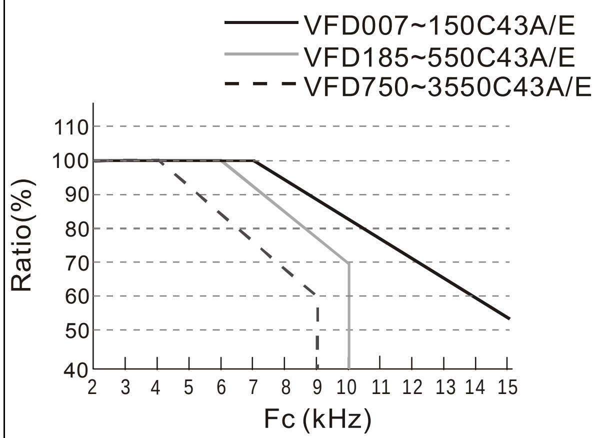
230V



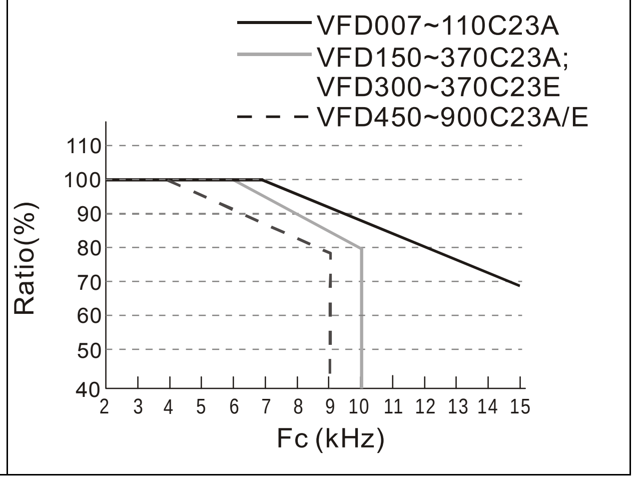
Setting=0 or 2

(40℃: UL open-type)
(30℃: UL type1 or open type_size by size)

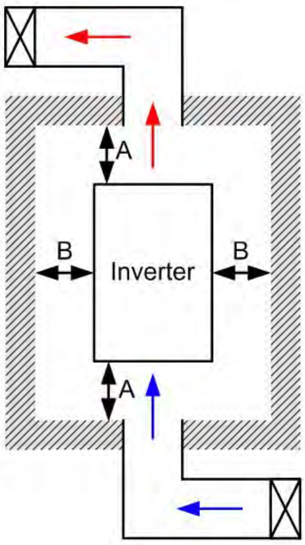
460V



230V



📖 It should be used with Pr. 00-16 and Pr.00-17 for setting.



NOTE

※ (As shown in the left figure), The mounting clearances are not for installing the drive in a confined space (such as cabinet or electric box). When installing in a confined space, except the same minimum mounting clearances, it needs to have the ventilation equipment or air conditioner to keep the surrounding temperature lower than the operation temperature.

※ The following table shows heat dissipation and the required air volume when installing a single drive in a confined space. When installing multiple drives, the required air volume shall be multiplied by the number the drives.

※ Please refer to the chart "Air Flow Rate for Cooling" for ventilation equipment design and selection.

※ Please refer to the chart "Power Dissipation" for air conditioner design and selection.

※ For more detail, please refer to Chapter 2 Installation.

Minimum mounting clearance:

Frame	A (mm)	B (mm)	C (mm)	D (mm)
A~C	60	30	10	0
D~F	100	50	-	0
G	200	100	-	0
H	350	0	0	200 (100, Ta=40℃)

	Air flow rate for cooling						Drive's power dissipation		
Model No.	Flow Rate (cfm)			Flow Rate (m^3/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	146	12	158	248	20	268	649	216	865
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	59
VFD015C43A/E	-	-	-	-	-	-	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

※ The required airflow shown in chart is for installing single drive in a confined space.

※ When installing the multiple drives, the required air volume should be the required air volume for single drive X the number of the drives.

Model series VFD007C23E; VFD015C23E; VFD022C23E; VFD037C23E; VFD055C23E; VFD75C23E; VFD110C23E; VFD150C23E; VFD185C23E; VFD220C23E will be available for ordering soon. Please contact your local distributor or Delta representative for detailed launch schedule.

※ The heat dissipation shown in the chart is for installing single drive in a confined space.

※ When installing multiple drives, volume of heat dissipation should be the heat dissipated for single drive X the number of the drives.

※ Heat dissipation for each model is calculated by rated voltage, current and default carrier.

06-56 PT100 Detection Level 1

Factory Setting:5.000

Settings 0.000~10.000V

06-57 PT100 Detection Level 2

Factory Setting: 7.000

Settings 0.000~10.000V

06-58 PT100 Level 1 Frequency Protection

Factory Setting: 0.00

Settings 0.00~600.00 Hz

06-59 Reserved

06-60 Software Detection GFF Current Level

Factory Setting: 60.0

Settings 0.0~6553.5 %

06-61 Software Detection GFF Filter Time

Factory Setting: 0.10

Settings 0.0~6553.5 %

06-62 Disable Level of dab

Factory Setting: 180.0/360.0

Settings 230V series: 0.0~220.0 Vic
460V series: 0.0~440.0 Vic

06-63 Fault Record 1 (min)
06-64 Fault Record 2 (min)
06-65 Fault Record 3 (min)
06-66 Fault Record 4 (min)
06-67 Fault Record 5 (min)
06-68 Fault Record 6 (min)

Factory Setting: Read only

Settings 0~64799 min

- Pr.06-63 to Pr.06-68 are used to record the operation time for 6 malfunctions and it can also check if there is any wrong with the drive according to the internal time.
- When the malfunction occurs during operation, it records fault in Pr.06-17~06-22 and operation time is recorded in Pr.06-63~06-68.
For example: When the first fault ovA occurs after operation 3000 min., second fault ovd occurs at 3482 min., third fault ovA occurs at 4051 min., fourth fault ocA at 5003 min., fifth fault ocA at 5824 min., sixth fault ocd occurs at 6402 min. and seven fault ocS at 6951 min..
It'll be recorded as the following table:

It will be recorded as the following table:

First fault	Pr.06-17	ovA	Pr.06-63	3000	ovA occurs at the 3000 min after operating.

Second fault	Pr.06-17	ovd	Pr.06-63	3482	*3482-3000=482 min* ovd occurs at 482 min after last fault (ovA)
	Pr.06-18	ovA	Pr.06-64	3000	

Third fault	Pr.06-17	ovA	Pr.06-63	4051	*4051-3482=569 min* ovA occurs at 569 min after last fault (ovd)
	Pr.06-18	ovd	Pr.06-64	3482	
	Pr.06-19	ovA	Pr.06-65	3000	

Seven fault	Pr.06-17	ocS	Pr.06-63	12	*(12-5824)+64800=58988 min* ocS occurs at 58988 min after last fault (ocA)
	Pr.06-18	ocA	Pr.06-64	5824	
	Pr.06-19	ocA	Pr.06-65	5003	
	Pr.06-20	ovA	Pr.06-66	4051	
	Pr.06-21	ovd	Pr.06-67	3482	
	Pr.06-22	ovA	Pr.06-68	3000	

06 - 69 Days of operation

Factory Setting: Read only

Settings Read only

06 - 70 Minutes of operation

Factory Setting: Read only

Settings Read only

06 - 71 Low Current Setting Level

Factory Setting: 0.0

Settings 0.0 ~ 6553.5 %

06 - 72 Low Current Detection Time

Factory Setting: 0.00

Settings 0.00 ~ 655.35 sec

06 - 73 Treatment for low current

Factory Setting: 0

Settings
0 : No function
1 : warn and coast to stop
2 : warn and ramp to stop by 2nd deceleration time
3 : warn and operation continue

07 Special Parameters

✐ The parameter can be set during operation.

✐ 07-00	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.

✐ 07-01	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/TQCPG mode, DC brake is zero-speed operation. It can enable DC brake function by setting to any value.

✐ 07-02	DC Brake Time at Start-up

Factory Setting: 0.0

Settings 0.00~60.0 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.

✐ 07-03	DC Brake Time at Stop

Factory Setting: 0.00

Settings 0.00~60.00 sec

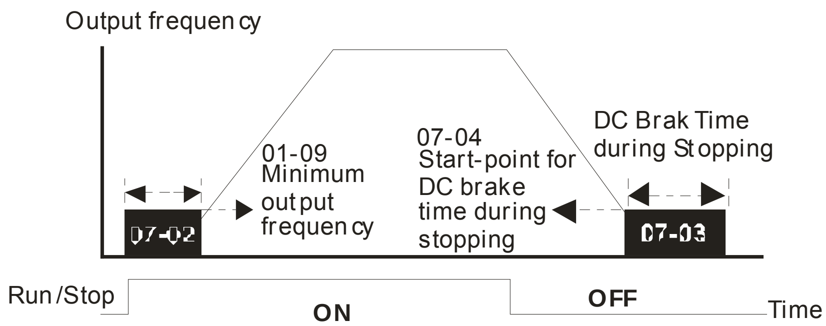
- The motor may be in the rotation status after drive stop outputting due to external force or itself inertia and can't stop accurately. This parameter can output DC current to force the motor drive stop after drive stops to make sure that the motor is stop.
- This parameter determines the duration of 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

✐ 07-04	Start-Point for DC Brake

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 Time

- 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.

07-05 Reserved

07-06 Restart 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 master 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 to0.

07-07 Maximum Power Loss Duration

Factory Setting: 2.0

Settings 0.1~20.0 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

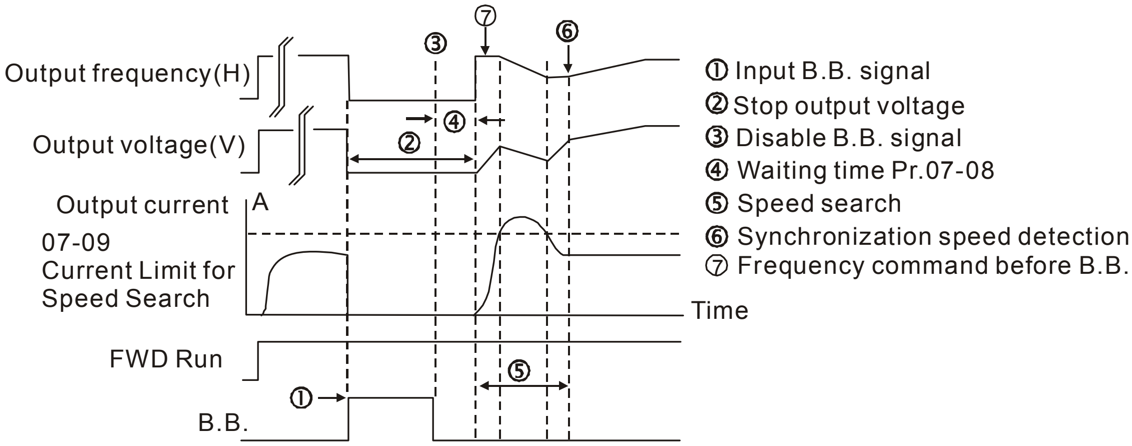
loss time is ≤5 seconds, the operation mode as set in Pr.07-06 is not executed. In that case it starts up normally.

07-08 Base block Time

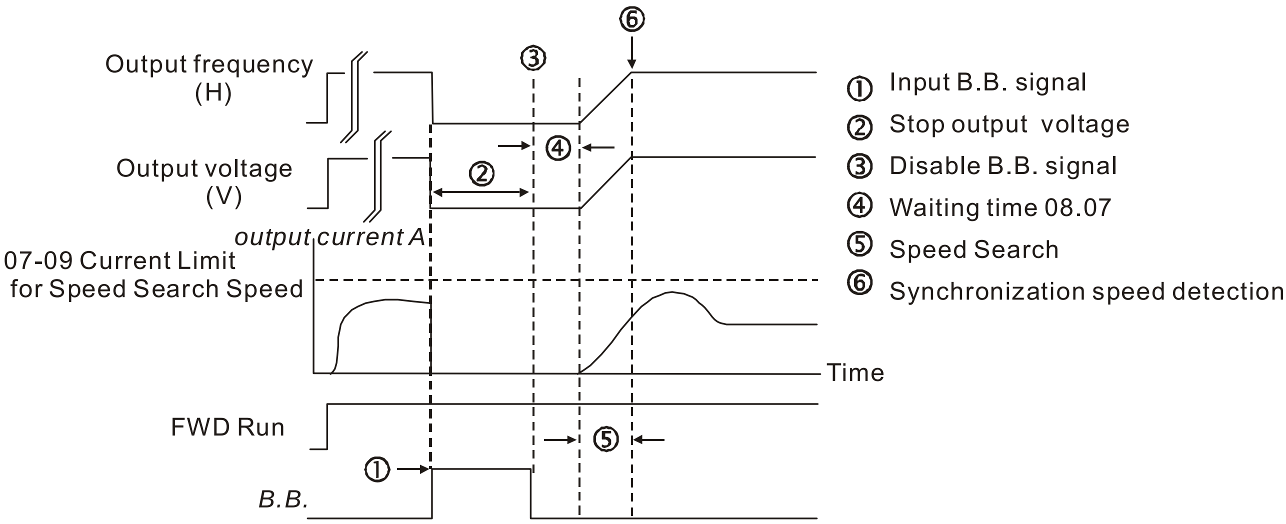
Factory Setting: 0.5

Settings 0.1~5.0 sec

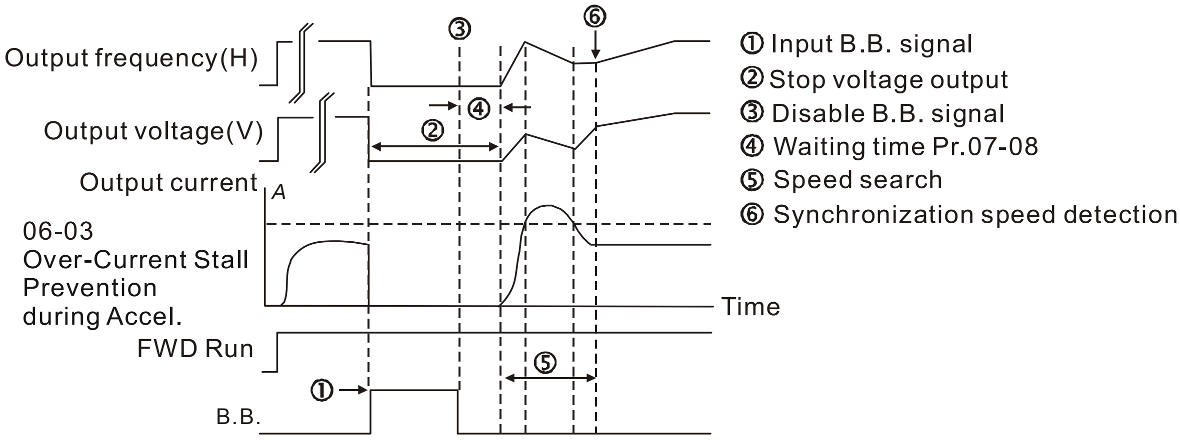
When momentary power loss is detected, the AC drive will block its output and then wait for a specified period of time (determined by Pr.07-08, called Base-Block Time) before resuming operation. This parameter should be set at a value to ensure that any residual regeneration voltage from the motor on 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

07-09 Current Limit for Speed Search

Factory Setting: 50

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 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 active overload protection.

07-10 Treatment to Reboots After Fault

Factory Setting: 0

Settings 0: Stop operation

1: Speed search starts with current speed

2: Speed search starts with minimum output frequency

- 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.
- Fault includes: bb,oc,ov,occ etc. To restart after oc, ov, occ, Pr.07-11 can not be set to 0.

07-11 # of Automatic Reboots After Fault

Factory Setting: 0

Settings 0~10

- The maximum automatic rest and reboots times for the AC motor drive when faults (oc, ov, occ) occur is up to 10 times. When this parameter is set to 0, there will be no reset or reboots. When auto reset and reboots are enabled, the AC motor drive perform a speed search before activate the drive.
- When the number of fault occur exceed Pr.07-11 and is within the duration less than Pr.07-33, the drive will refuse to re-start. Please press "RESET" key to continue the operation.

07-12 Speed Search during Start-up

Factory Setting: 0

Settings 0: Disable
1: Speed search from maximum output frequency
2: Speed search from start-up motor frequency
3: Speed search from minimum output frequency

This parameter is used for starting and stopping a motor with a high inertia. A motor with high inertia will take 2-5 minutes or longer to stop completely. By setting this parameter, the user does not need to wait for the motor to come to a complete stop before restarting the AC motor drive. If a PG card and encoder is used on the drive and motor, then the speed search will start from the speed that is detected by the encoder and accelerate quickly to the commanded frequency. The 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.

07-13 Decel. Time at Momentary Power Loss (dEb function)

Factory Setting: 0

Settings 0: Disable
1: 1st decel. time
2: 2nd decel. time
3: 3rd decel. time
4: 4th decel. time
5: Current decel. time
6: Auto decel. time

This parameter is used for the decel. time selection for momentary power loss.

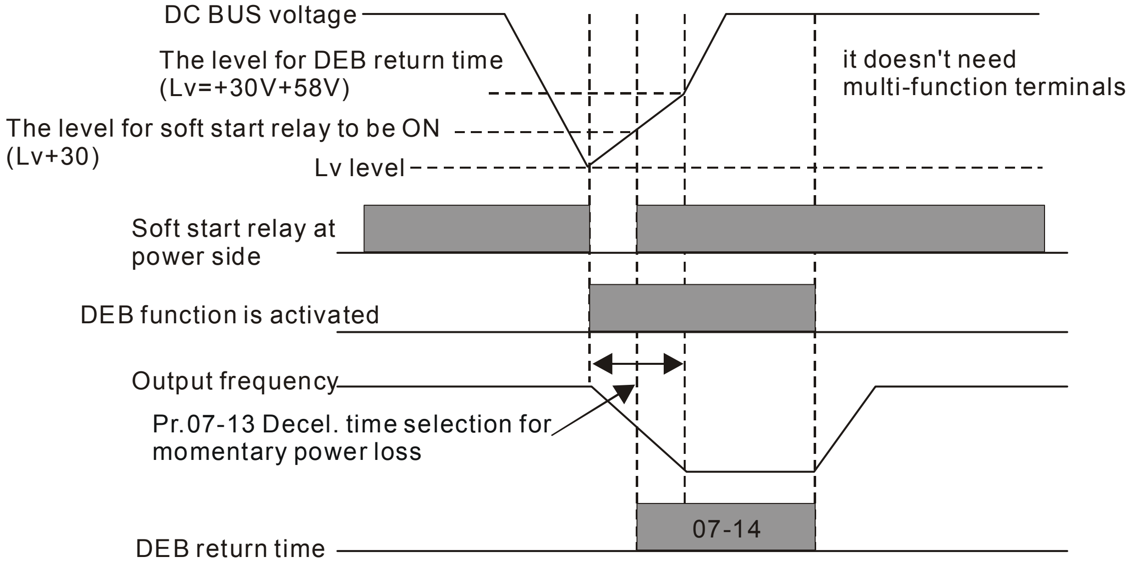
07-14 dEb Return Time

Factory Setting: 0.0

Settings 0.0~25.0 sec

function is the AC motor drive decelerates to stop after momentary power loss. When the momentary power loss occurs, this function can be used for the motor to decelerate to 0 speed with deceleration stop method. When the power is on again, motor will run again after DEB return time. (has applied on high-speed spindle)

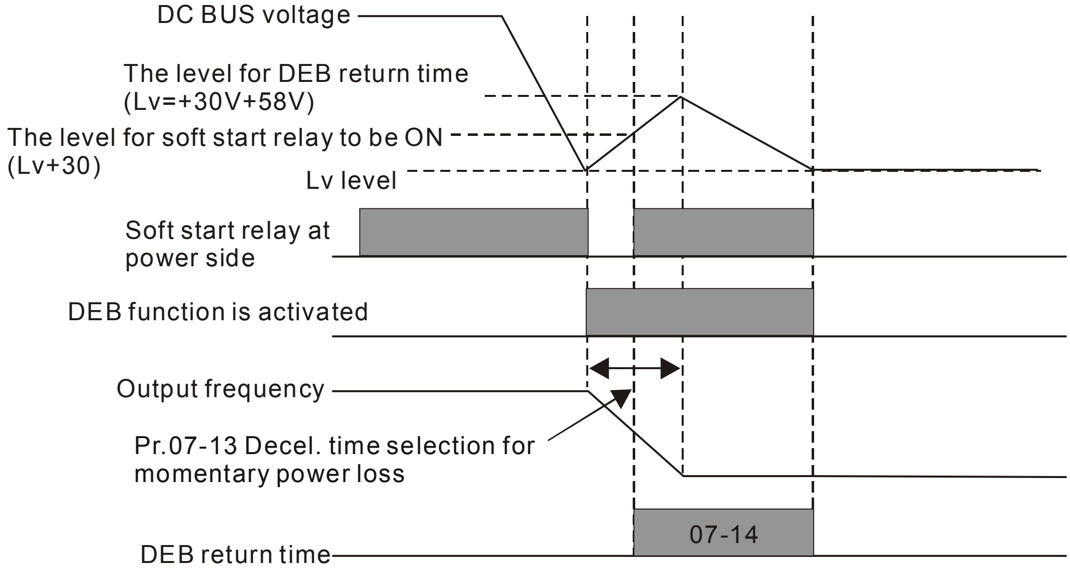
Status 1: Insufficient power supply due to momentary power-loss/unstable power (due to low voltage)/sudden heavy-load



NOTE

When Pr.07-14 is set to 0, the AC motor drive will be stopped and won't re-start at the power-on again.

Status 2: unexpected power off, such as momentary power loss



NOTE

For example, in textile machinery, you will hope that all the machines can be decelerated to stop to prevent broken stitching when power loss. In this case, the host controller will send a message to the AC motor drive to use dEb function with deceleration time via EF.

07-15	Dwell Time at Accel.
	Factory Setting: 0.00
Settings	0.00~600.00 sec

07-16	Dwell Frequency at Accel.
	Factory Setting: 0.00
Settings	0.00~600.00Hz

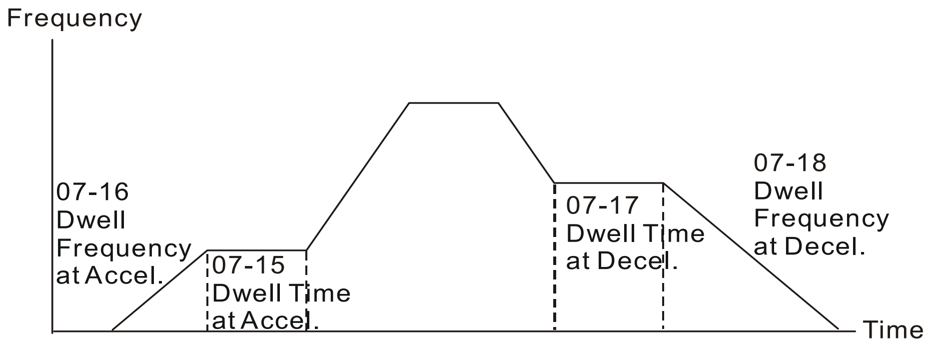
07-17	Dwell Time at Decel.
	Factory Setting: 0.00
Settings	0.00~600.00 sec

07-18 Dwell Frequency at Decel.

Factory Setting: 0.00

Settings 0.00~600.00 Hz

- In the heavy load situation, Dwell can make stable output frequency temporarily, such as crane or elevator.
- Pr.07-15 to Pr.07-18 is for heavy load to prevent OV or OC occurs.



Dwell at accel./decel.

07-19 Fan Cooling Control

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 heat sink temperature (around 60°C) is attained.

4: Fan always OFF

- 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 preliminary capacitance temperature is higher than 60°C. Fan will be OFF, when capacitance temperature is lower than 40°C.
- Setting 4: Fan is always OFF

07-20 Emergency Stop (EF) & Force Stop

Factory Setting: 0

Settings 0: Coast to stop

1: Stop by 1st deceleration time

2: Stop by 2nd deceleration time

3: Stop by 3rd deceleration time

4: Stop by 4th deceleration time

5: System Deceleration

6: Automatic Deceleration

📖 Pr.07-20 determines AC motor drive stop method. When the multi-function input terminal is set to 10 or 18 and is activated, the drive will stop according to the setting in Pr.07-20.

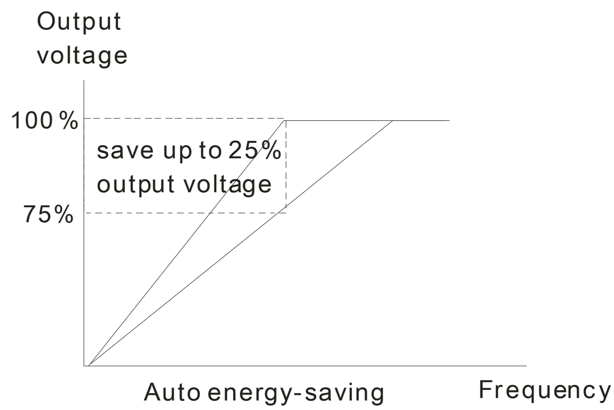
07-21 Auto Energy-saving Operation

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.



07-22 Energy-saving Gain

Factory Setting: 100

Settings 10~1000%

📖 When Pr.00-19 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.

07-23 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).

07-24 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.

07-25 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.05-22 and 05-23 to change the response time of compensation.
- If Pr.05-22 and 05-23 are set to 10seconds, the response time of compensation is the slowest. But the system may be unstable when the setting is too short.

07-26 Torque Compensation Gain (V/F and SVC control mode)

Factory Setting: 0

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.

07-27 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.

07-28 Reserved

07-29 Slip Deviation Level

Factory Setting: 0

Settings 0~100.0%

0: No detection

07-30 Detection Time of Slip Deviation

Factory Setting:1.0

Settings 0.0~10.0 sec

07-31 Over Slip Treatment

Factory Setting:0

Settings 0: Warn and keep operation

1: Warn and ramp to stop

2: Warn and coast to stop

3: No warning

- Pr.07-29 to Pr.07-31 are used to set allowable slip level/time and over slip treatment when the drive is running.

07-32 Motor Hunting Gain

Factory Setting:1000

Settings 0~10000

0: Disable

- The motor will have current wave motion in some specific area. It can improve this situation by setting this parameter. (When it is high frequency or run with PG, it can be set to 0. when the current wave motion happens in the low frequency, please increase Pr.05-29.)

07-33 Recovery Time to Pr.07-11 (# of automatic reboots after fault)

Factory Setting:60.0

Settings 00~6000.0 sec

- This parameter sets the time period for counting the # of faults (ov, oc, occ) occurred. If # of faults occurred within this time period does not exceed the setting in Pr.07-11, the counting will be cleared and start from 0 when the next reboots after fault happens. However, if the # of faults occurred within this time period have exceed the setting in Pr.07-11, user needs to press the RESET key manually.

08 High-function PID Parameters

⌿ The parameter can be set during operation.

08-00 Input Terminal for PID Feedback

Factory Setting:0

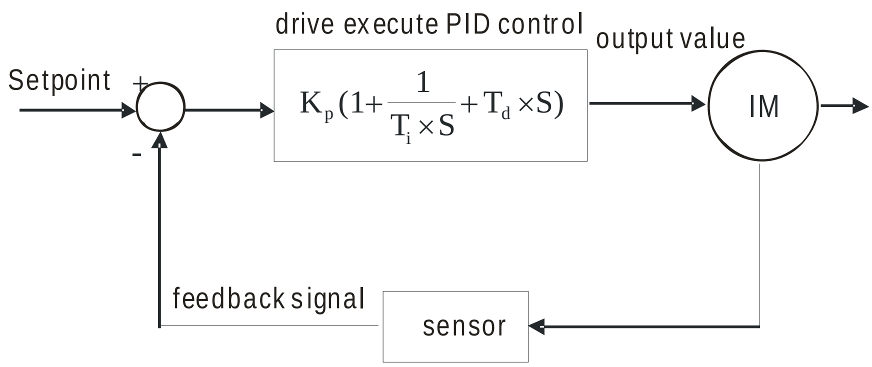
Settings
0: No function
1: Negative PID feedback: input from external terminal AVI (Pr.03-00)
2: Negative PID feedback from PG card (Pr.10-15, skip direction)
3: Negative PID feedback from PG card (Pr.10-15)
4: Positive PID feedback from external terminal AVI (Pr.03-00)
5: Positive PID feedback from PG card (Pr.10-15, skip direction)
6: Positive PID feedback from PG card (Pr.10-15)

📖 Negative feedback means: +target value – feedback. It is used for the detection value will be increased by increasing the output frequency.

📖 Positive feedback means: -target value + feedback. It is used for the detection value will be decreased by increasing the output frequency.

📖 Common applications for PID control
1. Flow control: A flow sensor is used to feedback the flow data and performs accurate flow control.
2. Pressure control: A pressure sensor is used to feedback the pressure data and performs precise pressure control.
3. Air volume control: An air volume sensor is used to feedback the air volume data to have excellent air volume regulation.
4. Temperature control: A thermocouple or thermistor is used to feedback temperature data for comfortable temperature control.
5. 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:

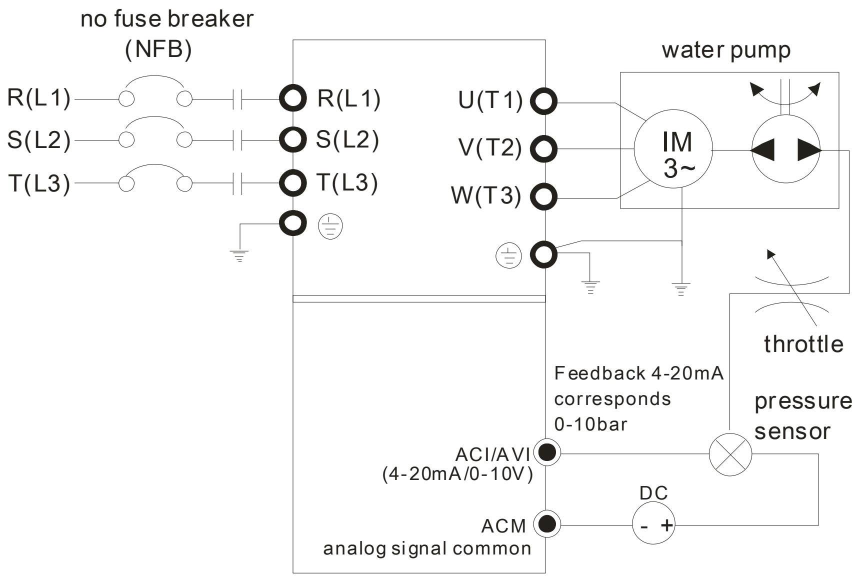


K_p: Proportional gain(P) T_i: Integral time(I) T_d: Derivative control(D) S: Operator

📖 Concept of PID control
1. 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 required

8.1 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.

08-01 Proportional Gain (P)

Factory Setting:80.0

Settings 0.0~500.0%

📖 It is used to eliminate the system error. It is usually used to decrease the error and get the faster response speed. But if setting too large value in Pr.08-01, 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.

08-02 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.

08-03 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.

08-04 Upper limit of Integral Control

Factory Setting:100.0

Settings 0.0~100.0%

- This parameter defines an upper bound or limit for the integral gain (I) and therefore limits the Master Frequency. The formula is: Integral upper bound = Maximum Output Frequency (Pr.01-00) x (Pr.08-04 %).
- Too large integral value will make the slow response due to sudden load change. In this way, it may cause motor stall or machine damage.

08-05 PID Output Frequency Limit

Factory Setting:100.0

Settings 0.0~110.0%

- This parameter defines the percentage of output frequency limit during the PID control. The formula is Output Frequency Limit = Maximum Output Frequency (Pr.01-00) X Pr.08-05 %.

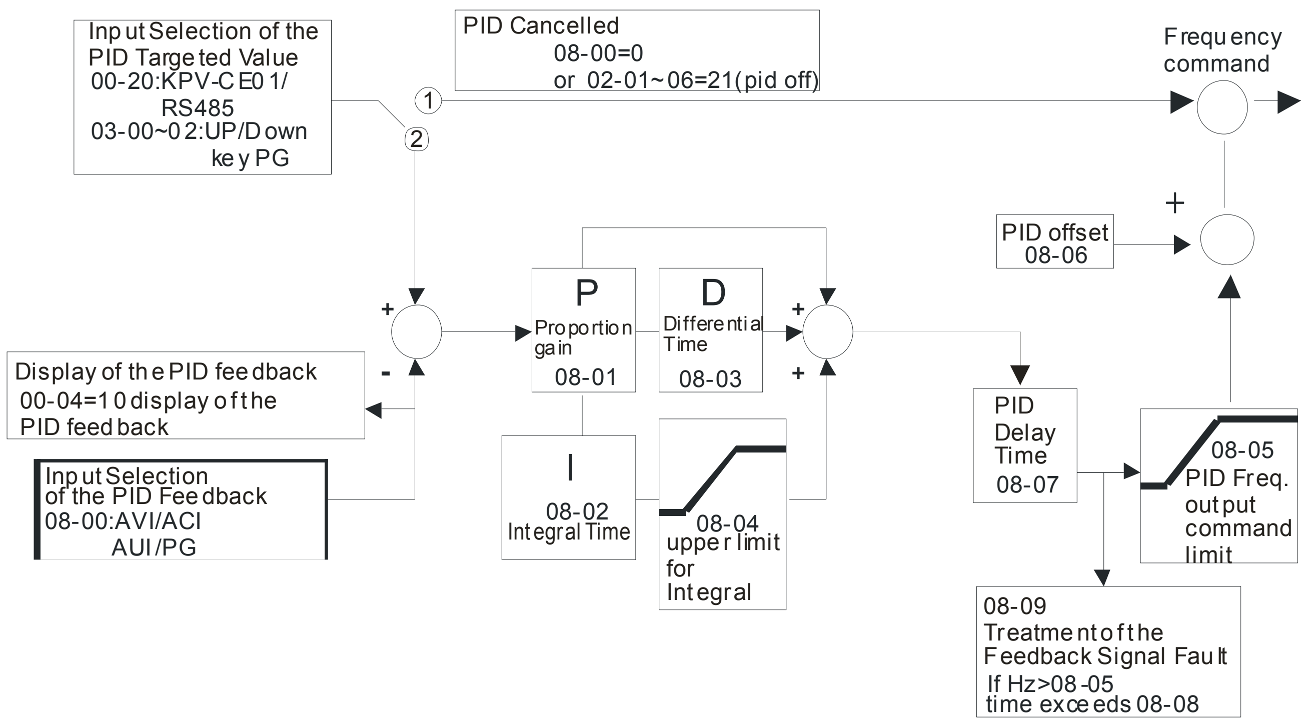
08-06 Reserved

08-07 PID Delay Time

Factory Setting:0.0

Settings 0.0~35.0 sec

- It is used to set the time that required for the low-pass filter of PID output. Increasing the setting, it may affect the drive's response speed.
- The frequency output of PID controller will filter after primary delay filter time. It can smooth the change of the frequency output. The longer primary delay filter time is set, the slower response time it will be.
- The unsuitable primary delay filter time may cause system oscillation.



- 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.

08-08 Feedback Signal Detection Time

Factory Setting: 0.0

Settings 0.0~3600.0 sec

- This parameter is only valid when the feedback signal is ACI.
- This parameter defines the time during which the PID feedback must be abnormal before a warning is given. It also can be modified according to the system feedback signal time.
- If this parameter is set to 0.0, the system would not detect any abnormality signal.

08-09 Feedback 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

- This parameter is only valid when the feedback signal is ACI.
- AC motor drive acts when the feedback signals (analog PID feedback or PG (encoder) feedback) are abnormal.

08-10 Sleep Frequency

Factory Setting: 0.00

Settings 0.00~600.00Hz

08-11 Wake-up Frequency

Factory Setting: 0.00

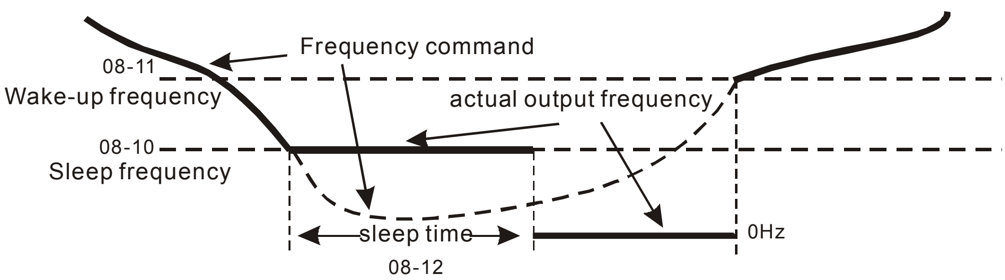
Settings 0.00~600.00Hz

08-12 Sleep Time

Factory Setting: 0.0

Settings 0.00~6000.0 sec

- If the command frequency falls below the sleep frequency, for the specified time in Pr. 08-12, then the drive will shut off the output and wait until the command frequency rises above Pr.08-11.



Sleep Function

08-13 PID Deviation Level

Factory Setting: 10.0

Settings 1.0~50.0%

08-14 PID Deviation Time

Factory Setting: 5.0

Settings 0.1~300.0 sec

08-15 Filter Time for PID Feedback

Factory Setting: 5.0

Settings 0.1~300.0 sec

- When the PID control function is normal, it should calculate within a period of time and close to the setpoint value.
- Refer to the PID control diagram for details. When executing PID feedback control, if |PID reference target value – detection value| > Pr.08-13 PID Deviation Level and exceeds Pr.08-14 setting, the PID control fault occurs. The treatment will be done as Pr.08-09 setting.

08-16 PID Compensation Selection

Factory Setting: 0

Settings 0: Parameter setting

1: Analog input

08-17 PID Compensation

Factory Setting: 0

Settings -100.0~+100.0%

08-18 Reserved

08-19 Reserved

08-20 PID Mode Selection

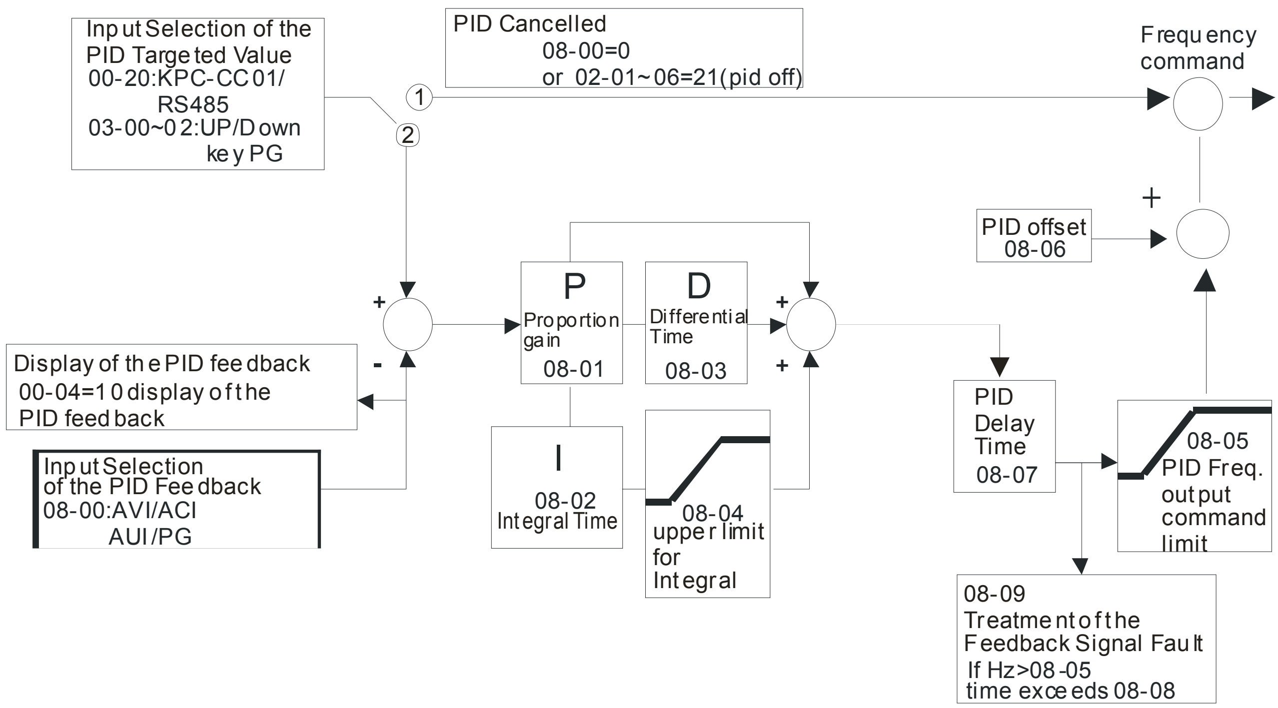
Factory Setting: 0

Settings 0: Serial connection

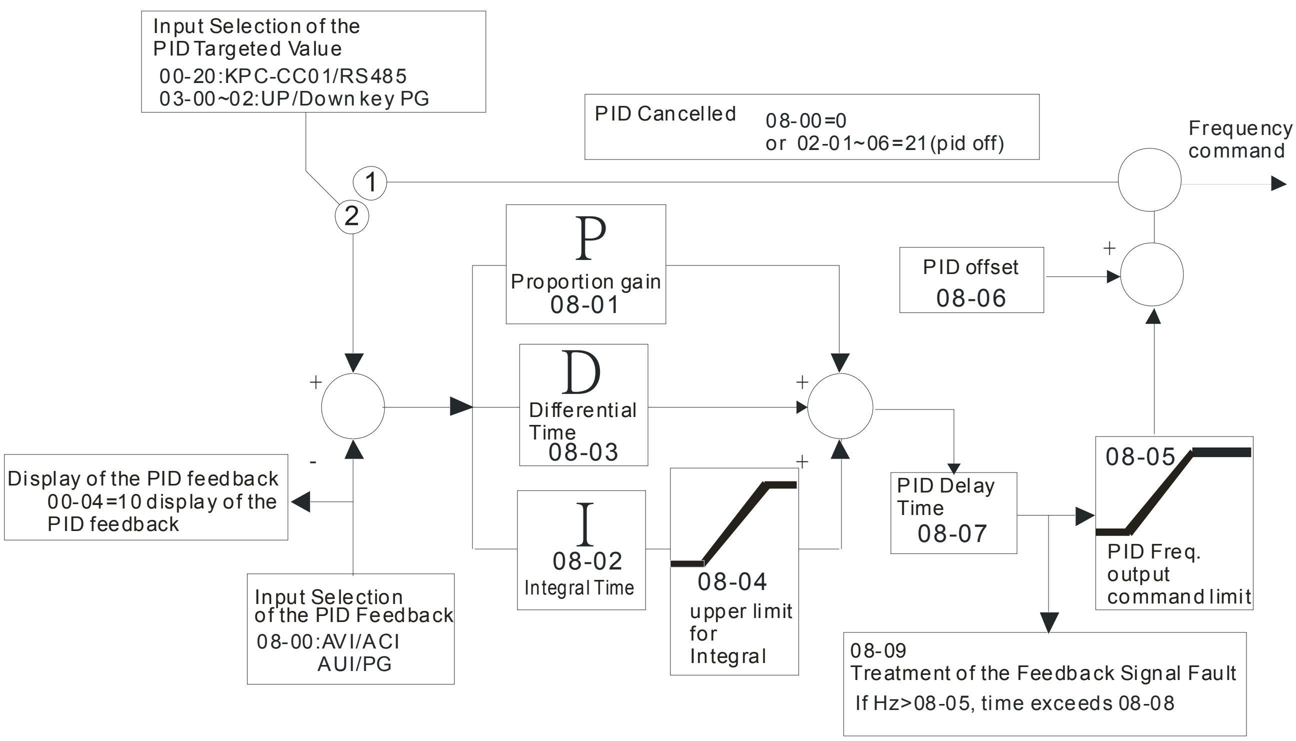
1: Parallel connection

- 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



08-21 Enable PID to Change the Operation Direction

Factory Setting: 0

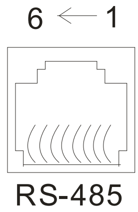
Settings 0: Disable change of direction

1: Enable change of direction

09 Communication Parameters

✓ The parameter can be set during the operation.

When controlling by communcation, it needs to connect the drive and PC by IFD6530 or IFD6500 converter.



Serial communication
1:+EV
2:GND
3:SG-
4:SG+
5:NC
6:NC

✓ 09-00 COM1 Communication Address

Factory Setting: 1

Settings 1~254

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 the communication address for each AC motor drive must be different and unique.

✓ 09-01 COM1 Transmission Speed

Factory Setting: 9.6

Settings 4.8~115.2 Kbps

This parameter is used to set the transmission speed between the RS485 master (PLC, PC, etc.) and AC motor drive.

✓ 09-02 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 set to how to react if transmission errors occur.

✓ 09-03 COM1 Time-out Detection

Factory Setting: 0.0

Settings 0.0~100.0 sec
0.0: Disable

It is used to set the transmission time between communication and keypad.

✓ 09-04 COM1 Communication Protocol

Factory Setting: 1

Settings
0: 7, N, 1 for ASCII
1: 7, N, 2 for ASCII
2: 7, E, 1 for ASCII
3: 7, O, 1 for ASCII
4: 7, E, 2 for ASCII
5: 7, O, 2 for ASCII

6: 8, N, 1 for ASCII
7: 8, N, 2 for ASCII
8: 8, E, 1 for ASCII
9: 8, O, 1 for ASCII
10: 8, E, 2 for ASCII
11: 8, O, 2 for ASCII
12: 8, N, 1 for RTU
13: 8, N, 2 for RTU
14: 8, E, 1 for RTU
15: 8, O, 1 for RTU
16: 8, E, 2 for RTU
17: 8, O, 2 for RTU

- Control by PC or PLC (Computer Link)

- 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:

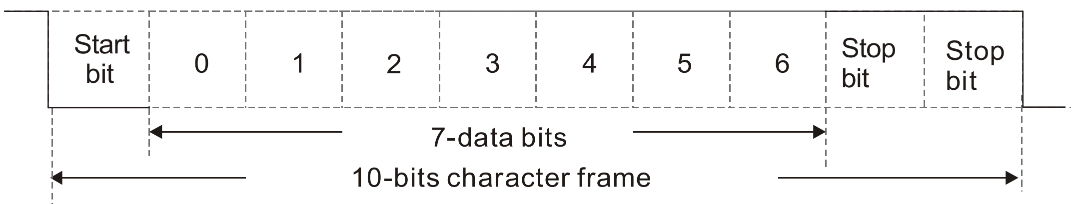
Character	‘0’	‘1’	‘2’	‘3’	‘4’	‘5’	‘6’	‘7’
ASCII code	30H	31H	32H	33H	34H	35H	36H	37H

Character	‘8’	‘9’	‘A’	‘B’	‘C’	‘D’	‘E’	‘F’
ASCII code	38H	39H	41H	42H	43H	44H	45H	46H

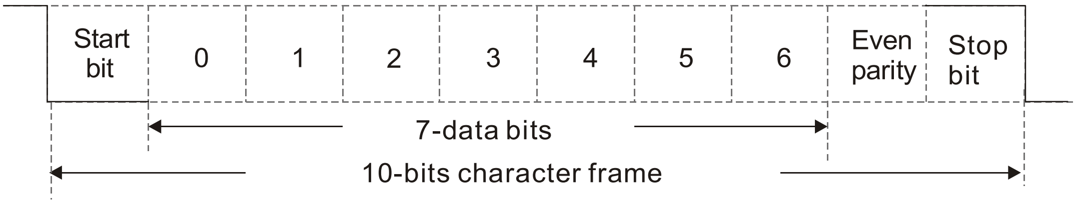
- Data Format

10-bit character frame (For ASCII):

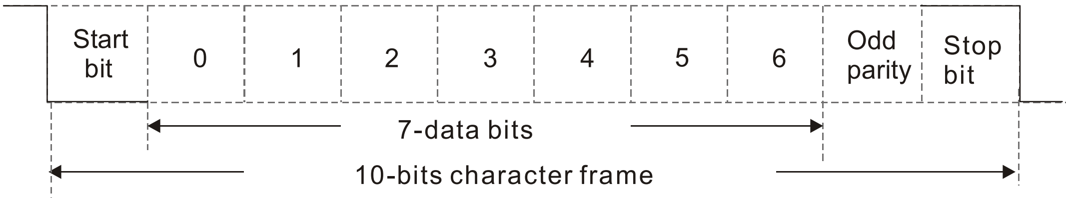
（7, N , 2）



（7 , E , 1）

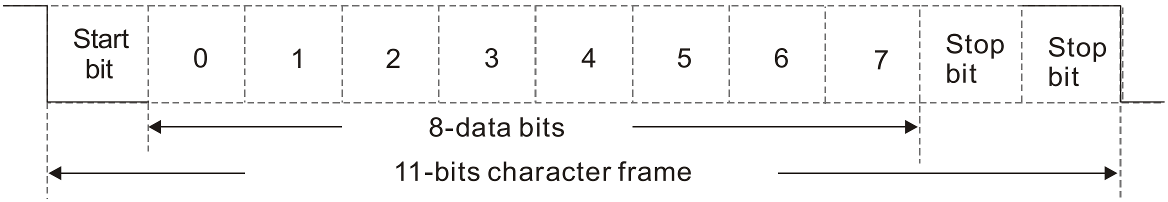


(7 , O , 1)

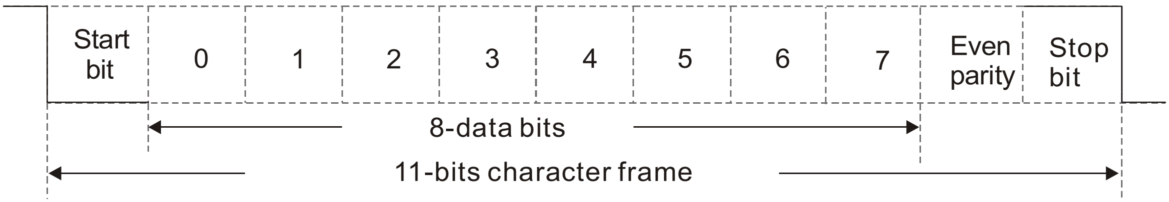


11-bit character frame (For RTU):

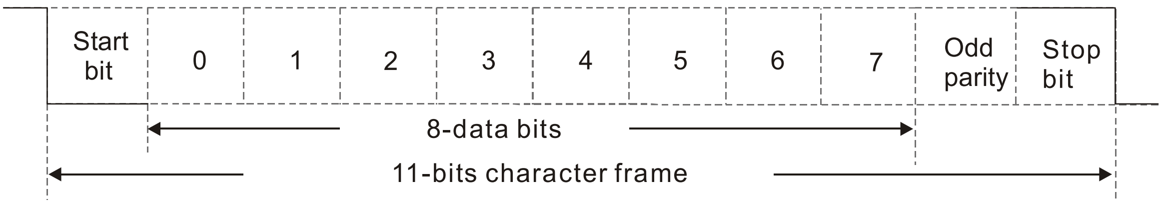
(8 , N , 2)



(8 , E , 1)



(8 , O , 1)



2. **Communication Protocol**

Communication Data Frame:

ASCII mode:

STX	Start character = ':' (3AH)
Address Hi	Communication address: 8-bit address consists of 2 ASCII codes
Address Lo	
Function Hi	Command code: 8-bit command consists of 2 ASCII codes
Function Lo	
DATA (n-1)	Contents of data: Nx8-bit data consist of 2n ASCII codes
…….	

DATA 0	n<=16, maximum of 32 ASCII codes
LRC CHK Hi	LRC check sum: 8-bit check sum consists of 2 ASCII codes
LRC CHK Lo	
END Hi	End characters: END1= CR (0DH), END0= LF(0AH)
END Lo	

RTU mode:

START	A silent interval of more than 10 ms
Address	Communication address: 8-bit address
Function	Command code: 8-bit command
DATA (n-1)	Contents of data: n×8-bit data, n<=16
…….	
DATA 0	
CRC CHK Low	CRC check sum: 16-bit check sum consists of 2 8-bit characters
CRC CHK High	
END	A silent interval of more than 10 ms

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 Message:

STX	':'
Address	'0'
	'1'
Function	'0'
	'3'
Starting address	'2'
	'1'
	'0'
	'2'
Number of data (count by word)	'0'
	'0'
	'0'
	'2'

Response Message

STX	':'
Address	'0'
	'1'
Function	'0'
	'3'
Number of data (count by byte)	'0'
	'4'
Content of starting address 2102H	'1'
	'7'
	'7'
	'0'
Content of address 2103H	'0'
	'0'

LRC Check	'D'
	'7'
END	CR
	LF

	'0'
	'0'
LRC Check	'7'
	'1'
END	CR
	LF

RTU mode:

Command Message:

Address	01H
Function	03H
Starting data address	21H
	02H
Number of data (count by world)	00H
	02H
CRC CHK Low	6FH
CRC CHK High	F7H

Response Message

Address	01H
Function	03H
Number of data (count by byte)	04H
Content of data address 2102H	17H
	70H
Content of data address 2103H	00H
	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 Message:

STX	':'
Address	'0'
	'1'
Function	'0'
	'6'
Data address	'0'
	'1'
	'0'
	'0'
Data content	'1'
	'7'
	'7'
	'0'
LRC Check	'7'
	'1'
END	CR
	LF

Response Message

STX	':'
Address	'0'
	'1'
Function	'0'
	'6'
Data address	'0'
	'1'
	'0'
	'0'
Data content	'1'
	'7'
	'7'
	'0'
LRC Check	'7'
	'1'
END	CR
	LF

RTU mode:

Command Message:

Address	01H
Function	06H
Data address	01H
	00H
Data content	17H
	70H
CRC CHK Low	86H
CRC CHK High	22H

Response Message

Address	01H
Function	06H
Data address	01H
	00H
Data content	17H
	70H
CRC CHK Low	86H
CRC CHK High	22H

10H: write multiple registers (write multiple data to registers)

Example: Set the multi-step speed,

Pr.04-00=50.00 (1388H), Pr.04-01=40.00 (0FA0H). AC drive address is 01H.

ASCII Mode

Command Message:

STX	':'
ADR 1	'0'
ADR 0	'1'
CMD 1	'1'
CMD 0	'0'
Starting data address	'0'
	'5'
	'0'
	'0'
Number of data (count by word)	'0'
	'0'
	'0'
	'2'
Number of data (count by byte)	'0'
	'4'
The first data content	'1'
	'3'
	'8'
	'8'
The second data content	'0'
	'F'
	'A'
	'0'
LRC Check	'9'
	'A'
END	CR
	LF

Response Message

STX	':'
ADR 1	'0'
ADR 0	'1'
CMD 1	'1'
CMD 0	'0'
Starting data address	'0'
	'5'
	'0'
	'0'
Number of data (count by word)	'0'
	'0'
	'0'
	'2'
LRC Check	'E'
	'8'
END	CR
	LF

RTU mode:

Command Message:

ADR	01H
CMD	10H
Starting data address	05H
	00H
Number of data (count by word)	00H
	02H
Number of data (count by byte)	04
The first data content	13H
	88H
The second data content	0FH
	A0H
CRC Check Low	'9'
CRC Check High	'A'

Response Message

ADR	01H
CMD 1	10H
Starting data address	05H
	00H
Number of data (count by word)	00H
	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 **D7**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 ← the quantity of bytes in the message buffer
The function returns the CRC value as a type of unsigned integer.
Unsigned int crc_chk(unsigned char* data, unsigned char length)

```
 {
 int j;
 unsigned int reg_crc=0Xffff;
 while(length--){
    reg_crc ^= *data++;
    for(j=0;j<8;j++){
    if(reg_crc & 0x01){   /* LSB(b0)=1 */
       reg_crc=(reg_crc>>1) ^ 0Xa001;
    }else{
       reg_crc=reg_crc >>1;
    }
 }
}

return reg_crc;                    // return register CRC
```

3. Address list

Content	Address	Function	
AC drive Parameters	GGnnH	GG means parameter group, nn means parameter number, for example, the address of Pr 4-01 is 0401H.	
Command Write only	2000H	Bit 0-3	0: No function 1: Stop 2: Run 3: Jog + Run
		Bit 4-5	00B: No function 01B: FWD 10B: REV 11B: Change direction
		Bit 6-7	00B: 1st accel/decel 01B: 2nd accel/decel 10B: 3rd accel/decel 11B: 4th accel/decel

Content	Address	Function	
		Bit 8-11	000B: master speed
			0001B: 1st accel/decel.
			0010B: 2nd accel/decel
			0011B: 3rd accel/decel
			0100B: 4th accel/decel
			0101B: 5th accel/decel
			0110B: 6th accel/decel
			0111B: 7th accel/decel
			1000B: 8th accel/decel
			1001B: 9th accel/decel
			1010B: 10th accel/decel
			1011B: 11th accel/decel
			1100B: 12th accel/decel
			1101B: 13th accel/decel
			1110B: 14th accel/decel
			1111B: 15th accel/decel
		Bit 12	1: enable bit06-11 function
		Bit 13~14	00B: No function
			01B: operated by digital keypad
			10B: operated by Pr.00-21 setting
			11B: change operation source
		Bit 15	Reserved
	2001H	Frequency command	
	2002H	Bit 0	1: EF (external fault) on
		Bit 1	1: Reset
		Bit 2	1: B.B. ON
		Bit 3-15	Reserved
Status monitor Read only	2100H	Error code: refer to Pr.06-17 to Pr.06-22	
	2119H	Bit 0	1: FWD command
		Bit 1	1: Operation status
		Bit 2	1: Jog command
		Bit 3	1: REV command
		Bit 4	1: REV command
		Bit 8	1: Master frequency Controlled by communication interface
		Bit 9	1: Master frequency controlled by analog signal
		Bit 10	1: Operation command controlled by communication interface
		Bit 11	1: Parameters have been locked
		Bit 12	1: enable to copy parameter from keypad
		Bit 13-15	Reserved
Status monitor Read only	2102H	Frequency command (F)	
	2103H	Output frequency (H)	
	2104H	Output current (AXXX.X)	
	2105H	DC-BUS Voltage (UXXX.X)	
	2106H	Output voltage (EXXX.X)	
	2107H	Current step number of Multi-Step Speed Operation	
	2109H	Counter value	
	2116H	Multi-function display (Pr.00-04)	
	211BH	Max. setting frequency	
	2200H	Display output current (A)	
	2201H	Display counter value of TRG terminal (c)	
	2202H	Display actual output frequency (H)	
	2203H	Display DC-BUS voltage (u)	
	2204H	Display output voltage of U, V, W (E)	
	2205H	Display output power angle of U, V, W (n)	

Content	Address	Function
	2206H	Display actual motor speed kW of U, V, W (P)
	2207H	Display motor speed in rpm estimated by the drive or encoder feedback (r00: positive speed, -00: negative speed)
	2208H	Display positive/negative output torque N-m estimated by the drive (t0.0: positive torque, -0.0: negative torque)
	2209H	Display PG feedback (as NOTE 1)
	220AH	Display PID feedback value after enabling PID function in % (b)
	220BH	Display signal of AVI analog input terminal, 0-10V corresponds to 0-100% (1.) (as NOTE 2)
	220CH	Display signal of ACI analog input terminal, 4-V20mA/0-10V corresponds to 0-100% (2.) (as NOTE 2)
	220DH	Display signal of AUI analog input terminal, -10V~10V corresponds to -100~100% (3.) (as NOTE 2)
	220EH	Display the IGBT temperature of drive power module in ^{o}C (c.)
	220FH	Display the temperature of capacitance in ^{o}C (i.)
	221OH	The status of digital input (ON/OFF), refer to Pr.02-10 (as NOTE 3)
	2211H	The status of digital output (ON/OFF), refer to Pr.02-15 (as NOTE 4)
	2212H	Display the multi-step speed that is executing (S)
	2213H	The corresponding CPU pin status of digital input (d.) (as NOTE 3)
	2214H	The corresponding CPU pin status of digital output (O.) (as NOTE 4)
	2215H	Number of actual motor revolution (PG1 of PG card) (P.) it will start from 9 when the actual operation direction is changed or keypad display at stop is 0. Max. is 65535 (P.)
	2216H	Pulse input frequency (PG2 of PG card)(S.)
	2217H	Pulse input position (PG2 of PG card)(4.)
	2218H	Position command tracing error (P.)
	2219H	Display times of counter overload (0.)
	221AH	Display GFF in % (G.)
	221BH	Reserved
	221CH	Display 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

4. 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 mode:

STX	‘:’
Address	‘0’
	‘1’
Function	‘8’
	‘6’
Exception code	‘0’
	‘2’
LRC CHK	‘7’
	‘7’
END	CR
	LF

RTU mode:

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

The explanation of exception codes:

Exception code	Explanation
1	Illegal data value: The data value received in the command message is not available for the AC drive.
2	Illegal data address: The data address received in the command message is not available for the AC motor drive.
3	Parameters are locked: parameters can’t be changed
4	Parameters can’t be changed during operation
10	Communication time-out.

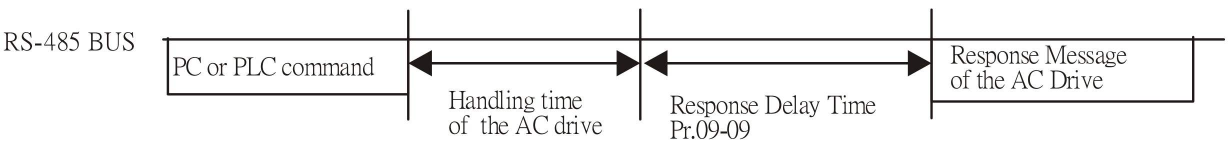
09-05 ~ 09-08 Reserved

09-09 Response Delay Time

Factory Setting: 2.0

Settings 0.0~200.0ms

📖 This parameter is the response delay time after AC drive receives communication command as shown in the following.



09-10 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 regards the frequency set in Pr.09-10 if no new frequency command is inputted.

09-11 Block Transfer 1

09-12 Block Transfer 2

09-13	Block Transfer 3
09-14	Block Transfer 4
09-15	Block Transfer 5
09-16	Block Transfer 6
09-17	Block Transfer 7
09-18	Block Transfer 8
09-19	Block Transfer 9
09-20	Block Transfer 10
09-21	Block Transfer 11
09-22	Block Transfer 12
09-23	Block Transfer 13
09-24	Block Transfer 14
09-25	Block Transfer 15
09-26	Block Transfer 16

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.09-20). User can use them (Pr.09-11 to Pr.09-20) to save those parameters that you want to read.

09-27 ~ 09-29 Reserved

09-30 Communication Decoding Method

Factory Setting: 1

Settings 0: by 20XX

1: by 60XX

09-31 ~ 09-34 Reserved

09-35 PLC Address

Factory Setting: 2

Settings 1~254

09-36 CANopen Slave Address

Factory Setting: 0

Settings 0: Disable

1~127

09-37 CANopen Speed

Factory Setting: 0

Settings 0: 1M
1: 500k
2: 250k
3: 125k
4: 100k (Delta only)
5: 50k

09-38 CANopen Frequency Gain

Factory Setting: 1.00

Settings 1.00~2.00

09-39 CANopen Warning Record

Factory Setting: 0

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

09-40 CANopen Decoding Method

Factory Setting: 1

Settings 0: Communication definition of C2000 series
1: CANopen Standard DS402 protocol

09-41 CANopen Status

Factory Setting: 0

Settings 0: Node Reset State
1: Com Reset State
2: Boot up State
3: Pre Operation State
4: Operation State
5: Stop State

09-42 CANopen Control Status

Factory Setting: 0

Settings 0: Not ready for use state
1: Inhibit start state
2: Ready to switch on state

3: Switched on state
4: Enable operation state
7: Quick stop active state
13: Err reaction activation state
14: Error state

09-43 Reset CANopen Index

Factory Setting: 0

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

09-44 Reserved

09-45 CANopen Master Function

Factory Setting: 0

Settings 0: Disable
1: Enable

09-46 CANopen Master Address

Factory Setting: 100

Settings 1~127

09-47 ~ 09-59 Reserved

09-60 Identifications for Communication Card

Factory Setting: ##

Settings 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

Factory Setting: ##

Settings Read only

09-62 Product Code

Factory Setting: ##

Settings Read only

09-63 Error Code

Factory Setting: ##

Settings Read only

09-64 ~ 09-69 Reserved

09-70 Address of Communication Card

Factory Setting: 1

Settings DeviceNet: 0-63

Profibus-DP: 1-125

09-71 Setting of DeviceNet Speed (according to Pr.09-72)

Factory Setting: 2

Settings Standard DeviceNet:

0: 100Kbps

1: 125Kbps

2: 250Kbps

3: 1Mbps (Delta only)

Non standard DeviceNet: (Delta only)

0: 10Kbps

1: 20Kbps

2: 50Kbps

3: 100Kbps

4: 125Kbps

5: 250Kbps

6: 500Kbps

7: 800Kbps

8: 1Mbps

09-72 Other Setting of DeviceNet Speed

Factory Setting: 0

Settings 0: Disable

1: Enable

📖 It needs to use with Pr.09-71.

📖 Setting 0: the baud rate can only be set to 0, 1, 2 or 3.

📖 Setting 1: setting of DeviceNet baud 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
09-79	IP Address 4 of the Communication Card

Factory Setting: 0

Settings 0~255

09-80	Address Mask 1 of the Communication Card
09-81	Address Mask 2 of the Communication Card
09-82	Address Mask 3 of the Communication Card
09-83	Address Mask 4 of the Communication Card

Factory Setting: 0

Settings 0~255

09-84	Getway Address 1 of the Communication Card
09-85	Getway Address 2 of the Communication Card
09-86	Getway Address 3 of the Communication Card
09-87	Getway Address 4 of the Communication Card

Factory Setting: 0

Settings 0~255

09-88	Password for Communication Card (Low word)
09-89	Password for Communication Card (High word)

Factory Setting: 0

Settings 0~255

09-90 Reset Communication Card

Factory Setting: 0

Settings 0: Disable

1: Reset, return to factory setting

09-91 Additional Setting for Communication Card

Factory Setting: 0

Settings Bit 0: Enable IP Filter

Bit 1: Internet parameters enable(1bit)

Enable to write internet parameters (1bit). This bit will change to disable when it finishes saving the update of internet parameters.

Bit 2: Login password enable(1bit)

Enable login password (1bit). This bit will be changed to disable when it finishes saving the update of internet parameters.

09-92 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

✓ The parameter can be set during operation.

In this parameter group, ASR is the abbreviation for Adjust Speed Regulator and PG is the abbreviation for Pulse Generator.

10-00 Encoder Type Selection

Factory Setting: 0

Settings 0: Disable
1: ABZ
2: ABZ (Delta encoder for PM motor)
3: Resolver (Standard encoder for PM motor)
4: ABZ/UVW (Standard encoder for PM motor)

- 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.
- 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.

10-01 Encoder Pulse

Factory Setting: 600

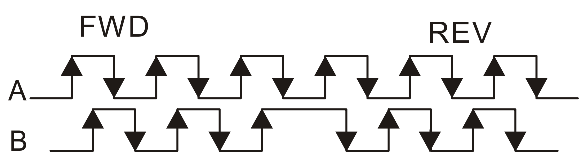
Settings 1~20000

- 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 errotic 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).

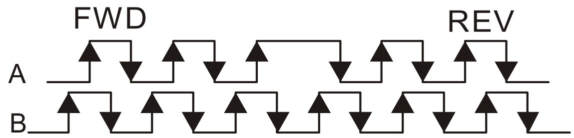
10-02 Encoder Input Type Setting

Factory Setting: 0

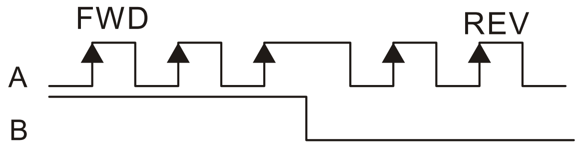
Settings 0: Disable
1: Phase A leads in a forward run command and phase B leads in a reverse run command



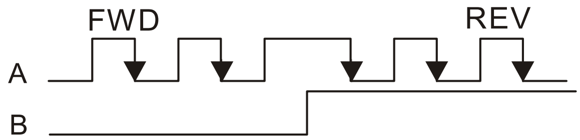
2: Phase B leads in a forward run command and phase A leads in a reverse run command



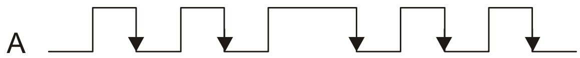
3: Phase A is a pulse input and phase B is a direction input. (L =reverse direction, H=forward direction)



4: Phase A is a pulse input and phase B is a direction input. (L=forward direction, H=reverse direction)



5: Single-phase input



10-03 Output Setting for Frequency Division (denominator)

Factory Setting: 1

Settings 1~255

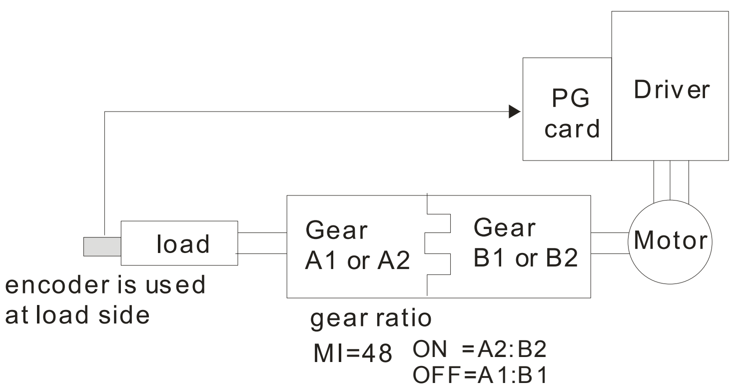
This parameter is used to set the denominator for frequency division (for PG card EMC-PG01L or EMC-PG01O). For example, when it is set to 2 with feedback 1024ppr, PG output will be 1024/2=512ppr.

10-04 Electrical Gear at Load Side A1
10-05 Electrical Gear at Motor Side B1
10-06 Electrical Gear at Load Side A2
10-07 Electrical Gear at Motor Side B2

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



10-08 Treatment for Encoder Feedback Fault

Factory Setting: 2

Settings 0: Warn and keep operating
1: Warn and RAMP to stop
2: Warn and COAST to stop

10-09 Detection Time of Encoder Feedback Fault

Factory Setting: 1.0

Settings 0.0~10.0 sec
0: No function

- When encoder loss, encoder signal error, pulse signal setting error or signal error, if time exceeds the detection time for encoder feedback fault (Pr.10-09), the encoder signal error will occur. Refer to the Pr.10-08 for encoder feedback fault treatment.

10-10 Encoder Stall Level

Factory Setting: 115

Settings 0~120%
0: No function

- This parameter determines the maximum encoder feedback signal allowed before a fault occurs. (Max. output frequency Pr.01-00 =100%)

10-11 Detection Time of Encoder Stall

Factory Setting: 0.1

Settings 0.0~2.0 sec

10-12 Treatment for Encoder Stall

Factory Setting: 2

Settings 0: Warn and keep operation
1: Warn and ramp to stop
2: Warn and coast to stop

- When the motor frequency exceeds Pr.10-10 setting and detection time exceeds Pr.10-11, it will operate as Pr.10-12 setting.

10-13 Encoder Slip Range

Factory Setting: 50

Settings 0~50%
0: Disable

10-14 Detection Time of Encoder Slip

Factory Setting: 0.5

Settings 0.0~10.0 sec

10-15 Treatment for Encoder Stall and Slip Error

Factory Setting: 2

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

2: Warn and coast to stop

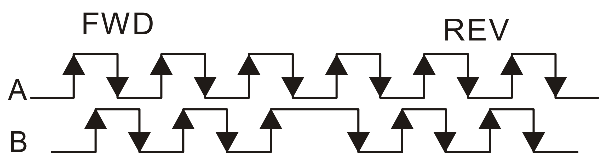
When the value of (rotation speed – motor frequency) exceeds Pr.10-13 setting, detection time exceeds Pr.10-14; it will start to accumulate time. If detection time exceeds Pr.10-14, the encoder feedback signal error will occur. Refer to Pr.10-15 encoder stall and slip error treatment.

10-16 Pulse Input Type Setting (PG card: PG2)

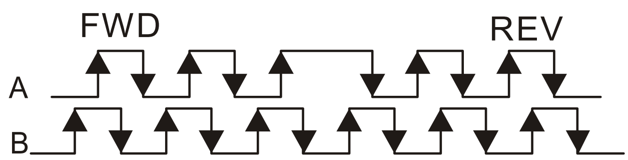
Factory Setting: 0

Settings 0: Disable

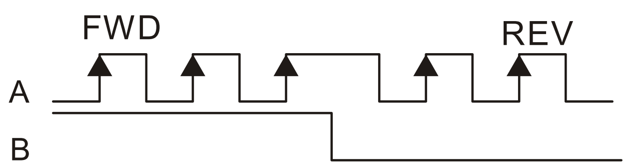
1: Phase A leads in a forward run command and phase B leads in a reverse run command



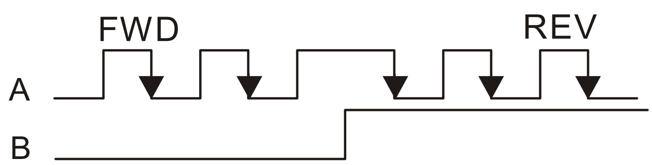
2: Phase B leads in a forward run command and phase A leads in a reverse run command



3: Phase A is a pulse input and phase B is a direction input. (L=reverse direction, H=forward direction)

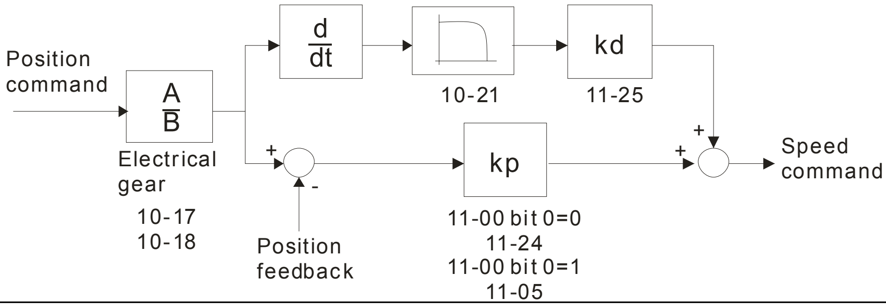


4: Phase A is a pulse input and phase B is a direction input. (L=forward direction, H=reverse direction)



When this setting is different from Pr.10-01 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.

Position control diagram



10-17	Electrical Gear A
10-18	Electrical Gear B

Factory Setting: 100

Settings 1~65535

- Rotation speed = pulse frequency/encoder pulse (Pr.10-00) * PG Electrical Gear A / PG Electrical Gear B.

10-19	Positioning for Encoder Position

Factory Setting: 0

Settings 0~65535 pulse

- This parameter determines 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

- 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.

10-21	Filter Time (PG2)

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.

10-22	Speed Mode (PG2)

Factory Setting: 0

Settings 0: Electronic Frequency

1: Mechanical Frequency (base on pole pair)

10-23	Reserved

10-24 FOC&TQC Function Control

Factory Setting: 0

Settings 0~65535

Bit#	Description
0	ASR control at sensorless torque 0:use PI as ASR; 1:use P as ASR
1	NA
2	NA
3	NA
4	NA
5	NA
6	NA
7	NA
8	NA
9	NA
10	NA
11	Activate DC braking when executing zero torque command 0:ON , 1:OFF
12	FOC Sensorless mode, speed cross zero point (forward to reverse or reverse to forward). 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

10-25 FOC Bandwidth of Speed Observer

Factory Setting:40.0

Settings 1.0~100.0Hz

- Setting speed observer to higher bandwidth could shorten the speed response time but will create greater noise interference during the speed observation. .

10-26 FOC Minimum Stator Frequency

Factory Setting:10.0

Settings 0.0~2.0%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.

10-27 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.

10-28 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 senslorless torque mode. When the drive's activation time is too long at torque mode, please adjust this parameter to a shorter time constant.

11 Advanced Parameters

✗ The parameter can be set during operation.

In this parameter group, ASR is the abbreviation for Adjust Speed Regulator

11-00 System Control

Factory Setting: 0

Settings 0: Auto tuning for ASR and APR
1: Inertia estimate (only in FOCPG mode)
2: Zero servo
3: Dead Time compensation closed

Bit 0=0: Pr.11-06 to 11-11 will be valid and Pr.11-03~11-05 are invalid.

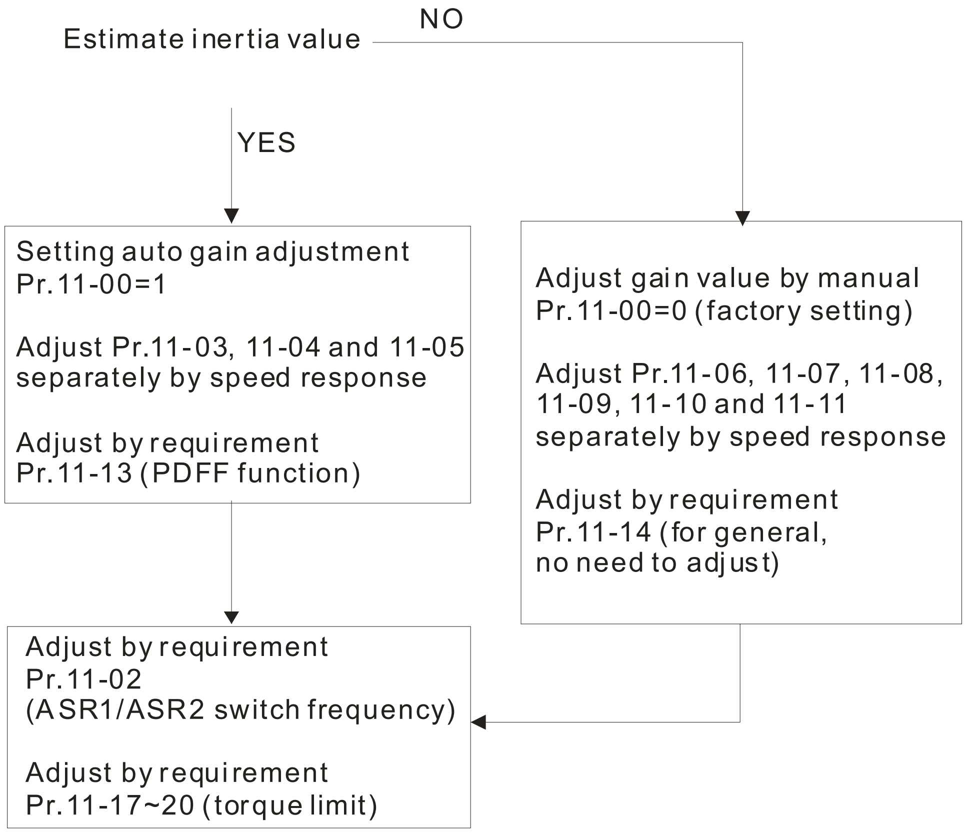
Bit 0=1: system will generate an ASR setting. At this moment, Pr.11-06~11-11 will be invalid and Pr.11-03~11-05 are valid.

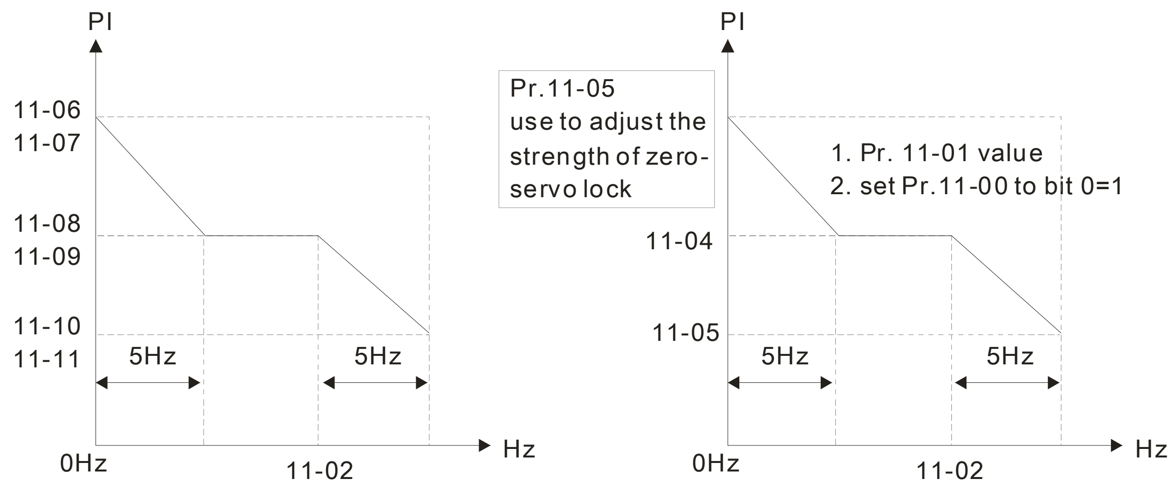
Bit 1=0: no function.

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.





PI adjustment-manual gain   PI adjustment-auto gain

11-01	Per Unit of System Inertia

Factory Setting: 400

Settings 1~65535（256=1PU）

📖 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.

11-02	ASR1/ASR2 Switch Frequency

Factory Setting: 7.00

Settings 0.00~600.00Hz
0: Disable

11-03	ASR1 Low-speed Bandwidth

Factory Setting: 10

Settings 1~40Hz (IM)/ 1~100Hz (PM)

11-04	ASR2 High-speed Bandwidth

Factory Setting: 10

Settings 1~40Hz (IM)/ 1~100Hz (PM)

11-05	Zero-speed Bandwidth

Factory Setting: 10

Settings 1~40Hz (IM)/ 1~100Hz (PM)

📖 After estimating inertia and set Pr.11-00 to bit 0=1 (auto tuning), user can adjust parameters Pr.11-03, 11-04 and 11-05 separately by speed response. The larger number you set, the faster response you will get. Pr.11-02 is the switch frequency for low-speed/high-speed bandwidth.

11-06	ASR (Auto Speed Regulation) control (P) 1

Factory Setting: 10

Settings 0~40 Hz (IM)/ 1~100Hz (PM)

11-07	ASR (Auto Speed Regulation) control (I) 1

Factory Setting: 0.100

Settings 0.000~10.000 sec

11-08 ASR (Auto Speed Regulation) control (PI) 2

Factory Setting: 10

Settings 0~40 Hz (IM)/ 0~100Hz (PM)

11-09 ASR (Auto Speed Regulation) control (I) 2

Factory Setting: 0.100

Settings 0.000~10.000 sec

11-10 ASR(Auto Speed Regulation) Control (P) of Zero Speed

Factory Setting: 10

Settings 0~40 Hz (IM)/ 0~100Hz (PM)

11-11 ASR(Auto Speed Regulation) Control (I) of Zero Speed

Factory Setting: 0.100

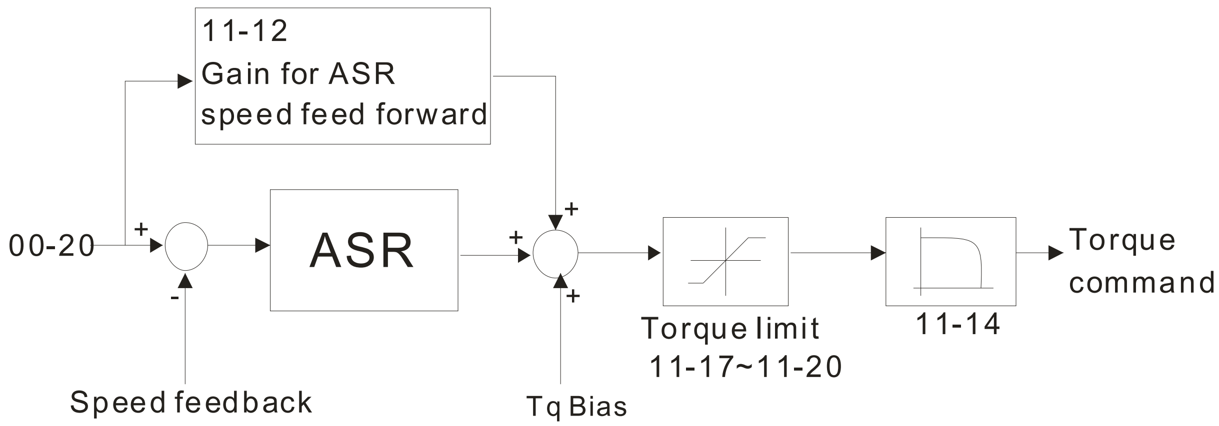
Settings 0.000~10.000 sec

11-12 Gain for ASR Speed Feed Forward

Factory Setting: 0

Settings 0~100%

- This parameter is used to improve speed response.

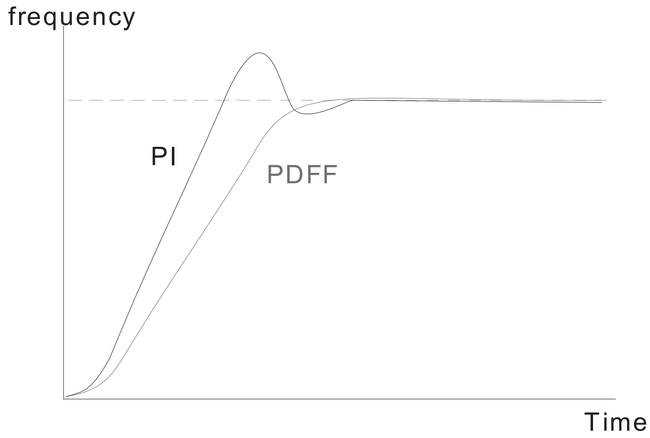


11-13 PDFF Gain Value

Factory Setting: 30

Settings 0~200%

- After finishing estimating and set Pr.11-00 to bit 0=1 (auto tuning), using Pr.11-13 to reduce overshoot. Please adjust PDFF gain value by actual situation.
- This parameter will be invalid when Pr.05-24 is set to 1.



11-14	Low-pass Filter Time of ASR Output

Factory Setting: 0.008

Settings 0.000~0.350 sec

- It is used to set the filter time of ASR command.

11-15	Notch Filter Depth

Factory Setting: 0

Settings 0~20db

11-16	Notch Filter Frequency

Factory Setting: 0.00

Settings 0.00~200.00Hz

- This parameter is used to set resonance frequency of mechanical system. It can be used to suppress the resonance of mechanical system.
- The larger number you set Pr.11-15, the better suppression resonance function you will get.
- The notch filter frequency is the resonance of mechanical frequency.

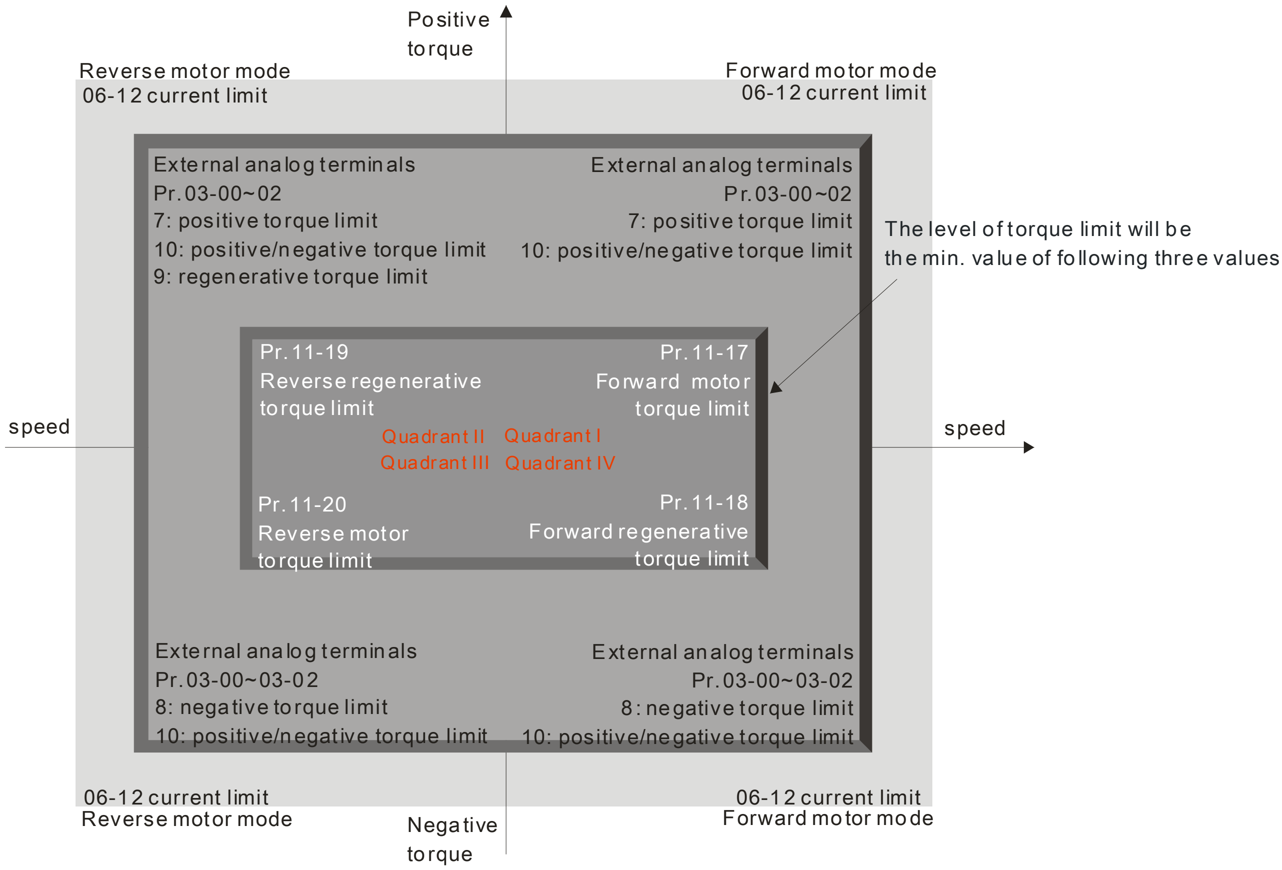
11-17	Forward Motor Torque Limit
11-18	Forward Regenerative Torque Limit
11-19	Reverse Motor Torque Limit
11-20	Reverse Regenerative Torque Limit

Factory Setting: 500

Settings 0~500%

- The motor rated torque 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.
- Formula of motor rated torque:

$T(N.M)=\frac{P(W)}{\omega(rad/s)}$, P (W) is according to Pr.05-02 setting, ω (rad/s) is according to Pr.05-03. $\frac{RPM}{60\times 2\pi}=rad/s$



11-21 Gain Value of Flux Weakening Curve for Motor 1

Factory Setting: 90

Settings 0~200%

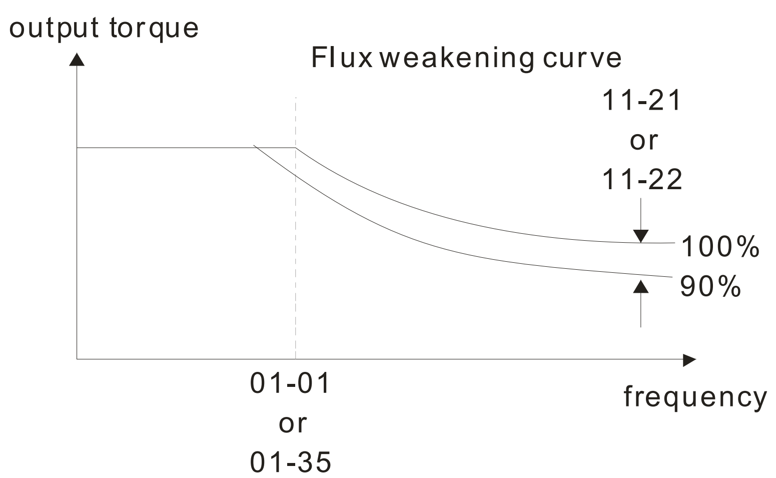
11-22 Gain Value of Flux Weakening Curve for Motor 2

Factory Setting: 90

Settings 0~200%

Pr.11-21 and 11-22 are used to adjust the output voltage of flux weakening curve.

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.



11-23 Speed Response of Flux Weakening Area

Factory Setting: 65

Settings 0: Disable

0~150%

It is used to control the speed in the flux weakening area. The larger value is set in Pr.11-23, the faster acceleration/deceleration will generate. In general, it is not necessary to adjust this parameter.

11-24 APR Gain

Factory Setting: 10.00

Settings 0.00~40.00 (IM)/ 0~100.00Hz (PM)

Kip gain of internal position is determined by Pr.11-05.

11-25 Gain Value of APR Feed Forward

Factory Setting: 30

Settings 0~100

For the position control, if it set a larger value in Pr.11-25, it can shorten the pulse differential and speed up the position response. But it may overshoot.

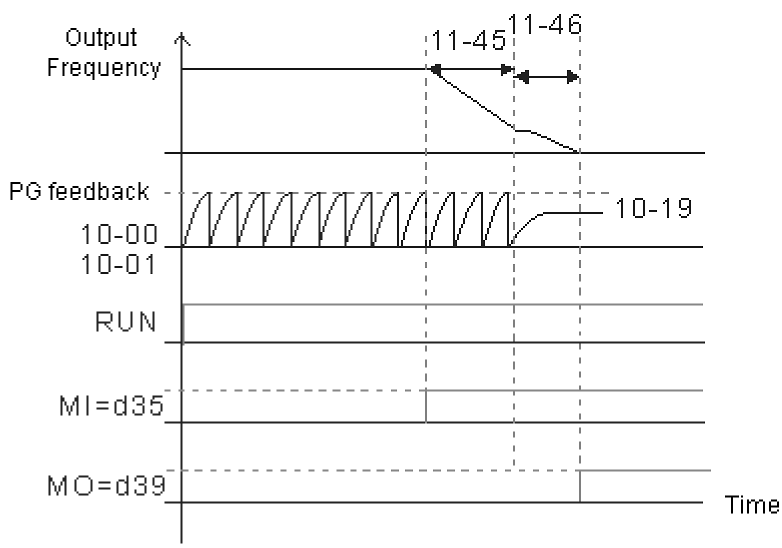
When the multi-function input terminal is set to 37(ON), this parameter can be set as required. If this parameter is set to a non zero value and adjust Pr.10-21 (PG2 Filter Time) to reduce the position overshoot and pulse differential. If it is set to 0, it won't have overshoot problem in position control but the pulse differential is decided by Pr.11-05 (KP gain).

11-26 APR Curve Time

Factory Setting: 3.00

Settings 0.00~655.35 sec

It is valid when the multi-function input terminal is set to 35(ON). The larger it is set, the longer the position time will be.



11-27 Max. Torque Command

Factory Setting: 100

Settings 0~500%

- The upper limit of torque command is 100%.
- Formula of motor rated torque:

$T(N.M)=\frac{P(W)}{\omega(rad/s)}$ is according to Pr.05-02 setting, ω (rad/s) is according to Pr.05-03

$\frac{RPM}{60\times 2\pi}=rad/s$

11-28 Source of Torque Offset

Factory Setting: 0

Settings 0: Disable

1: Analog input (Pr.03-00)

2: Torque offset setting (Pr.11-29)

Control by external terminal (by Pr.11-30 to Pr.11-32)

- This parameter is the source of torque offset.
- When it is set to 3, source of torque offset would determine Pr.11-30 to Pr.11-32 by
- When it is set to 3, the source of torque offset will regard Pr.11-30~11-32 by the multi-function input terminals (MI) setting (31, 32 or 33).

N.O. switch status: ON= contact closed, OFF= contact open

Pr. 11-32	Pr. 11-31	Pr. 11-30	
MI=33(High)	MI=32(Mid)	MI=31(Low)	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

11-29 Torque Offset Setting

Factory Setting: 0.0

Settings 0.0~100.0%

- This parameter is torque offset. The motor rated torque is 100%.
- Formula of motor rated torque: $T(N.M)=\frac{P(W)}{\omega(rad/s)}$ is according to Pr.05-02 setting, ω(rad/s) is according to Pr.05-03. $\frac{RPM}{60\times 2\pi}=rad/s$

11-30 High Torque Offset

Factory Setting: 30.0

Settings 0.0~100.0%

11-31 Middle Torque Offset

Factory Setting: 20.0

Settings 0.0~100.0%

11-32 Low Torque Offset

Factory Setting: 10.0

Settings 0.0~100.0%

- When it is set to 3, the source of torque offset will regard Pr.11-30, Pr.11-31 and Pr.11-32 by the multi-function input terminals setting (31, 32 or 33). The motor rated torque is 100%.
- Formula of motor rated torque:

$T(N.M) = \frac{P(W)}{\omega(rad/s)}$, P(W) is according to Pr.05-02 setting, ω(rad/s) is according to Pr.05-03.

$$\frac{RPM}{60 \times 2\pi} = rad/s$$

11-33 Source of Torque Command

Factory Setting: 0

Settings 0: Digital Keypad (Pr.11-34)

1: RS485 serial communication

2: Analog signal (Pr.03-00)

3: CANopen

4: Reserved

5: Communication card

- When Pr.11-33 is set to 0, torque command can be set in Pr.11-34.
- When Pr.11-33 is set to 1 or 2, Pr.11-34 would only display the torque command

11-34 Torque Command

Factory Setting: 0.0

Settings -100.0~100.0%(Pr.11-27=100%)

- This parameter is for the torque command. When Pr.11-27 is set to 250% and Pr.11-34 is set to 100%, actual torque command=250X100%=250% motor rated torque.
- The drive will save the setting to the record before power turns off.

11-35 Low-pass Filter Time of Torque Command

Factory Setting: 0.000

Settings 0.000~1.000 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 maybe unstable. User can adjust the setting by the control and response situation.

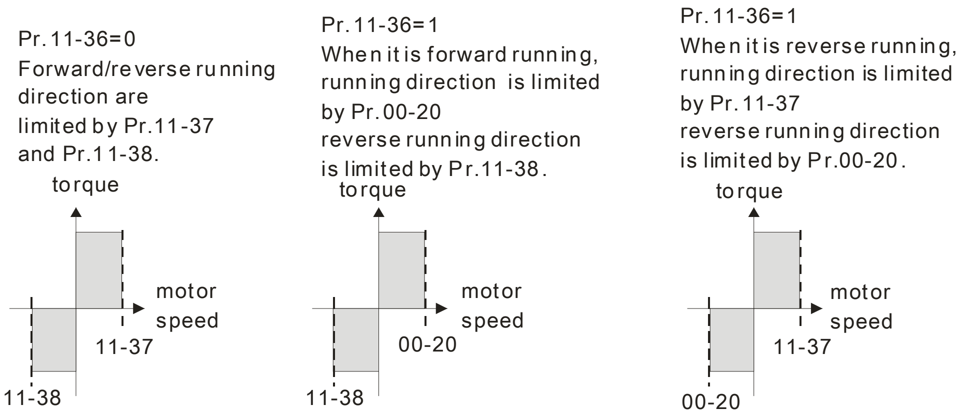
11-36 Speed Limit Selection

Factory Setting: 0

Settings 0: By Pr.11-37 and Pr.11-38

1: Source of Frequency command (Pr.00-20)

- 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.
- When the torque is positive direction, speed limit is positive direction. When the torque is negative direction, speed limit is negative direction.



11-37 Forward Speed Limit (torque mode)

Factory Setting: 10

Settings 0~120%

11-38 Reverse Speed Limit (torque mode)

Factory Setting: 10

Settings 0~120%

- These parameters are used in the torque mode to limit the running direction and opposite direction. (Pr.01-00 max. output frequency=100%)

11-39 Reserved

11-40 Command Source of Point-to-Point Position Control

Factory Settings:0

Settings 0: External terminal
1: Reserved
2: Reserved
3: CAN
4: PLC
5: Communication card

11-41 Reserved

11-42 Reserved

11-43 Max. Frequency of Point- to-Point Position Control

Factory Settings:10.00

Settings 0.00~327.67Hz

11-44 Accel. Time of Point-to Point Position Control

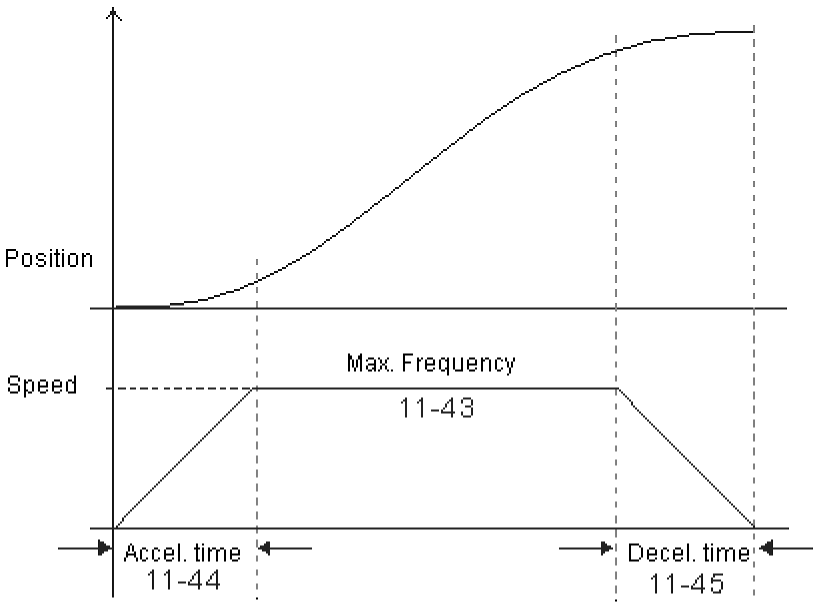
Factory Settings:1.00

Settings 0.00~655.35sec

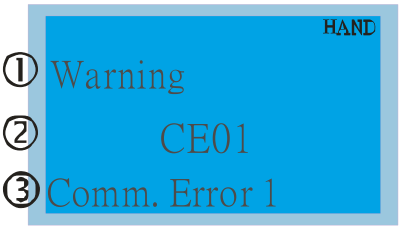
11-45 Decel. Time of Point-to Point Position Control

Factory Settings:3.00

Settings 0.00~655.35sec



Chapter 13Warning Codes



① Display error signal

② Abbreviate error code
The code is displayed as shown on KPC-CE01.

③ Display error description

Display on LCM Keypad	Descriptions
HAND Warning CE01 Comm. Error 1	Modbus function code error
HAND Warning CE02 Comm. Error 2	Address of Modbus data is error
HAND Warning CE03 Comm. Error 3	Modbus data error
HAND Warning CE04 Comm. Error 4	Modbus communication error
HAND Warning CE10 Comm. Error 10	Modbus transmission time-out
HAND Warning CP10 Keypad time out	Keypad transmission time-out
HAND Warning SE1 Save Error 1	Keypad COPY error 1
HAND Warning SE2 Save Error 2	Keypad COPY error 2
HAND Warning SE3 Copy Model Err 3	Keypad COPY error 3

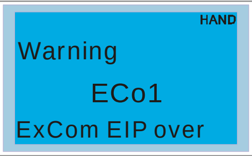
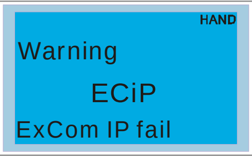
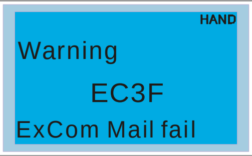
HAND Warning oH1 Over heat 1 warn	IGBT over-heating warning
HAND Warning oH2 Over heat 2 warn	Capacity over-heating warning
HAND Warning PID PID FBK Error	PID feedback error
HAND Warning ANL Analog loss	ACI signal error When Pr03-19 is set to 1 and 2.
HAND Warning uC Under Current	Low current
HAND Warning AUE Auto-tune error	Auto tuning error
HAND Warning PGFB PG FBK Warn	PG feedback error
HAND Warning PGL PG Loss Warn	PG feedback loss
HAND Warning oSPD Over Speed Warn	Over-speed warning
HAND Warning DAvE Deviation Warn	Over speed deviation warning
HAND Warning PHL Phase Loss	Phase loss
HAND Warning ot1 Over Torque 1	Over torque 1

HAND Warning ot2 Over Torque 2	Over torque 2
HAND Warning oH3 Motor Over Heat	Motor over-heating
HAND Warning oSL Over Slip Warn	Over slip
HAND Warning tUn Auto tuning	Auto tuning processing
HAND Warning CGdn Guarding T-out	CAN guarding time-out 1
HAND Warning CHbn Heartbeat T-out	CAN heartbeat time-out 2
HAND Warning CSYn SYNC T-out	CAN synchrony time-out
HAND Warning CbFn Can Bus Off	CAN bus off
HAND Warning CSdn SDO T-out	CAN SDO transmission time-out
HAND Warning CSbn Buf Overflow	CAN SDO received register overflow
HAND Warning Cbtn Boot up fault	CAN boot up error
HAND Warning CPtn Error Protocol	CAN format error
HAND Warning CIdn CAN/S Idx exceed	CAN index error

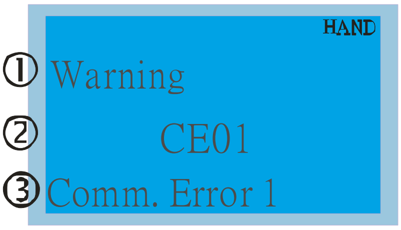
HAND Warning CAdn CAN/S Addres set	CAN station address error
HAND Warning CFrn CAN/S FRAM fail	CAN memory error
HAND Warning PLod Opposite Defect	PLC download error
HAND Warning PLSv Save mem defect	Save error of PLC download
HAND Warning PLdA Data defect	Data error during PLC operation
HAND Warning PLFn Function defect	Function code of PLC download error
HAND Warning PLor Buf overflow	PLC register overflow
HAND Warning PLFF Function defect	Function code of PLC operation error
HAND Warning PLSn Check sum error	PLC checksum error
HAND Warning PLEd No end command	PLC end command is missing
HAND Warning PLCr PLC MCR error	PLC MCR command error
HAND Warning PLdF Download fail	PLC download fail

HAND Warning PLSF Scane time fail	PLC scan time exceed
HAND Warning PCGd CAN/M Guard err	CAN Master guarding error
HAND Warning PCbF CAN/M bus off	CAN Master bus off
HAND Warning PCnL CAN/M Node Lack	CAN Master node error
HAND Warning PCCt CAN/M Cycle Time	CAN/M cycle time-out
HAND Warning PCSF CAN/M SDO over	CAN/M SDOover
HAND Warning PCSd CAN/M Sdo Tout	CAN/M SDO time-out
HAND Warning PCAd CAN/M Addres set	CAN/M station address error
HAND Warning ECid ExCom ID failed	Duplicate MAC ID error Node address setting error
HAND Warning ECLv ExCom pwr loss	Low voltage of communication card
HAND Warning ECtt ExCom Test Mode	Communication card in test mode

HAND Warning ECbF ExCom Bus off	DeviceNet bus-off
HAND Warning ECnP ExCom No power	DeviceNet no power
HAND Warning ECFF ExCom Facty def	Factory default setting error
HAND Warning ECiF ExCom Inner err	Serious internal error
HAND Warning ECio ExCom IONet brk	IO connection break off
HAND Warning ECPP ExCom Pr data	Profibus parameter data error
HAND Warning ECPi ExCom Conf data	Profibus configuration data error
HAND Warning ECEF ExCom Link fail	Ethernet Link fail
HAND Warning ECto ExCom Inr T-out	Communication time-out for communication card and drive
HAND Warning ECCS ExCom Inr CRC	Check sum error for Communication card and drive
HAND Warning ECrF ExCom Rtn def	Communication card returns to default setting
HAND Warning ECo0 ExCom MTCP over	Modbus TCP exceed maximum communication value

	EtherNet/IP exceed maximum communication value
	IP fail
	Mail fail
	Communication card busy

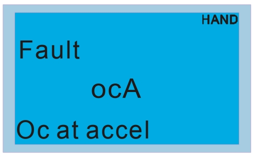
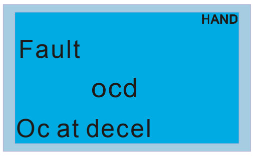
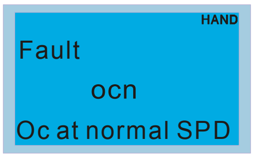
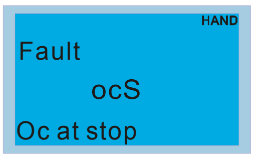
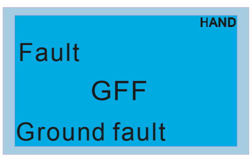
Chapter 14 Fault Codes and Descriptions



① Display error signal

② Abbreviate error code
The code is displayed as shown on KPC-CE01.

③ Display error description

Fault Name	Fault Descriptions	Corrective Actions
	Over-current during acceleration (Output current exceeds triple rated current during acceleration.)	1. Short-circuit at motor output: Check for possible poor insulation at the output. 2. Acceleration Time too short: Increase the Acceleration Time. 3. AC motor drive output power is too small: Replace the AC motor drive with the next higher power model.
	Over-current during deceleration (Output current exceeds triple rated current during deceleration.)	1. Short-circuit at motor output: Check for possible poor insulation at the output. 2. Deceleration Time too short: Increase the Deceleration Time. 3. AC motor drive output power is too small: Replace the AC motor drive with the next higher power model.
	Over-current during steady state operation (Output current exceeds triple rated current during constant speed.)	1. Short-circuit at motor output: Check for possible poor insulation at the output. 2. Sudden increase in motor loading: Check for possible motor stall. 3. AC motor drive output power is too small: Replace the AC motor drive with the next higher power model.
	Hardware failure in current detection	Return to the factory
	Ground fault	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. NOTE: The short circuit protection is provided for AC motor drive protection, not for protecting the user. 1. Check the wiring connections between the AC motor drive and motor for possible short circuits, also to ground. 2. Check whether the IGBT power module is damaged. 3. Check for possible poor insulation at the output.

Fault Name	Fault Descriptions	Corrective Actions
HAND Fault occ Short Circuit	Short-circuit is detected between upper bridge and lower bridge of the IGBT module	Return to the factory
HAND Fault ovA Ov at accel	DC BUS over-voltage during acceleration (230V: DC 450V; 460V: DC 900V)	1. Check if the input voltage falls within the rated AC motor drive input voltage range. 2. Check for possible voltage transients. 3. If DC BUS over-voltage due to regenerative voltage, please increase the Deceleration Time or add an optional brake resistor.
HAND Fault ovd Ov at decel	DC BUS over-voltage during deceleration (230V: DC 450V; 460V: DC 900V)	1. Check if the input voltage falls within the rated AC motor drive input voltage range. 2. Check for possible voltage transients. 3. If DC BUS over-voltage due to regenerative voltage, please increase the Deceleration Time or add an optional brake resistor.
HAND Fault ovn Ov at normal SPD	DC BUS over-voltage at constant speed (230V: DC 450V; 460V: DC 900V)	1. Check if the input voltage falls within the rated AC motor drive input voltage range. 2. Check for possible voltage transients. 3. If DC BUS over-voltage due to regenerative voltage, please increase the Deceleration Time or add an optional brake resistor.
HAND Fault ovS Ov at stop	Hardware failure in voltage detection	1. Check if the input voltage falls within the rated AC motor drive input voltage range. 2. Check for possible voltage transients.
HAND Fault LvA Lv at accel	DC BUS voltage is less than Pr.06-00 during acceleration	1. Check if the input voltage is normal 2. Check for possible sudden load
HAND Fault Lvd Lv at decel	DC BUS voltage is less than Pr.06-00 during deceleration	1. Check if the input voltage is normal 2. Check for possible sudden load
HAND Fault Lvn Lv at normal SPD	DC BUS voltage is less than Pr.06-00 in constant speed	1. Check if the input voltage is normal 2. Check for possible sudden load
HAND Fault LvS Lv at stop	DC BUS voltage is less than Pr.06-00 at stop	1. Check if the input voltage is normal 2. Check for possible sudden load

Fault Name	Fault Descriptions	Corrective Actions
HAND 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.
HAND Fault oH1 IGBT over heat	IGBT overheating IGBT temperature exceeds protection level 1 to15HP: 90 °C 20 to 100HP: 100 °C	1. Ensure that the ambient temperature falls within the specified temperature range. 2. Make sure that the ventilation holes are not obstructed. 3. Remove any foreign objects from the heatsinks and check for possible dirty heat sink fins. 4. Check the fan and clean it. 5. Provide enough spacing for adequate ventilation.
HAND Fault oH2 Heat Sink oH	Heatsink overheating Capacitance temperature exceeds 90°C cause heatsink overheating.	1. Ensure that the ambient temperature falls within the specified temperature range. 2. Make sure heat sink is not obstructed. Check if the fan is operating 3. Check if there is enough ventilation clearance for AC motor drive.
HAND Fault oH3 Motor over heat	Motor overheating The AC motor drive detects that the internal temperature exceeds Pr.06-30 (PTC level)	1. Make sure that the motor is not obstructed. 2. Ensure that the ambient temperature falls within the specified temperature range. 3. Take the next higher power AC motor drive model.
HAND Fault tH1o Thermo 1 open	IGBT Hardware Error	Return to the factory
HAND Fault tH2o Thermo 2 open	Capacitor Hardware Error	Return to the factory
HAND Fault PWR Power RST OFF	Power off	
HAND Fault oL Over load	Overload The AC motor drive detects excessive drive output current.	1. Check if the motor is overloaded. 2. Take the next higher power AC motor drive model.

Fault Name	Fault Descriptions	Corrective Actions
HAND Fault EoL1 Thermal relay 1	Electronics thermal relay 1 protection	1. Check the setting of electronics thermal relay (Pr.06-14) Take the next higher power AC motor drive model
HAND Fault EoL2 Thermal relay 2	Electronics thermal relay 2 protection	1. Check the setting of electronics thermal relay (Pr.06-28) 2. Take the next higher power AC motor drive model
HAND 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 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.	1. Check whether the motor is overloaded. 2. Check whether motor rated current setting (Pr.05-01) is suitable 3. Take the next higher power AC motor drive model.
HAND Fault ot2 Over torque 2		
HAND Fault uC Under torque	Low current detection	Check Pr.06-71, Pr.06-72, Pr.06-73.
HAND Fault LMIT Limit Error	Limit error	
HAND Fault cF1 EEPROM write err	Internal EEPROM can not be programmed.	1. Press "RESET" key to the factory setting 2. Return to the factory.
HAND Fault cF2 EEPROM read err	Internal EEPROM can not be read.	1. Press "RESET" key to the factory setting 2. Return to the factory.
HAND Fault cd1 Ias sensor err	U-phase error	Reboots the power. If fault code is still displayed on the keypad please return to the factory

Fault Name	Fault Descriptions	Corrective Actions
HAND 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
HAND 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
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
HAND 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
HAND 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
HAND 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
HAND Fault AUE Auto tuning err	Auto tuning error	1. Check cabling between drive and motor 2. Try again.
HAND Fault AFE PID Fbk error	PID loss (ACI)	1. Check the wiring of the PID feedback 2. Check the PID parameters settings
HAND Fault PGF1 PG Fbk error	PG feedback error	Check if encoder parameter setting is accurate when it is PG feedback control.
HAND Fault PGF2 PG Fbk loss	PG feedback loss	Check the wiring of the PG feedback

Fault Name	Fault Descriptions	Corrective Actions
HAND Fault PGF3 PG Fbk over SPD	PG feedback stall	1. Check the wiring of the PG feedback 2. Check if the setting of PI gain and deceleration is suitable 3. Return to the factory
HAND Fault PGF4 PG Fbk deviate	PG slip error	1. Check the wiring of the PG feedback 2. Check if the setting of PI gain and deceleration is suitable 3. Return to the factory
HAND Fault PGr1 PG Ref error	Pulse input error	1. Check the pulse wiring 2. Return to the factory
HAND Fault PGr2 PG Ref loss	Pulse input loss	1. Check the pulse wiring 2. Return to the factory
HAND Fault ACE ACI loss	ACI loss	1. Check the ACI wiring 2. Check if the ACI signal is less than 4mA
HAND Fault EF External fault	External Fault	1. Input EF (N.O.) on external terminal is closed to GND. Output U, V, W will be turned off. 2. Give RESET command after fault has been cleared.
HAND Fault EF1 Emergency stop	Emergency stop	1. 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. 2. Press RESET after fault has been cleared.
HAND Fault bb Base block	External Base Block	1. When the external input terminal (B.B) is active, the AC motor drive output will be turned off. 2. Deactivate the external input terminal (B.B) to operate the AC motor drive again.
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.
HAND Fault ccod SW Code Error	Software code error	

Fault Name	Fault Descriptions	Corrective Actions
HAND Fault CE1 PC err command	Illegal function code	Check if the function code is correct (function code must be 03, 06, 10, 63)
HAND Fault CE2 PC err address	Illegal data address (00H to 254H)	Check if the communication address is correct
HAND Fault CE3 PC err data	Illegal data value	Check if the data value exceeds max./min. value
HAND Fault CE4 PC slave fault	Data is written to read-only address	Check if the communication address is correct
HAND Fault CE10 PC time out	Modbus transmission time-out	
HAND Fault CP10 PU time out	Keypad transmission time-out	
HAND 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.
HAND Fault ydc Y-delta connect	Y-connection/Δ-connection switch error	1. Check the wiring of the Y-connection/Δ-connection 2. Check the parameters settings
HAND 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.	1. Set Pr.07-13 to 0 2. Check if input power is stable
HAND Fault oSL Over slip error	It will be displayed when slip exceeds Pr.05-26 setting and time exceeds Pr.05-27 setting.	1. Check if motor parameter is correct (please decrease the load if overload 2. Check the settings of Pr.05-26 and Pr.05-27

Fault Name	Fault Descriptions	Corrective Actions
HAND Fault S1 S1-emergy stop	Emergency stop for external safety	
HAND Fault Uocc A phase short	Phase A short circuit	
HAND Fault Vocc B phase short	Phase B short circuit	
HAND Fault Wocc C phase short	C phase short circuit	
HAND Fault ryF MC Fault	The electromagnet switch of the power board is not sealed. (For larger power model: Frame E and above)	
HAND Fault PGF5 PG HW Error	Hardware error of PG Card	
HAND Fault ocU Unknow over Amp	Unknown over current	
HAND Fault ovU Unknow over volt.	Unknown over voltage	
HAND Fault OPHL U phase lacked	Output phase loss (Phase U)	
HAND Fault OPHL V phase lacked	Output phase loss (Phase V)	

Fault Name	Fault Descriptions	Corrective Actions
HAND Fault OPHL W phase lacked	Output phase loss (Phase W)	
HAND Fault TRAP CPU Trap Error	CPU trap error	
HAND Fault CGdE Guarding T-out	CANopen guarding error	
HAND Fault CHbE Heartbeat T-out	CANopen heartbeat error	
HAND Fault CSYE SYNC T-out	CANopen synchronous error	
HAND Fault CbFE Can bus off	CANopen bus off error	
HAND Fault CIdE Can bus Index Err	CANopen index error	
HAND Fault CAdE Can bus Add. Err	CANopen station address error	
HAND Fault CFrE Can bus off	CANopen memory error	

Chapter 15 CANopen Overview

Newest version is available at http://www.delta.com.tw/industrialautomation/

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 http://www.can-cia.org/ 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~ PDO2
- SDO (Service Data Object):
  Initiate SDO Download;
  Initiate SDO Upload;
  Abort SDO;
  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.

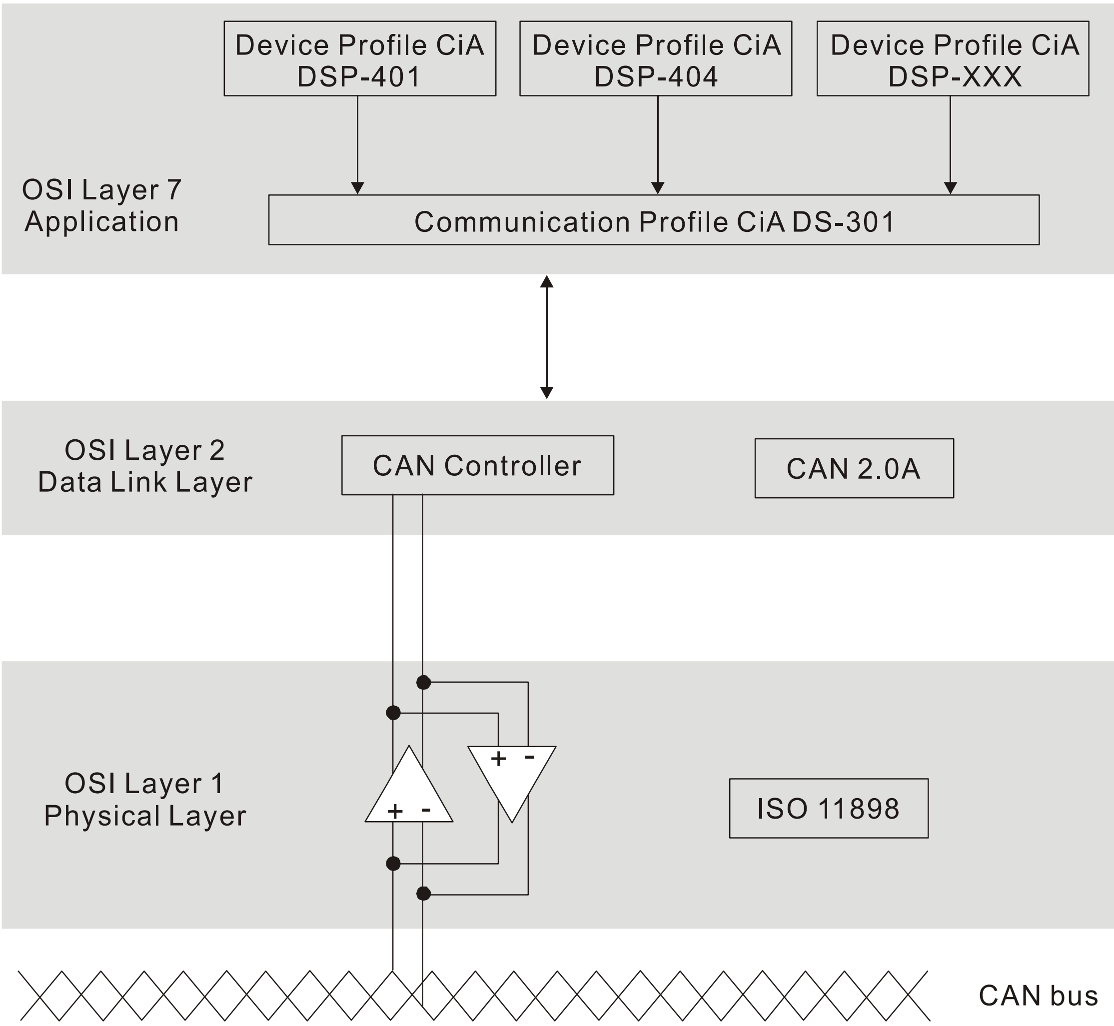
Delta CANopen not supporting service:

- Time Stamp service

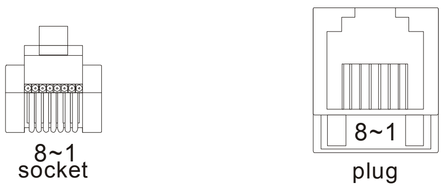
15.1 CANopen Overview

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 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).



RJ-45 Pin Definition



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-
7	CAN_GND	Ground / 0V /V-

Pre-Defined Connection Set

To reduce configuration effort for simple networks, CANopen define a mandatory default identifier allocation scheme. The 11-bit identifier structure in predefined connection is set as follows:

COB Identifier (CAN Identifier)										
10	9	8	7	6	5	4	3	2	1	0
Function Code				Node Number						

Object	Function Code	Node Number	COB-ID	Object Dictionary Index
Broadcast messages				
NMT	0000	-	0	-
SYNC	0001	-	80H	1005H, 1006H, 1007H
TIME STAMP	0010	-	100H	1012H, 1013H
Point-to-point messages				
Emergency	0001	1-127	81H-FFH	1014H, 1015H
TPDO1	0011	1-127	181H-1FFH	1800H
RPDO1	0100	1-127	201H-27FH	1400H
TPDO2	0101	1-127	281H-2FFH	1801H
RPDO2	0110	1-127	301H-37FH	1401H
TPDO3	0111	1-127	381H-3FFH	1802H
RPDO3	1000	1-127	401H-47FH	1402H
TPDO4	1001	1-127	481H-4FFH	1803H
RPDO4	1010	1-127	501H-57FH	1403H
Default SDO (tx)	1011	1-127	581H-5FFH	1200H
Default SDO (rx)	1100	1-127	601H-67FH	1200H
NMT Error Control	1110	1-127	701H-77FH	1016H, 1017H

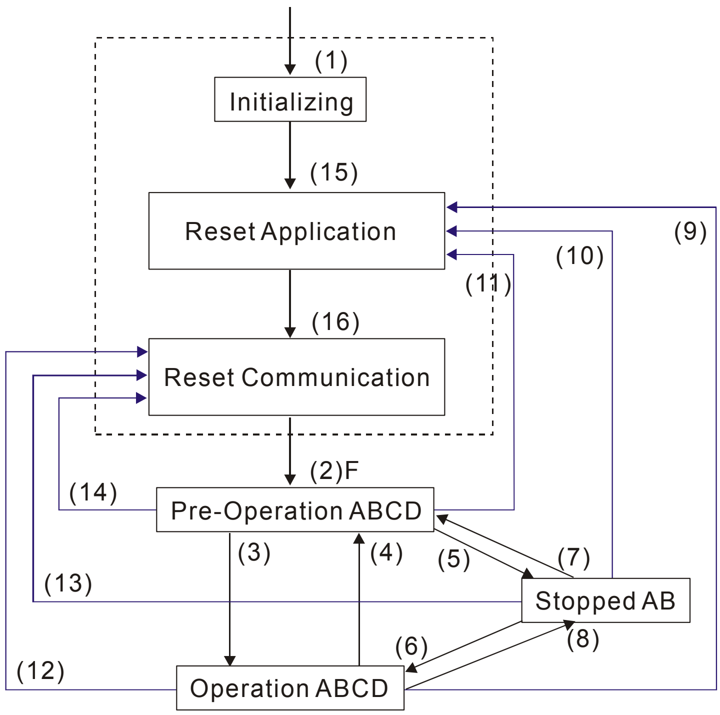
CANopen Communication Protocol

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:

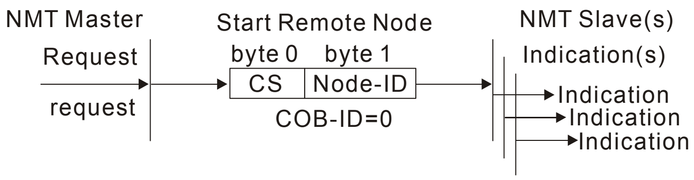


(1) After power is applied, it is auto in initialization state
(2) Enter pre-operational state automatically
(3) (6) Start remote node
(4) (7) Enter pre-operational state
(5) (8) Stop remote node
(9) (10) (11) Reset node
(12) (13) (14) Reset communication
(15) Enter reset application state automatically
(16) Enter reset communication state automatically

A: NMT
B: Node Guard
C: SDO
D: Emergency
E: PDO
F: Boot-up

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

NMT Protocol is shown as follows:



Value	CS Definition
1	Start
2	Stop
128	Enter Pre-Operational
129	Reset Node
130	Reset Communication

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:

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

N: Bytes not use
E: normal(0)/expedited(1)
S: size indicated

PDO (Process Data Object)

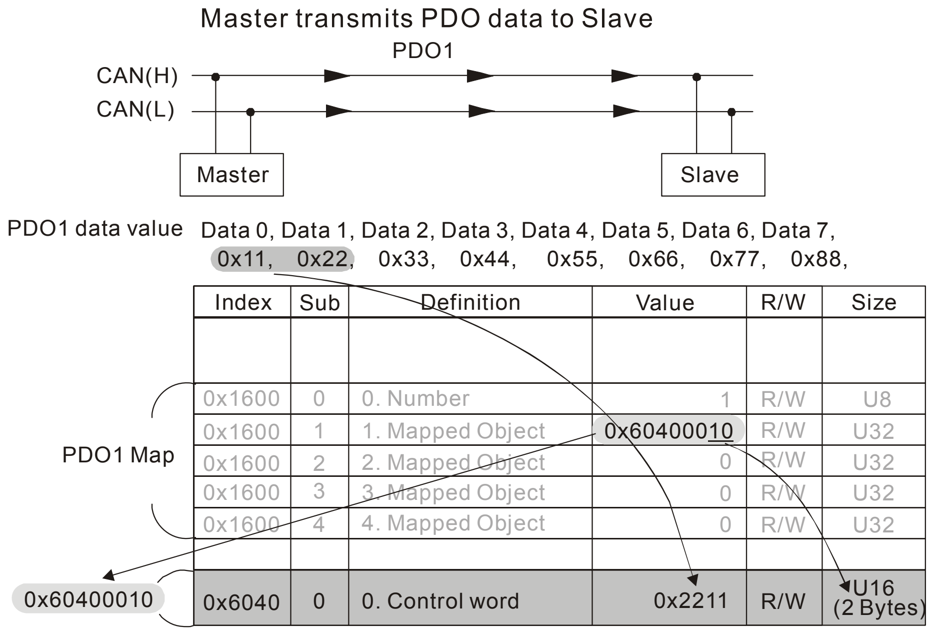
PDO communication can be described by the producer/consumer model. Each node of the network will listen to the messages of the transmission node and distinguish if the message has to be processed or not after receiving the message. PDO can be transmitted from one device to one another device or to many other devices. Every PDO has two PDO services: a TxPDO and a RxPDO. PDOs are transmitted in a non-confirmed mode.

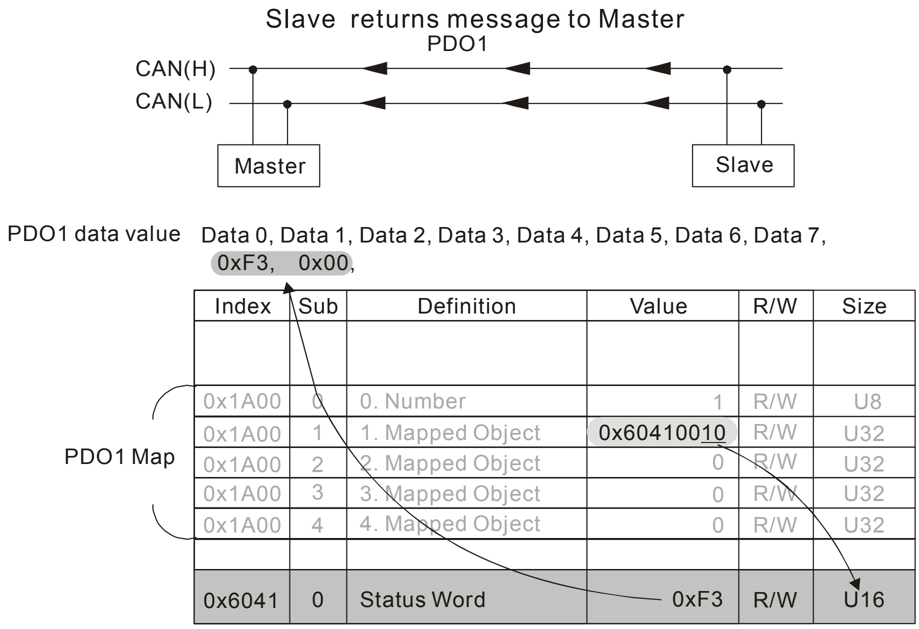
PDO Transmission type is defined in the PDO communication parameter index (1400h for the 1st RxPDO or 1800h for the 1st TxPDO), and all transmission types are listed in the following table:

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

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.
Example:





EMCY (Emergency Object)

Emergency objects are triggered when hardware failure occurs for a warning interrupt. The data format of a emergency object is a 8 bytes data as shown in the following:

Byte	0	1	2	3	4	5	6	7
Content	Emergency Error Code		Error register (Object 1001H)	Manufacturer specific Error Field				

Please refer to Chapter 5 CANopen error codes for emergency definition of C2000.

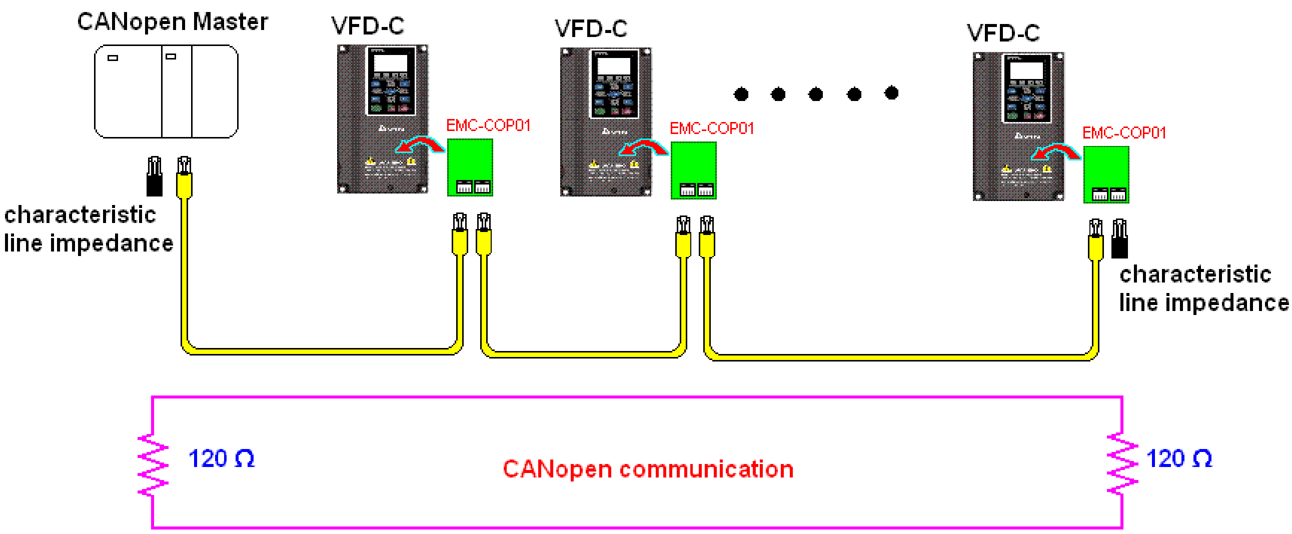
Example:

NO.	COB-ID	RTR	DLC	D0	D1	D2	D3	D4	D5	D6	D7	Time	Description
1	000	0	2	81	01							93633355289810	NMT
2	081	0	8	00	00	00	00	00	00	00	00	93633469867147	EMG:node 1
3	701	0	1	00								93633470029134	NMT Err:node 1
4	601	0	8	2B	40	60	00	7E	00	00	00	93638456352665	SDO RX(Master):node 1
5	581	0	8	60	40	60	00	00	00	00	00	93638457784984	SDO TX(Slaver):node 1
6	601	0	8	2B	40	60	00	7F	00	00	00	93641854704580	SDO RX(Master):node 1
7	581	0	8	60	40	60	00	00	00	00	00	93641855252946	SDO TX(Slaver):node 1
8	601	0	8	40	41	60	00	00	00	00	00	93644908425033	SDO RX(Master):node 1
9	581	0	8	4B	41	60	00	37	06	00	00	93644909145739	SDO TX(Slaver):node 1
10	080	0	0									93646699436227	SYNC
11	201	0	2	11	22							93649160925635	PDO RX(Master)1:node 1

Master send NM message to slave 1 for RESET request.
Slave 1 responds no error
Slave 1 responds a boot up message
Master enter Index6040 = 7EH in slave 1
Slave 1 responds OK
Master enter Index6040= 7FH in slave 1
Slave 1 responds OK
Master enter value for Index6041 to slave 1
Slave 1 responds 0640H
Master enter SYNC
Master enter PD01=2211H to slave 1

15.2 CANopen Wiring

An external adapter card: EMC-COP01 is used for CANopen wiring; establish CANopen to VFD C2000 connection. The link is enabled by using RJ45 cable. The two farthest ends must be terminated with 120Ω terminating resistors.



15.3 How to Control by CANopen

15.3.1 CANopen Control Mode

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.

15.3.2 DS402 Standard Mode

To control the AC motor drive by CANopen, please set the parameters by the following steps:

1. Wiring for hardware (refer to Chapter 2 Wiring for CANopen)
2. Operation source setting: set Pr.00.21 to 3 (CANopen communication. Keypad STOP/RESET disabled.)
3. Frequency source setting: set Pr.02.00 to 6 (CANopen communication)
4. Torque source setting: set Pr.11-33
5. 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.)
6. CANopen baud rate setting: set Pr.09.37 (CANBUS Baud Rate: 1M(0), 500K(1), 250K(2), 125K(3), 100K(4) and50K(5))
7. 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.)
8. Switch to C2000 operation mode via the NMT string; control word 0x6040 (bit 0, bit 1, bit 2, bit 3 and bit 7) and status word 0x6041.

For example:

1. If the multi-function input terminal MI set Quick Stop to disable, enable the responsive terminal of such MI terminal.
2. Set index 6040H to 7EH.
3. Set index 6040H to 7FH, the drive is now in operation mode.
4. Set index 6042H to 1500 (rpm), the default setting for pole is 4 (50Hz). Set the pole in Pr.05.04 (Motor1) and Pr.05.16 (Motor 2).

Calculation for motor speed: $n = f \times \frac{120}{p}$ where n = ramp per minute (rpm);

P = poles

f = frequency (Hz)

Example 1: set motor running in forward direction, f = 30Hz, P = 4.

(120*30)/4 = 900rpm

Example 2: set motor running in reverse direction, f = 20Hz, P = 6.

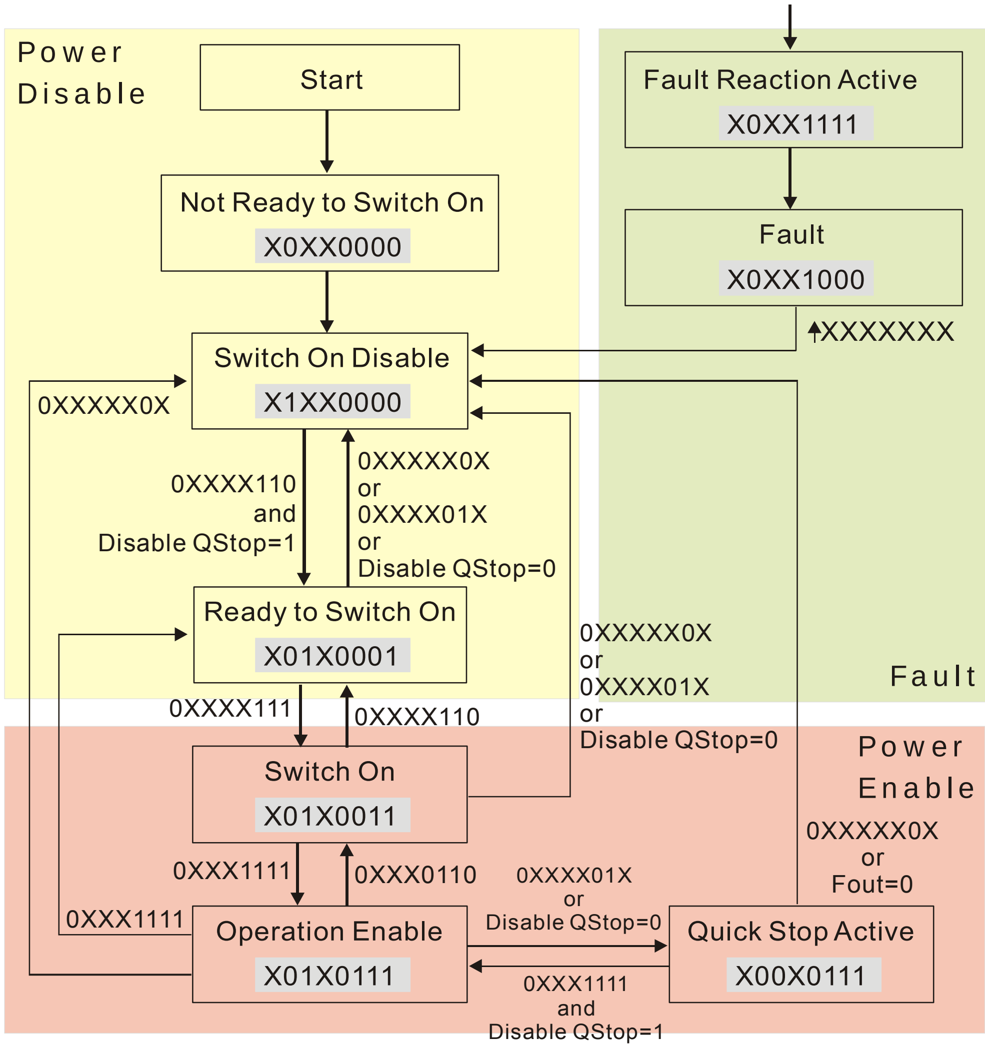
(120*15)/6 = 300rpm; 300rpm = 0x012C

Also,

Bit15 defines the positive and negative sign.

i.e. Index 6042 = -300 = (300' + 1) = 012CH' + 1 = FED3H +1 = FED4H

Switching mode:



< Status Switching Graph>

9. The operation of AC motor drive in DS402 standard is controlled by the Control Word 0x6040 (bit4~bit6), as shown in the following chart:

bit 6	bit 5	bit 4	Outcome
ramp function reference	ramp function disable	ramp function enable	
0	0	0	STOP
1	0	0	STOP
0	1	0	STOP
1	1	0	STOP
0	0	1	STOP
1	0	1	LOCK (at present frequency)
0	1	1	STOP
1	1	1	RUN

10. Follow the same steps, refer to status switching process for status word 0x6041(bit 0 to bit 6), bit 7= warn, bit 9 = 1 (permanently), bit 10= target frequency reached, bit 11= output exceeds maximum frequency.

15.3.3 Delta Standard Mode

1. Wiring (refer to Chapter 2 Wiring for CANopen).
2. Rest CANopen Index, set Pr. 00.02 to 7. (Note, CANopen Index will return to factory setting)
3. Operating source setting: set Pr.00.21 to 3 (Select CANopen communication mode)
4. Frequency source setting: set Pr.00.20 to 6 (CANopen setting. If torque control or position control is required, set Pr.0.02 to 2. Also set Pr.09.30 to 1(default setting) to allow new address 60XX to function, the old address 20XX can not support the control function for position and torque.
5. Torque source setting: Pr.11.33 。
6. CANopen station setting: set Pr.09.36 (CANopen communication address 0-127)
7. CANopen baud rate setting: set Pr.09.37 (Baud rate options: 1M(0), 500K(1), 250K(2), 125K(3), 100K(4) and 50K(5)
8. CANopen decode method setting: set Pr.09.40 to 0.
9. 20XX address (old): in index 2020.01 enter 0002H for motor run; 0001H for motor stop. In index 2020.02 enter 1000, frequency will be 10.00Hz. Refer to Index 2020 and 2021 for more detail.
10. 60XX address (new): in index 2060.01 enter 0080H for motor servo on; enter 0x81 for motor run to the target frequency. Various control mode options are available in Pr.00.40, select your control mode.

15.4 CANopen Supporting Index

Basic Index Support by C2000:

Index	Sub	Definition	Factory Setting	R/W	Size	Note
1000H	0	Device type	00010192H	R	U32	
1001H	0	Error register	0	R	U8	
1005H	0	COB-ID SYNC message	80H	R	U32	
1006H	0	Communication cycle period	0	RW	U32	Unit: us The setting value should be in a multiple of 500us (integer) within the range 500us to 16ms
1008H	0	Manufacturer device name	0	R	U32	
1009H	0	Manufacturer hardware version	0	R	U32	
100AH	0	Manufacturer software version	0	R	U32	
100CH	0	Guarding time	0	RW	U16	Unit: ms
100DH	0	Guarding factor	0	RW	U8	
1010H	0	Store Parameter	2	R	U8	
	1	Save all parameters	0	RW	U32	
	2	Save communication parameter	1	RW	U32	
1011H	0	Restore Parameter	2	R	U8	
	1	Restore all parameters	0	RW	U32	
	2	Restore communication parameter	1	RW	U32	
1014H	0	COB-ID emergency	0000080H+Node-ID	R	U32	
1015H	0	Inhibit time EMCY	0	RW	U16	Unit:100us The setting value should be in a multiple of 10 (integer)
1016H	0	Consumer heartbeat time	1	R	U8	
	1	Consumer 1	0	RW	U32	Unit: 1ms Disable Guarding time to function properly
1017H	0	Producer heartbeat time	0	RW	U16	Unit: 1ms Disable Guarding time to function properly
1018H	0	Number	0	R	U8	
	1	Vender ID	000001DDH	R	U32	
	2	Product code	2A00+machine code	R	U32	
	3	Revision	00010000H	R	U32	
1200H	0	Server SDO Parameter	2	R	U8	
	1	COB-ID Client -> Server	0000600H+Node-ID	R	U32	
	2	COB-ID Client <- Server	0000580H+Node-ID	R	U32	
1400H	0	Number	2	R	U8	

Index	Sub	Definition	Factory Setting	R/W	Size	Note
	1	COB-ID used by PDO	00000200H+Node-ID	RW	U32	
	2	Transmission Type	5	RW	U8	00:Acyclic& Synchronous 01~240:Cyclic & Synchronous 255:Asynchronous
1401H	0	Number	2	R	U8	
	1	COB-ID used by PDO	80000300H+Node-ID	RW	U32	
	2	Transmission Type	5	RW	U8	00: Acyclic & Synchronous 01~240:Cyclic & Synchronous 255:Asynchronous
1402H	0	Number	2	R	U8	
	1	COB-ID used by PDO	80000400H+Node-ID	RW	U32	
	2	Transmission Type	5	RW	U8	00: Acyclic & Synchronous 01~240:Cyclic & Synchronous 255:Asynchronous
1403H	0	Number	2	R	U8	
	1	COB-ID used by PDO	80000500H+Node-ID	RW	U32	
	2	Transmission Type	5H	RW	U8	00: Acyclic & Synchronous 01~240:Cyclic & Synchronous 255:Asynchronous
1600H	0	Number	2	RW	U8	
	1	1.Mapped Object	60400010H	RW	U32	
	2	2.Mapped Object	60420010H	RW	U32	
	3	3.Mapped Object	0	RW	U32	
	4	4.Mapped Object	0	RW	U32	
1601H	0	Number	3	RW	U8	
	1	1.Mapped Object	20264110H	RW	U32	
	2	2.Mapped Object	2026A110H	RW	U32	
	3	3.Mapped Object	2026A210H	RW	U32	
	4	4.Mapped Object	0	RW	U32	
1602H	0	Number	3	RW	U8	
	1	1.Mapped Object	60400010H	RW	U32	
	2	2.Mapped Object	607A0020H	RW	U32	
	3	3.Mapped Object	60600008H	RW	U32	
	4	4.Mapped Object	0	RW	U32	
1603H	0	Number	3	RW	U8	
	1	1.Mapped Object	60400010H	RW	U32	
	2	2.Mapped Object	60710010H	RW	U32	
	3	3.Mapped Object	60600008H	RW	U32	
	4	4.Mapped Object	0	RW	U32	

Index	Sub	Definition	Factory Setting	R/W	Size	Note
1800H	0	Number	5	R	U8	
	1	COB-ID used by PDO	00000180H+Node-ID	RW	U32	
	2	Transmission Type	5	RW	U8	00: Acyclic & Synchronous 01~240:Cyclic & Synchronous 255:Asynchronous
	3	Inhibit time	0	RW	U16	Unit: 100us The setting value should be in a multiple of 10 (integer)
	4	CMS-Priority Group	3	RW	U8	
	5	Event timer	0	RW	U16	Unit: 1ms
1801H	0	Number	5	R	U8	
	1	COB-ID used by PDO	80000280H+Node-ID	RW	U32	
	2	Transmission Type	5	RW	U8	00: Acyclic & Synchronous 01~240:Cyclic & Synchronous 255:Asynchronous
	3	Inhibit time	0	RW	U16	Unit: 100us The setting value should be in a multiple of 10 (integer)
	4	CMS-Priority Group	3	RW	U8	
	5	Event timer	0	RW	U16	Unit: 1ms
1802H	0	Number	5	R	U8	
	1	COB-ID used by PDO	80000380H+Node-ID	RW	U32	
	2	Transmission Type	5	RW	U8	00: Acyclic & Synchronous 01~240:Cyclic & Synchronous 255:Asynchronous
	3	Inhibit time	0	RW	U16	Unit: 100us The setting value should be in a multiple of 10 (integer)
	4	CMS-Priority Group	3	RW	U8	
	5	Event timer	0	RW	U16	Unit: 1ms
1803H	0	Number	5	R	U8	
	1	COB-ID used by PDO	80000480H+Node-ID	RW	U32	
	2	Transmission Type	5	RW	U8	00: Acyclic & Synchronous 01~240:Cyclic & Synchronous 255:Asynchronous
	3	Inhibit time	0	RW	U16	Unit: 100us The setting value should be in a multiple of 10 (integer)
	4	CMS-Priority Group	3	RW	U8	
	5	Event timer	0	RW	U16	Unit: 1ms
1A00H	0	Number	2	RW	U8	
	1	1.Mapped Object	60410010H	RW	U32	
	2	2.Mapped Object	60430010H	RW	U32	

Index	Sub	Definition	Factory Setting	R/W	Size	Note
	3	3.Mapped Object	0	RW	U32	
	4	4.Mapped Object	0	RW	U32	
1A01H	0	Number	4	RW	U8	
	1	1.Mapped Object	20260110H	RW	U32	
	2	2.Mapped Object	20266110H	RW	U32	
	3	3.Mapped Object	20266210H	RW	U32	
	4	4.Mapped Object	20266310H	RW	U32	
1A02H	0	Number	3	RW	U8	
	1	1.Mapped Object	60410010H	RW	U32	
	2	2.Mapped Object	60640020H	RW	U32	
	3	3.Mapped Object	60610008H	RW	U32	
	4	4.Mapped Object	0	RW	U32	
1A03H	0	Number	3	RW	U8	
	1	1.Mapped Object	60410010H	RW	U32	
	2	2.Mapped Object	60770010H	RW	U32	
	3	3.Mapped Object	60610008H	RW	U32	
	4	4.Mapped Object	0	RW	U32	

C2000 Index:

Parameter index corresponds to each other as following:

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

For example:

Pr.10.15 (Encoder Slip Error Treatment)

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

Index = 2000H + 0AH = 200A

Sub Index = 0FH + 1H = 10H

C2000 Control Index:

Delta Standard Mode (Old definition)

Index	Sub	Definition	Factory Setting	R/W	Size	Note	
2020H	0	Number	3	R	U8		
	1	Control word	0	RW	U16	Bit 0~1	00B:disable
							01B:stop
							10B:disable

Index	Sub	Definition	Factory Setting	R/W	Size	Note	
							11B: JOG Enable
						Bit2~3	Reserved
						Bit4~5	00B:disable
							01B: Direction forward
							10B: Reverse
							11B: Switch Direction
						Bit6~7	00B: 1st step acceleration/deceleration
							01B: 2nd step acceleration/deceleration
						Bit8~15	Reserved
	2	vl target velocity（Hz）	0	RW	U16		
	3	Other trigger	0	RW	U16	Bit0	1: E.F. ON
						Bit1	1: Reset
						Bit2~15	Reserved
2021H	0	Number	DH	R	U8		
	1	Error code	0	R	U16		
2021H	2	AC motor drive status	0	R	U16	Bit 0~1	00B: stop
							01B: decelerate to stop
							10B: waiting for operation command
							11B: in operation
						Bit 2	1: JOG command
						Bit 3~4	00B: forward running
							01B: switch from reverse running to forward running
							10B: switch from forward running to reverse running
							11B: reverse running
						Bit 5~7	reserved
						Bit 8	1: master frequency command controlled by communication interface
						Bit 9	1: master frequency command controlled by analog signal input
						Bit 10	1: operation command controlled by communication interface
						Bit 11~15	reserved
	3	Frequency command（F）	0	R	U16		
	4	Output frequency（H）	0	R	U16		
	5	Output current（AXX.X）	0	R	U16		
	6	Reserved	0	R	U16		
	7	Reserved	0	R	U16		
	8	Reserved	0	R	U16		
	9	Display output current（A）	0	R	U16		
	A	Display counter value（c）	0	R	U16		
	B	Display actual output frequency (H)	0	R	U16		
	C	Display DC-BUS voltage (u)	0	R	U16		
	D	Display output voltage (E)	0	R	U16		
	E	Display output power angle (n)	0	R	U16		
	F	Display output power in kW (P)	0	R	U16		
	10	Display actual motor speed in rpm (r)	0	R	U16		

Index	Sub	Definition	Factory Setting	R/W	Size	Note
2021H	11	Display estimate output torque N-m (t)	0	R	U16	
	12	Display PG feedback (G) (refer to Pr.10.00 and Pr.10.01)	0	R	U16	
	13	Display PID feedback in % (b)	0	R	U16	
	14	Display AVI in % (1.)	0	R	U16	
	15	Display ACI in % (2.)	0	R	U16	
	16	Display AUI in % (3.)	0	R	U16	
	17	Display the temperature of heat sink in oC (i.)	0	R	U16	
	18	Display the IGBT temperature of drive power module oC (c.)	0	R	U16	
	19	The status of digital input (ON/OFF) (i)	0	R	U16	
	1A	The status of digital output (ON/OFF) (o)	0	R	U16	
	1B	Display the multi-step speed that is executing (S)	0	R	U16	
	1C	The corresponding CPU pin status of digital input (d.)	0	R	U16	
	1D	The corresponding CPU pin status of digital output (0.)	0	R	U16	
	1E	Number of actual motor revolution (PG1 of PG card) (P.)	0	R	U16	
	1F	Pulse input frequency (PG2 of PG card) (S.)	0	R	U16	
	20	Pulse input position (PG2 of PG card) (4.)	0	R	U16	
	21	Position command tracing error (P.)	0	R	U16	
	22	Reserved	0	R	U16	
	23	Reserved	0	R	U16	
	24	Reserved	0	R	U16	
	25	Display PLC register D1043 data (C)	0	R	U16	

Delta Standard Mode (New definition):

Index	sub	R/W	bit	Bit	Bit name	Limit	Speed		Torque mode
2060h	00h	R							
	01h	RW	0	0	**CMD_ACT**	**4**	fcmd =0		Tcmd = 0
				Pulse 0					
				1			fcmd = Fset(Fpid)		Tcmd =Tset
				Pulse 1					
			1		**EXT_CMD**	**4**	Pulse 00	None	
							Pulse 01	Forward running	
			2				Pulse 10	Reverse running	
							Pulse 11	Change current running direction	
			3	0	**HALT**	**3**	Running till target speed is		Free (running till target

Index	sub	R/W	bit	Bit	Bit name	Limit	Speed	Torque mode
							reached	torque is reached)
				1			Temporary stop according to deceleration setting	Lock (torque stop at present speed)
			4	0	**LOCK**	**4**	Running till target speed is reached	
				1			Frequency stop at present frequency level	
			5	0	**JOG**	**4**	JOG OFF	JOG OFF
				1				
				Pulse 1			JOG RUN	JOG RUN
			6	0	**QSTOP**	**2**	None	None
				1			Quick Stop	Quick Stop
			7	0	**SERVO_ON**	**1**	Servo OFF	Servo OFF
				1			Servo ON	Servo ON
			11~8	0000	**GEAR**	**4**	Main speed	Main torque
				0001~1111			1~15 multi-steps frequency switch	
			13~12	00	**ACC/DEC**	**4**	1st step acceleration/deceleration time	
				01			2nd step acceleration/ deceleration time	
				10			3rd step acceleration/ deceleration time	
				11			4th step acceleration/ deceleration time	
			14	0	**EN_SW**	**4**	Switch in multi-step frequency and acceleration/deceleration time are not allow	Switch in multi-step frequency and acceleration/ deceleration time are not allow
				1			Switch in multi-step frequency and acceleration/deceleration time are allow	Switch in multi-step frequency and acceleration/ deceleration time are allow
			15	Pulse 1	**RST**	**4**	Clear error code	Clear error code
	02h	RW						
	03h	RW					Velocity command (unsigned)	Profile velocity(unsigned)
	04h	RW						-
	05h	RW						-
	06h	RW						Torque command(signed)
	07h	RW						
2061h	01h	R	0	0	**ARRIVE**		Target frequency is not reached	Target torque is not reached
				1			Target frequency is not reached	Target torque is not reached
			2~1	00	**DIR**		Forward direction	Forward run
				01			Switch from reverse direction to forward direction	Switch from reverse direction to forward direction
				10			Switch from forward direction to reverse direction	Switch from forward direction to reverse direction
				11			Reverse direction	Reverse direction
			5	0	**JOG**		None	None
				1			On JOG	On JOG
			6	0	**QSTOP**		None	None
				1			On Quick Stop	On Quick Stop
			7	0	**SERVO_ON**		PWM OFF	PWM OFF
				1			PWM ON	PWM ON
			8	0	**PRLOCK**		Parameter is not locked	Parameter is not locked
				1			Parameter locked	Parameter locked
			9	0	**WARN**		No warning	No warning
				1			Warning	Warning
			10	0	**ERROR**		No error	No error

Index	sub	R/W	bit	Bit	Bit name	Limit	Speed	Torque mode
				1			Error	Error
			11	0	**IGBT_OK**		IGBT OFF	IGBT OFF
				1			IGBT ON	IGBT ON
			15~11	-	-		-	-
	02h	R			**Velocity cmd**		Actual frequency output	Actual frequency output
	03h	R			**-**			
	04h	R	-		**Pos Cmd**		-	-
	05h	R					Actual position (Absolute)	Actual position (Absolute)
	06h	R			**Torq Cmd**			
	07h	R					Actual torque	Actual torque

DS402 Standard

Index	Sub	Definition	Factory Setting	R/W	Size	Unit	PDO Map	Mode	Note
6007h	0	Abort connection option code	2	RW	S16		Yes		0: No action 2: Disable Voltage, 3: quick stop
603Fh	0	Error code	0	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 check if the setting is set to 0.
6050h	0	vl slow down time	10000	RW	U32	1ms	Yes	vl	
6051h	0	vl quick stop time	1000	RW	U32	1ms	Yes	vl	
605Ah	0	Quick stop option code	2	RW	S16		No		0 : disable drive function 1 :slow down on slow down ramp 2: slow down on quick stop ramp 5 slow down on slow down ramp and stay in QUICK STOP 6 slow down on quick stop ramp and stay in QUICK STOP
605Ch	0	Disable operation option code	1	RW	S16		No		0: Disable drive function 1: Slow down with slow down ramp; disable 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	pp	
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	

Index	Sub	Definition	Factory Setting	R/W	Size	Unit	PDO Map	Mode	Note
						%			
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	pp	

15.5 CANopen Fault Code

Display	Fault code	Description	CANopen fault code	CANopen fault register (bit 0~7)
HAND Fault ocA Oc at accel	0009H	Over-current during acceleration	2310H	1
HAND ocd Oc at decel	000AH	Over-current during deceleration	2310H	1
HAND Fault ocn Oc at normal SPD	000BH	Over-current during steady status operation	2310H	1
HAND Fault GFF Ground fault	000CH	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
HAND Fault occ Short Circuit	000DH	Short-circuit is detected between upper bridge and lower bridge of the IGBT module.	2240H	1
HAND Fault ocS Oc at stop	000EH	Over-current at stop. Hardware failure in current detection	2310H	1
HAND ovA Ov at accel	000FH	Over-current during acceleration. Hardware failure in current detection	3210H	2
HAND Fault ovn Ov at normal SPD	0010H	Over-current during steady speed. Hardware failure in current detection. 230V: 450Vdc; 460V: 900Vdc	3210H	2
HAND Fault ovS Ov at stop	0011H	Over-voltage at stop. Hardware failure in current detection	3210H	2

HAND Fault LvA Lv at accel	0012H	DC BUS voltage is less than Pr.06.00 during acceleration.	3220H	2
HAND Fault Lvd Lv at decel	0013H	DC BUS voltage is less than Pr.06.00 during deceleration.	3220H	2
HAND Fault Lvn Lv at normal SPD	0014H	DC BUS voltage is less than Pr.06.00 in constant speed.	3220H	2
HAND Fault LvS Lv at stop	0015H	DC BUS voltage is less than Pr.06-00 at stop	3220H	2
HAND Fault PHL Phase Lacked	0016H	Phase Loss.	3130H	2
HAND Fault oH1 IGBT over heat	0017H	IGBT overheat IGBT temperature exceeds protection level. 1~15HP: 90℃ 20~100HP: 100℃	4310H	3
HAND Fault oH2 Hear Sink oH	0018H	Heatsink overheat Heat sink temperature exceeds 90oC	4310H	3
HAND Fault tH1o Thermo 1 open	0019H	Temperature detection circuit error (IGBT) IGBT NTC	4300H	3
HAND Fault tH2o Thermo 2 open	001AH	Temperature detection circuit error (capacity module) CAP NTC	4200H	3
HAND Fault PWR Power RST OFF	001BH	Power RST off	3120H	2
HAND Fault oL Inverter oL	001CH	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

HAND Fault EoL1 Thermal relay 1	001DH	Electronics thermal relay 1 protection	2310H	1
HAND Fault EoL2 Thermal relay 2	001EH	Electronics thermal relay 2 protection	2310H	1
HAND Fault oH3 Motor over heat	001FH	Motor overheating The AC motor drive detects that the internal temperature exceeds Pr.06-30 (PTC level)	7120H	1
HAND Fault ot1 Over torque 1	0020H	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 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
HAND Fault ot2 Over torque 2	0021H		8311H	3
HAND Fault UC1 Under torque 1	0022H	Low torque 1	8321H	1
HAND Fault UC2 Under torque 2	0023H	Low torque 2	8321H	1
HAND Fault cF1 EEPROM write Err	0024H	Internal EEPROM can not be programmed.	5530H	5
HAND Fault cF2 EEPROM read Err	0025H	Internal EEPROM can not be read.	5530H	5
HAND Fault cd0 Isum sensor Err	0026H	Current and calculation error	2300H	1
HAND Fault cd1 Ias sensor Err	0027H	U-phase error	2300H	1
HAND Fault cd2 Ibs sensor Err	0028H	V-phase error	2300H	1

HAND Fault cd3 Ics sensor Err	0029H	W-phase error	2300H	1
HAND Fault Hd0 cc HW Error	002AH	CC (current clamp) hardware error.	5000H	5
HAND Fault Hd1 oc HW Error	002BH	OC hardware error.	5000H	5
HAND Fault Hd2 ov HW Error	002CH	OV hardware error.	5000H	5
HAND Fault Hd3 GFF HW Error	002DH	GFF hardware error.	5000H	5
HAND Fault AUE Auto tuning Err	002DH	Auto tuning error	7120H	1
HAND Fault AFE PID Fbk Error	002EH	PID loss (ACI)	7300H	7
HAND Fault PGF1 PG Fbk Error	002FH	PG feedback error	7300H	7
HAND Fault PGF2 PG Fbk Loss	0030H	PG feedback loss	7300H	7
HAND Fault PGF3 PG Fbk Over SPD	0031H	PG feedback stall	7300H	7
HAND Fault PGF4 PG Fbk deviate	0032H	PG slip error	7300H	7
HAND Fault PGr1 PG ref Error	0033H	Pulse input error	7300H	7

HAND Fault PGr2 PG ref loss	0034H	Pulse input loss	7300H	7
HAND Fault ACE ACI loss	0035H	ACI loss	FF00H	1
HAND Fault EF External Fault	0036H	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
HAND Fault EF1 Emergency stop	0037H	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
HAND Fault bb Base block	0038H	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
HAND Fault Pcod Password Error	0039H	Password will be locked if three fault passwords are entered	6320H	5
HAND Fault ccod SW code Error	003AH	Software error	6320H	5
HAND Fault cE1 Modbus CMD err	0031H	Illegal function code	7500H	4
HAND Fault cE2 Modbus ADDR err	0032H	Illegal data address (00H to 254H)	7500H	4
HAND Fault cE3 Modbus DATA err	0033H	Illegal data value	7500H	4

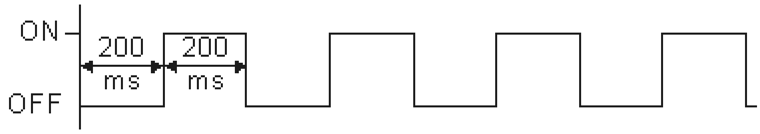
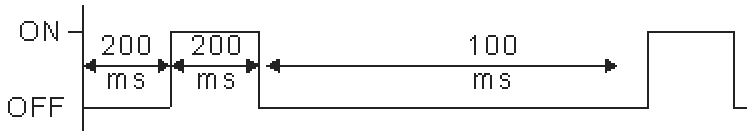
HAND Fault cE4 Modbus slave FLT	0034H	Data is written to read-only address	7500H	4
HAND Fault cE10 Modbus time out	0035H	Modbus transmission timeout.	7500H	4
HAND Fault cP10 Keypad time out	0036H	Keypad transmission timeout.	7500H	4
HAND Fault bF Braking fault	0037H	Brake resistor fault	7110H	4
HAND Fault Ydc Y-delta connect	0038H	Y-connection/Δ-connection switch error	3330H	2
HAND Fault oSL Over slip Error	0039H	Overslip error occurs when the slip exceeds Pr.05.26 limit and the time exceeds Pr.05.27 setting.	FF00H	7
HAND Fault ocU Over Apm. unknow	003AH	Unknown over current	2310H	1
HAND Fault ovU Over volt. Unknow	003BH	Unknown over voltage	3210H	2
HAND Fault S1 S1-Emergy stop	003CH	External emergency stop	9000H	5
HAND Fault aocc A phase short	003DH	A-phase short-circuit	2240H	1
HAND Fault bocc B phase short	003EH	B-phase short-circuit	2240H	1
HAND Fault cocc C phase short	003FH	C-phase short-circuit	2240H	1

HAND Fault CGdE Guarding T-out	0040H	Guarding time-out 1	8130H	4
HAND Fault CHbE Heartbeat T-out	0041H	Heartbeat time-out	8130H	4
HAND Fault CSyE SYNC T-out	0042H	CAN synchrony error	8700H	4
HAND Fault CbFE CAN/S bus off	0043H	CAN bus off	8140H	4
HAND Fault CIdE CAN/S Idx exceed	0044H	Can index exceed	8110H	4
HAND Fault CAdE CAN/S add. set	0045H	CAN address error	0x8100	4
HAND Fault CFdE CAN/S FRAM fail	0046H	CAN frame fail	0x8100	4

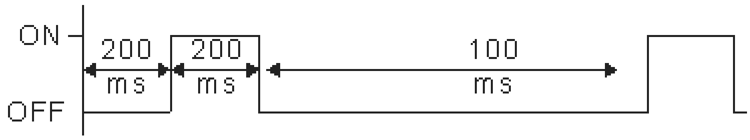
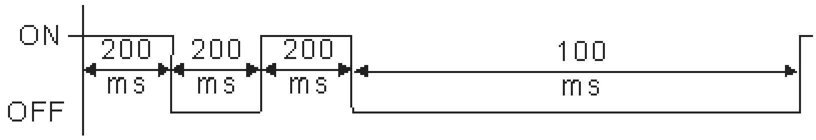
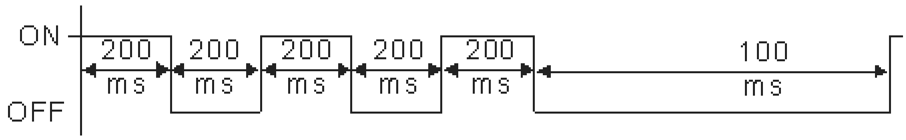
15.6 CANopen LED Function

There are two CANopen flash signs: RUN and ERR.

RUN LED:

LED status	Condition	CANopen State
OFF		Initial
Blinking		Pre-Operation
Single flash		Stopped
ON		Operation

ERR LED:

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

Chapter 16 PLC Function

16.1 PLC Overview

16.1.1 Introduction

The built in PLC function in C2000 allows following commands: WPLSoft, basic commands and application commands; the operation methods are the same as Delta DVPPLC series. Other than that, CANopen master provides 8 station synchronous control and 126 asynchronous controls.

NOTE

In C2000, CANopen master synchronous control complies with DS402 standard and supports control mode as return to origin point, speed, torque and point to point control; CANopen slave supports two control modes, speed and torque.

16.1.2 Ladder Diagram Editor – WPLSoft

WPLSoft is a program editor of Delta DVP-PLC series and C2000 series for WINDOWS. Besides general PLC program planning and general WINDOWS editing functions, such as cut, paste, copy, multi-windows, WPLSoft also provides various Chinese/English comment editing and other special functions (e.g. register editing, settings, the data readout, the file saving, and contacts monitor and set, etc.).

Following is the system requirement for WPLSoft:

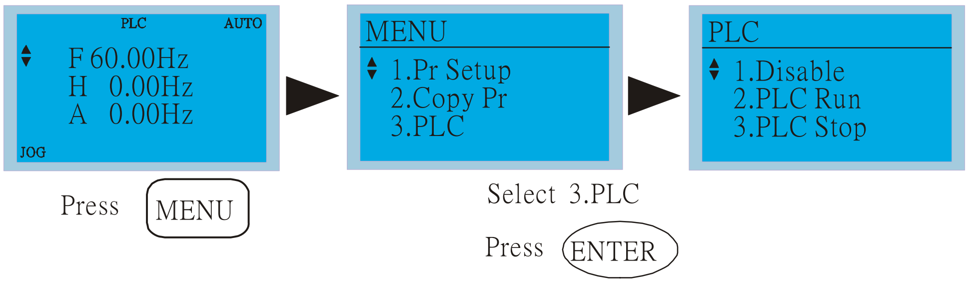
Item	System Requirement
Operation System	Windows 95/98/2000/NT/ME/XP
CPU	Pentium 90 and above
Memory	16MB and above (32MB and above is recommended)
Hard Disk	Capacity: 50MB and above CD-ROM (for installing WPLSoft)
Monitor	Resolution: 640×480, 16 colors and above, It is recommended to set display setting of Windows to 800×600.
Mouse	General mouse or the device compatible with Windows
Printer	Printer with Windows driver
RS-232 port	At least one of COM1 to COM8 can be connected to PLC
Applicable Models	All Delta DVP-PLC series and C2000 series

16.2 Start-up

16.2.1 The Steps for PLC Execution

Please operate PLC follows the five steps.

1. Press menu key on KPC-CC01 → select $\boxed{\text{3: PLC}}$ → ENTER. (See the figure below)



NOTE

Operate the KPC-CE01 (the optional digital keypad) by following steps (switch PLC mode to PLC2 for program download/upload):

A. Go to “PLC0” page by pressing the MODE key

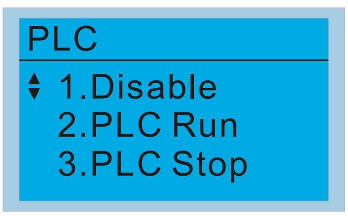
B. Change to “PLC2” by pressing the “UP” key and then press the “ENTER” key after confirmation

C. If succeeded, “END” is displayed and back to “PLC2” after one or two seconds.

The PLC warning that is displayed before the program is downloaded to C2000 can be ignored, please continue the operation.

2. Connection: Please connect the RJ-45 of AC motor drive to computer via RS485-to-RS232 converter.

3. Run the program.



■ PLC function, select function 2 (PLC Run).

1: Disable (PLC0)

2: PLC Run (PLC1)

3: PLC Stop (PLC2)

Optional accessories: Digital keypad KPC-CE01, display PLC function as shown in the ( ).

When external input terminals (MI1~MI8) are set to PLC Mode select bit0 (51) or PLC Mode select bit1 (52), it will force to switch to PLC mode regardless the terminal is ON or OFF.

Meanwhile, switching via keypad is disabled. Please refer to the chart below:

PLC Mode	PLC Mode select bit1(52)	PLC Mode select bit0 (51)
Disable (PLC 0)	OFF	OFF
PLC Run (PLC 1)	OFF	ON
PLC Stop (PLC 2)	ON	OFF
Previous state	ON	ON

When KPC-CE01 execute PLC function:

1. When switching the page from PLC to PLC1, it will execute PLC. The motion of PLC (Execute/Stop) is controlled by WPL editor.
2. When switching the page from PLC to PLC2, it will stop PLC. Again the motion of PLC (Execute/Stop) is controlled by WPL editor.
3. The control of external terminals follows the same method.

NOTE

When input/output terminals (FWD REV MI1~MI8 MI10~15, Relay1, Relay2 RY10~RY15, MO1~MO2 MO10~MO11,) are used in PLC program, they cannot be used in other places. Fro example, when PLC program (PLC1 or PLC2) is activated, such as when it controls Y0, the corresponding output terminals Relay (RA/RB/RC) will be used. At this moment, Pr.03.00 setting will be invalid since the terminal has been used by PLC. Refer to Pr.02-52, 02-53, 03-30 to check which DI DO AO are occupied by PLC.

16.2.2 I/O Device Reference Table

Input device:

Device	X0	X1	X2	X3	X4	X5	X6	X7	X10	X11	X12	X13	X14	X15	X16	X17
1	FWD	REV	MI1	MI2	MI3	MI4	MI5	MI6	MI7	MI8						
2											MI10	MI11	MI12	MI13	MI14	MI15
3											MI10	MI11	MI12	MI13		

1: I/O extension card
2: I/O extension card EMC-D611A (D1022=4)
3: I/O extension card EMC-D42A (D1022=5)

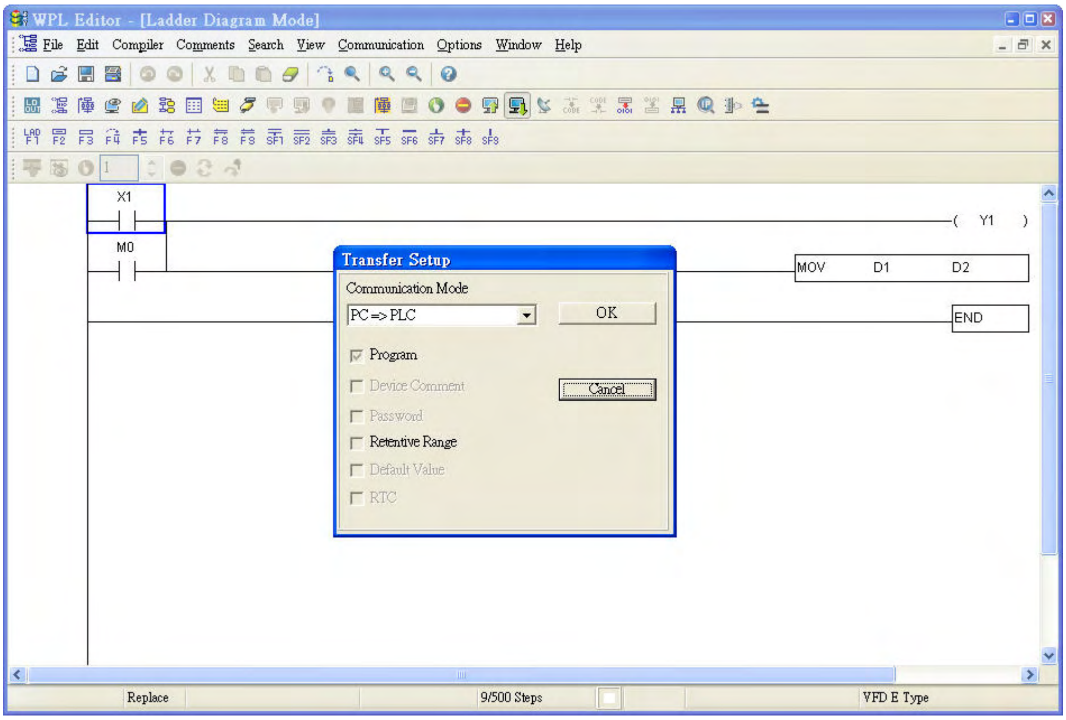
Output device:

Device	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17
1	RY 1	RY2		MO1	MO2											
2						MO10	MO11									
3						RY10	RY11	RY12	RY13	RY14	RY15					

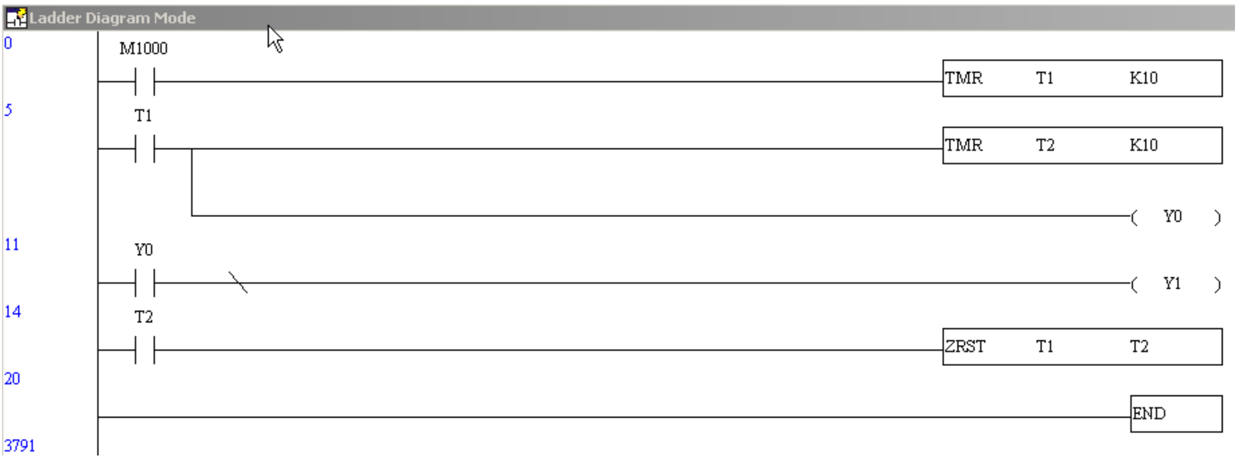
1: I/O extension card
2: I/O extension card EMC-D42A (D1022=5)
3: I/O extension card EMC-R6AA (D1022=6)

16.2.3 WPLSoft Installation

Download PLC program toC2000: Refer to D.3 to D.7 for program coding and download the editor (WPLSoft V2.09) at DELTA website http://www.delta.com.tw/industrialautomation/



16.2.4 Program Input



16.2.5 Program Download

Please download the program by following steps:

Step 1. Press  button for compiler after inputting program in WPLSoft.

Step 2. After compiler is finished, choose the item "Write to PLC" in the communication items.

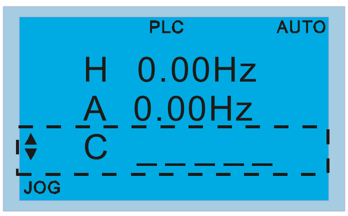
After finishing Step 2, the program will be downloaded from WPLSoft to the AC motor drive by the communication format.

16.2.6 Program Monitor

If you execute "start monitor" in the communication item during executing PLC, the ladder diagram will be shown as follows.

16.2.7 Restriction of PLC

1. The protocol of PLC is 7,N,2 ,9600, station number 2
2. Make sure that the AC drive is in stop status.
3. Stop the PLC before upload/download the program.
4. When using WPR command, do not change the value over 10^9 times or serious error would result.
5. Set Pr. 00.04 to 28 to display the value in PLC register D1043, as shown in the figure follows:

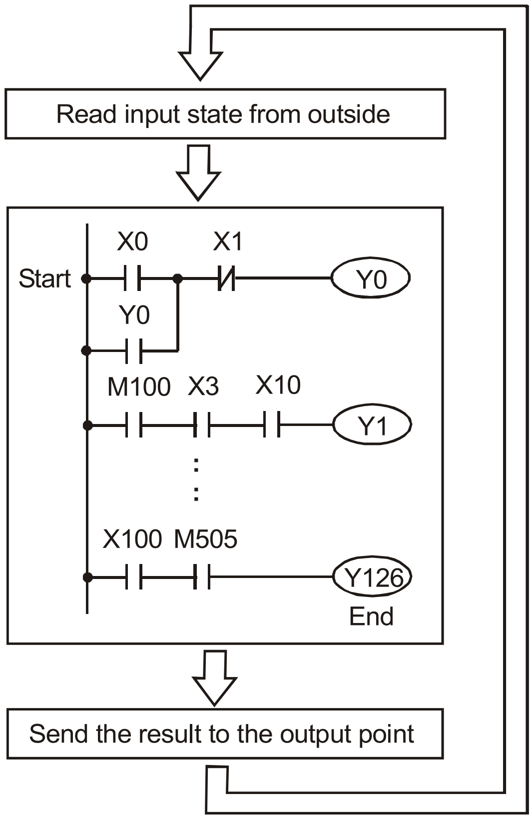
Digital Keypad KPC-CC01 can display 0~65535	Digital keypad KPC-CE01 can display 0~9999
	 When exceed 9999: 

6. When PLC is Stop, communication RS-485 is occupied by PLC.
7. When PLC is in Run and Stop mode, Pr00.02 can not be set to 9 or 10, which means can not return to factory setting.
8. Set Pr.00.02 to 6, return to factory setting of PLC.

16.3 Ladder Diagram

16.3.1 Program Scan Chart of the PLC Ladder Diagram

Calculate the result by ladder diagram algorithm (it doesn't sent to the outer output point but the inner equipment will output immediately.)



Repeats the execution in cycle.

16.3.2 Ladder Diagram

Ladder diagram is a diagram language that applied on the automatic control and it is also a diagram that made up of the symbols of electric control circuit. PLC procedures are finished after ladder diagram editor edits the ladder diagram. It is easy to understand the control flow that indicated with diagram and also accept by technical staff of electric control circuit. Many basic symbols and motions of ladder diagram are the same as mechanical and electrical equipments of traditional automatic power panel, such as button, switch, relay, timer, counter and etc.

The kinds and amounts of PLC internal equipment will be different with brands. Although internal equipment has the name of traditional electric control circuit, such as relay, coil and contact. It doesn't have the real components in it. In PLC, it just has a basic unit of internal memory. If this bit is 1, it means the coil is ON and if this bit is 0, it means the coil is OFF. You should read the corresponding value of that bit when using contact (Normally Open, NO or contact a). Otherwise, you should read the opposite sate of corresponding value of that bit when using contact (Normally Closed, NC or contact b). Many relays will need many bits, such as 8-bits makes up a byte. 2 bytes can make up a word. 2 words make up double word. When using many relays to do calculation, such as add/subtraction or shift, you could use byte, word or double word. Furthermore, the two equipments, timer and counter, in PLC not only have coil but also value of counting time and times.

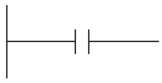
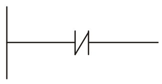
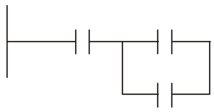
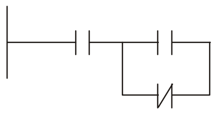
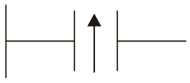
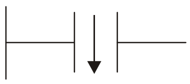
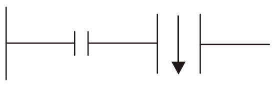
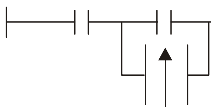
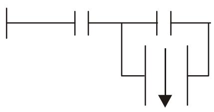
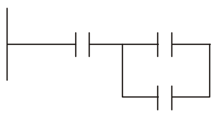
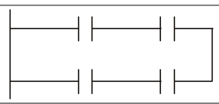
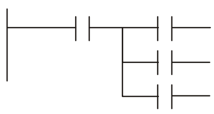
In conclusion, each internal storage unit occupies fixed storage unit. When using these equipments, the corresponding content will be read by bit, byte or word.

Brief introduction to the internal devices of PLC:

Internal Device	Function

Input Relay	Input relay is the basic storage unit of internal memory that corresponds to external input point (it is the terminal that used to connect to external input switch and receive external input signal). Input signal from external will decide it to display 0 or 1. You couldn't change the state of input relay by program design or forced ON/OFF via WPLSoft. The contacts (contact a, b) can be used unlimitedly. If there is no input signal, the corresponding input relay could be empty and can't be used with other functions. ☑ Equipment indication method: X0, X1…X7, X10, X11… The symbol of equipment is X and numbering in octal.
Output Relay	Output relay is the basic storage unit of internal memory that corresponds to external output point (it is used to connect to external load). It can be driven by input relay contact, the contact of other internal equipment and itself contact. It uses a normally open contact to connect to external load and other contacts can be used unlimitedly as input contacts. It doesn't have the corresponding output relay, if need, it can be used as internal relay. ☑ Equipment indication: Y0, Y1…Y7, Y10, Y11… The symbol of equipment is Y and numbering in octal.
Internal Relay	The internal relay doesn't connect directly to outside. It is an auxiliary relay in PLC. Its function is the same as the auxiliary relay in electric control circuit. Each auxiliary relay has the corresponding basic unit. It can be driven by the contact of input relay, output relay or other internal equipment. Its contacts can be used unlimitedly. Internal auxiliary relay can't output directly, it should output with output point. ☑ Equipment indication: M0, M1…M799. The symbol of equipment is M and numbering in decimal system.
Counter	Counter is used to count. It needs to set counter before using counter (i.e. the pulse of counter). There are coil, contacts and storage unit of counter in counter. When coil is from OFF to ON, that means input a pulse in counter and the counter should add 1. There are 16-bit, 32-bit and high-speed counter for user to use. ☑ Equipment indication: C0, C1… C79. The symbol of equipment is C and numbering in decimal system.
Timer	Timer is used to control time. There are coil, contact and timer storage. When coil is ON, its contact will act (contact a is close, contact b is open) when attaining desired time. The time value of timer is set by settings and each timer has its regular period. User sets the timer value and each timer has its timing period. Once the coil is OFF, the contact won't act (contact a is open and contact b is close) and the timer will be set to zero. ☑ Equipment indication: T0, T1…T159. The symbol of equipment is T and numbering in decimal system. The different number range corresponds with the different timing period.
Data register	PLC needs to handle data and operation when controlling each order, timer value and counter value. The data register is used to store data or parameters. It stores 16-bit binary number, i.e. a word, in each register. It uses two continuous number of data register to store double words. ☑ Equipment indication: D0, D1,…,D399. The symbol of equipment is D and numbering in decimal system.

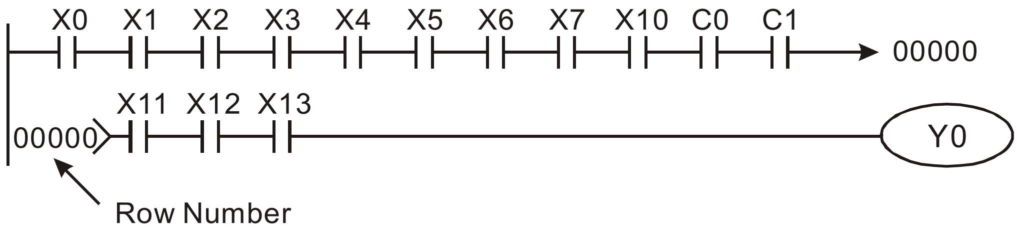
The structure of ladder diagram and information:

Ladder Diagram Structure	Explanation	Command	Device
	Normally open, contact a	LD	X, Y, M, T, C
	Normally closed, contact b	LDI	X, Y, M, T, C
	Serial normally open	AND	X, Y, M, T, C
	Parallel normally open	OR	X, Y, M, T, C
	Parallel normally closed	ORI	X, Y, M, T, C
	Rising-edge trigger switch	LDP	X, Y, M, T, C
	Falling-edge trigger switch	LDF	X, Y, M, T, C
	Rising-edge trigger in serial	ANDP	X, Y, M, T, C
	Falling-edge trigger in serial	ANDF	X, Y, M, T, C
	Rising-edge trigger in parallel	ORP	X, Y, M, T, C
	Falling-edge trigger in parallel	ORF	X, Y, M, T, C
	Block in serial	ANB	none
	Block in parallel	ORB	none
	Multiple output	MPS MRD MPP	none

	Output command of coil drive	OUT	Y, M
	Basic command, Application command	Basic command/ Application command	
	Inverse logic	INV	none

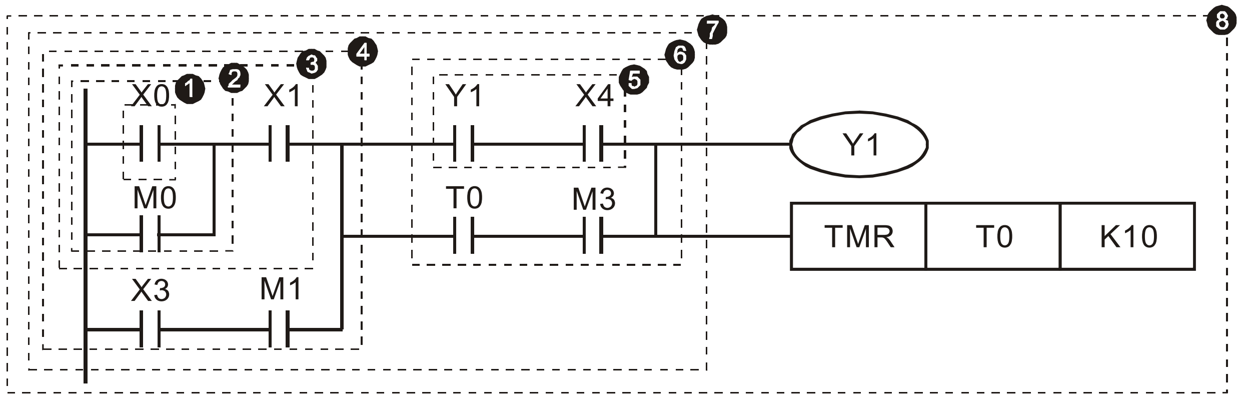
16.3.3 The Edition of PLC Ladder Diagram

The program edited method is from left power line to right power line. (The right power line will be omitted during the edited of WPLSoft.) After editing a row, go to editing the next row. The maximum contacts in a row are 11 contacts. If you need more than 11 contacts, you could have the new row and start with continuous line to continue more input devices. The continuous number will be produced automatically and the same input point can be used repeatedly. The drawing is shown as follows.



The operation of ladder diagram is to scan from left upper corner to right lower corner. The output handling, including the operation frame of coil and application command, at the most right side in ladder diagram.

Take the following diagram for example; we analyze the process step by step. The number at the right corner is the explanation order.



The explanation of command order:

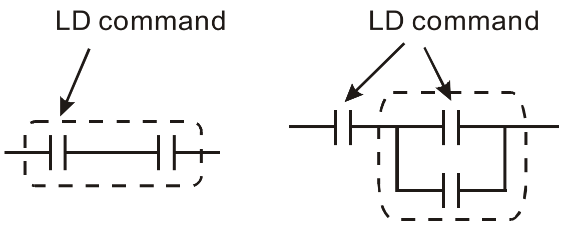
1	LD	X0	
2	OR	M0	
3	AND	X1	
4	LD	X3	
	AND	M1	
	ORB		
5	LD	Y1	
	AND	X4	

The explanation of command order:

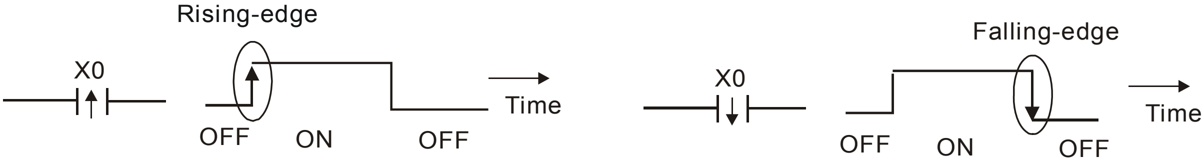
6	LD	T0	
	AND	M3	
	ORB		
7	ANB		
8	OUT	Y1	
	TMR	T0	K10

The detail explanation of basic structure of ladder diagram

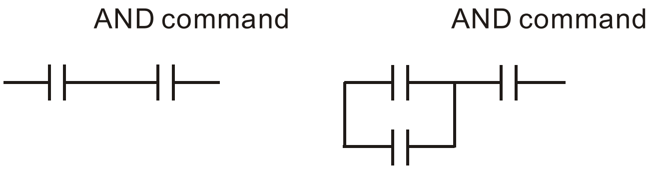
1. **LD (LDI) command:** give the command LD or LDI in the start of a block.



The structures of command LDP and LDF are similar to the command LD. The difference is that command LDP and LDF will act in the rising-edge or falling-edge when contact is ON as shown in the following.

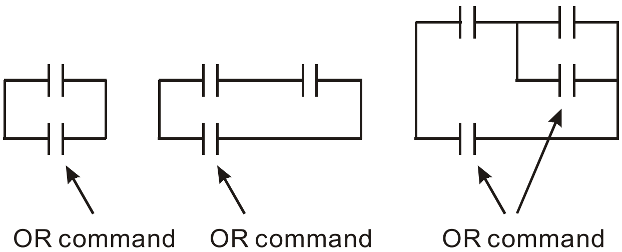


2. **AND (ANI) command:** single device connects to a device or a block in series.



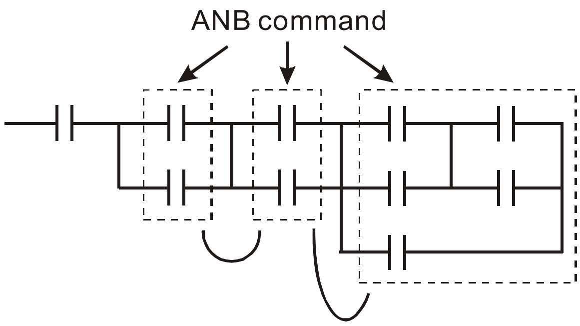
The structures of ANDP and ANDF are the same but the action is in rising-edge or falling-edge.

3. **OR (ORI) command:** single device connects to a device or a block.

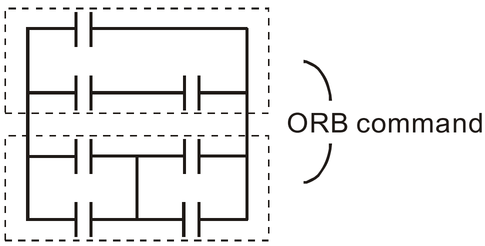


The structures of ORP and ORF are the same but the action is in rising-edge or falling-edge.

4. **ANB command:** a block connects to a device or a block in series.

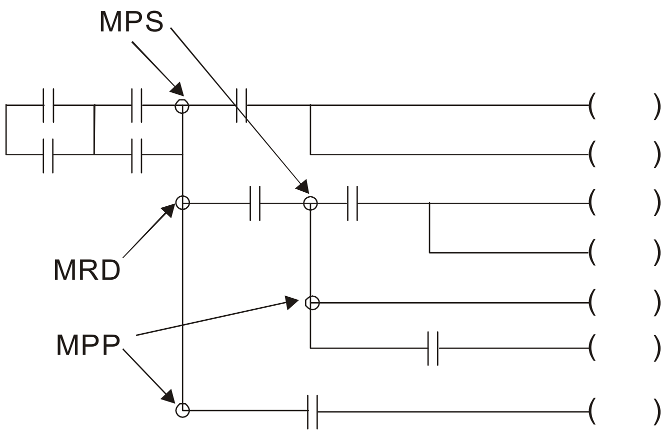


5. **ORB command:** a block connects to a device or a block in parallel.



If there are several blocks when operate ANB or ORB, they should be combined to blocks or network from up to down or from left to right.

6. **MPS, MRD, MPP commands:** Divergent memory of multi-output. It can produce many various outputs.
7. The command MPS is the start of divergent point. The divergent point means the connection place between horizontal line and vertical line. We should determine to have contact memory command or not according to the contacts status in the same vertical line. Basically, each contact could have memory command but in some places of ladder diagram conversion will be omitted due to the PLC operation convenience and capacity limit. MPS command can be used for 8 continuous times and you can recognize this command by the symbol "┬".
8. MRD command is used to read memory of divergent point. Because the logical status is the same in the same horizontal line, it needs to read the status of original contact to keep on analyzing other ladder diagram. You can recognize the command MRD by the symbol "├".
9. MPP command is used to read the start status of the top level and pop it out from stack. Because it is the last item of the horizontal line, it means the status of this horizontal line is ending.



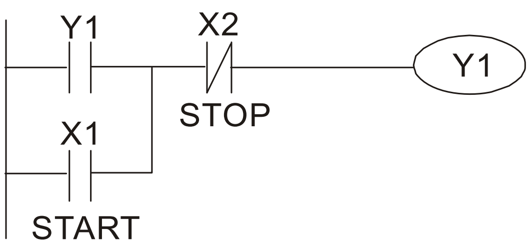
16.3.4 The Example for Designing Basic Program

Start, Stop and Latching

In the same occasions, it needs transient close button and transient open button to be start and stop switch. Therefore, if you want to keep the action, you should design latching circuit. There are several latching circuits in the following:

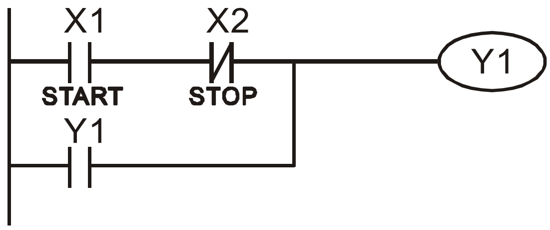
Example 1: the latching circuit for priority of stop

When start normally open contact X1=On, stop normally contact X2 = Off, and Y1=On are set at the same time, if X2=On, the coil Y1 will stop acting. Therefore, it calls priority of stop.



Example 2: the latching circuit for priority of start

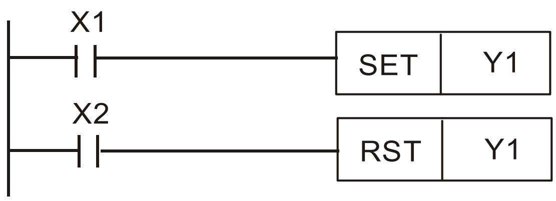
When start normally open contact X1=On, stop normally contact X2=Off and Y1=On (coil Y1 will be active and latching) are valid at the same time, if X2=On, coil Y1 will be active due to latched contact. Therefore, it calls priority of start.



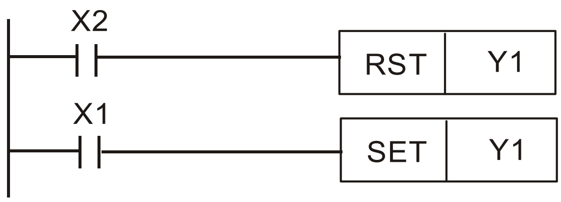
Example 3: the latching circuit of SET and RST commands

The figure at the right side is latching circuit that made up of RST and SET command.
It is top priority of stop when RST command is set behind SET command. When executing PLC from up to down, The coil Y1 is ON and coil Y1 will be OFF when X1 and X2 act at the same time, therefore it calls priority of stop.
It is top priority of start when SET command is set after RST command. When X1 and X2 act at the same time, Y1 is ON so it calls top priority of start.

Top priority of stop



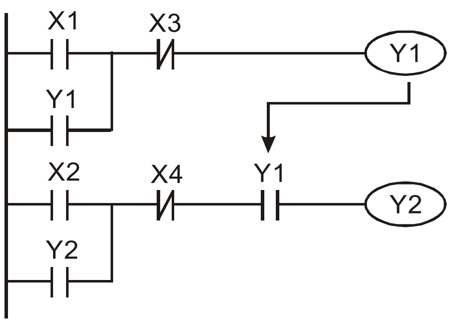
Top priority of start

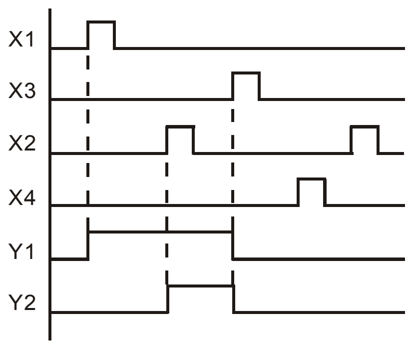


The common control circuit

Example 4: condition control

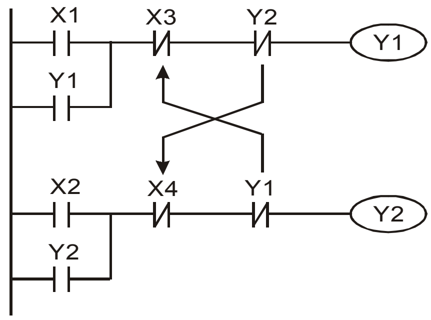
X1 and X3 can start/stop Y1 separately, X2 and X4 can start/stop Y2 separately and they are all self latched circuit. Y1 is an element for Y2 to do AND function due to the normally open contact connects to Y2 in series. Therefore, Y1 is the input of Y2 and Y2 is also the input of Y1.

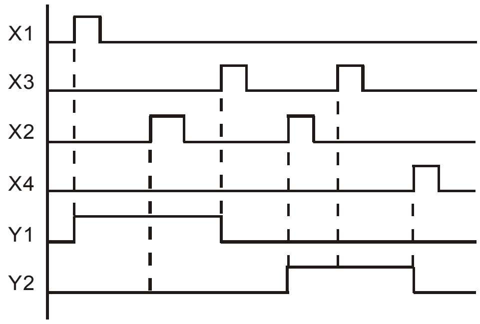




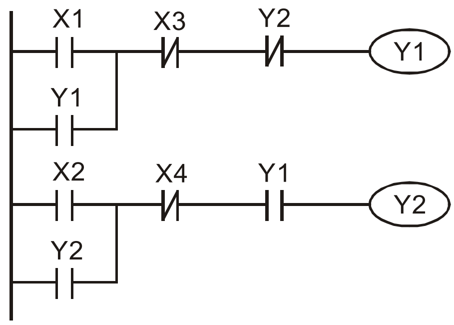
Example 5: Interlock control

The figure above is the circuit of interlock control. Y1 and Y2 will act according to the start contact X1 and X2. Y1 and Y2 will act not at the same time, once one of them acts and the other won't act. (This is called interlock.) Even if X1 and X2 are valid at the same time, Y1 and Y2 won't act at the same time due to up-to-down scan of ladder diagram. For this ladder diagram, Y1 has higher priority than Y2.





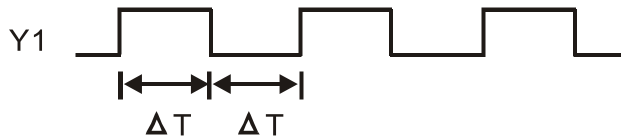
Example 6: Sequential Control



If add normally close contact Y2 into Y1 circuit to be an input for Y1 to do AND function. (as shown in the left side) Y1 is an input of Y2 and Y2 can stop Y1 after acting. In this way, Y1 and Y2 can execute in sequential.

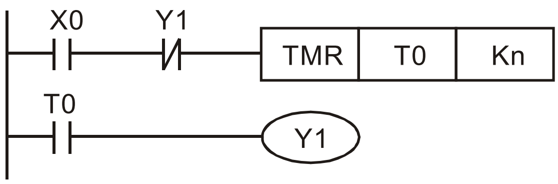
Example 7: Oscillating Circuit

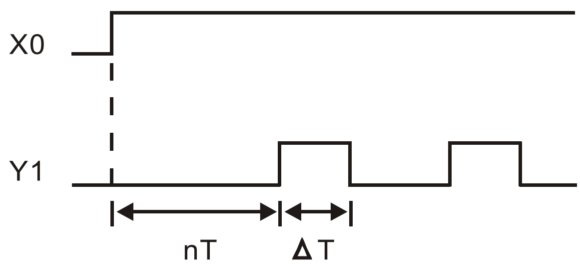
The period of oscillating circuit is ΔT+ΔT



The figure above is a very simple ladder step diagram. When starting to scan Y1 normally close contact, Y1 normally close contact is close due to the coil Y1 is OFF. Then it will scan Y1 and the coil Y1 will be ON and output 1. In the next scan period to scan normally close contact Y1, Y1 normally close contact will be open due to Y1 is ON. Finally, coil Y1 will be OFF. The result of repeated scan, coil Y will output the vibrating pulse with cycle time ΔT (On) +ΔT (Off).

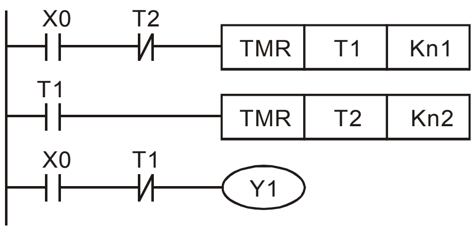
The vibrating circuitry of cycle time ΔT (On) +ΔT (Off):

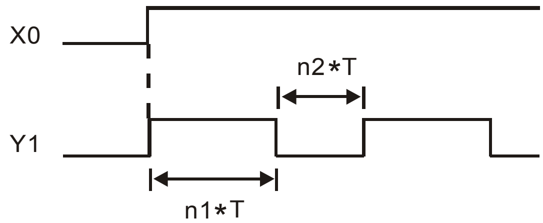




The figure above uses timer T0 to control coil Y1 to be ON. After Y1 is ON, timer T0 will be closed at the next scan period and output Y1. The oscillating circuit will be shown as above. (n is the setting of timer and it is decimal number. T is the base of timer. (clock period))

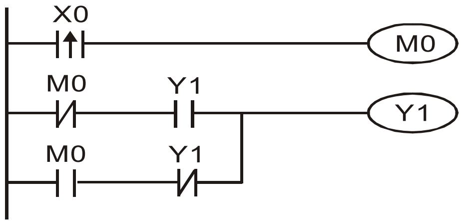
Example 8: Blinking Circuit

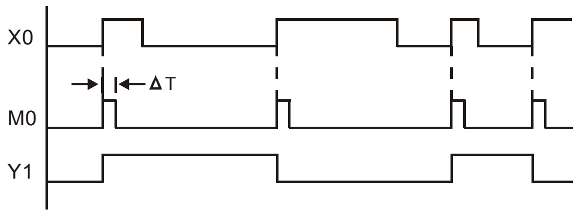




The figure above is common used oscillating circuit for indication light blinks or buzzer alarms. It uses two timers to control On/OFF time of Y1 coil. If figure, n1 and n2 are timer setting of T1 and T2. T is the base of timer (clock period)

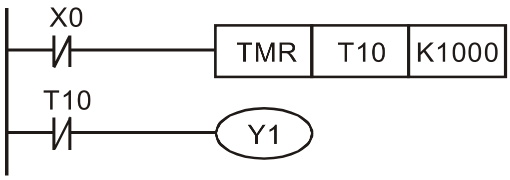
Example 9: Triggered Circuit

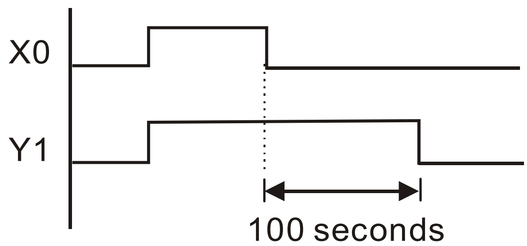




In figure above, the rising-edge differential command of X0 will make coil M0 to have a single pulse of ΔT (a scan time). Y1 will be ON during this scan time. In the next scan time, coil M0 will be OFF, normally close M0 and normally close Y1 are all closed. However, coil Y1 will keep on being ON and it will make coil Y1 to be OFF once a rising-edge comes after input X0 and coil M0 is ON for a scan time. The timing chart is as shown above. This circuit usually executes alternate two actions with an input. From above timing: when input X0 is a square wave of a period T, output coil Y1 is square wave of a period 2T.

Example 10: Delay Circuit

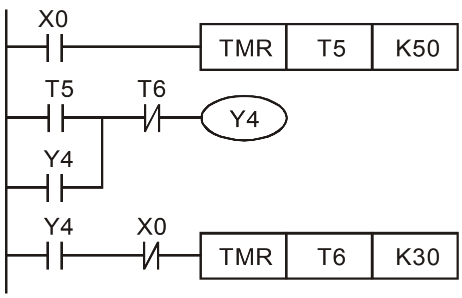


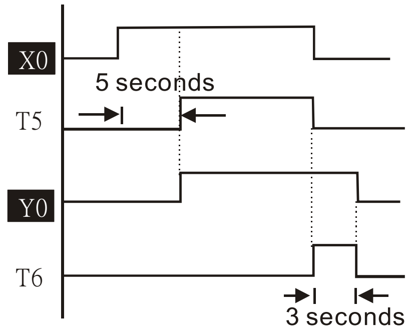


When input X0 is ON, output coil Y1 will be ON at the same time due to the corresponding normally close contact OFF makes timer T10 to be OFF. Output coil Y1 will be OFF after delaying 100 seconds (K1000*0.1 seconds =100 seconds) once input X0 is OFF and T10 is ON. Please refer to timing chart above.

Example 11: Output delay circuit, in the following example, the circuit is made up of two timers.

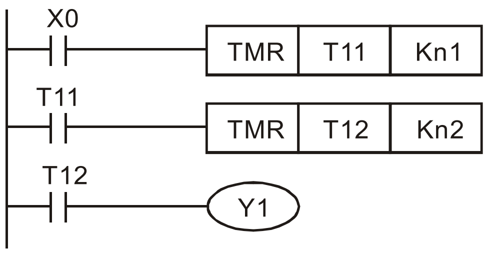
No matter input X0 is ON or OFF, output Y4 will be delay.

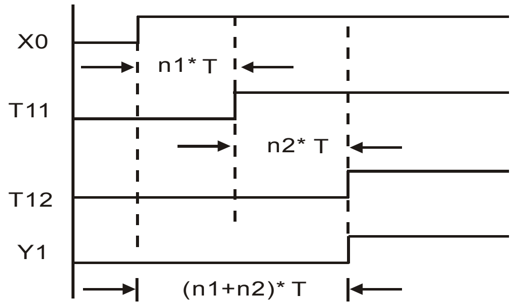




Example12: Extend Timer Circuit

In this circuit, the total delay time from input X0 is close and output Y1 is ON= (n1+n2)* T. where T is clock period. Timer: T11, T12; Timer cycle: T.





16.4 PLC Devices Function

Items	Specifications	Remarks
Control Method	Stored program, cyclic scan system	
I/O Processing Method	Batch processing (when END instruction is executed)	I/O refresh instruction is available
Execution Speed	Basic commands (minimum 0.24 us)	Application commands (1 ~ dozens us)
Program Language	Instruction, Ladder Logic, SFC	
Program Capacity	1000 STEPS	
Commands	80 commands	30 basic commands 50 application commands
Input/Output Contact	Input (X): 10, output (Y): 4	

<table>
<tr><th></th><th>Device</th><th colspan="2">Item</th><th colspan="2">Range</th><th>Function</th></tr>
<tr><td rowspan="7">Relay bit mode</td><td>X</td><td colspan="2">External Input Relay</td><td>X0~X17, 16 points, octal number system</td><td rowspan="2">Total is 32 points</td><td>Correspond to external input point</td></tr>
<tr><td>Y</td><td colspan="2">External Output Relay</td><td>Y0~Y17, 16 points, octal number system</td><td>Correspond to external output point</td></tr>
<tr><td rowspan="2">M</td><td rowspan="2">Auxiliary</td><td>For general</td><td>M0~M799, 800 points</td><td rowspan="2">Total is 192 points</td><td rowspan="2">Contacts can switch to On/Off in program</td></tr>
<tr><td>For special</td><td>M1000~M1079, 80 points</td></tr>
<tr><td>T</td><td>Timer</td><td>100ms timer</td><td>T0~T159, 160 points</td><td>Total is 16 points</td><td>When the timer indicated by TMR command attains the setting, the T contact with the same number will be On.</td></tr>
<tr><td>C</td><td>Counter</td><td>16-bit count up for general</td><td>C0~C79, 80 points</td><td>Total is 80 points</td><td>When the counter indicated by CNT command attains the setting, the C contact with the same number will be On.</td></tr>
<tr><td colspan="6"></td></tr>
<tr><td rowspan="5">Register WORD data</td><td>T</td><td colspan="2">Present value of timer</td><td colspan="2">T0~T15, 160 points</td><td>When timer attains, the contact of timer will be On.</td></tr>
<tr><td>C</td><td colspan="2">Present value of counter</td><td colspan="2">C0~C79, 16-bit counter, 80 points</td><td>When timer attains, the contact of timer will be On.</td></tr>
<tr><td rowspan="3">D</td><td rowspan="3">Data register</td><td>For latched</td><td>D0~D399, 400 points</td><td rowspan="3">Total is 1300 points</td><td rowspan="3">It can be memory area for storing data.</td></tr>
<tr><td>For general</td><td>D1000~D1099, 100 points</td></tr>
<tr><td>For special</td><td>D2000~D2799, 800 points</td></tr>
<tr><td rowspan="2">Constant</td><td>K</td><td colspan="2">Decimal</td><td colspan="3">K-32,768 ~ K32,767 (16-bit operation)</td></tr>
<tr><td>H</td><td colspan="2">Hexadecimal</td><td colspan="3">H0000 ~ HFFFF (16-bit operation)</td></tr>
<tr><td colspan="4">Communication port (program read/write)</td><td colspan="3">RS485 (slave)</td></tr>
<tr><td colspan="4">Analog input/output</td><td colspan="3">Built-in 2 analog inputs and 1 analog output</td></tr>
</table>

Function extension module (optional)	EMC-D42A; EMC-R6AA; EMCD611A

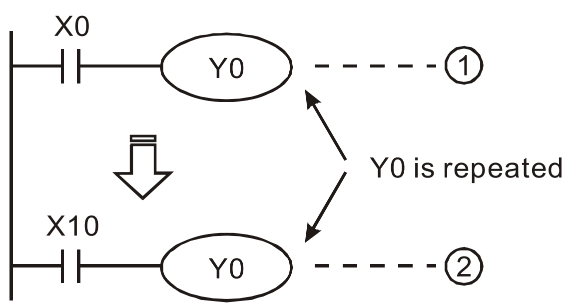
16.4.1 Devices Functions

The Function of Input/output Contacts

The function of input contact X: input contact X reads input signal and enter PLC by connecting with input equipment. It is unlimited usage times for contact A or contact B of each input contact X in program. The On/Off of input contact X can be changed with the On/Off of input equipment but can't be changed by using peripheral equipment (WPLSoft).

The Function of Output Contact Y

The mission of output contact Y is to drive the load that connects to output contact Y by sending On/Off signal. There are two kinds of output contact: one is relay and the other is transistor. It is unlimited usage times for A or B contact of each output contact Y in program. But there is number for output coil Y and it is recommended to use one time in program. Otherwise, the output result will be decided by the circuit of last output Y with PLC program scan method.



The output of Y0 will be decided by circuit 2, i.e. decided by On/Off of X10.

Value, Constant [K] / [H]

Constant	K	Decimal	K-32,768 ~ K32,767 (16-bit operation)
	H	Hexadecimal	H0000 ~ HFFFF (16-bit operation)

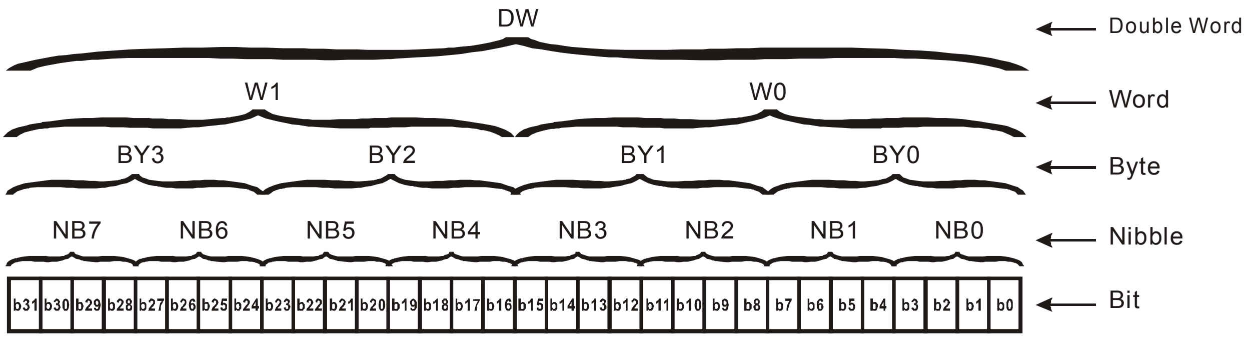
There are five value types for DVP-PLC to use by the different control destination. The following is the explanation of value types.

Binary Number (BIN)

It uses binary system for the PLC internal operation or storage. The relative information of binary system is in the following.

Bit	Bit is the basic unit of binary system, the status are 1 or 0.
Nibble	It is made up of continuous 4 bits, such as b3~b0. It can be used to represent number 0~9 of decimal or 0~F of hexadecimal.
Byte	It is made up of continuous 2 nibbles, i.e. 8 bits, b7~b0. It can used to represent 00~FF of hexadecimal system.
Word	It is made up of continuous 2 bytes, i.e. 16 bits, b15~b0. It can used to represent 0000~FFFF of hexadecimal system.
Double Word	It is made up of continuous 2 words, i.e. 32 bits, b31~b0. It can used to represent 00000000~FFFFFFFF of hexadecimal system.

The relations among bit, nibble, byte, word, and double word of binary number are shown as follows.



- Octal Number (OCT)

  The numbers of external input and output terminal of DVP-PLC use octal number.

  Example:

  External input: X0~X7, X10~X17… (device number)

  External output: Y0~Y7, Y10~Y17… (device number)

- Decimal Number, DEC

  The suitable time for decimal number to be used in DVP-PLC system.

  ☑ To be the setting value of timer T or counter C, such as TMR C0 K50. (K constant)

  ☑ To be the device number of M, T, C and D. For example: M10, T30. (device number)

  ☑ To be operand in application command, such as MOV K123 D0. (K constant)

- Binary Code Decimal (BCD)

  It shows a decimal number by a unit number or four bits so continuous 16 bits can use to represent the four numbers of decimal number. BCD code is usually used to read the input value of DIP switch or output value to 7-segment display to be display.

- Hexadecimal Number (HEX)

  The suitable time for hexadecimal number to be used in DVP-PLC system.

  ☑ To be operand in application command. For example: MOV H1A2B D0. (constant H)

- Constant K:

  In PLC, it is usually have K before constant to mean decimal number. For example, K100 means 100 in decimal number.

  Exception: The value that is made up of K and bit equipment X, Y, M, S will be bit, byte, word or double word. For example, K2Y10, K4M100. K1 means a 4-bit data and K2~K4 can be 8, 12 and 16-bit data separately.

- Constant H:

  In PLC, it is usually have H before constant to mean hexadecimal number. For example, H100 means 100 in hexadecimal number.

The Function of Auxiliary Relay

There are output coil and A, B contacts in auxiliary relay M and output relay Y. It is unlimited usage times in program. User can control loop by using auxiliary relay, but can't drive external load directly. There are two types divided by its characteristics.

1.Auxiliary relay for general : It will reset to Off when power loss during running. Its state will be Off when power on after power loss.

2.Auxiliary relay for special : Each special auxiliary relay has its special function. Please don't use undefined auxiliary relay.

The Function of Timer

The unit of timer is 1ms, 10ms and 100ms. The count method is count up. The output coil will be On when the present value of timer equals to the settings. The setting is K in decimal number. Data register D can be also used as settings.

- The real setting time of timer = unit of timer * settings

The Features and Functions of Counter

Item	16 bits counters	32 bits counters	
Type	General	General	High speed
Count direction	Count up	Count up/down	
Settings	0~32,767	-2,147,483,648~+2,147,483,647	
Designate for constant	Constant K or data register D	Constant K or data register D (2 for designated)	
Present value change	Counter will stop when attaining settings	Counter will keep on counting when attaining settings	
Output contact	When count attains the settings value, contact will be On and latched.	When count up attains settings, contact will be On and latched. When count down attains settings, contact will reset to Off.	
Reset action	The present value will reset to 0 when RST command is executed and contact will reset to Off.		
Present register	16 bits	32 bits	
Contact action	After scanning, act together.	After scanning, act together. Act immediately when count attains. It has no relation with scan period.	

Functions:

When pulse input signal of counter is from Off to On, the present value of counter equals to settings and output coil is On. Settings are decimal system and data register D can also be used as settings.

16-bit counters C0~C79:

☑ Setting range of 16-bit counter is K0~K32, 767. (K0 is the same as K1. output contact will be On immediately at the first count.

☑ General counter will be clear when PLC is power loss. If counter is latched, it will remember the value before power loss and keep on counting when power on after power loss.

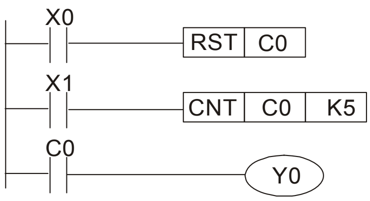
☑ If using MOV command, WPLSoft to send a value, which is large than setting to C0, register, at the next time that X1 is from Off to On, C0 counter contact will be On and present value will be set to the same as settings.

☑ The setting of counter can use constant K or register D (not includes special data register D1000~D1044) to be indirect setting.

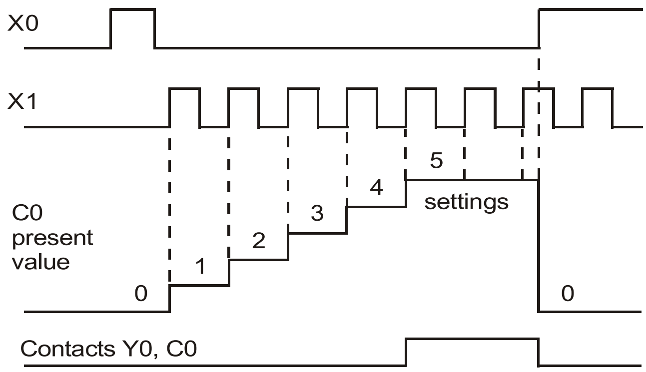
☑ If using constant K to be setting, it can only be positive number but if setting is data register D, it can be positive/negative number. The next number that counter counts up from 32,767 is -32,768.

Example:

LD	X0
RST	C0
LD	X1
CNT	C0 K5
LD	C0
OUT	Y0



1. When X0=On, RST command is executed, C0 reset to 0 and output contact reset to Off.
2. When X1 is from Off to On, counter will count up (add 1).
3. When counter C0 attains settings K5, C0 contact is On and C0 = setting =K5. C0 won't accept X1 trigger signal and C0 remains K5.



16.4.2 Special Auxiliary Relays

Special M	Function	Read(R)/ Write(W)
M1000	Normally open contact (a contact). This contact is On when running and it is On when the status is set to RUN.	Read only
M1001	Normally closed contact (b contact). This contact is Off when running and it is Off when the status is set to RUN.	Read only
M1002	On only for 1 scan after RUN. Initial pulse is contact a. It will get positive pulse in the RUN moment. Pulse width=scan period.	Read only
M1003	Off only for 1 scan after RUN. Initial pulse is contact a. It will get negative pulse in the RUN moment. Pulse width=scan period.	Read only
M1004	Reserved	Read only
M1005	Fault indication of the AC motor drives	Read only
M1006	Output frequency is 0	Read only
M1007	Operation direction of AC motor drives (FWD: 0, REV: 1)	Read only
M1008 ~ M1010	Reserved	Read only
M1011	10ms clock pulse, 5ms On/5ms Off	Read only
M1012	100ms clock pulse, 50ms On / 50ms Off	Read only
M1013	1s clock pulse, 0.5s On / 0.5s Off	Read only
M1014	1min clock pulse, 30s On / 30s Off	Read only
M1015	Frequency attained	Read only
M1016	Parameter read/write error	Read only
M1017	Succeed to write parameter	Read only
M1018	Reserved	Read only
M1019	Reserved	Read only

M1020	Zero flag	Read only
M1021	Borrow flag	Read only
M1022	Carry flag	Read only
M1023	Divisor is 0	Read only
M1024	Reserved	Read only
M1025	RUN(ON) / STOP(OFF) the AC motor drive	Read/Write
M1026	The operation direction of the AC motor drive (FWD: OFF, REV: ON)	Read/Write
M1027	Reset	Read/Write
M1028	Reserved	Read/Write
M1029	Reserved	Read/Write
M1030	Reserved	Read/Write
M1031	Reserved	Read/Write
M1032	Reserved	Read/Write
M1033	Reserved	Read/Write
M1034	Activate CANopen instant control	Read/Write
M1035 ~ M1039	Reserved	Read/Write
M1040	Power On	Read/Write
M1041	Reserved	Read/Write
M1042	Quick stop	Read/Write
M1043	Reserved	Read/Write
M1044	Halt	Read/Write
M1045 ~ M1051	Reserved	Read/Write
M1052	Lock	Read/Write
M1053 ~ M1055	Reserved	Read/Write
M1056	Power on ready	Read only
M1057	Reserved	Read only
M1058	On quick stopping	Read only
M1059	CANopen master setting complete	Read only
M1060	Initializing CANopen slave	Read only
M1061	Initialize CANopen slave failed	Read only
M1062	Reserved	Read only
M1063	Target torque attained	Read only
M1064	Reserved	Read only
M1065	Reserved	Read only
M1066	Read/ Write CANopen data complete	Read only
M1067	Read/ Write CANopen data complete	Read only

M1068 ~ M1071	Reserved	Read only
M1072	Reserved	Read/Write
M1073 ~ M1079	Reserved	Read only

16.4.3 Special Registers

Special D	Function	Read(R)/ Write(W)
D1000	Reserved	-
D1001	PLC firmware version	Read only
D1002	Program capacity	Read only
D1003	Checksum	Read only
D1004 ~ D1009	Reserved	-
D1010	Present scan time (Unit: 0.1ms)	Read only
D1011	Minimum scan time (Unit: 0.1ms)	Read only
D1012	Maximum scan time (Unit: 0.1ms)	Read only
D1013 ~ D1019	Reserved	-
D1020	Output frequency (0.000~600.00Hz)	Read only
D1021	Output current (####.#A)	Read only
D1022	The ID of the extension card: 0: no card 1: Relay Card(6 out) 2: I/O Card (4 in 2 out) 3~7: Reserved	Read only
D1023	The ID of the extension card: 0: no car 1: DeviceNet Slave 2: Profibus-DP Slave 3: CANopen Slave 4: Modbus-TCP Slave 5: EtherNet/IP Slave 6~8: Reserved	Read only
D1024 ~ D1026	Reserved	-
D1027	Frequency command of the PID control	Read only
D1028	The responsive value of AUI AVI (analog voltage input) (0.00~100.00%)	Read only
D1029	The responsive value of AUI ACI (analog current input) (0.0~100.00%)	Read only
D1030	The corresponding value for AUI (-100.0~100.00%)	Read only
D1031 ~ D1035	Reserved	-
D1036	AC motor drive error code	Read only

Special D	Function	Read(R)/ Write(W)
D1037	Output frequency from AC motor drive command	Read only
D1038	DC Bus voltage	Read only
D1039	Output voltage	Read only
D1040	Analog output value AFM1 (-100.00~100.00%)	Read/Write
D1041 ~ D1042	Reserved	-
D1043	User defined (When Pr.00.04 is set to 28, the register data will be displayed as C xxx)	Read/Write
D1044	Reserved	-
D1045	Analog output value AFM2 (-100.00~100.00%)	Read/Write
D1046 ~ D1049	Reserved	-
D1050	Actual mode 0: speed 2: torque	Read only
D1051 ~ D1052	Reserved	-
D1053	Actual torque	Read only
D1054 ~ D1059	Reserved	Read only
D1060	Mode setting 0: speed 2: torque	Read/Write
D1061 ~ D1069	Reserved	-

CANopen Master Special D (It can be written only when PLC is at STOP)

Special D	Function	PDO Map	Power Failure Memory	Factory Setting	R/W
D1070	The station which completed CANopen initialization (bit0=Machine code0 …….)	NO	NO	0	R
D1071	The station which error occurs during CANopen initialization (bit0=Machine code0 …….)	NO	NO	0	R
D1072	Reserved	-	-		-
D1073	CANopen station cut off (bit0=Machine code0 …….)	NO	NO		R
D1074	Error code of main station error 0: no error 1: slave setting error 2: synchronous cycle setting error (the setting is too low)	NO	NO	0	R
D1075	Reserved	-	-		-
D1076	SDO fault (main index value)	NO	NO		R
D1077	SDO fault (sub-index value)	NO	NO		R

Special D	Function	PDO Map	Power Failure Memory	Factory Setting	R/W
D1078	SDO fault (error code)	NO	NO		R
D1079	SDO fault (error code)	NO	NO		R
D1080	Reserved	-	-		-
D1081	Reserved	NO	NO		R
D1082	Reserved	NO	NO		R
D1083	Reserved	NO	NO		R
D1084	Reserved	NO	NO		R
D1085	Reserved	NO	NO		R
D1086	Reserved	NO	NO		R
D1087 ~ D1089	Reserved	-	-		-
D1090	Synchronous cycle setting	NO	YES	4	RW
D1091	The station which request for initialization during initializing process.	NO	YES	FFFFH	RW
D1092	Delay time before initializing	NO	YES	0	RW
D1093	Break off detection time	NO	YES	1000ms	RW
D1094	Break off detection frequency	NO	YES	3	RW
D1095 ~ D1096	Reserved	-	-		-
D1097	Type of P to P send (PDO) Setting range: 1~240	NO	YES	1	RW
D1098	Type of P to P received (PDO) Setting range: 1~240	NO	YES	1	RW
D1099	Delay time of initialization complete Setting range: 1~60000 sec.	NO	YES	15 sec	RW

C2000 supports up to 8 CANopen protocol slaves; each slave occupies 100 of special D register and is numbered in 1~8. There are in total of 8 stations.

Slave No.	Slave No. 1	D2000	Station number
		D2001	Factory code(L)
		~	~
		D2099	Mapping address 4 (H)of receiving station
	Slave No. 2	D2100	Station number
		D2101	Factory code(L)
		~	~
		D2199	Mapping address 4(H) of receiving station 4
	Slave No. 3	D2200	Station number
		D2201	Factory code(L)
		~	~
		D2299	Mapping address 4(H) of receiving station

⇩ 4

Slave No. 8

D2700	Station number
D2701	Factory code(L)
~	~
D2799	Mapping address 4(H)of receiving station 4

Slave No. 0~7

Special D	Function	PDO Map	Save	Pre-defined setting	R/W
D2000+100*n	Station number of slave No. n Setting range: 0~127 0: CANopen disable	NO		0	RW
D2001+100*n	The category of slave No. n 192H: AC motor drive/ AC servo motor and drive 191H: remote I/O module	NO		0	R
D2002+100*n	Factory code (L) of slave No. n	NO		0	R
D2003+100*n	Factory code (H) of slave No. n	NO		0	R
D2004+100*n	Factory product code (L) of slave No. n	NO		0	R
D2005+100*n	Factory product code (H) of slave No. n	NO		0	R

Basic definition

Slave No. 0~7

Special D	Function	PDO Map	Save	Pre-defined setting	CAN Index	PDO 1	PDO 2	PDO 3	PDO 4	R/W
D2006+100*n	Treatment for slave No. n communication disconnect	YES		0	6007H-0010H	●		●	●	RW
D2007+100*n	Error code of slave No. n	YES		0	603FH-0010H	●		●	●	R
D2008+100*n	Control word of slave No. n	YES		0	6040H-0010H					RW
D2009+100*n	Status word of slave No. n	YES		0	6041H-0010H					R
D2010+100*n	Control mode of slave No. n	YES		2	6060H-0008H					RW
D2011+100*n	Actual mode of slave No. n	YES		2	6061H-0008H					R

Speed Control

Slave No. 0~7

Special D	Function	PDO Map	Save	Pre-defined Setting	CAN Index	PDO 1	PDO 2	PDO 3	PDO 4	R/W
D2012+100*n	Target speed of slave No. n	YES		0	6042H-0010H	●				RW
D2013+100*n	Actual speed of slave No. n	YES		0	6043H-0010H	●				R
D2014+100*n	Speed deviation of slave No. n	YES		0	6044H-0010H					R
D2015+100*n	Accel. Time of slave No. n	YES		1000	604FH-0020H					R
D2016+100*n	Decel. Time of slave No. n	YES		1000	6050H-0020H					RW

Torque control

Slave No. 0~7

Special D	Function	PDO Map	Save	Pre-defined Setting	CAN Index	PDO 1	PDO 2	PDO 3	PDO 4	R/W
D2017+100*n	Target torque of slave No. n	YES		0	6071H-0010H				●	RW
D2018+100*n	Actual torque of slave No. n	YES		0	6077H-0010H				●	R
D2019+100*n	Actual current of slave No. n	YES		0	6078H-0010H					R

Position control

Slave No. 0~7

Special D	Function	PDO Map	Save	Pre-defined Setting	CAN Index	PDO 1	PDO 2	PDO 3	PDO 4	R/W
D2020+100*n	Target position(L) of slave No. n	YES		0	607AH-0020H			●		RW
D2021+100*n	Target position(H) of slave No. n	YES		0						RW
D2022+100*n	Actual position(L) of slave No. n	YES		0	6064H-0020H			●		R
D2023+100*n	Actual position(H) of slave No. n	YES		0						R
D2024+100*n	Speed diagram(L) of slave No. n	YES		10000	6081H-0020H					RW
D2025+100*n	Speed diagram (H) of slave No. n	YES		0						RW

20XXH address corresponds to MI MO AI AO.

Slave No. n=0~7

Special D	Function	PDO Map	Save	Pre-defined Setting	CAN Index	PDO 1	PDO 2	PDO 3	PDO 4	R/W
D2026+100*n	MI status of slave No. n	YES		0	2026H-0110H		●			RW

D2027+100*n	MO setting of slave No. n	YES		0	2026H-4110H		●			RW
D2028+100*n	AI1 status of slave No. n	YES		0	2026H-6110H		●			RW
D2029+100*n	AI2 status of slave No. n	YES		0	2026H-6210H		●			RW
D2030+100*n	AI3 status of slave No. n	YES		0	2026H-6310H		●			RW
D2031+100*n	AO1 status of slave No. n	YES		0	2026H-A110H		●			RW
D2032+100*n	AO2 status of slave No. n	YES		0	2026H-A210H		●			RW
D2033+100*n	AO3 status of slave No. n	YES		0	2026H-A310H		●			RW

Special D	Function	PDO Map	Save	Pre-defined Setting	R/W
D2034+100*n	Transmission setting of slave No. n	NO	YES	000AH	RW
D2035+100*n	The mapping address 1(L) for slave No. n transmitting station 1	NO	YES	0010H	RW
D2036+100*n	The mapping address 1(H) for slave No.n transmitting station 1	NO	YES	6040H	RW
D2037+100*n	The mapping address 2(L) for slave No. n transmitting station 1	NO	YES	0010H	RW
D2038+100*n	The mapping address 2(H) for slave No.n transmitting station 1	NO	YES	6042H	RW
D2039+100*n	The mapping address 3(L) for slave No. n transmitting station 1	NO	YES	0	RW
D2040+100*n	The mapping address 3(H) for slave No.n transmitting station 1	NO	YES	0	RW
D2041+100*n	The mapping address 4(L) for slave No. n transmitting station 1	NO	YES	0	RW
D2042+100*n	The mapping address 4(H) for slave No.n transmitting station 1	NO	YES	0	RW
D2043+100*n	The mapping address 1(L) for slave No. n transmitting station 2	NO	YES	0110H	RW
D2044+100*n	The mapping address 1(H) for slave No.n transmitting station 2	NO	YES	2026H	RW
D2045+100*n	The mapping address 2(L) for slave No. n transmitting station 2	NO	YES	6110H	RW
D2046+100*n	The mapping address 2(H) for slave No.n transmitting station 2	NO	YES	2026H	RW
D2047+100*n	The mapping address 3(L) for slave No. n transmitting station 2	NO	YES	6210H	RW
D2048+100*n	The mapping address 3(H) for slave No.n transmitting station 2	NO	YES	2026H	RW

Special D	Function	PDO Map	Save	Pre-defined Setting	R/W
D2049+100*n	The mapping address 4(L) for slave No. n transmitting station 2	NO	YES	6310H	RW
D2050+100*n	The mapping address 4(H) for slave No.n transmitting station 2	NO	YES	2026H	RW
D2051+100*n	The mapping address 1(L) for slave No. n transmitting station 3	NO	YES	0010H	RW
D2052+100*n	The mapping address 1(H) for slave No.n transmitting station 3	NO	YES	6040H	RW
D2053+100*n	The mapping address 2(L) for slave No. n transmitting station 3	NO	YES	0020H	RW
D2054+100*n	The mapping address 2(H) for slave No.n transmitting station 3	NO	YES	607AH	RW
D2055+100*n	The mapping address 3(L) for slave No. n transmitting station 3	NO	YES	0	RW
D2056+100*n	The mapping address 3(H) for slave No.n transmitting station 3	NO	YES	0	RW
D2057+100*n	The mapping address 4(L) for slave No. n transmitting station 3	NO	YES	0	RW
D2058+100*n	The mapping address 4(H) for slave No.n transmitting station 3	NO	YES	0	RW
D2059+100*n	The mapping address 1(L) for slave No. n transmitting station 4	NO	YES	0010H	RW
D2060+100*n	The mapping address 1(H) for slave No.n transmitting station 4	NO	YES	6040H	RW
D2061+100*n	The mapping address 2(L) for slave No. n transmitting station 4	NO	YES	0010H	RW
D2062+100*n	The mapping address 2(H) for slave No.n transmitting station 4	NO	YES	6071H	RW
D2063+100*n	The mapping address 3(L) for slave No. n transmitting station 4	NO	YES	0	RW
D2064+100*n	The mapping address 3(H) for slave No.n transmitting station 4	NO	YES	0	RW
D2065+100*n	The mapping address 4(L) for slave No. n transmitting station 4	NO	YES	0	RW
D2066+100*n	The mapping address 4(H) for slave No.n transmitting station 4	NO	YES	0	RW
D2067+100*n	Receiving setting of slave No. n	NO	YES	0000H	RW
D2068+100*n	The mapping address 1(L) for slave No. n receiving station 1	NO	YES	0010H	RW
D2069+100*n	The mapping address 1(H) for slave No.n receiving station 1	NO	YES	6041H	RW
D2070+100*n	The mapping address 2(L) for slave No. n receiving station 1	NO	YES	0010H	RW
D2071+100*n	The mapping address 2(H) for slave No.n receiving station 1	NO	YES	6043H	RW
D2072+100*n	The mapping address 3(L) for slave No. n receiving station 1	NO	YES	0	RW
D2073+100*n	The mapping address 3(H) for slave No.n receiving station 1	NO	YES	0	RW

Special D	Function	PDO Map	Save	Pre-defined Setting	R/W
D2074+100*n	The mapping address 4(L) for slave No. n receiving station 1	NO	YES	0	RW
D2075+100*n	The mapping address 4(H) for slave No.n receiving station 1	NO	YES	0	RW
D2076+100*n	The mapping address 1(L) for slave No. n receiving station 2	NO	YES	4110H	RW
D2077+100*n	The mapping address 1(H) for slave No.n receiving station 2	NO	YES	2026H	RW
D2078+100*n	The mapping address 2(L) for slave No. n receiving station 2	NO	YES	A110H	RW
D2079+100*n	The mapping address 2(H) for slave No.n receiving station 2	NO	YES	2026H	RW
D2080+100*n	The mapping address 3(L) for slave No. n receiving station 2	NO	YES	A210H	RW
D2081+100*n	The mapping address 3(H) for slave No.n receiving station 2	NO	YES	2026H	RW
D2082+100*n	The mapping address 4(L) for slave No. n receiving station 2	NO	YES	A310H	RW
D2083+100*n	The mapping address 4(H) for slave No.n receiving station 2	NO	YES	2026H	RW
D2084+100*n	The mapping address 1(L) for slave No. n receiving station 3	NO	YES	0010H	RW
D2085+100*n	The mapping address 1(H) for slave No.n receiving station 3	NO	YES	6041H	RW
D2086+100*n	The mapping address 2(L) for slave No. n receiving station 3	NO	YES	0020H	RW
D2087+100*n	The mapping address 2(H) for slave No.n receiving station 3	NO	YES	6064H	RW
D2088+100*n	The mapping address 3(L) for slave No. n receiving station 3	NO	YES	0	RW
D2089+100*n	The mapping address 3(H) for slave No.n receiving station 3	NO	YES	0	RW
D2090+100*n	The mapping address 4(L) for slave No. n receiving station 3	NO	YES	0	RW
D2091+100*n	The mapping address 4(H) for slave No.n receiving station 3	NO	YES	0	RW
D2092+100*n	The mapping address 1(L) for slave No. n receiving station 4	NO	YES	0010H	RW
D2093+100*n	The mapping address 1(H) for slave No.n receiving station 4	NO	YES	6041H	RW
D2094+100*n	The mapping address 2(L) for slave No. n receiving station 4	NO	YES	0010H	RW
D2095+100*n	The mapping address 2(H) for slave No.n receiving station 4	NO	YES	6077H	RW
D2096+100*n	The mapping address 3(L) for slave No. n receiving station 4	NO	YES	0	RW
D2097+100*n	The mapping address 3(H) for slave No.n receiving station 4	NO	YES	0	RW

Special D	Function	PDO Map	Save	Pre-defined Setting	R/W
D2098+100*n	The mapping address 4(L) for slave No. n receiving station 4	NO	YES	0	RW
D2099+100*n	The mapping address 4(H) for slave No.n receiving station 4	NO	YES	0	RW

16.4.4 Communication Address for PLC Devices

Device	Range	Type	Address (Hex)
X	00~17 (Octal)	bit	0400~040F
Y	00~17 (Octal)	bit	0500~050F
T	00~159	bit/word	0600~069F
M	000~799	bit	0800~0B1F
M	1000~1079	bit	0BE8~0C37
C	0~79	bit/word	0E00~0E47
D	00~399	word	1000~118F
D	1000~1099	word	13E8~144B
D	2000~2799	word	17D0~1AEF

Function Code

Function Code	Description	Supported Devices
01	Read coil status	Y, M, T, C
02	Read input status	X,Y,M,T,C
03	Read one data	T,C,D
05	Force changing one coil status	Y,M,T,C
06	Write in one data	T,C,D
0F	Force changing multiple coil status	Y,M,T,C
10	Write in multiple data	T,C,D

Only when PLC is at Stop status, PLC data can be read/write via communication device. When PLC is at Run status, the communication address should be the mapping address, e.g. for Pr.04-00 it maps to 0400H.

NOTE

When PLC function is activated, C2000 can Read/Write the PLC and drive's parameter by different addresses (pre-defined station number for the AC motor drive is 1, for PLC station number is 2)

16.5 Commands

16.5.1 Basic Commands

Commands

Commands	Function	Operands
LD	Load contact A	X, Y, M, T, C
LDI	Load contact B	X, Y, M, T, C
AND	Series connection with A contact	X, Y, M, T, C
ANI	Series connection with B contact	X, Y, M, T, C
OR	Parallel connection with A contact	X, Y, M, T, C
ORI	Parallel connection with B contact	X, Y, M, T, C
ANB	Series connects the circuit block	--
ORB	Parallel connects the circuit block	--
MPS	Save the operation result	--
MRD	Read the operation result (the pointer is not moving)	--
MPP	Read the result	--

Output Command

Commands	Function	Operands
OUT	Drive coil	Y, M
SET	Action latched (ON)	Y, M
RST	Clear the contacts or the registers	Y, M, T, C, D

Timer and Counter

Commands	Function	Operands
TMR	16-bit timer	T-K or T-D
CNT	16-bit counter	C-K or C-D（16 bit）

Main Control Command

Commands	Function	Operands
MC	Connect the common series connection contacts	N0~N7
MCR	Disconnect the common series connection contacts	N0~N7

Rising-edge/falling-edge Detection Commands of Contact

Commands	Function	Operands
LDP	Rising-edge detection operation starts	X, Y, M, T, C
LDF	Falling-edge detection operation starts	X, Y, M, T, C
ANDP	Rising-edge detection series connection	X, Y, M, T, C
ANDF	Falling-edge detection series connection	X, Y, M, T, C
ORP	Rising-edge detection parallel connection	X, Y, M, T, C
ORF	Falling-edge detection parallel connection	X, Y, M, T, C

Rising-edge/falling-edge Output Commands

Commands	Function	Operands
PLS	Rising-edge output	Y, M
PLF	Falling-edge output	Y, M

End Command

Commands	Function	Operands
END	Program end	--

Other Command

Commands	Function	Operands
NOP	No function	--
INV	Inverse operation result	--
P	Indicator	P

16.5.2 Explanation for the Command

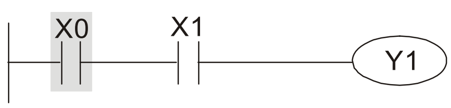
Mnemonic	**Function**					
LD	Load A contact					
Operand	X0~X17	Y0~Y17	M0~M799	T0~159	C0~C79	D0~D399
	✓	✓	✓	✓	✓	—

Explanation

L The LD command is used on the A contact that has its start from the left BUS or the A contact that is the start of a contact circuit. Function of the command is to save present contents, and at the same time, save the acquired contact status into the accumulative register.

Example

Ladder diagram



Command code		Operation
LD	**X0**	Load contact A of X0
AND	X1	Connect to contact A of X1 in series
OUT	Y1	Drive Y1 coil

Mnemonic	**Function**					
LDI	Load B contact					
Operand	X0~X17	Y0~Y17	M0~M799	T0~159	C0~C79	D0~D399
	✓	✓	✓	✓	✓	—

Explanation

The LDI command is used on the B contact that has its start from the left BUS or the B contact that is the start of a contact circuit. Function of the command is to save present contents, and at the same time, save the acquired contact status into the accumulative register.

Example

Ladder diagram:

Command code:		Operation:
LDI	**X0**	Load contact B of X0
AND	X1	Connect to contact A of X1 in series
OUT	Y1	Drive Y1 coil

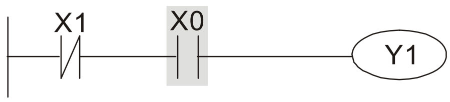
Mnemonic	Function					
AND	Series connection- A contact					
Operand	X0~X17	Y0~Y17	M0~M799	T0~159	C0~C79	D0~D399
	✓	✓	✓	✓	✓	—

Explanation

The AND command is used in the series connection of A contact. The function of the command is to readout the status of present specific series connection contacts first, and then to perform the "AND" calculation with the logic calculation result before the contacts, thereafter, saving the result into the accumulative register.

Example

Ladder diagram:



Command code:		Operation:
LDI	X1	Load contact B of X1
AND	**X0**	Connect to contact A of X0 in series
OUT	Y1	Drive Y1 coil

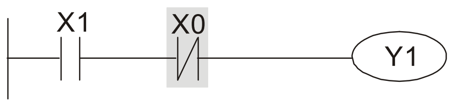
Mnemonic	Function					
ANI	Series connection- B contact					
Operand	X0~X17	Y0~Y17	M0~M799	T0~159	C0~C79	D0~D399
	✓	✓	✓	✓	✓	—

Explanation

The ANI command is used in the series connection of B contact. The function of the command is to readout the status of present specific series connection contacts first, and then to perform the "AND" calculation with the logic calculation result before the contacts, thereafter, saving the result into the accumulative register.

Example

Ladder diagram:



Command code:		Operation:
LD	X1	Load contact A of X1
ANI	**X0**	Connect to contact B of X0 in series
OUT	Y1	Drive Y1 coil

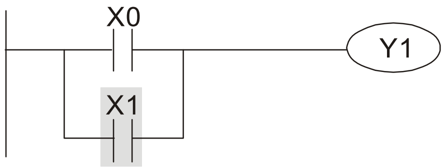
Mnemonic	Function					
OR	Parallel connection- A contact					
Operand	X0~X17	Y0~Y17	M0~M799	T0~159	C0~C79	D0~D399
	✓	✓	✓	✓	✓	—

Explanation

The OR command is used in the parallel connection of A contact. The function of the command is to readout the status of present specific series connection contacts, and then to perform the "OR" calculations with the logic calculation result before the contacts, thereafter, saving the result into the accumulative register.

Example

Ladder diagram:



Command code:		Operation:
LD	X0	Load contact A of X0
OR	**X1**	Connect to contact A of X1 in parallel
OUT	Y1	Drive Y1 coil

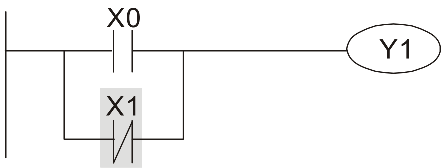
Mnemonic	Function					
ORI	Parallel connection- B contact					
Operand	X0~X17	Y0~Y17	M0~M799	T0~159	C0~C79	D0~D399
	✓	✓	✓	✓	✓	—

Explanation

The ORI command is used in the parallel connection of B contact. The function of the command is to readout the status of present specific series connection contacts, and then to perform the "OR" calculations with the logic calculation result before the contacts, thereafter, saving the result into the accumulative register.

Example

Ladder diagram:



Command code:		Operation:
LD	X0	Load contact A of X0
ORI	**X1**	Connect to contact B of X1 in parallel
OUT	Y1	Drive Y1 coil

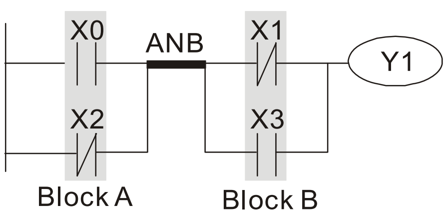
Mnemonic	Function
ANB	Series connection (Multiple Circuits)
Operand	None

Explanation

To perform the "ANB" calculation between the previous reserved logic results and contents of the accumulative register.

Example

Ladder diagram:



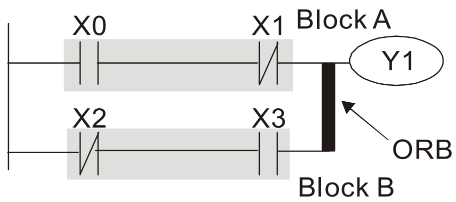
Command code:		Operation:
LD	X0	Load contact A of X0
ORI	X2	Connect to contact B of X2 in parallel
LDI	X1	Load contact B of X1
OR	X3	Connect to contact A of X3 in parallel
ANB		Connect circuit block in series
OUT	Y1	Drive Y1 coil

Mnemonic	Function

ORB	Parallel connection (Multiple circuits)
Operand	None

Explanation ORB is to perform the "OR" calculation between the previous reserved logic results and contents of the accumulative register.

Example Ladder diagram:



Command code: Operation:

LD	X0	Load contact A of X0
ANI	X1	Connect to contact B of X1 in series
LDI	X2	Load contact B of X2
AND	X3	Connect to contact A of X3 in series
ORB		Connect circuit block in parallel
OUT	Y1	Drive Y1 coil

Mnemonic	**Function**
MPS	Store the current result of the internal PLC operations
Operand	None

Explanation To save contents of the accumulative register into the operation result. (the result operation pointer pluses 1)

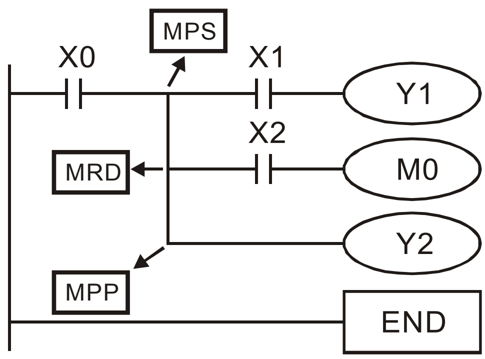
Mnemonic	**Function**
MRD	Reads the current result of the internal PLC operations
Operand	None

Explanation Reading content of the operation result to the accumulative register. (the pointer of operation result doesn't move)

Mnemonic	**Function**
MPP	Reads the current result of the internal PLC operations
Operand	None

Explanation Reading content of the operation result to the accumulative register. (the stack pointer will decrease 1)

Example Ladder diagram:



Command code: Operation:

LD	X0	Load contact A of X0
MPS		Save in stack
AND	X1	Connect to contact A of X1 in series
OUT	Y1	Drive Y1 coil
MRD		Read from the stack (without moving pointer)
AND	X2	Connect to contact A of X2 in series
OUT	M0	Drive M0 coil

MPP		Read from the stack
OUT	Y2	Drive Y2 coil
END		End program

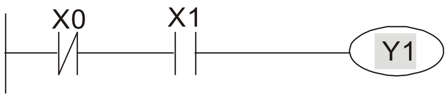
Mnemonic	Function					
OUT	Output coil					
Operand	X0~X17	Y0~Y17	M0~M799	T0~159	C0~C79	D0~D399
	—	✓	✓	—	—	—

Explanation Output the logic calculation result before the OUT command to specific device.

Motion of coil contact:

Operation result	OUT command		
	Coil	Contact	
		A contact (normally open)	B contact (normally closed)
FALSE	Off	Non-continuity	Continuity
TRUE	On	Continuity	Non-continuity

Example Ladder diagram:

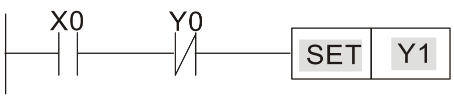


Command code:		Operation:
LD	X0	Load contact B of X0
AND	X1	Connect to contact A of X1 in series
OUT	**Y1**	Drive Y1 coil

Mnemonic	Function					
SET	Latch (ON)					
Operand	X0~X17	Y0~Y17	M0~M799	T0~159	C0~C79	D0~D399
	—	✓	✓	—	—	—

Explanation When the SET command is driven, its specific device is set to be “ON,” which will keep “ON” whether the SET command is still driven. You can use the RST command to set the device to “OFF”.

Example Ladder diagram:



Command code:		Operation:
LD	X0	Load contact A of X0
AN	Y0	Connect to contact B of Y0 in series
SET	**Y1**	Y1 latch (ON)

Mnemonic	Function					
RST	Clear the contacts or the registers					
Operand	X0~X17	Y0~Y17	M0~M799	T0~159	C0~C79	D0~D399
	—	✓	✓	✓	✓	✓

Explanation

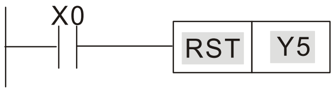
When the RST command is driven, motion of its specific device is as follows:

Device	Status
Y, M	Coil and contact will be set to “OFF”.
T, C	Present values of the timer or counter will be set to 0, and the coil and contact will be set to “OFF.”
D	The content value will be set to 0.

When the RST command is not driven, motion of its specific device is unchanged.

Example

Ladder diagram



Command code:		Operation:
LD	X0	Load contact A of X0
RST	**Y5**	Clear contact Y5

Mnemonic	Function	
TMR	16-bit timer	
Operand	T-K	T0~T159, K0~K32,767
	T-D	T0~T159, D0~D399

Explanation

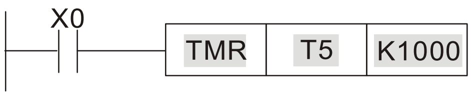
When TMR command is executed, the specific coil of timer is ON and timer will start to count. When the setting value of timer is attained (counting value >= setting value), the contact will be as following

NO(Normally Open) contact	Open collector
NC(Normally Closed) contact	Close collector

When the RST command is not driven, motion of its specific device remains unchanged.

Example

Ladder Diagram:



Command code:		Operation:
LD	X0	Load contact A of X0
TMR	T5 K1000	Setting of T5 counter is K1000.

Mnemonic	Function	
CNT	Clear contact or register	
Operand	C-K	C0~C79, K0~K32,767
	C-D	C0~C79, D0~D399

Explanation

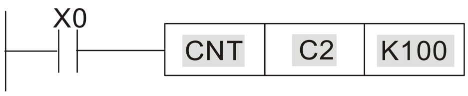
When the CNT command is executed from OFF→ON, which means that the counter coil is driven, and 1 should thus be added to the counter's value; when the counter achieved specific set value (value of counter = the setting value), motion of the contact is as follows:

NO(Normally Open) contact	Open collector
NC(Normally Close) contact	Close collector

If there is counting pulse input after counting is attained, the contacts and the counting values will be unchanged. To re-count or to conduct the CLEAR motion, please use the RST command.

Example

Ladder diagram:



Command code:		Operation
LD	X0	Load contact A of
CNT	**C2 K100**	Setting of C2 counter is K100.

Mnemonic	Function
MC/MCR	Master control Start/Reset
Operand	N0~N7

Explanation

1. MC is the main-control start command. When the MC command is executed, the execution of commands between MC and MCR will not be interrupted. When MC command is OFF, the motion of the commands that between MC and MCR is described as follows:

Command	Description
Timer	The counting value is set back to zero, the coil and the contact are both turned OFF
Accumulative timer	The coil is OFF, and the timer value and the contact stay at their present condition
Subroutine timer	The counting value is back to zero. Both coil and contact are turned OFF.
Counter	The coil is OFF, and the counting value and the contact stay at their present condition
Coils driven up by the OUT command	All turned OFF
Devices driven up by the SET and RST commands	Stay at present condition
Application commands	All of them are not acted , but the nest loop FOR-NEXT command will still be executed for times defined by users even though the MC-MCR commands is OFF.

2. MCR is the main-control ending command that is placed at the end of the main-control program and there should not be any contact commands prior to the MCR command.

3. Commands of the MC-MCR main-control program support the nest program structure, with 8 layers as its greatest. Please use the commands in order from N0~ N7, and refer to the following:

Command code: Operation:

Ladder Diagram:

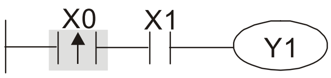
LD	X0	Load A contact of X0
MC	**N0**	Enable N0 common series connection contact
LD	X1	Load A contact of X1
OUT	Y0	Drive Y0 coil
:		
LD	X2	Load A contact of X2
MC	**N1**	Enable N1 common series connection contact
LD	X3	Load A contact of X3
OUT	Y1	Drive Y1 coil
:		
MCR	**N1**	Disable N1 common series connection contact
:		
MCR	**N0**	Disable N0 common series connection contact
:		
LD	X10	Load A contact of X10
MC	**N0**	Enable N0 common series connection contact
LD	X11	Load A contact of X0
OUT	Y10	Enable N0 common series connection contact
:		Load A contact of X1
MCR	**N0**	Drive Y0 coil

Mnemonic	**Function**					
LDP	Rising-edge detection operation					
Operand	X0~X17	Y0~Y17	M0~M799	T0~159	C0~C79	D0~D399
	✓	✓	✓	✓	✓	—

Explanation Usage of the LDP command is the same as the LD command, but the motion is different. It is used to reserve present contents and at the same time, saving the detection status of the acquired contact rising-edge into the accumulative register.

Example

Ladder diagram:



Command code:		Operation:
LDP	**X0**	Start X0 rising-edge detection
AND	X1	Series connection A contact of X1
OUT	Y1	Drive Y1 coil

Remarks

Please refer to the specification of each model series for the applicable range of operands.

If rising-edge status is ON when PLC power is off, then the rising-edge status will be TRUE when PLC power is on.

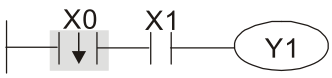
Mnemonic	**Function**					
LDF	Falling-edge detection operation					
Operand	X0~X17	Y0~Y17	M0~M799	T0~159	C0~C79	D0~D399
	✓	✓	✓	✓	✓	—

Explanation

Usage of the LDF command is the same as the LD command, but the motion is different. It is used to reserve present contents and at the same time, saving the detection status of the acquired contact falling-edge into the accumulative register.

Example

Ladder diagram:



Command code: Operation:

LDF	**X0**	Start X0 falling-edge detection
AND	X1	Series connection A contact of X1
OUT	Y1	Drive Y1 coil

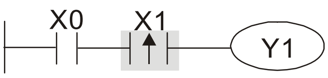
Mnemonic	**Function**					
ANDP	Rising-edge series connection					
Operand	X0~X17	Y0~Y17	M0~M799	T0~159	C0~C79	D0~D399
	✓	✓	✓	✓	✓	—

Explanation

ANDP command is used in the series connection of the contacts' rising-edge detection.

Example

Ladder diagram:



Command code: Operation:

LD	X0	Load A contact of X0
ANDP	**X1**	X1 rising-edge detection in series connection
OUT	Y1	Drive Y1 coil

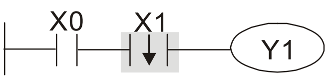
Mnemonic	**Function**					
ANDF	Falling-edge series connection					
Operand	X0~X17	Y0~Y17	M0~M799	T0~159	C0~C79	D0~D399
	✓	✓	✓	✓	✓	—

Explanation

ANDF command is used in the series connection of the contacts' falling-edge detection.

Example

Ladder diagram:



Command code: Operation:

LD	X0	Load A contact of X0
ANDF	**X1**	X1 falling-edge detection in series connection
OUT	Y1	Drive Y1 coil

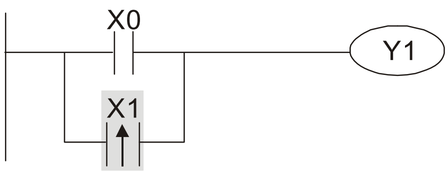
Mnemonic	**Function**					
ORP	Rising-edge parallel connection					
Operand	X0~X17	Y0~Y17	M0~M799	T0~159	C0~C79	D0~D399
	✓	✓	✓	✓	✓	—

Explanation

The ORP commands are used in the parallel connection of the contact's rising-edge detection.

Example

Ladder diagram:



Command code:		Operation:
LD	X0	Load A contact of X0
ORP	**X1**	X1 rising-edge detection in parallel connection
OUT	Y1	Drive Y1 coil

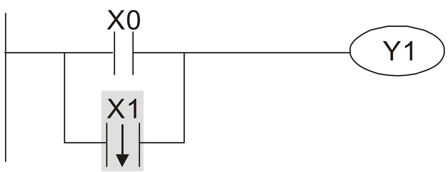
Mnemonic	**Function**					
ORF	Falling-edge parallel connection					
Operand	X0~X17	Y0~Y17	M0~M799	T0~159	C0~C79	D0~D399
	✓	✓	✓	✓	✓	—

Explanation

The ORP commands are used in the parallel connection of the contact's falling-edge detection.

Example

Ladder diagram:



Command code:		Operation:
LD	X0	Load A contact of X0
ORF	**X1**	X1 falling-edge detection in parallel connection
OUT	Y1	Drive Y1 coil

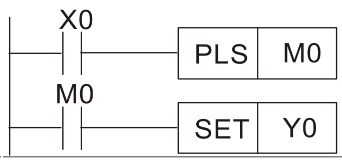
Mnemonic	**Function**					
PLS	Rising-edge output					
Operand	X0~X17	Y0~Y17	M0~M799	T0~159	C0~C79	D0~D399
	—	✓	✓	—	—	—

Explanation

When X0=OFF→ON (rising-edge trigger), PLS command will be executed and M0 will send the pulse of one time which the length is the time needed for one scan cycle.

Example

Ladder diagram:



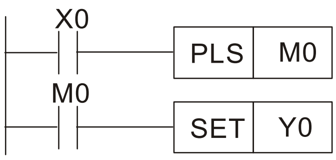
Command code:		Operation:
LD	X0	Load A contact of X0
PLS	**M0**	M0 rising-edge output
LD	M0	Load the contact A of M0

SET	Y0	Y0 latched (ON)

Mnemonic	Function					
PLF	Falling-edge output					
Operand	X0~X17	Y0~Y17	M0~M799	T0~159	C0~C79	D0~D399
	—	✓	✓	—	—	—

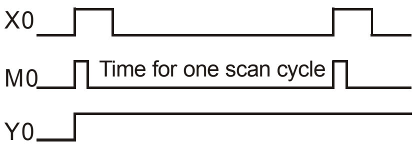
Explanation When X0= ON→OFF (falling-edge trigger), PLF command will be executed and M0 will send the pulse of one time which the length is the time for scan one time.

Example Ladder diagram:



Command code:		Operation:
LD	X0	Load contact A of X0
PLF	**M0**	M0 falling-edge output
LD	M0	Load contact A of M0
SET	Y0	Y0 latched (ON)

Timing Diagram:



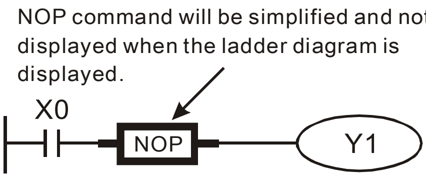
Mnemonic	Function
END	Program End
Operand	None

Explanation It needs to add the END command at the end of ladder diagram program or command program. PLC will scan from address o to END command, after the execution it will return to address 0 and scan again.

Mnemonic	Function
NOP	No action
Operand	None

Explanation NOP command does no operation in the program; the result of executing this command will remain the logic operation. Use NOP command if user wants to delete certain command without changing the length of the program.

Example Ladder diagram:

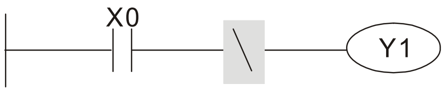


Command code:		Operation:
LD	X0	Load contact B of X0
NOP		No function
OUT	Y1	Drive Y1 coil

Mnemonic	Function
INV	Inverse operation result
Operand	None

Explanation The operation result (before executing INV command) will be saved inversely into cumulative register.

Example Ladder diagram:

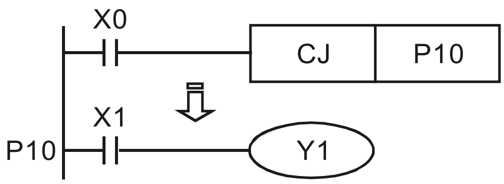


Command code:		Operation:
LD	X0	Load contact A of X0
INV		Operation result inversed
OUT	Y1	Drive Y1 coil

Mnemonic	Function
P	Indicator
Operand	P0~P255

Explanation Indicator P allows API 00 CJ command and API 01 CALL command to skip from 0. Though it is not necessary to start from number 0, same number can not be used twice or serious error would occur.

Example Ladder diagram:



Command code:		Operation:
LD	X0	Load contact A of X0
CJ	P10	Skip command CJ to P10
:		
P10		Indicator P10
LD	X1	Load contact A of X1
OUT	Y1	Drive Y1 coil

16.5.3 Description of the Application Commands

	API	Mnemonic Codes		P Command	Function	STEPS	
		16 bits	32 bits			16bit	32bit
Loop control	01	CALL	-	✓	CALL subroutine	3	-
	06	FEND	-	-	The end of main program	1	-
Transmission Comparison	10	CMP	–	✓	Compare	7	13
	11	ZCP	–	✓	Zone compare	9	17
	12	MOV	–	✓	Data Move	5	9
	15	BMOV	–	✓	Block move	7	–
Four Fundamental Operations of Arithmetic	20	ADD	–	✓	Perform the addition of BIN data	7	13
	21	SUB	–	✓	Perform the subtraction of BIN data	7	13
	22	MUL	–	✓	Perform the multiplication of BIN data	7	13
	23	DIV	–	✓	Perform the division of BIN data	7	13
	24	INC	–	✓	Perform the addition of 1	3	5
	25	DEC	–	✓	Perform the subtraction of 1	3	5
	30	ROR	–	✓	Rotate to the right	5	–

	31	ROL	–	✓	Rotate to the left	5	–
Data Processing	40	ZRST	–	✓	Zero Reset	5	-
Contact type logic operation	215	LD&	DLD&	-	Contact Logical Operation LD#	5	9
	216	LD|	DLD|	-	Contact type logic operation LD＃	5	9
	217	LD^	DLD^	-	Contact Logical Operation LD#	5	9
	218	AND&	DAND&	-	Contact Logical Operation AND#	5	9
	219	ANDI	DANDI	-	Contact Logical Operation AND#	5	9
	220	AND^	DAND^	-	Contact Logical Operation AND#	5	9
	221	OR&	DOR&	-	Contact Logical Operation OR＃	5	9
	222	OR|	DOR|	-	Contact Logical Operation OR＃	5	9
	223	OR^	DOR^	-	Contact Logical Operation OR＃	5	9
Contact Type Comparison	224	LD＝	DLD＝	-	Load Compare LD※	5	9
	225	LD＞	DLD＞	-	Load Compare LD※	5	9
	226	LD＜	DLD＜	-	Load Compare LD※	5	9
	228	LD＜＞	DLD＜＞	-	Load Compare LD※	5	9
	229	LD＜＝	DLD＜＝	-	Load Compare LD※	5	9
	230	LD＞＝	DLD＞＝	-	Load Compare LD※	5	9
	232	AND＝	DAND＝	-	AND Compare※	5	9
	233	AND＞	DAND＞	-	AND Compare※	5	9
	234	AND＜	DAND＜	-	AND Compare※	5	9
	236	AND＜＞	DAND＜＞	-	AND Compare※	5	9
	237	AND＜＝	DAND＜＝	-	AND Compare※	5	9
	238	AND＞＝	DAND＞＝	-	AND Compare※	5	9
	240	OR＝	DOR＝	-	OR compare ※	5	9
	241	OR＞	DOR＞	-	OR compare ※	5	9
	242	OR＜	DOR＜	-	OR compare ※	5	9
	244	OR＜＞	DOR＜＞	-	OR compare ※	5	9
	245	OR＜＝	DOR＜＝	-	OR compare ※	5	9
	246	OR＞＝	DOR＞＝	-	OR compare ※	5	9
Special command for AC motor drive	139	RPR	–	✓	Read the parameters	5	–
	140	WPR	–	✓	Write the parameters	5	–
	141	FPID	–	✓	Drive PID control	9	–
	142	FREQ	–	✓	Control the drive frequency	7	–
	261	CANRX	–	✓	Read CANopen Slave data	9	-

	263	TORQ	–	✓	Set target torque	5	-
	264	CANTX	–	✓	Write CANopen Slave data	9	-
	265	CANFLS	–	✓	Update the mapping special D of CANopen	3	-

16.5.4 Explanation for the Application Commands

API		CALL		S	Call Subroutine
01			P		

	Bit Devices			Word devices								16 bits command (3 STEPS)
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D	CALL CALLP
Operands: S: Operand S can designate P. Operand S of C2000 series can designate P0~P63.												32 bits command — — — —
												Flag signal: None

Explanation

1. **S**: The pointer of call subroutine.
2. Edit the subroutine designated by the pointer after FEND instruction.
3. If only CALL instruction is in use, it can call subroutines of the same pointer number with no limit of times.
4. Subroutine can be nested for 5 levels including the initial CALL instruction. (If entering the sixth level, the subroutine won't be executed.)

API		FEND		–	The end of the main program (First End)
06					

	Bit Devices			Word devices							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D

Operands:

No operand

No contact to drive the instruction is required.

16 bits command (1 STEP)

FEND – –

32 bits command

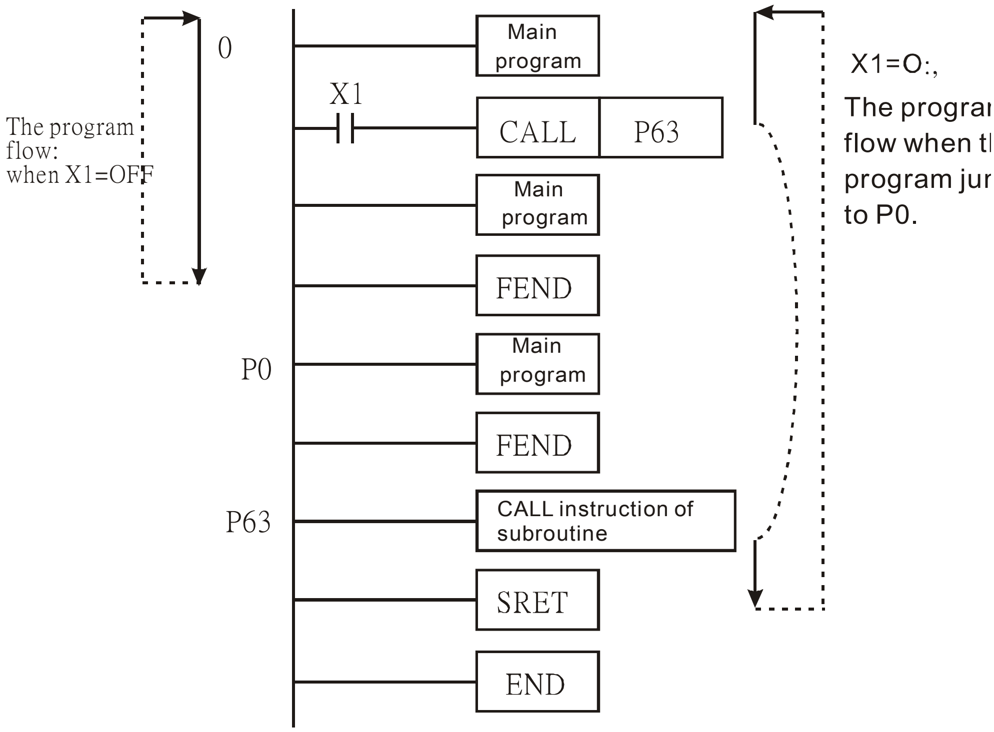
– – – –

Flag signal: None

Explanation

1. This instruction denotes the end of the main program. It has the same function as that of END instruction when being executed by PLC.
2. CALL must be written after FEND instruction and add SRET instruction in the end of its subroutine. Interruption program has to be written after FEND instruction and IRET must be added in the end of the service program.
3. If several FEND instructions are in use, place the subroutine and interruption service programs between the final FEND and END instruction.
4. After CALL instruction is executed, executing FEND before SRET will result in errors in the program.

CALL Command



API					
10	D	**CMP**	P	S1 S2 D	Compare

	Bit Devices			Word devices							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S1				*	*	*	*	*	*	*	*
S2				*	*	*	*	*	*	*	*
D		*	*								

Operand

Operand D occupies 3 consecutive devices.

16 bits command (7 STEPS)

CMP CMPP

32bits command (13 STEPS)

— — — —

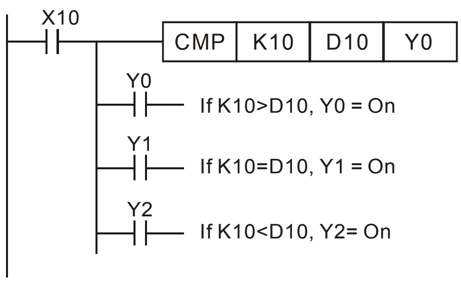
Flag signal: None

Explanation

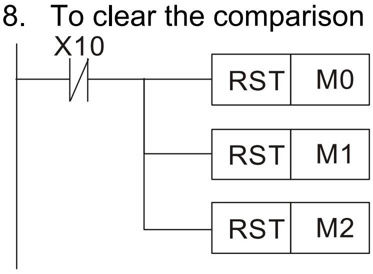
1. S1 : value comparsion 1, S2 : value comparsion 2 , D : result comparsion
2. The contents in S1 and S2 are compared and result is stored in D.
3. The two comparison values are compared algebraically and the two values are signed binary values. When b15 = 1 in 16-bit instruction, the comparison will regard the value as negative binary values.

Example

5. Designate device Y0, and operand D automatically occupies Y0, Y1, and Y2.
6. When X10 = On, CMP instruction will be executed and one of Y0, Y1, and Y2 will be On. When X10 = Off, CMP instruction will not be executed and Y0, Y1, and Y2 remain their status before X10 = Off.
7. If the user need to obtain a comparison result with ≥ ≤, and ≠, make a series parallel connection between Y0 ~ Y2.



8. To clear the comparison result, use RST or ZRST instruction.



API					
11	D	**ZCP**	P	S1 S2 S D	Zone Compare

	Bit Devices			Word devices							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S1				*	*	*	*	*	*	*	*
S2				*	*	*	*	*	*	*	*
S				*	*	*	*	*	*	*	*
D		*	*								

16 bits command (9 STEPS)

ZCP ZCPP

32 bits command (17 STEPS)

— — — —

Flag signal: none

Operands:

S1: Lower bound of zone comparison S2: Upper bound of zone comparison S: Comparison value

D: Comparison result

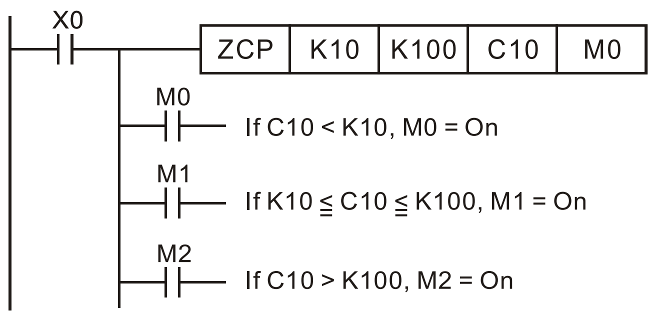
Explanation

1. S1: Lower bound of zone comparison S2: Upper bound of zone comparison S: Comparison value D: Comparison result
2. S is compared with its S1 S2 and the result is stored in D.
3. When S1 > S2, the instruction performs comparison by using S1 as the lower/upper bound.
4. The two comparison values are compared algebraically and the two values are signed binary values. When b15 = 1 in 16-bit instruction or b31 = 1 in 32-bit instruction, the comparison will regard the value as negative binary values.

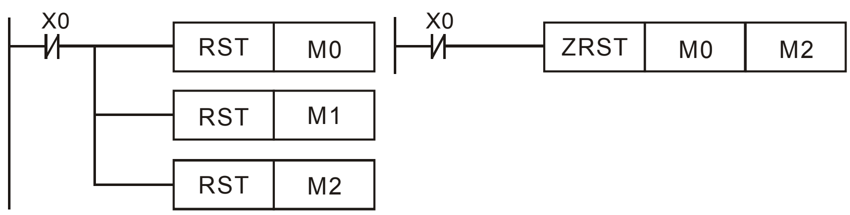
Example

1. Designate device M0, and operand D automatically occupies M0, M1 and M2.
2. When X0 = On, ZCP instruction will be executed and one of M0, M1, and M2 will be On. When X10 = Off, ZCP instruction will not be executed and M0, M1, and M2 remain their status before X0 = Off.
3. If the user need to obtain a comparison result with ≥ ≤, and ≠, make a series parallel connection between Y0 ~ Y2.

■



4. To clear the comparison result, use RST or ZRST instruction.



API					
12	**D**	**MOV**	**P**	(S) (D)	Moving the data

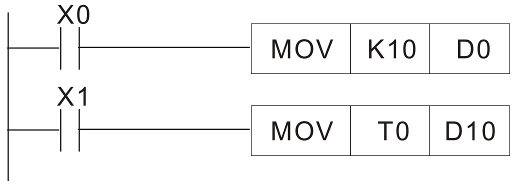
	Bit Devices			Word devices								16 bits command (5 STEPS)
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D	MOV MOVP
S				*	*	*	*	*	*	*	*	32 bits command (9 STEPS)
D							*	*	*	*	*	— — — —
Operand: None												Flag signal: None

Explanation

1. S: Source of data D: Destination of data
2. When this instruction is executed, the content of S will be moved directly to D. When this instruction is not executed, the content of D remains unchanged.

Example

1. When X0 = Off, the content in D10 will remain unchanged. If X0 = On, the value K10 will be moved to D10 data register.
2. When X1 = Off, the content in D10 will remain unchanged. If X1 = On, the present value T0 will be moved to D10 data register.



API				
15	**BMOV**	**P**	S D n	Block Move

	Bit Devices			Word devices							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S						*	*	*	*	*	*
D							*	*	*	*	*
n				*	*						

Operand:
Range of n =1~512

16 bits command (7 STEPS)
BMOV BMOVP

32 bits command
— — — —

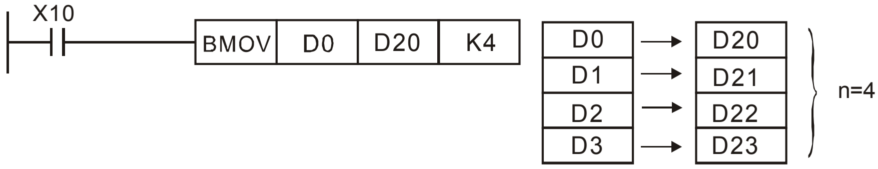
Flag signal: None

Explanation

1. S: Start of source devices D: Start of destination devices n: Number of data to be moved
2. The contents in n registers starting from the device designated by S will be moved to n registers starting from the device designated by D. If n exceeds the actual number of available source devices, only the devices that fall within the valid range will be used.

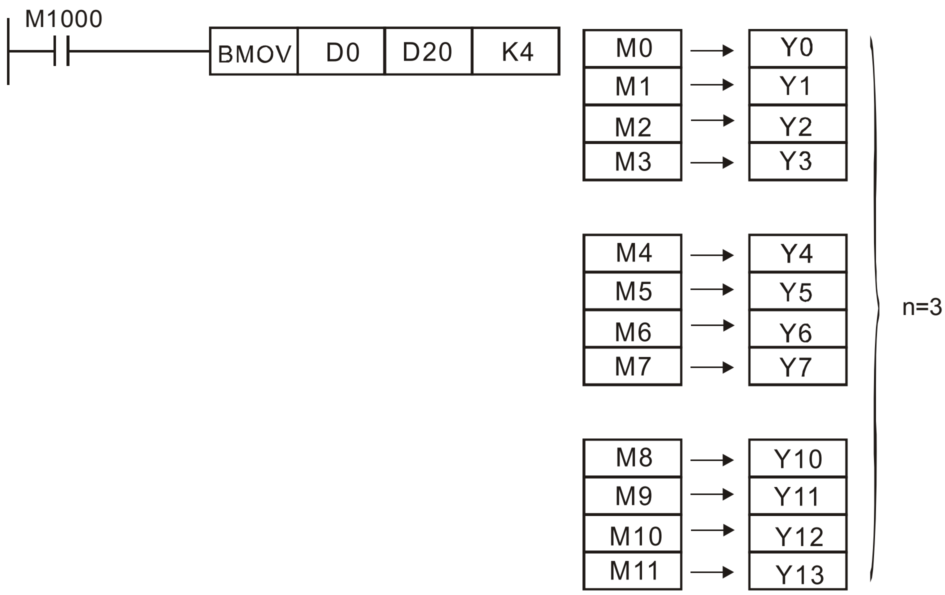
Example 1

When X10 = On, the contents in registers D0 ~ D3 will be moved to the 4 registers D20 ~ D23.



Example 2

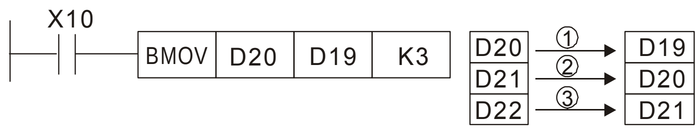
Assume the bit devices KnX, KnY, KnM and KnS are designated for moving, the number of digits of S and D has to be the same, i.e. their n has to be the same.



Example 3

To avoid coincidence of the device numbers to be moved designated by the two operands and cause confusion, please be aware of the arrangement on the designated device numbers.

When S > D, the BMOV command is processed in the order as ①→②→③



When S < D, the BMOV command is processed in the order as ③→②→①

API					
20	D	ADD	P	S1 S2 D	BIN Addition

	Bit Devices			Word devices							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S1				*	*	*	*	*	*	*	*
S2				*	*	*	*	*	*	*	*
D							*	*	*	*	*

Operands: None

16 bits command (7 STEPS)
ADD ADDP

32 bits command (13 STEPS)
— — — —

Flag signal: M1020 Zero flag
M1021 Borrow flag
M1022 Carry flag

Explanation

1. S1: Summand S2: Addend D: Sum
2. This instruction adds S1 and S2 in BIN format and store the result in D.
3. The highest bit is symbolic bit 0 (+) and 1 (-), which is suitable for algebraic addition, e.g. 3 + (-9) = -6.
4. Flag changes in binary addition

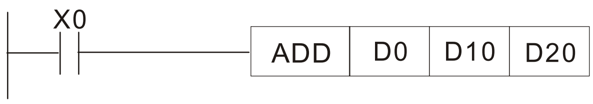
   16-bit command:

   A. If the operation result = 0, zero flag M1020 = On.
   B. If the operation result < -32,768, borrow flag M1021 = On.
   C. If the operation result > 32,767, carry flag M1022 = On.

Example

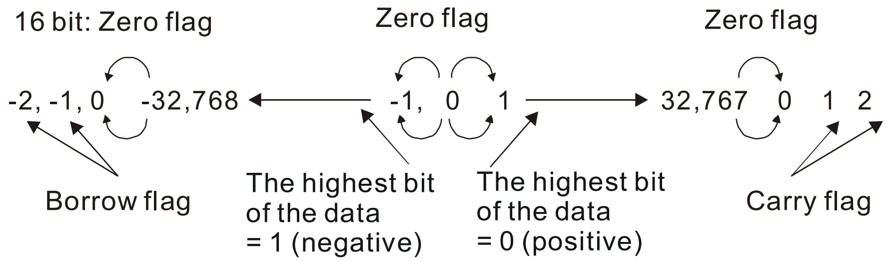
16-bit command:

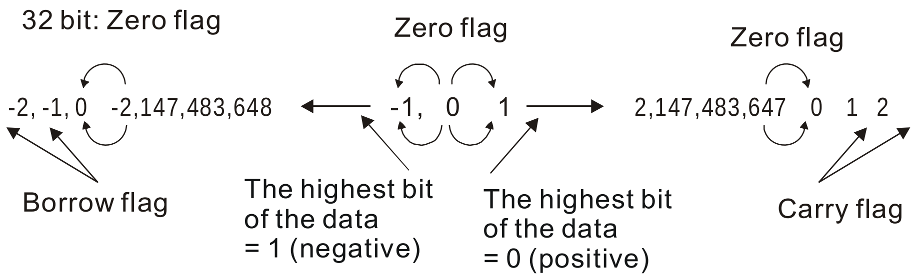
When X0 = On, the content in D0 will plus the content in D10 and the sum will be stored in D20.



Remarks

Flags and the positive/negative sign of the values:





API					
21	D	**SUB**	P	(S1) (S2) (D)	Subtraction

	Bit Devices			Word devices							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S1				*	*	*	*	*	*	*	*
S2				*	*	*	*	*	*	*	*
D							*	*	*	*	*

Operands: None

16 bits command (7 STEPS)
SUB SUBP

32 bits command (13 STEPS)
— — — —

Flag signal: M1020 Zero flag
M1021 Borrow flag
M1022 Carry flag

Explanation

1. S1: Minuend S2: Subtrahend D: Remainder
2. This instruction subtracts S1 and S2 in BIN format and stores the result in D.
3. The highest bit is symbolic bit 0 (+) and 1 (-), which is suitable for algebraic subtraction.
4. Flag changes in binary subtraction

   In 16-bit instruction:

   If the operation result = 0, zero flag M1020 = On.

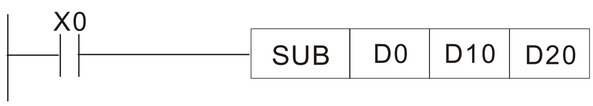
   If the operation result < -32,768, borrow flag M1021 = On.

   If the operation result > 32,767, carry flag M1022 = On.

Example

In 16-bit BIN subtraction:

When X0 = On, the content in D0 will minus the content in D10 and the remainder will be stored in D20.



API					
22	D	**MUL**	P	S1 S2 D	BIN Multiplication

	Bit Devices			Word devices							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S1				*	*	*	*	*	*	*	*
S2				*	*	*	*	*	*	*	*
D							*	*	*	*	*

Operands:
In 16-bit instruction, D occupies 2 consecutive devices.

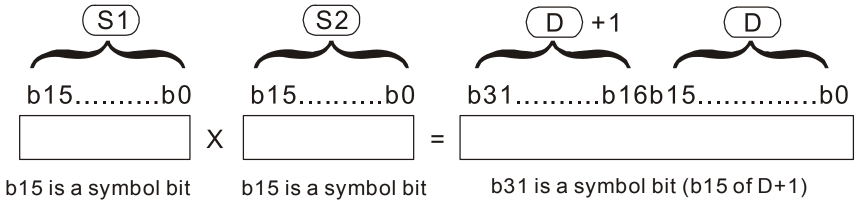
16 bits command (7 STEPS)
MUL MULP

32 bits command (13 STEPS)
— — — —

Flag signal: None

Explanation

1. S1: Multiplicand S2: Multiplication D: Product
2. This instruction multiplies S1 by S2 in BIN format and stores the result in D. Be careful with the positive/negative signs of S1, S2 and D when doing 16-bit and 32-bit operations.
   16-bit command:

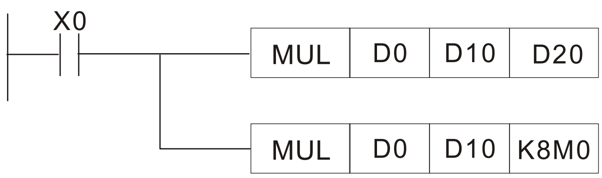


Symbol bit = 0 refers to a positive value.
Symbol bit = 1 refers to a negative value.

When D serves as a bit device, it can designate K1 ~ K4 and construct a 16-bit result, occupying consecutive 2 groups of 16-bit data.

Example

The 16-bit D0 is multiplied by the 16-bit D10 and brings forth a 32-bit product. The higher 16 bits are stored in D21 and the lower 16-bit are stored in D20. On/Off of the most left bit indicates the positive/negative status of the result value.



API					
23	**D**	**DIV**	**P**	(S1) (S2) (D)	BIN Division

	Bit Devices			**Word devices**								16 bits command (7 STEPS) DIV DIVP
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D	
S1				*	*	*	*	*	*	*	*	
S2				*	*	*	*	*	*	*	*	32 bits command (13 STEPS) — — — —
D							*	*	*	*	*	

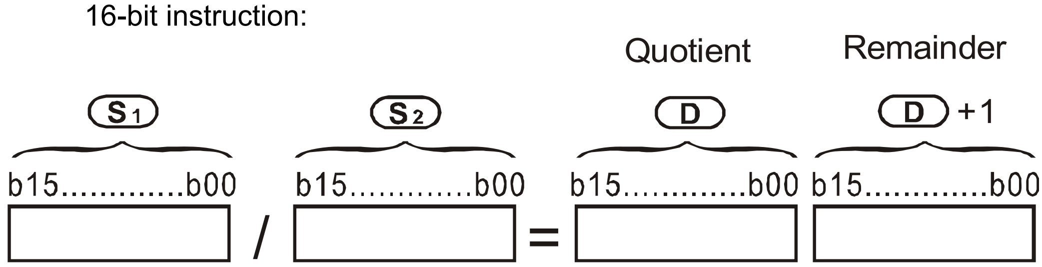
Operands:
In 16-bit instruction, **D** occupies 2 consecutive devices.

Flag signal: none`

Explanation

1. S1: Dividend S2: Divisor D: Quotient and remainder
2. This instruction divides S1 and S2 in BIN format and stores the result in D. Be careful with the positive/negative signs of S1, S2 and D when doing 16-bit and 32-bit operations.

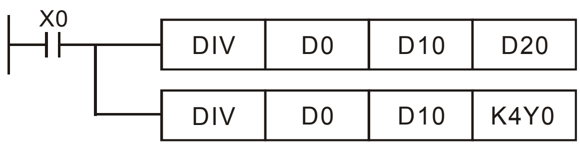
16-bit instruction:



If D is the bit device, it allocates K1~K14 to 16 bits and occupies 2 continuous sets of quotient and remainder.

Example

When X0 = On, D0 will be divided by D10; the quotient will be stored in D20 and remainder in D21. On/Off of the highest bit indicates the positive/negative value of the result.



API					
24	D	**INC**	P	(D)	Increment: BIN plus 1

	Bit Devices			Word devices							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
D							*	*	*	*	*

Operands: none

16 bits command (3 STEPS)
INC INCP

32 bits command (5 STEPS)
— — — —

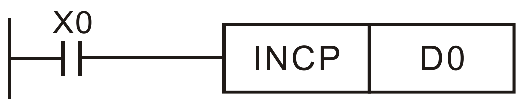
Flag signal: none

Explanation

1. D: Destination device
2. If the instruction is not a pulse execution one, the content in the designated device D will plus “1” in every scan period whenever the instruction is executed.
3. This instruction adopts pulse execution instructions (INCP).
4. In 16-bit operation, 32,767 pluses 1 and obtains -32,768. In 32-bit operation, 2,147,483,647 pluses 1 and obtains -2,147,483,648.

Example

When X0 goes from Off to On, the content in D0 pluses 1 automatically.



API					
25	**D**	**DEC**	**P**	(D)	Decrement: BIN minus 1

	Bit Devices			Word devices							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
D				*	*	*	*	*			

Operands: none

16 bits command (3 STEPS)
DEC DECP

32 bits command (5 STEPS)
— — — —

Flag signal: none

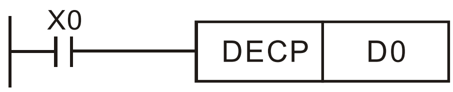
Explanation

D: Destination

1. If the command is not a pulse execution type, the content in the designated device D will minus "1" in every scan period whenever the instruction is executed.
2. This instruction adopts pulse execution instructions (DECP).
3. In 16-bit operation, -32,768 minuses 1 and obtains 32,767. In 32-bit operation, -2,147,483,648 minuses 1 and obtains 2,147,483,647.

Example

When X0 goes from Off to On, the content in D0 minuses 1 automatically.



API				
30	**ROR**	**P**	(D) (n)	Rotate to the Right

	Bit Devices			**Word devices**							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
D							*	*	*	*	*
n				*	*						

Operands:
D: if in KnY and KnM, only K4 (16 bits) is valid
n: n=K1~K16 (16 bits)

16 bit command (5 STEPS)
ROR RORP

32 bits command
— — — —

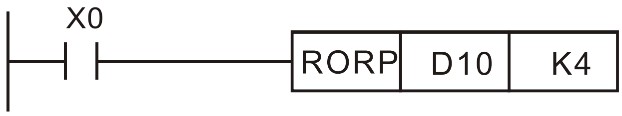
Flag signal: M1022 Carry flag

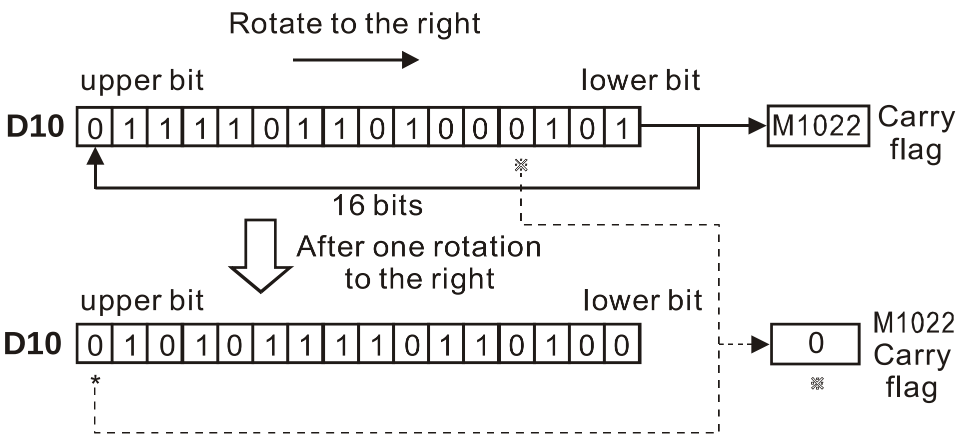
Explanation

1. D: Device to be rotated n: Number of bits to be rotated in 1 rotation
2. This instruction rotates the device content designated by **D** to the right for **n** bits.
3. This instruction adopts pulse execution instructions (RORP).

Example

When X0 goes from Off to On, the 16 bits (4 bits as a group) in D10 will rotate to the right, as shown in the figure below. The bit marked with ※ will be sent to carry flag M1022.





API		ROL		D n	Rotate to the Left
31			P		

	Bit Devices			Word devices							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
D							*	*	*	*	*
n				*	*						

Operands:
D: if in KnY and KnM, only K4 (16 bits) is valid
n: n=K1~K16 (16 bits)

16 bits command (5 STEPS)
ROL ROLP

32 bits command
— — — —

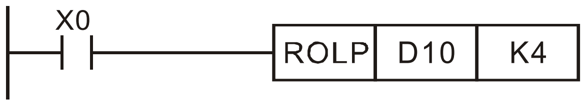
Flag signal: M1022 Carry flag

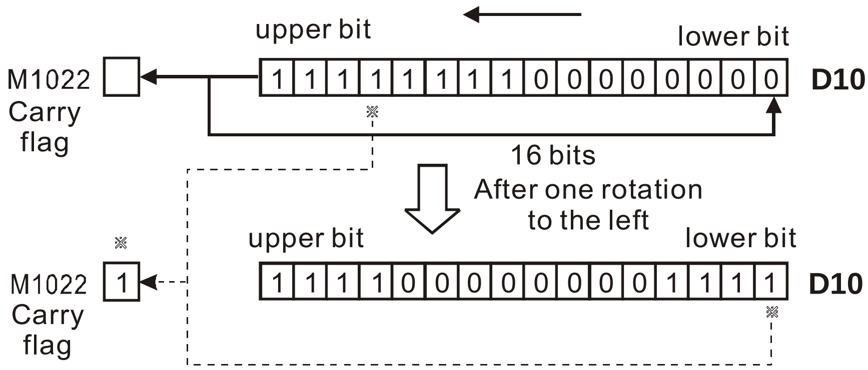
Explanation

1. D: Device to be rotated; n: Number of bits to be rotated in 1 rotation
2. This instruction rotates the device content designated by **D** to the left for **n** bits.
3. This instruction adopts pulse execution instructions (ROLP).

Example

When X0 goes from Off to On, the 16 bits (4 bits as a group) in D10 will rotate to the left, as shown in the figure below. The bit marked with ※ will be sent to carry flag M1022.





API		ZRST		D1 D2	Zero Reset
40			P		

	Bit Devices			Word devices								16 bits command (5 STEPS)
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D	ZRST ZRSTP
D1		*	*						*	*	*	32 bits command
D2		*	*						*	*	*	— — — —

Operands:
No of D_1 operand. ≦No. of D_2 operand
D_1 and D_2 must select same device type

Please refer to the specification of each model series for applicable range of the device.

Flag signal: none

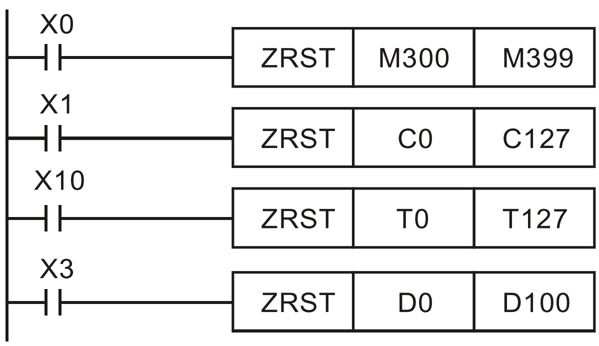
Explanation

D_1: Start device of the range to be reset **D_2**: End device of the range to be reset

When **D_1** > **D_2**, only operands designated by **D_2** will be reset.

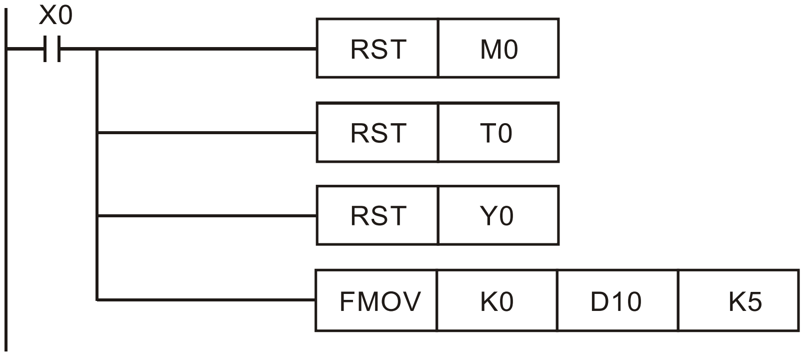
Example

1. When X0 = On, auxiliary relays M300 ~ M399 will be reset to Off.
2. When X1 = On, 16 counters C0 ~ C127 will all be reset (writing in 0; contact and coil being reset to Off).
3. When X10 = On, timers T0 ~ T127 will all be reset (writing in 0; contact and coil being reset to Off).
4. When X3 = On, data registers D0 ~ D100 will be reset to 0.



Remarks

1. Devices, e.g. bit devices Y, M, S and word devices T, C, D, can use RST instruction.
2. API 16 FMOV instruction is also to send K0 to word devices T, C, D or bit registers KnY, KnM, KnS for reset.



API					
215~217	D	**LD#**		(S1) (S2)	Contact Logical Operation LD#

	Bit Devices			Word devices							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S1				*	*	*	*	*	*	*	*
S2				*	*	*	*	*	*	*	*

Operands: #: &, |, ^

Please refer to the specifications of each model for the range of operands.

16 bits command (5 STEPS)

LD# ZRSTP

32 bits command (9 STEPS)

DLD# — — —

Flag signal: none

Explanation

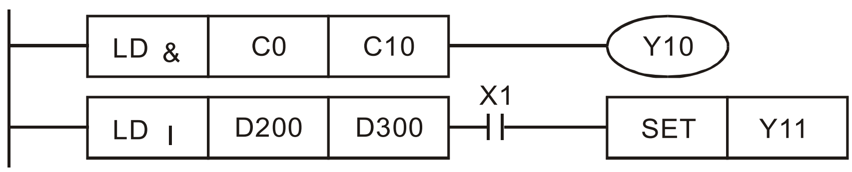
1. $\mathbf{S_1}$: Data source device 1 $\mathbf{S_2}$: Data source device 2
2. This instruction compares the content in $\mathbf{S_1}$ and $\mathbf{S_2}$. If the result is not "0", the continuity of the instruction is enabled. If the result is "0", the continuity of the instruction is disabled.
3. LD# (#: &, |, ^) instruction is used for direct connection with BUS.

API No.	16 -bit instruction	32 -bit instruction	Continuity condition	No-continuity condition
215	LD&	**D**LD&	$\mathbf{S_1}$ & $\mathbf{S_2}$ $\neq 0$	$\mathbf{S_1}$ & $\mathbf{S_2}$ $=0$
216	LD|	**D**LD|	$\mathbf{S_1}$ | $\mathbf{S_2}$ $\neq 0$	$\mathbf{S_1}$ | $\mathbf{S_2}$ $=0$
217	LD^	**D**LD^	$\mathbf{S_1}$ ^ $\mathbf{S_2}$ $\neq 0$	$\mathbf{S_1}$ ^ $\mathbf{S_2}$ $=0$

4. **&:** Logical "AND" operation
5. **|:** Logical "OR" operation
6. **^:** Logical "XOR" operation

Example

1. When the result of logical AND operation of C0 and C10 ≠ 0, Y10 = On.
2. When the result of logical OR operation of D200 and D300 ≠ 0 and X1 = On, Y11 = On will be retained.



API					
218~ 220	D	**AND#**		(S1) (S2)	Contact Logical Operation AND#

	Bit Devices			Word devices							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S1				*	*	*	*	*	*	*	*
S2				*	*	*	*	*	*	*	*

Operands: #: &, |, ^
Please refer to the specifications of each model for the range of operands.

16 bits command (5 STEPS)
AND# ZRSTP

32 bits command (9 STEPS)
DAND# — — —

Flag signal: none

Explanation

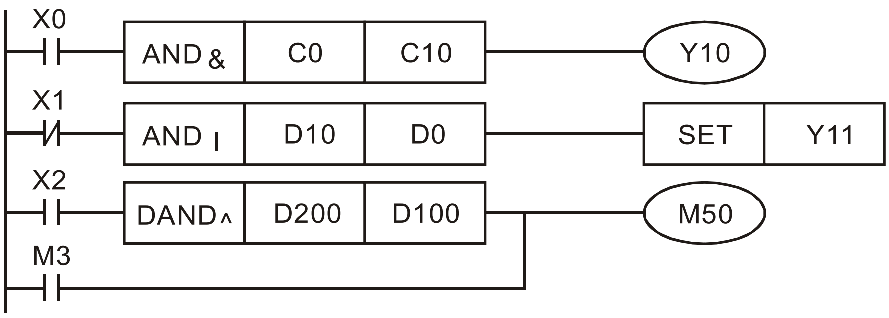
1. **S₁**: Data source device 1 **S₂**: Data source device 2
2. This instruction compares the content in S_1 and S_2. If the result is not "0", the continuity of the instruction is enabled. If the result is "0", the continuity of the instruction is disabled.
3. AND# (#: &, |, ^) is an operation instruction used on series contacts.

API No.	16 -bit instruction	32 -bit instruction	Continuity condition	No-continuity condition
218	AND&	**DAND&**	S_1 & S_2 $\neq 0$	S_1 & S_2 $=0$
219	AND|	**DAND|**	S_1 | S_2 $\neq 0$	S_1 | S_2 $=0$
220	AND^	**DAND^**	S_1 ^ S_2 $\neq 0$	S_1 ^ S_2 $=0$

4. **&:** Logical "AND" operation
5. **|:** Logical "OR" operation
6. **^:** Logical "XOR" operation

Example

1. When X0 = On and the result of logical AND operation of C0 and C10 ≠ 0, Y10 = On.
2. When X1 = Off and the result of logical OR operation of D10 and D0 ≠ 0 and X1 = On, Y11 = On will be retained.
3. When X2 = On and the result of logical XOR operation of 32-bit register D200 (D201) and 32-bit register D100 (D101) ≠ 0 or M3 = On, M50 = On.



API					
221~ 223	D	**OR#**		(S1) (S2)	Contact Logical operation OR#

	Bit Devices			Word devices							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S1				*	*	*	*	*	*	*	*
S2				*	*	*	*	*	*	*	*

Operand: #: &, |, ^

Please refer to the specifications of each model for the range of operands.

16 bits command (5 STEPS)

OR# ZRSTP

32 bits command (9 STEPS)

DOR# — — —

Flag signal: none

Explanation

1. $\mathbf{S_1}$: Data source device 1 $\mathbf{S_2}$: Data source device 2
2. This instruction compares the content in $\mathbf{S_1}$ and $\mathbf{S_2}$. If the result is not "0", the continuity of the instruction is enabled. If the result is "0", the continuity of the instruction is disabled.
3. OR# (#: &, |, ^) is an operation instruction used on parallel contacts.

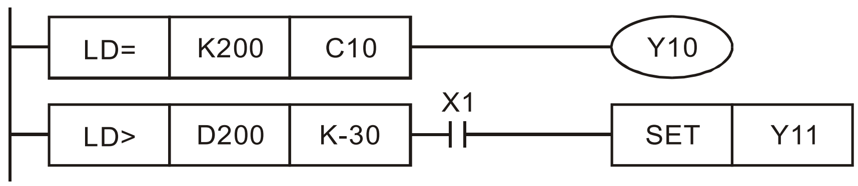
API No.	16 -bit instruction	32 -bit instruction	Continuity condition	No-continuity condition
221	OR&	**D**OR&	$\mathbf{S_1}$ & $\mathbf{S_2}$ $\neq 0$	$\mathbf{S_1}$ & $\mathbf{S_2}$ $= 0$
222	OR|	**D**OR|	$\mathbf{S_1}$ | $\mathbf{S_2}$ $\neq 0$	$\mathbf{S_1}$ | $\mathbf{S_2}$ $= 0$
223	OR^	**D**OR^	$\mathbf{S_1}$ ^ $\mathbf{S_2}$ $\neq 0$	$\mathbf{S_1}$ ^ $\mathbf{S_2}$ $= 0$

4. **&:** Logical "AND" operation
5. **|:** Logical "OR" operation
6. **^:** Logical "XOR" operation

Example

When X1 = On and the result of logical AND operation of C0 and C10 ≠ 0, Y10 = On.

1. M60 will be On, if X2 and M30 are On with one of the following two conditions: 1. The OR operation result of 32-bit register D10 (D11) and 32 bits register D20(D21) does not equal to 0. 2. The XOR operation result of 32 bits counter C235 and 32bits register D200 (D201) does not equal 0.



API					
224~ 230	D	**LD※**		(S1) (S2)	Load Compare※

	Bit Devices			Word devices								16 bits command (5 STEPS) LD※ ZRSTP
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D	32 位 bits command (9 STEPS) DLD※ — — —
S1				*	*	*	*	*	*	*	*	
S2				*	*	*	*	*	*	*	*	
Operands: ※: =, >, <, <>,≦,≧ Please refer to the specifications of each model for the range of operands.												Flag signal: none

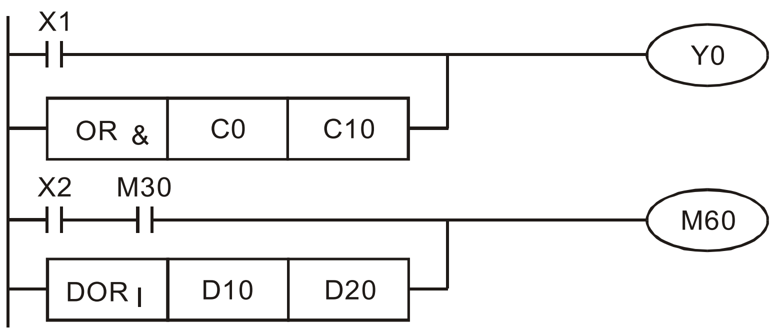
Explanation

1. S_1: Data source device 1 S_2: Data source device 2
2. This instruction compares the content in S_1 and S_2. Take API224 (LD=) for example, if the result is "=", the continuity of the instruction is enabled. If the result is "≠", the continuity of the instruction is disabled.
3. LD※ (※: =, >, <, <>, ≤, ≥) instruction is used for direct connection with BUS.

API No.	16 -bit instruction	32 -bit instruction	Continuity condition	No-continuity condition
224	LD=	DLD=	$S_1 = S_2$	$S_1 \neq S_2$
225	LD>	DLD>	$S_1 > S_2$	$S_1 \leqq S_2$
226	LD<	DLD<	$S_1 < S_2$	$S_1 \geqq S_2$
228	LD<>	DLD<>	$S_1 \neq S_2$	$S_1 = S_2$
229	LD<=	DLD<=	$S_1 \leqq S_2$	$S_1 > S_2$
230	LD>=	DLD>=	$S_1 \geqq S_2$	$S_1 < S_2$

Example

1. When the content in C10 = K200, Y10 = On.
2. When the content in D200 > K-30 and X1 = On, Y11= On will be retained.



API				
232~ 238	D	**AND※**	(S1) (S2)	AND Compare※

	Bit Devices			Word devices							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S1				*	*	*	*	*	*	*	*
S2				*	*	*	*	*	*	*	*

Operands: ※: =, >, <, <>, ≦, ≧

Please refer to the specifications of each model for the range of operands.

16 bits command (5 STEPS)

AND※ ZRSTP

32 bits command (9 STEPS)

DAND※ — — —

Flag signal: none

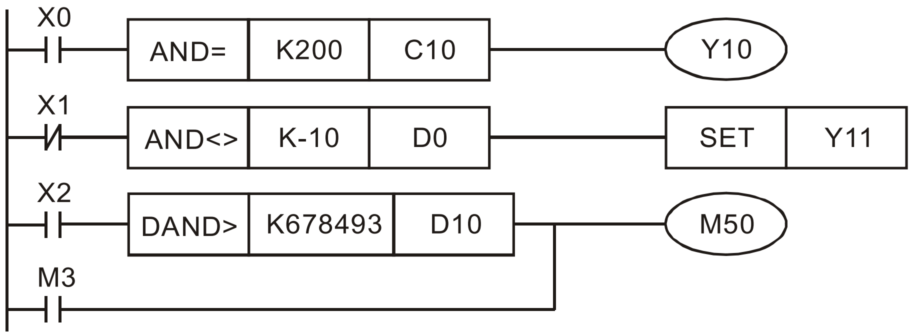
Explanation

1. S_1: Data source device 1 S_2: Data source device 2
2. This instruction compares the content in S_1 and S_2. Take API232 (AND=) for example, if the result is "=", the continuity of the instruction is enabled. If the result is "≠", the continuity of the instruction is disabled.
3. AND※ (※: =, >, <, <>, ≤, ≥) is a comparison instruction is used on series contacts

API No.	16 –bit instruction	32 –bit instruction	Continuity condition	No-continuity condition
232	AND＝	DAND＝	$S_1 = S_2$	$S_1 \neq S_2$
233	AND＞	DAND＞	$S_1 > S_2$	$S_1 \leqq S_2$
234	AND＜	DAND＜	$S_1 < S_2$	$S_1 \geqq S_2$
236	AND＜＞	DAND＜＞	$S_1 \neq S_2$	$S_1 = S_2$
237	AND＜＝	DAND＜＝	$S_1 \leqq S_2$	$S_1 > S_2$
238	AND＞＝	DAND＞＝	$S_1 \geqq S_2$	$S_1 < S_2$

Example

1. When X0 = On and the content in C10 = K200, Y10 = On.
2. When X1 = Off and the content in D0 ≠ K-10, Y11= On will be retained.
3. When X2 = On and the content in 32-bit register D0 (D11) < 678,493 or M3 = On, M50 = On.



API					
240~ 246	D	**OR※**		(S1) (S2)	OR Compare※

	Bit Devices			Word devices								16 bits command (5 STEPS)
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D	OR※ ZRSTP
S1				*	*	*	*	*	*	*	*	32 bits command (9 STEPS)
S2				*	*	*	*	*	*	*	*	DOR※ — — —

Operands: ※: =, >, <, <>,≦,≧

Please refer to the specifications of each model for the range of operands.

Flag signal: none

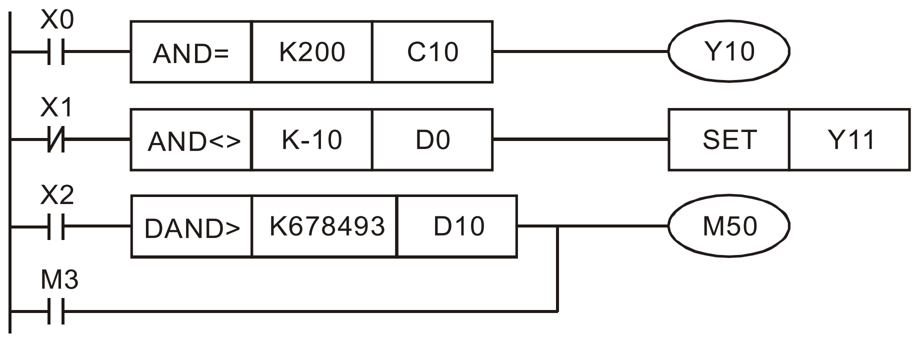
Explanation

1. **S_1**: Data source device 1 **S_2**: Data source device 2
2. This instruction compares the content in **S_1** and **S_2**. Take API240 (OR=) for example, if the result is "=", the continuity of the instruction is enabled. If the result is "≠", the continuity of the instruction is disabled.
3. OR※ (**※:** =, >, <, <>, ≤, ≥) is an comparison instruction used on parallel contacts.

API No.	16 -bit instruction	32 -bit instruction	Continuity condition	No-continuity condition
232	AND＝	**D**AND＝	$S_1 = S_2$	$S_1 \neq S_2$
233	AND＞	**D**AND＞	$S_1 > S_2$	$S_1 \leqq S_2$
234	AND＜	**D**AND＜	$S_1 < S_2$	$S_1 \geqq S_2$
236	AND＜＞	**D**AND＜＞	$S_1 \neq S_2$	$S_1 = S_2$
237	AND＜＝	**D**AND＜＝	$S_1 \leqq S_2$	$S_1 > S_2$
238	AND＞＝	**D**AND＞＝	$S_1 \geqq S_2$	$S_1 < S_2$

Example

4. When X1 = On and the present value of C10 = K200, Y0 = On.
5. When X1 = Off and the content in D0 ≠ K-10, Y11= On will be retained.
6. M50 will be On when X2=On and the content of 32 bits register D0(D11) <678,493 or M3= On.



16.5.5 Description to drive's special commands

API				
139	RPR	P	S1 S2	Read the AC motor drive's parameters

	Bit Devices			Word devices							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S1				*	*						*
S2											*

Operands: none

16 bits command (5 STEPS)
RPR RPRP

32 bits command
— — — —

Flag signal: none

Explanation S1: Data address for reading S2: The register that saves the read data

API				
140	WPR	P	S1 S2	Write the AC motor drive's parameters

	Bit Devices			Word devices							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S1				*	*						*
S2				*	*						*

Operands: None

16 bits command (5 STEPS)
WPR WPRP

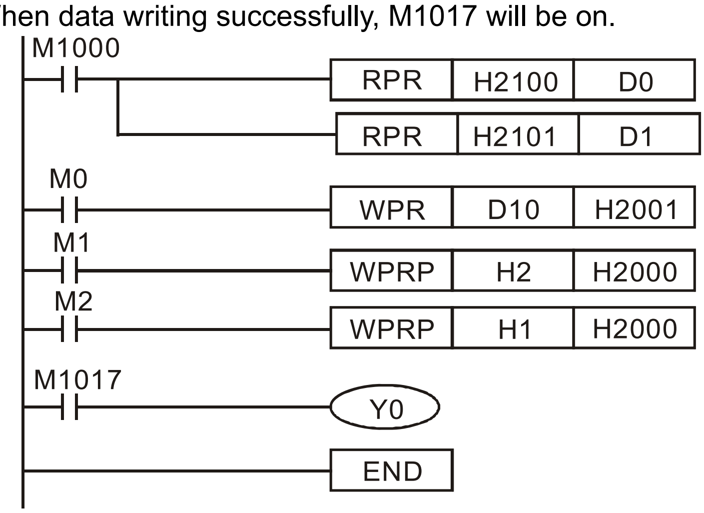
32 bits command
— — — —

Flag signal: none

Explanation S1: The data for writing; S2: The parameters address for the write data.

Example

1. It will read the data in parameter H2100 of the C2000 and write into D0; the data in parameter H2101 is read and write into D1.
2. When M0=On, data in D10 will be written into Pr. H2001 of C2000.
3. When M1=ON, data in H2 will be written into Pr. H2001 of C2000, which is to activate the AC motor drive.
4. When M2=ON, data in H1 will be written into H2000 of C2000, which is to stop the AC motor drive.
5. When data writing successfully, M1017 will be on.



API		FPID		S1 S2 S3 S4	PID control for the AC motor drive
141			P		

	Bit Devices			Word devices								16 bits command (9 STEPS)
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D	FPID FPIDP
S1				*	*						*	
S2				*	*						*	32 bits command
S3				*	*						*	— — — —
S4				*	*						*	
Operands: None												Flag signal: None

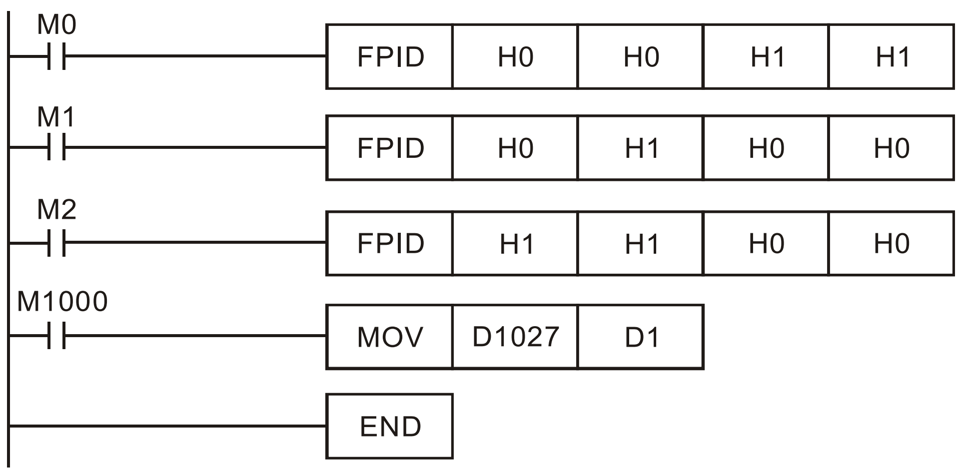
Explanation

1. S1: PID Set Point Selection(0-4), S2: Proportional gain P (0-100), S3: Integral Time I (0-10000), S4: Derivative control D (0-100)

2. This command FPID can control the PID parameters of the AC motor drive directly, including Pr.08.00 PID set point selection, Pr.08.01 Proportional gain (P), Pr.08.02 Integral time (I) and Pr.08.03 Derivative control (D)

Example

1. Assume that when M0=ON, S1 is set to 0 (PID function is disabled), S2=0, S3=1 (unit: 0.01 seconds) and S4=1 (unit: 0.01 seconds).
2. Assume that when M1=ON, S1 is set to 0 (PID function is disabled), S2=1 (unit: 0.01), S3=0 and S4=0.
3. Assume that when M2=ON, S1 is set to 1(frequency is inputted by digital keypad), S2=1 (unit: 0.01), S3=0 and S4=0.
4. D1027: frequency command after PID calculation.



API		
142	**FREQ** P	S1 S2 S3	Operation control of the AC motor drive

	Bit Devices			Word devices							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S1				*	*						*
S2				*	*						*
S3				*	*						*

Operands: None

16 bits command (7 STEPS)
FREQ FREQP

32 bits command
— — — —

Flag signal: M1028

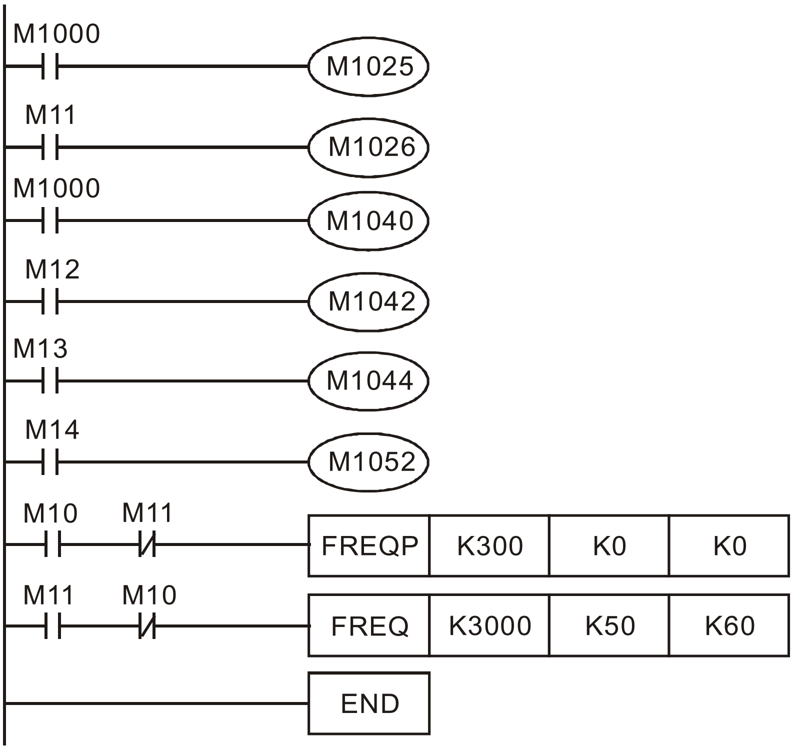
Explanation

1. S1: frequency command, S2: acceleration time, S3: deceleration time
2. This command can control frequency command, acceleration time and deceleration time of the AC motor drive. Special register control is shown as following:

M1025: controls RUN (On)/STOP (Off) of the drive. (Run is valid when Servo is On (M1040 On).)
M1026: Operation directions FWD (On)/REV (Off) of the drive.
M1040: controls Servo On (On)/ Servo Off (Off).
M1042: enable quick stop(ON)/ disable quick stop(Off)
M1044: enable Stop (On)/ disable stop(Off)
M1052: frequency locked (On)/ disable frequency locked(Off)

Example

1. M1025: controls RUN (On)/STOP (Off) of the drive. M1026: operation direction FWD (On)/REV (Off) of the drive. M1015: frequency attained.
2. When M10=ON, setting frequency command of the AC motor drive to K300(3.00Hz) and acceleration/deceleration time is 0.
3. When M11=ON, setting frequency command of the AC motor drive to K3000(30.00Hz), acceleration time is 50 and deceleration time is 60.



API		CANRX		(S1) (S2) (S3) (D)	Read CANopen slave data
261			P		

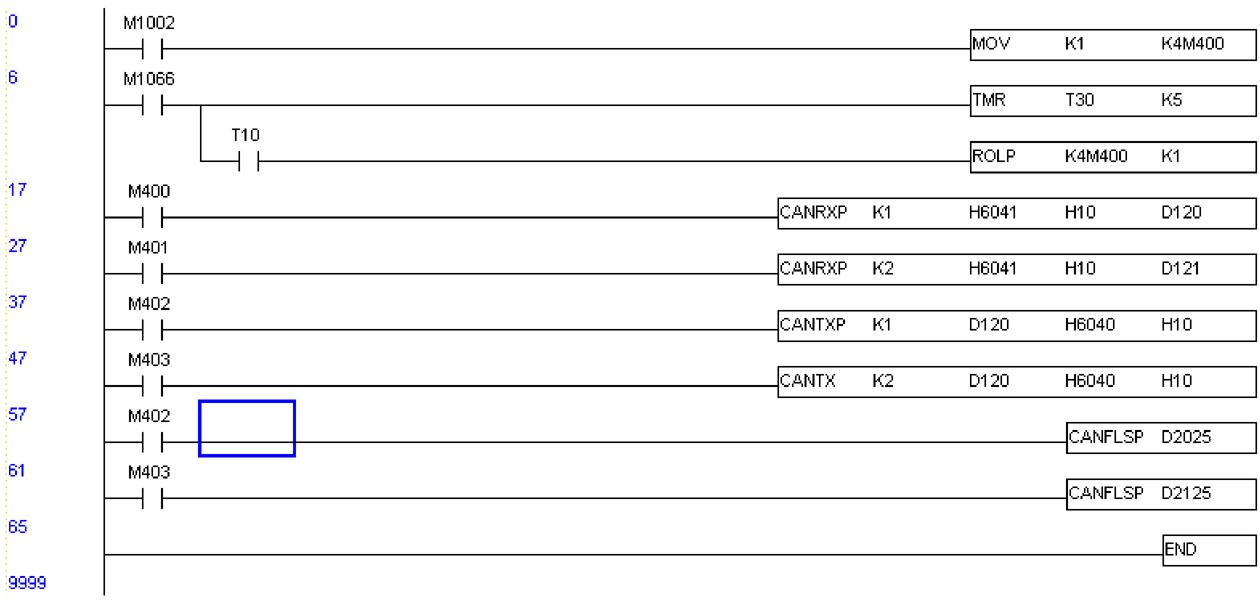
	Bit Devices			Word devices								16 bits command (7 STEPS)
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D	FREQ FREQP
S1				*	*							32 bits command
S2				*	*							– – – –
S3				*	*							
D									*	*	*	Flag signal: M1028
Operand: none												

Explanation

- S1: Slave station number, S2: main index,
  S3: sub-index + bit length, D: save address
- Command CANRX can read the corresponding slave. Index. When executing this command, it will send SDO message to the slave. At this time, M1066 and M1067 are 0 but when reading is complete M1066 will set to 1. If the slave replied an accurate response, the value will be written to the designated register and M1067 is now set to 1. However, if the slave replied an inaccurate response, this error message will be recorded in D1076~D1079.

Example

M1002: touch once to activate PLC and change K4M400=K1. After the change, different message will be displayed when M1066 is set to 1.



API	CANTX	P	S1 S2 S3 S4	Write CANopen slave data
264				

	Bit Devices			Word devices							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S1				*	*						
S2				*	*				*	*	*
S3				*	*						
S4				*	*						

Operands: None

16 bits command (7 STEPS)
FREQ FREQP

32 bits command
— — — —

Flag signal: M1028

Explanation

- S1: slave station number, S2: the address to write,
- S3: main index, S4: sub-index+ bit length.
- Command CANTX can read the corresponding index of the slave. When executing this command, it will send SDO message to the slave. At this time, M1066 and M1067 are 0 but when reading is complete M1066 will set to 1. If the slave replied an accurate response, the value will be written to the designated register and M1067 is now set to 1. However, if the slave replied an inaccurate response, this error message will be recorded in D1076~D1079.

API		CANFLS		D	Update the mapping special D of CANopen
265			P		

	Bit Devices			Word devices							16 bits command (7 STEPS) FREQ FREQP
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
D				*	*						

Operands: None

32 bits command
— — — —

Flag signal: M1028

Explanation

- D: the special D for update.
- CANFLS can update the Special D command. When it executes in read only mode, it sends equivalent message as CANRX to the slave and saves the slave response to this particular Special D. When it executes in read/write mode, it sends equivalent message as CANTX to the slave and saves this special D value to the corresponding slave.
- M1066 and M1067 are both 0. When reading is complete, M1066 will be 1 and this value will write to the designated register if the slave replies an accurate response. When slave replies a fault response then M1067 will be 0 and this error message will be recorded to D1076~D1079.

16.6 Error and Troubleshoot

Fault	ID	Fault Descript	Corrective Action
PLod	50	Data write error	Check if there is error in the program and download the program again.
PLSv	51	Data write error when executing	Re-apply the power and download the program again.
PLdA	52	Program upload error	Upload again. If error occurs continuously, please return to the factory.
PLFn	53	Command error when download program	Check if there is error in the program and download the program again.
PLor	54	Program capacity exceeds memory capacity	Re-apply the power and download the program again.
PLFF	55	Command error when executing	Check if there is error in the program and download the program again.
PLSn	56	Check sum error	Check if there is error in the program and download the program again.
PLEd	57	There is no “END” command in the program	Check if there is error in the program and download the program again.
PLCr	58	The command MC is continuous used more than 9 times	Check if there is error in the program and download the program again.
PLdF	59	Download program error	Check if there is error in the program and download the program again.
PLSF	60	PLC scan time over-time	Check if the program code is inaccurately written and download the program again.

16.7 CANopen Master Application

Simple control of multiple-axes for certain application can be done by C2000 if the device supports CANopen protocol. One of the C2000 could acts as Master to perform simple synchronous control, e.g. position, speed, zero return, and torque control. The setup can be done in 7 steps:

Step 1: Activate CANopen Master

1. Set Pr.09-45 to 1. (To activate Master function, turn off the power after setting and reboot. The digital keypadKPC-CC01 status will display “CAN Master”.)
2. Set Pr.00-02 to 6 for PLC reset. (Note: This action will erase the program and PLC register and will be set to factory setting.)
3. Turn off the power and reboot.
4. Set PLC control to”**PLC Stop mode**” by digital keypad KPC-CC01. (If the digital keypad is KPC-CE01 series, set PLC control to”PLC 2”. If the drive just came out of the factory, since PLC program is not yet installed, the digital keypad will show PLFF warning code.)

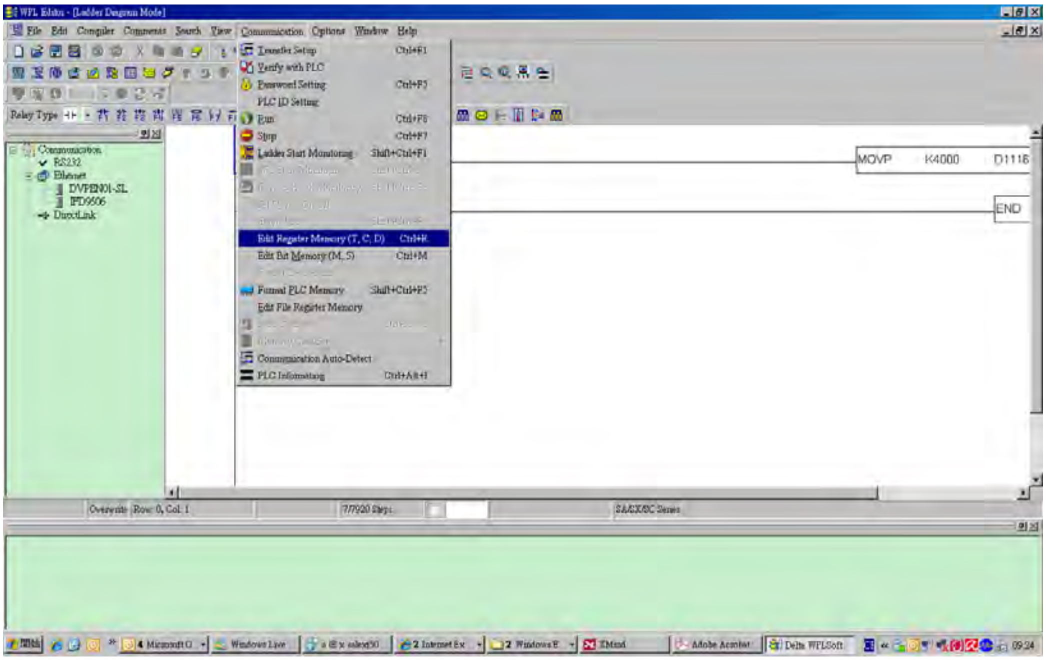
Step 2: Configuration of the Special D in Master

Each slave occupies 100 of Special D space and is numbered 1 to 8. There are in total of 8 stations. Please refer to 4-3 Special Register in this chapter for Special D register definition.

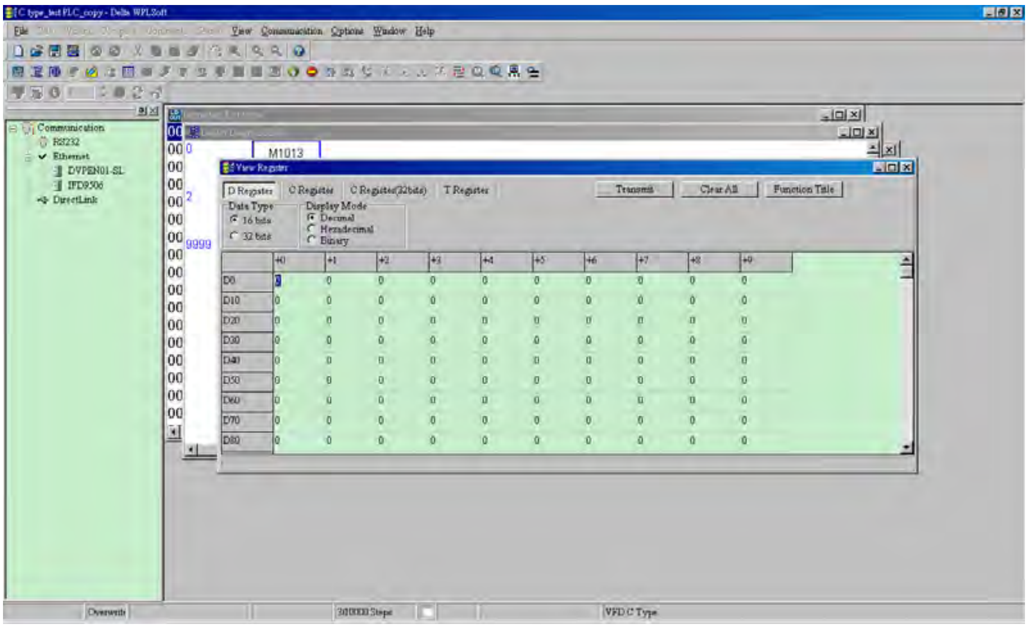
Slave No.	Slave No. 1	D2000	Station number
		D2001	Factory code(L)
		~	~
		D2099	The mapping address 4(H) of receiving station 4
	Slave No. 2	D2100	Station number
		D2101	Factory code(L)
		~	~
		D2199	The mapping address 4 (H)of receiving station 4
	Slave No. 3	D2200	Station number
		D2201	Factory code(L)
		~	~
		D2299	The mapping address 4 (H)of receiving station 4
	Slave No. 8	D2700	Station number
		D2701	Factory code(L)
		~	~
		D2799	The mapping address 4(H) of receiving station 4

1. When communication cable 485 is connected, set PLC status to “stop” by WPL soft. (If PLC had already switched to “PLC Stop” mode then PLC status should be “stop” already.)

2. To control the slave address and corresponding station. For example, control 2 stations of the slave (max. 8 stations synchronous control), if the station number is 21 and 22, set D2000 and D2100 to 20 and 21 and then set D2200, D2300, D2400, D2500, D2600 and D2700 to 0. The setting can be done via PLC software editor WPL, follow the steps shown:
   - Open WPL Editor > communication> Edit Register Memory**(T C D)**



   - When the "Register" window appears, click "Transmit".



   - When transmission window appear, select "read" and input the range D2000~D2799 then press enter. The value in D2000~D2799 will be read. If communication failed, check the communication format (pre-defined PLC station is 2, 9600, 7N2, ASCII).
   - Insert the slave station for control. Set D2000 and D2100 to 20 and 21 then set D2200, D2300, D2400, D2500, D2600 and D2700 to 0.
   - Click"Transmit" again. When transmission window appears, input the range D2000~D2799 and enter. The value in D2000~D2799 will be write (If communication

error occur and display failed, it means PLC is not in “stop” status. The value can only be write in “stop” status, pleas switch PLC to “stop”.)

- Another method is by setting D1091. Set the corresponding bit of the excluding slave to 0 (slave station range from No.1~8). For example, if the user wants to exclude slave No. 2, 6 and 7, please set D1091 = 003B by following steps: WPL Editor > communication> Edit Register Memory**(T C D)**

3. Setup the communication setting. If following conditions apply to you then no additional setting needs to be done:

☑ **If the only control in this application is the speed mode of AC motor drive.** (For other control such as position and torque control, D2000~D2799 should be set. Please refer to synchronous control on position, torque and zero return for more set up detail.

To perform synchronous control on position for the slave, please enable the corresponding function PDO 3. (P to P function is not yet supported by C2000.)

- To activate PDO 3 TX (Master sending command to Slave), please set up bit 8~11 of the PLC address D2034+n*100. This special D register is defined as below:

	PDO4		PDO3		PDO2		PDO1	
	Torque		Position		Remote I/O		Speed	
Bit	15	14 ~ 12	11	10 ~ 8	7	6 ~ 4	3	2 ~ 0
Definition	En	Number	En	Number	En	Number	En	Number

The pre-defined setting of PDO 3 TX has corresponded to CANopen control word “Index 6040”and CANopen target position” Index 607A”. If position control is the only control in this application then simply set Special D register value to 0x0A00.

- To activate PDO 3 RX (Slave response with the status to Master), please set up bit 8~11 of the PLC address D2067+n*100. This special D register is defined as below:

	PDO4		PDO3		PDO2		PDO1	
	Torque		Position		Remote I/O		Speed	
Bit	15	14 ~ 12	11	10 ~ 8	7	6 ~ 4	3	2 ~ 0
Definition	En	Number	En	Number	En	Number	En	Number

The pre-defined setting of PDO 3 TX has corresponded to CANopen control word “Index 6041”and CANopen actual position” Index 6064”. If position control is the only control in this application then simply set Special D register value to 0x0A00.

In same theory, to perform torque control, please enable the mapping function PDO4.

☑ The speed for 1 corresponding cycle is 8ms. (When shorten the cycle time to **<** 8ms, make sure the time is enough for the data to be transmitted.

User should calculate the corresponding PDO quantity before setting the cycle. The PDO quantity should not be greater than the N. The quantity can be calculated by the following formula.

N = (1 cycle (ms) * rate (kbs))/250

Example: 1 cycle is 2ms, speed= 1000k, max PDO value is 2*1000/250 = 8. If user wants to set the cycle time to 2ms, turns off 4 of the C type AC motor drive slave stations must be turned off (since the pre-defined setting is 8 slaves, half of the slave station would be 4). The slave station can be turned off by setting the D2000+n*100 of the unused slaves to 0.

☑ **Number of control station ≤ 8.**

Controlling 8 slave stations at once can only be done by asynchronous control where to Read/Write the slave is done by CANRX and CANTX command. This is similar to the Read/Write action of Modbus protocol.

☑ **The slave complies with DS402 standard.**

☑ **Does not control Slave IO terminal.**

☑ If above conditions do not apply, please set up the slave corresponding addresses manually by open WPL editor > communication> Edit Register Memory **(T C D)**.

Step 3: Set up Master station number and communication speed.

☑ Set up the station number for the Master (the default setting of Pr.09-46=100). Do not to set the same station number as the Slave.

☑ Set up CANopen communication parameter Pr.09-37. It does not matter if the drive is defined as a Master or a Slave, communication speed is set by Pr.09-37 in both case.

Step 4: Coding

Real-time corresponding action: the data can be Read/Write directly to the corresponding special “D” register.

Non Real-time corresponding action:

Read: Reading is made by CANRX command. When reading process is complete, M1066=1. If reading succeeded, M1067 =1; if reading failed, M1067= 0.

Write: Writing is made by CANTX command. When writing process is complete, M1066 =1. If writing succeeded, M1067=1; if reading failed, M1067 =0.

Update: Updating the data is made by CANFLS command. (If special D register is defined as RW type, Master will write the value into the slave. If special D register is defined as RO type, then the data in the Slave will be read and write into the Master.) When updating process is complete, M1066 will be 1. If updating succeeded, M1067=1; if updating failed, M1067=0.

NOTE

When executing CANRX, CANTX and CANFLS commands, the device will wait till M1066 is completed before the next CANRX, CANT or CANFLS begins. When the commands completed, download the program to the drive. (Note: The factory setting of PLC communication protocol is ASCII 7N2 9600 and station number is 2. Please change WPL

Editor setting at Setting> Communication Setting)

Step 5: Setting the Slave station number, communication speed, operation source and command source

CANopen communication is supported by Delta C2000 series and EC series AC motor drive. The corresponding slave and CANopen speed are shown as below:

	Corresponding Parameter of Drive		Value	Definition
	C2000	E-C		
Slave address	09-36	09-20	0	Disable CANopen Hardware Interface
			1~127	CANopen communication address
CANopen speed	09-37	09-21	0	1M
			1	500K
			2	250K
			3	125K
			4	100K
			5	50K
Source of operation command	00-21		3	
		02-01	5	
Source of frequency command	00-20		6	
		02-00	5	
Torque command	11-34		3	

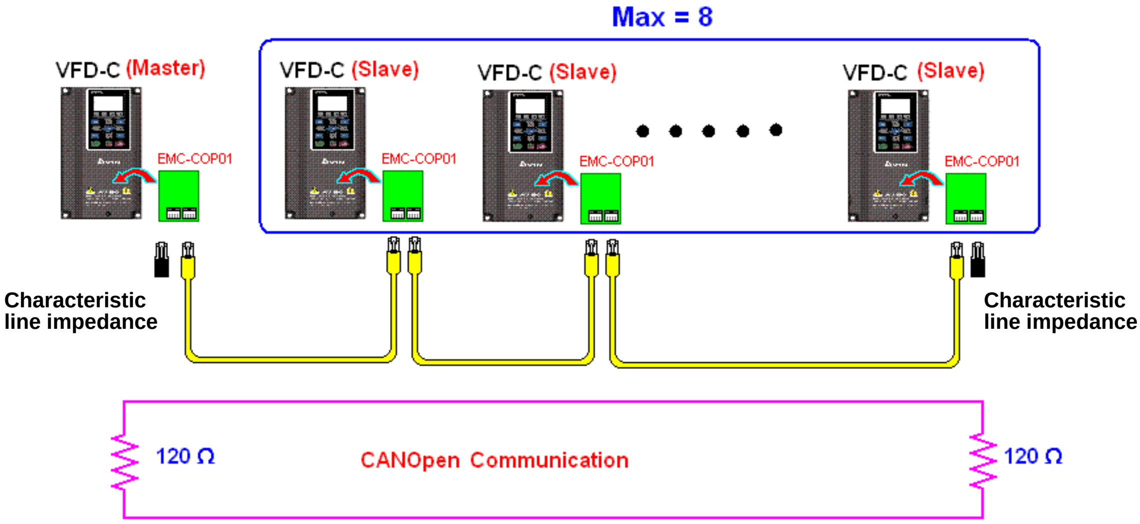
The only servo motor and drive that supports CANopen communication interface is A2 series. The corresponding slave station number and communication speed are shown as below:

	Corresponding Parameter of Drive	Value	Definition
	A2		
Slave address	03-00	1~127	CANopen communication address
CANopen speed	bit8~11 of Pr.03-01 XRXX	R= 0	125K
		R= 1	250K
		R= 2	500K
		R= 3	750K
		R= 4	1M

Control/Command Source	01-01	B	

Step 6: Hardware connection

The terminating resistor must be installed at the two farthest ends as shown in the figure below:



Step 7: Activate PLC Control Function

Download the program after coding is complete and switch PLC mode to Run status. Then reboots the power for Slave and Master. Please refer to CANMaster Test 1 vs. 2 driver.dvp.

➢ **Example:**

C2000 AC motor drive (1 master vs. 2 slave control)

Step 1: Activate CANopen Master

- ☑ Set Pr.09-45 to 1. (To activate Master function, turn off the power after setting and reboot. The digital keypadKPC-CC01 status will display “CAN Master”.)
- ☑ Set Pr.00-02 to 6 for PLC reset. (Note: This action will erase the program and PLC register and will be set to factory setting.)
- ☑ Turn off the power and reboot.
- ☑ Set PLC control to”**PLC Stop mode**” by digital keypad KPC-CC01. (If the digital keypad is KPC-CE01 series, set PLC control to”PLC 2”. If the drive just came out of the factory, since PLC program is not yet installed, the digital keypad will show PLFF warning code.)

Step 2: Configuration of the Special D in Master

- ☑ Open WPL editor
- ☑ Set PLC mode to PLC Stop (PLC2) via the keypad
- ☑ WPL editor read D1070~D1099 and

D2000~D2799

- ☑ Set D2000=10 and D2100=11
- ☑ Set D2100, 2200, 2300 2400 2500 2600 2700=0
- ☑ Download D2000~D2799 setting

Step 3: Set up Master station number and communication speed

- ☑ Set up the station number for the Master (the default setting of Pr.09-46=100). Do not to set the same station number as the Slave.
- ☑ Set up CANopen communication speed to 1 M (parameter Pr.09-37= 0). It does not matter if the drive is defined as a Master or a Slave, communication speed is set by Pr.09-37 in both case.

Step 4: Coding

Real-time corresponding action: the data can be Read/Write directly to the corresponding special "D" register.

Non Real-time corresponding action:

Read: Reading is made by CANRX command. When reading process is complete, M1066=1. If reading succeeded, M1067 =1; if reading failed, M1067= 0.

Write: Writing is made by CANTX command. When writing process is complete, M1066 =1. If writing succeeded, M1067=1; if reading failed, M1067 =0.

Update: Updating the data is made by CANFLS command. (If special D register is defined as RW type, Master will write the value into the slave. If special D register is defined as RO type, then the data in the Slave will be read and write into the Master.) When updating process is complete, M1066 will be 1. If updating succeeded, M1067=1; if updating failed, M1067=0.

NOTE

When executing CANRX, CANTX and CANFLS commands, the device will wait till M1066 is completed before the next CANRX, CANT or CANFLS begins. When the commands completed, download the program to the drive. (Note: The factory setting of PLC communication protocol is ASCII 7N2 9600 and station number is 2. Please change WPL setting at setting> communication setting**)**

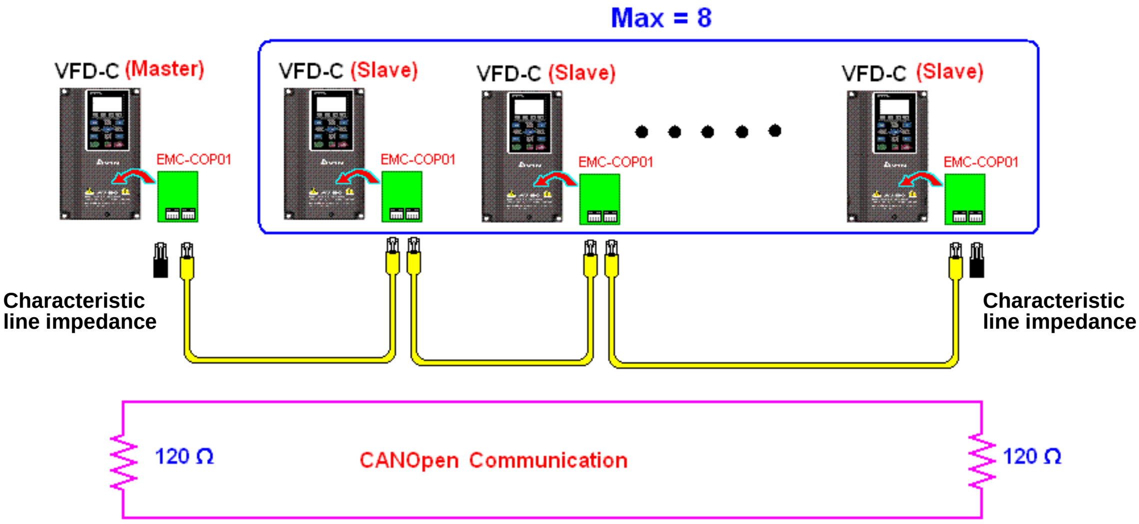
Step 5: Set Slave station number and communication speed.

Slave No.1: Pr.09-37 = 0(speed 1M), Pr.09-36=10 (station number 10)

Slave No.2: Pr. 09-37 = 0(speed 1M), Pr.09-36=10 (station number 11)

Step 6: Hardware connection

The terminating resistor must be installed at the two farthest ends as shown in the figure below:



Step 7: Activate PLC Control Function

Download the program after coding is complete and switch PLC mode to Run status. Then reboots the power for Slave and Master. Please refer to CAN Master Test 1 vs. 2 driver.dvp.