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Smarter. Greener. Together.

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Delta Fan/Pump Vector Control Drive
CP2000 Series
User Manual

Smarter. Greener. Together.

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.
- ☑ The performance of electrolytic capacitor will degrade if it is not charged for a long time. It is recommended to charge the driver which is stored in no charge condition every 2 years for 3~4 hours.
- ☑ Please use adjustable AC power source (ex: AC autotransformer) to charge the driver gradually to rated voltage, and should not charge it directly with rated voltage.
- ☑ Pay attention to the following when transporting and installing this package (including wooden crate, wood stave and carton box)
  1. If you need to sterilize, deworm the wooden crate or carton box, please do not use steamed smoking sterilization or you will damage the VFD.
  2. Please use other ways to sterilize or deworm.
  3. You may use high temperature to sterilize or deworm. Leave the packaging materials in an environment of over 56℃ for 30 minutes.
- ☑ It is strictly forbidden to use steamed smoking sterilization. The warranty does not covered VFD damaged by steamed smoking sterilization.

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 Board: V1.22 Keypad: V1.10

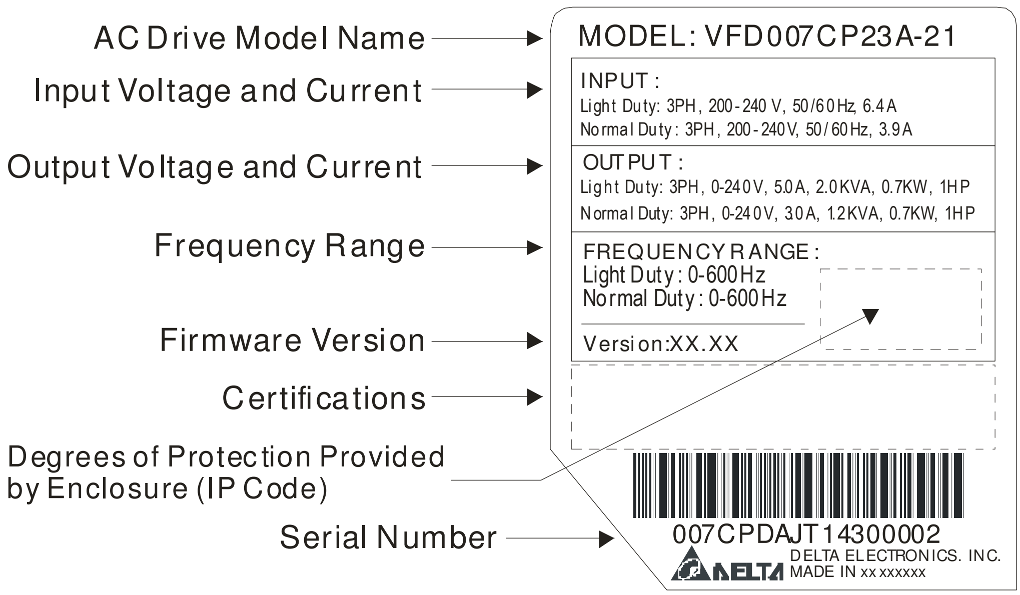
Chapter 1 Introduction

Receiving and Inspection

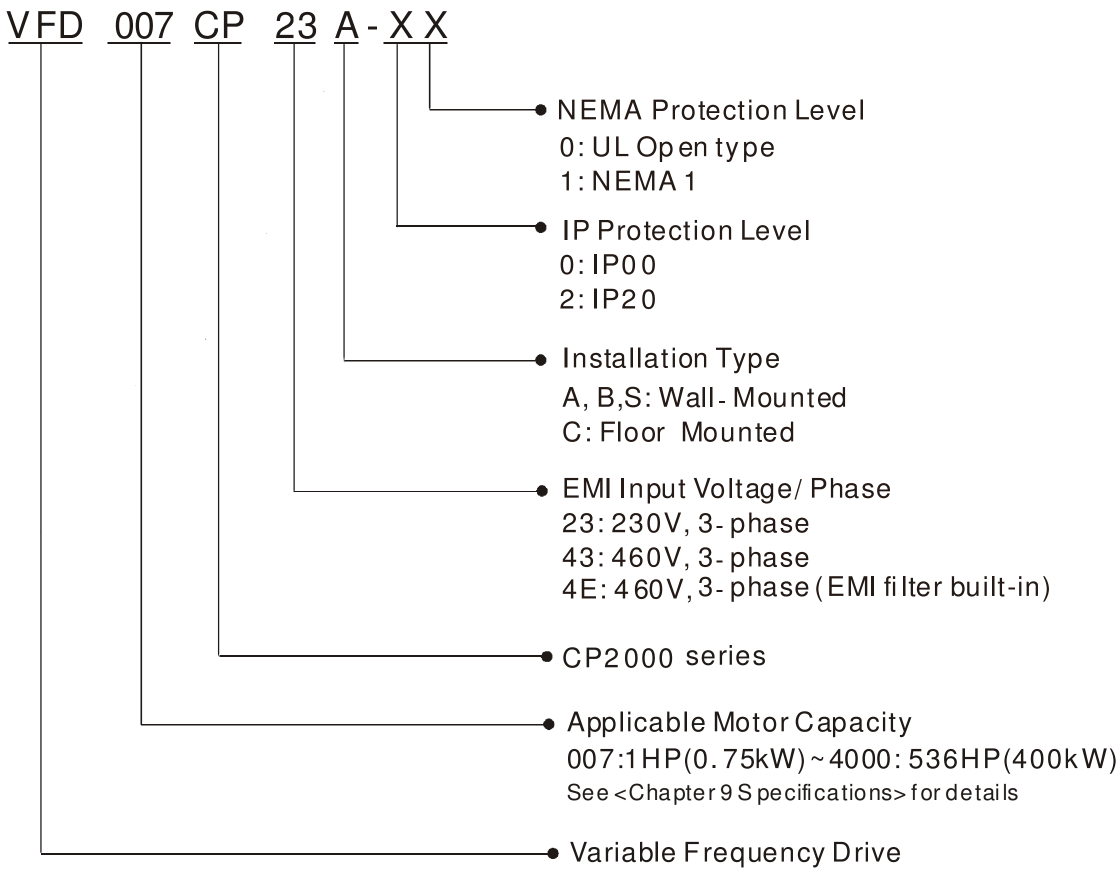
After receiving the AC motor drive, please check for the following:

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. When wiring the AC motor drive, please make sure that the wiring of input terminals “R/L1, S/L2, T/L3” and output terminals”U/T1, V/T2, W/T3” are correct to prevent drive damage.
5. When power is applied, select the language and set the parameter groups via the digital keypad (KPC-CC01).

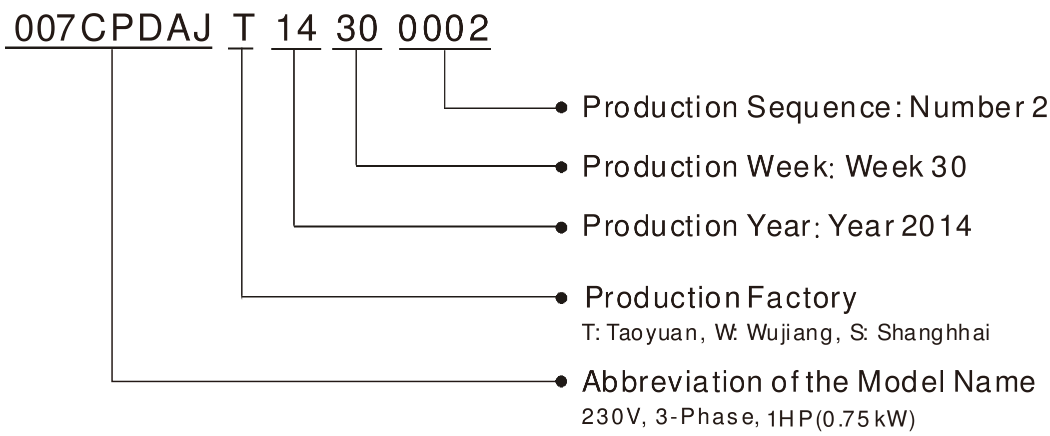
Nameplate Information:



Model Name:



Serial Number:



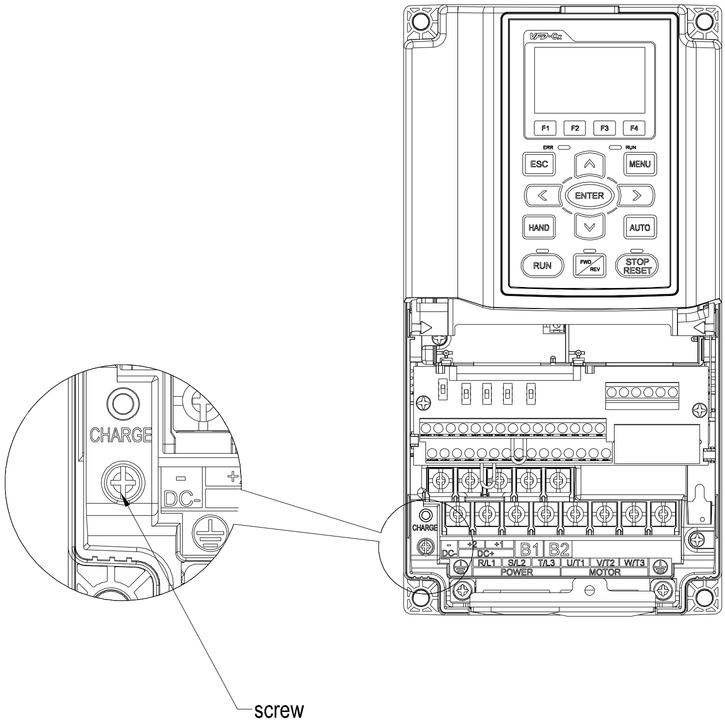
RFI Jumper

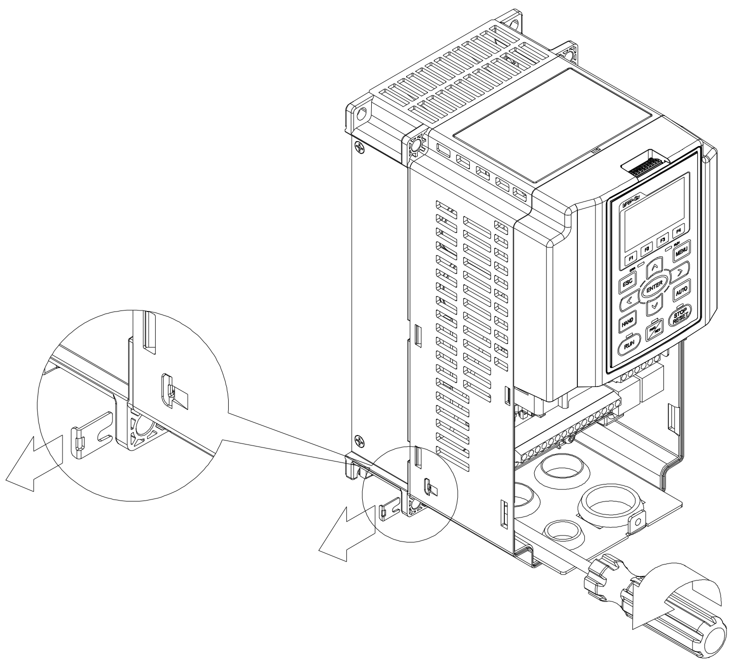
RFI Jumper: The AC motor drive may emit the electrical noise. The RFI jumper can enable internal filter to suppress the interference (Radio Frequency Interference) on the power line.

Frame A~C

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

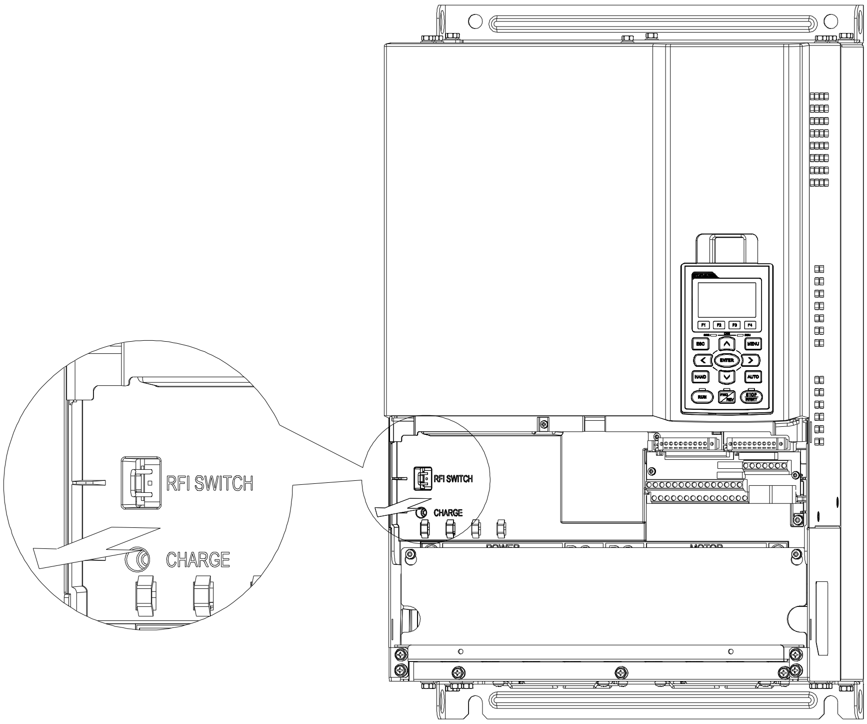
Loosen the screws and remove the RFI jumper. Fasten the screws back to the original position after RFI jumper is removed.





Frame D0~H

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

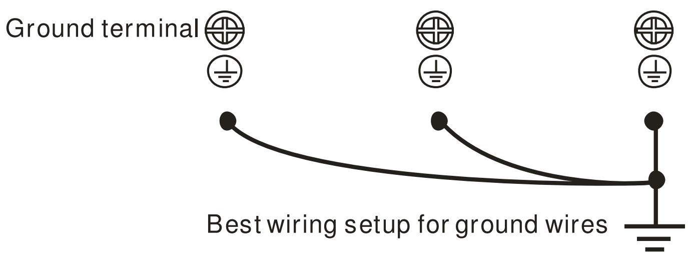


Isolating main power from ground:

When the power distribution system of the AC motor drive is a floating ground system (IT) or an asymmetric ground system (TN), the RFI jumper must be removed. After removing RFI jumper, cuts off the internal RFI capacitor (filter capacitor) between the system's frame and the central circuits to avoid damaging the central circuits and (according to IEC 61800-3) reduce the ground leakage current.

Important points regarding ground connection

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



Pay particular attention to the following points:

☑ After turning on the main power, do not remove the RFI jumper while the power is on.

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

☑ Cutting the RFI short-circuit cable will also cut off the conductivity of the capacitor. Gap discharge may occur once the transient voltage exceeds 1000V.

If the RFI jumper is removed, there will no longer be reliable electrical isolation. In other words, all controlled input and outputs can only be seen as low-voltage terminals with basic electrical isolation. Also, when the internal RFI capacitor is cut off, the AC motor drive will no longer be electromagnetic compatible.

☑ The RFI jumper may not be removed if the main power is a grounded power system.

☑ The RFI jumper may not be removed while conducting high voltage tests. When conducting a high voltage test to the entire facility, the main power and the motor must be disconnected if leakage current is too high.

Floating Ground System(IT Systems)

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

☑ Disconnect the ground cable from the internal EMC filter.

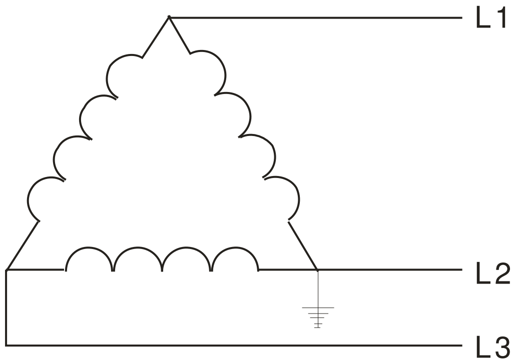
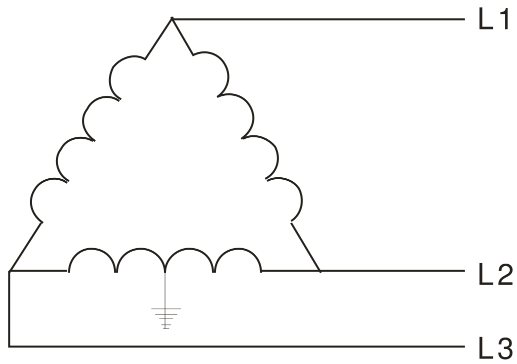
☑ In situations where EMC is required, check whether there is excess electromagnetic radiation affecting nearby low-voltage circuits. In some situations, the adapter and cable naturally provide enough suppression. If in doubt, install an extra electrostatic shielded cable on the power supply side between the main circuit and the control terminals to increase security.

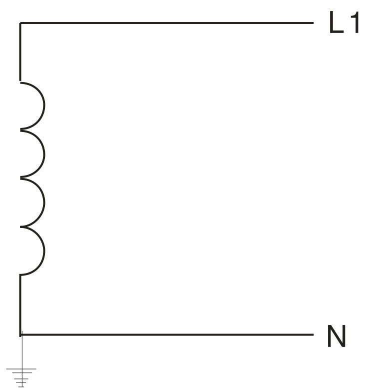
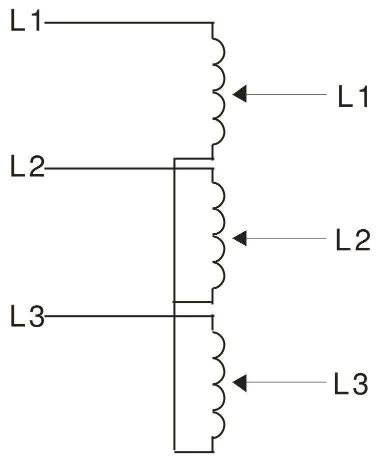
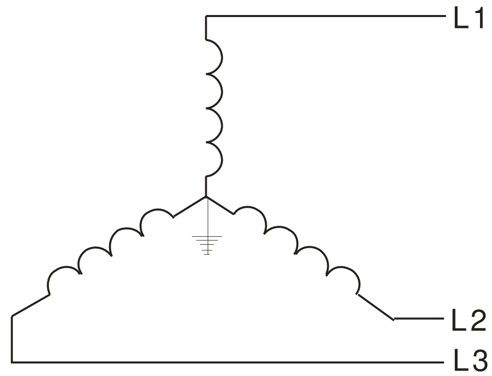
☑ Do not install an external RFI/EMC filter, the EMC filter will pass through a filter capacitor, thus connecting power input to ground. This is very dangerous and can easily damage the AC motor drive.

Asymmetric Ground System(Corner Grounded TN Systems)

Caution: Do not cut the RFI jumper while the input terminal of the AC motor drive carries power.

In the following four situations, the RFI jumper must be removed. This is to prevent the system from grounding through the RFI capacitor, damaging the AC motor drive.

RFI jumper must be removed	
1 Grounding at a corner in a triangle configuration 	2 Grounding at a midpoint in a polygonal configuration 

<table>
<tr><td>3 Grounding at one end in a single-phase configuration
</td><td>4 No stable neutral grounding in a three-phase autotransformer configuration
</td></tr>
<tr><td colspan="2">RFI jumper can be used</td></tr>
<tr><td colspan="2">Internal grounding through internal RFI filter, which reduces electromagnetic radiation. In a situation with higher requirements for electromagnetic compatibility, and using a symmetrical grounding power system, an EMC filter can be installed. As a reference, the diagram on the right is a symmetrical grounding power system.
</td></tr>
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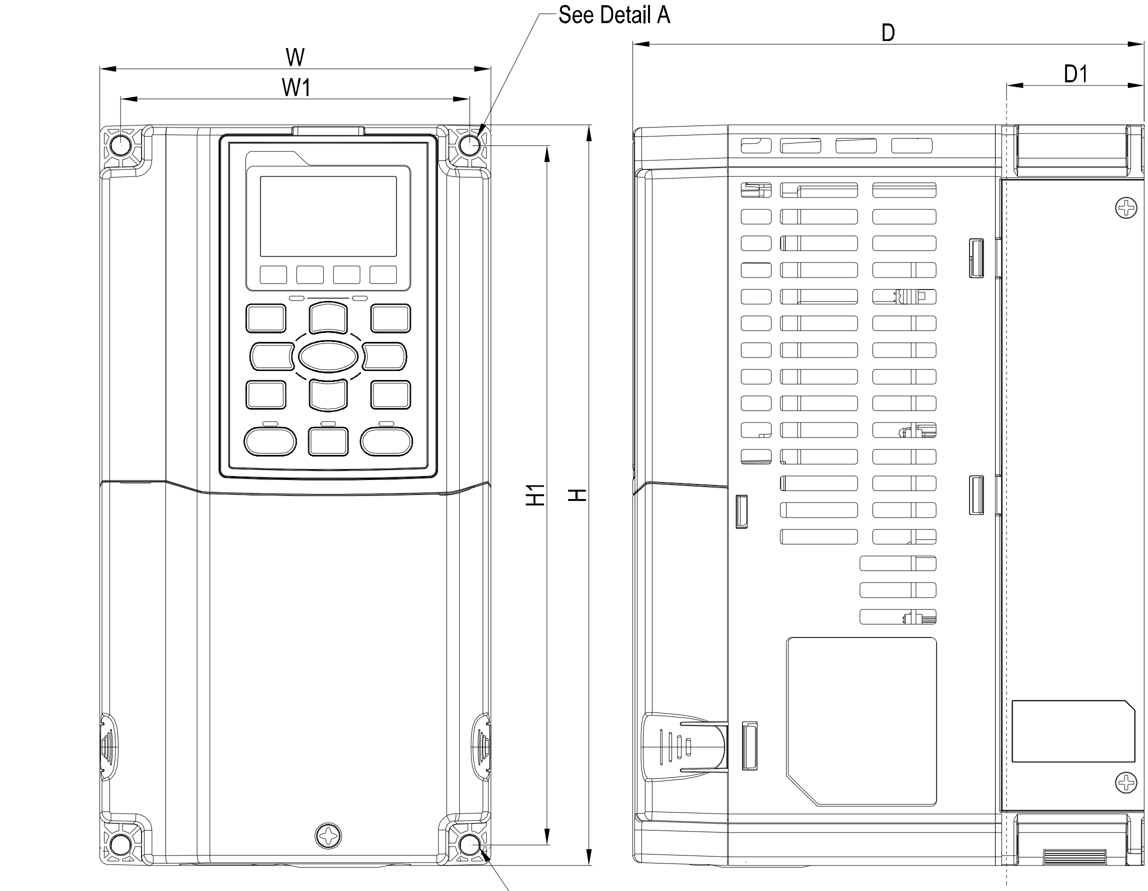
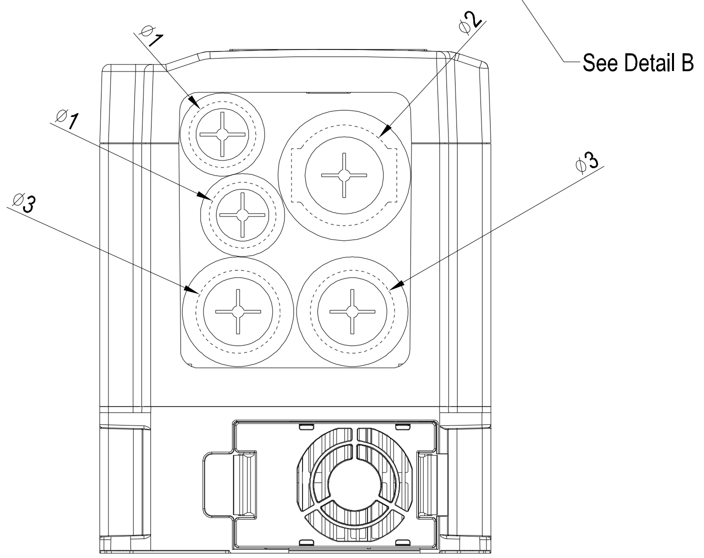
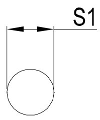
Dimensions:

Frame A

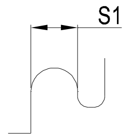
VFD007CP23A-21, VFD015CP23A-21, VFD022CP23A-21, VFD037CP23A-21, VFD055CP23A-21, VFD007CP43A-21, VFD015CP43B-21, VFD022CP43B-21, VFD037CP43B-21, VFD040CP43A-21, VFD055CP43B-21, VFD075CP43B-21, VFD007CP4EA-21, VFD015CP4EB-21,VFD022CP4EB-21, VFD037CP4EB-21, VFD040CP4EA-21, VFD055CP4EB-21, VFD075CP4EB-21







Detail A (Mounting Hole)



Detail B (Mounting Hole)

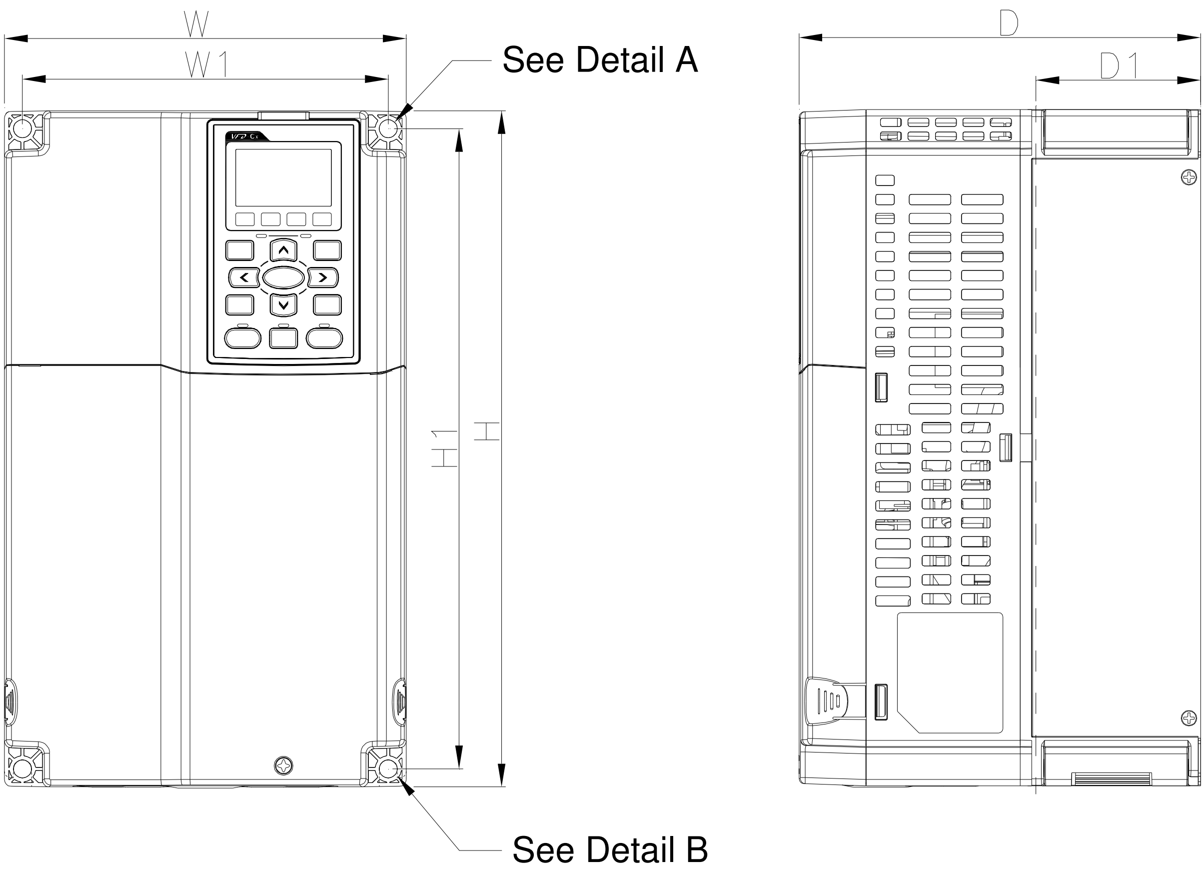
Unit: mm [inch]

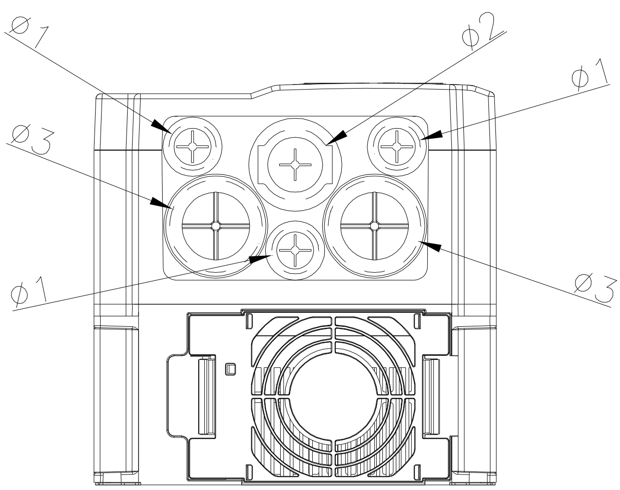
Frame	W	H	D	W1	H1	D1*	S1	Φ1	Φ2	Φ3
A1	130.0 [5.12]	250.0 [9.84]	170.0 [6.69]	116.0 [4.57]	236.0 [9.29]	45.8 [1.80]	6.2 [0.24]	22.2 [0.87]	34.0 [1.34]	28.0 [1.10]

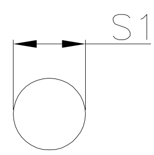
D1*: Flange mounting

Frame B

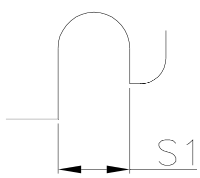
VFD075CP23A-21,VFD110CP23A-21,VFD150CP23A-21,VFD110CP43AB-21,
VFD150CP43B-21,VFD185CP43B-21,VFD110CP4EB-21,VFD150CP4EB-21,
VFD185CP4EB-21







Detail A (Mounting Hole)



Detail B (Mounting Hole)

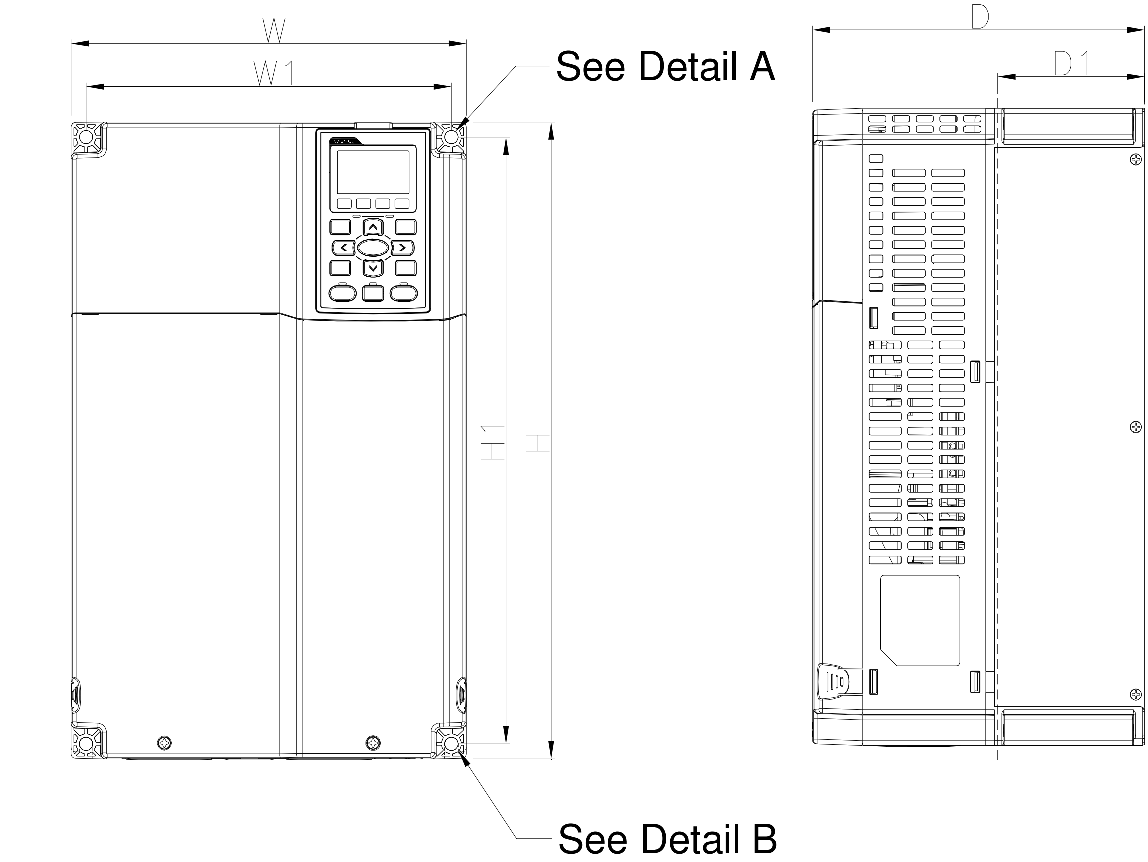
Unit: mm [inch]

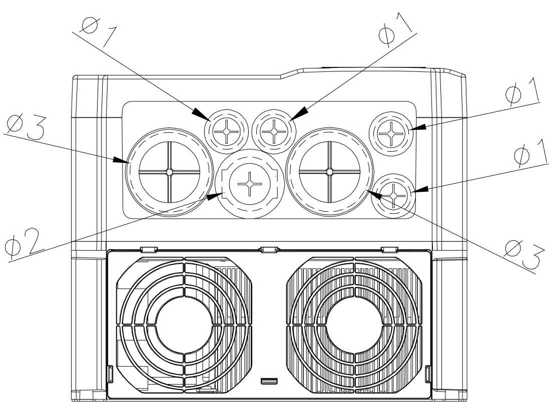
Frame	W	H	D	W1	H1	D1*	S1	Φ1	Φ2	Φ3
B	190.0 [7.48]	320.0 [12.60]	190.0 [7.48]	173.0 [6.81]	303.0 [11.93]	77.9 [3.07]	8.5 [0.33]	22.2 [0.87]	34.0 [1.34]	43.8 [1.72]

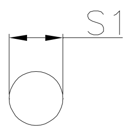
D1*: Flange mounting

Frame C

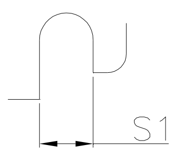
VFD185CP23A-21,VFD220CP23A-21,VFD300CP23A-21,VFD220CP43A-21,
VFD300CP43B-21,VFD370CP43B-21,VFD220CP4EA-21,VFD300CP4EB-21,
VFD370CP4EB-21







Detail A (Mounting Hole)



Detail B (Mounting Hole)

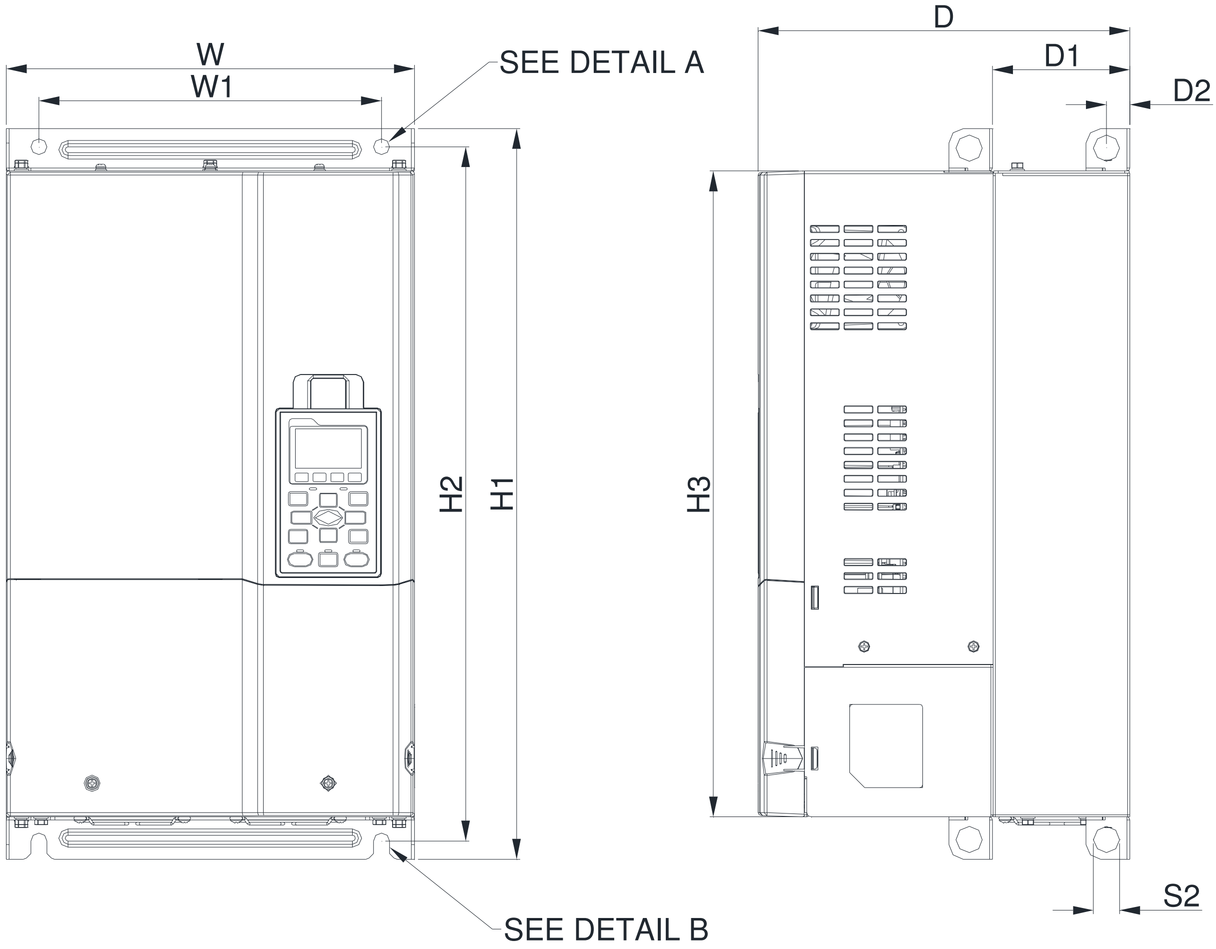
Unit: mm [inch]

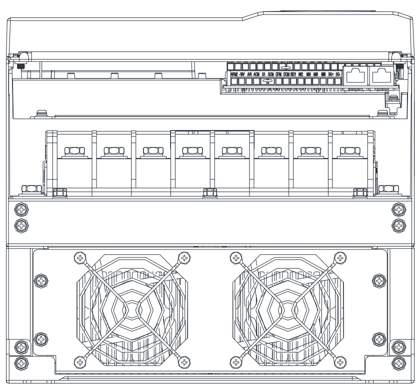
Frame	W	H	D	W1	H1	D1*	S1	Φ1	Φ2	Φ3
C	250.0 [9.84]	400.0 [15.75]	210.0 [8.27]	231.0 [9.09]	381.0 [15.00]	92.9 [3.66]	8.5 [0.33]	22.2 [0.87]	34.0 [1.34]	50.0 [1.97]

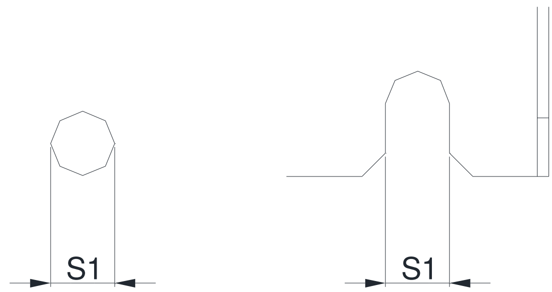
D1*: Flange mounting

Frame D

D0-1: VFD450CP43S-00; VFD550CP43S-00







DETAIL A
(MOUNTING HOLE)

DETAIL B
(MOUNTING HOLE)

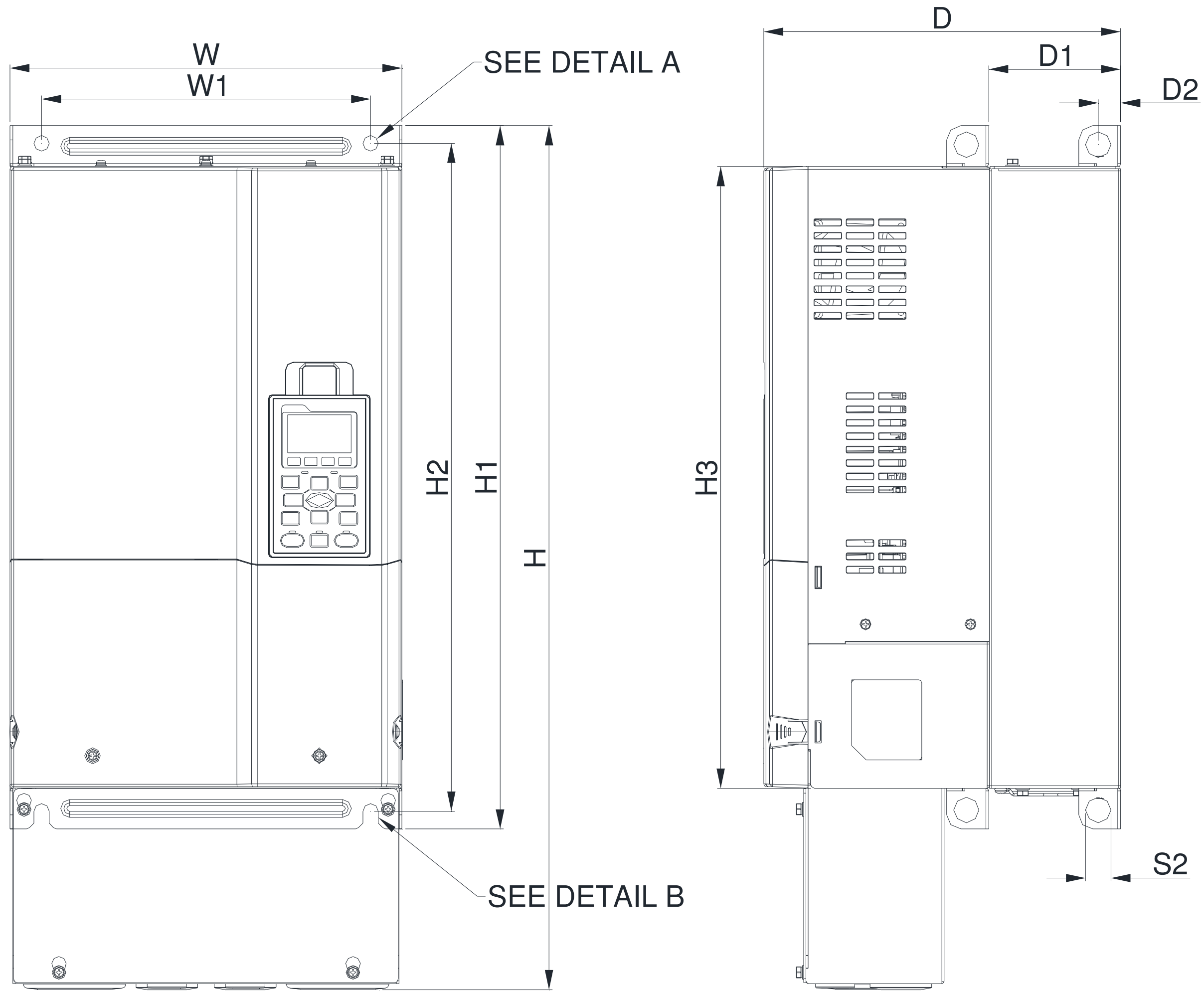
Unit: mm [inch]

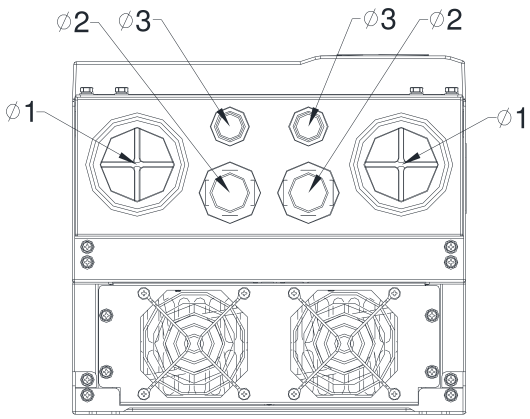
Frame	W	H1	D	W1	H2	H3	D1*	D2	S1	S2
D0-1	280.0 [11.02]	500.0 [19.69]	255.0 [10.04]	235.0 [9.25]	475.0 [18.70]	442.0 [17.40]	94.2 [3.71]	16.0 [0.63]	11.0 [0.43]	18.0 [0.71]

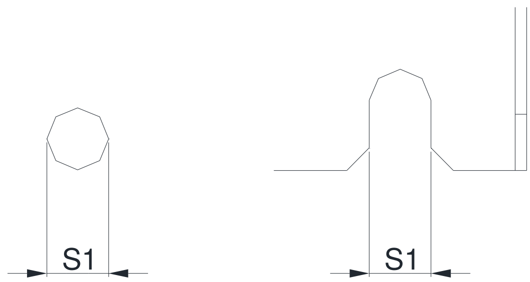
D1*: Flange mounting

Frame D

D0-2 VFD450CP43S-21; VFD550CP43S-21







DETAIL A
(MOUNTING HOLE)

DETAIL B
(MOUNTING HOLE)

Unit: mm [inch]

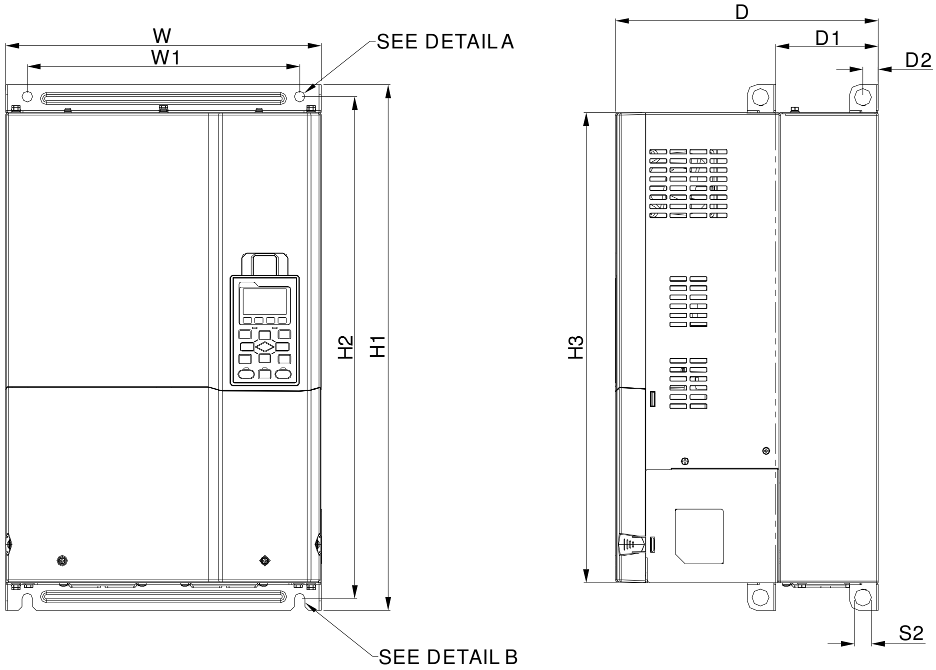
Frame	W	H	D	W1	H1	H2	H3	D1*	D2	S1	S2	Φ1	Φ2	Φ3
D0-2	280.0 [11.02]	614.4 [24.19]	255.0 [10.04]	235.0 [9.25]	500.0 [19.69]	475.0 [18.70]	442.0 [17.40]	94.2 [3.71]	16.0 [0.63]	11.0 [0.43]	18.0 [0.71]	62.7 [2.47]	34.0 [1.34]	22.0 [0.87]

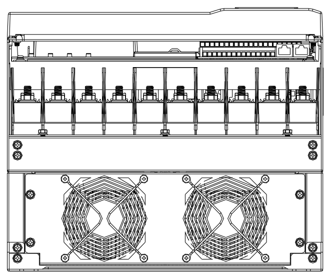
D1*: Flange mounting

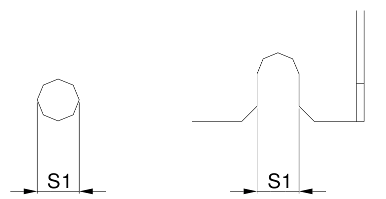
Frame D

Frame D1:
VFD370CP23A-00, VFD450CP23A-00, VFD750CP43B-00, VFD900CP43A-00

FRAME_D1







DETAIL A
(MOUNTING HOLE)

DETAIL B
(MOUNTING HOLE)

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]	-	-	-

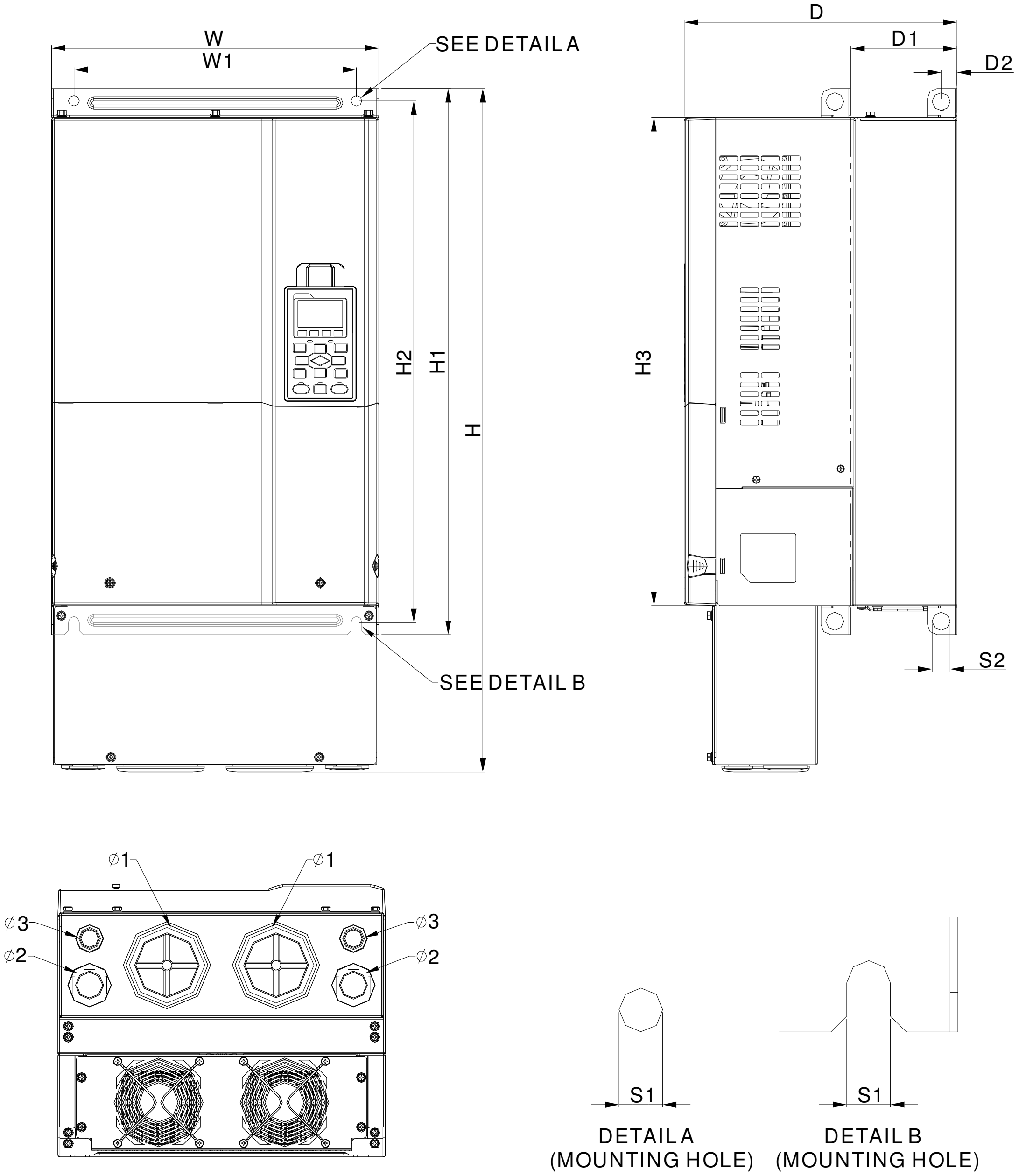
D1*: Flange mounting

Frame D

D2:

VFD370CP23A-21, VFD450CP23A-21, VFD750CP43B-21, VFD900CP43A-21

FRAME_D2



Unit: mm[inch]

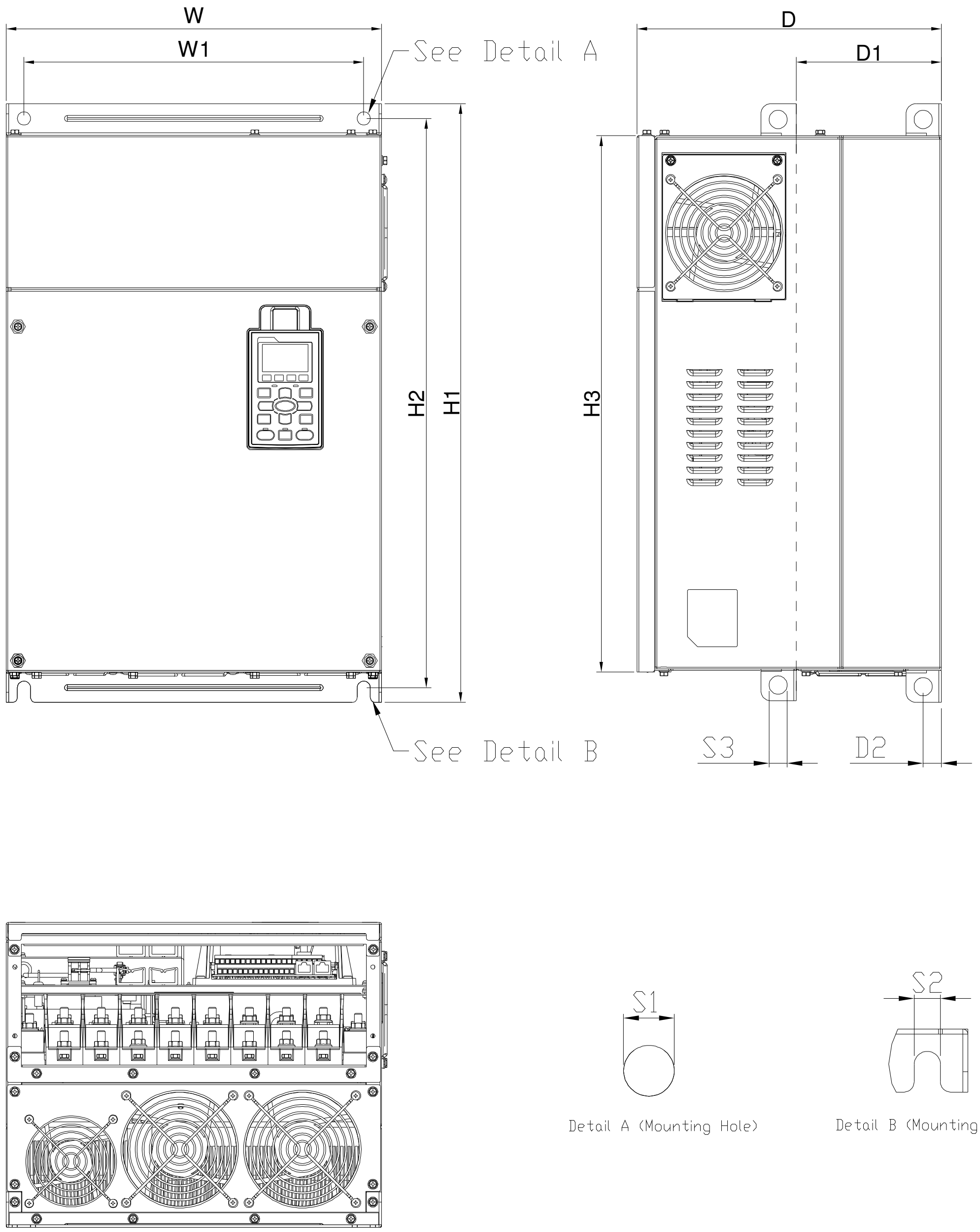
框号	W	H	D	W1	H1	H2	H3	D1*	D2	S1	S2	Φ1	Φ2	Φ3
D2	330.0 [12.99]	688.3 [27.10]	275.0 [10.83]	285.0 [11.22]	550.0 [21.65]	525.0 [20.67]	492.0 [19.37]	107.2 [4.22]	16.0 [0.63]	11.0 [0.43]	18.0 [0.71]	76.2 [3.00]	34.0 [1.34]	22.0 [0.87]

D1*: Flange mounting

Frame E

Frame E1:
VFD550CP23A-00, VFD750CP23A-00,VFD900CP23A-00,VFD1100CP43A-00, VFD1320CP43B-00

FRAME_E1



Unit: mm [inch]

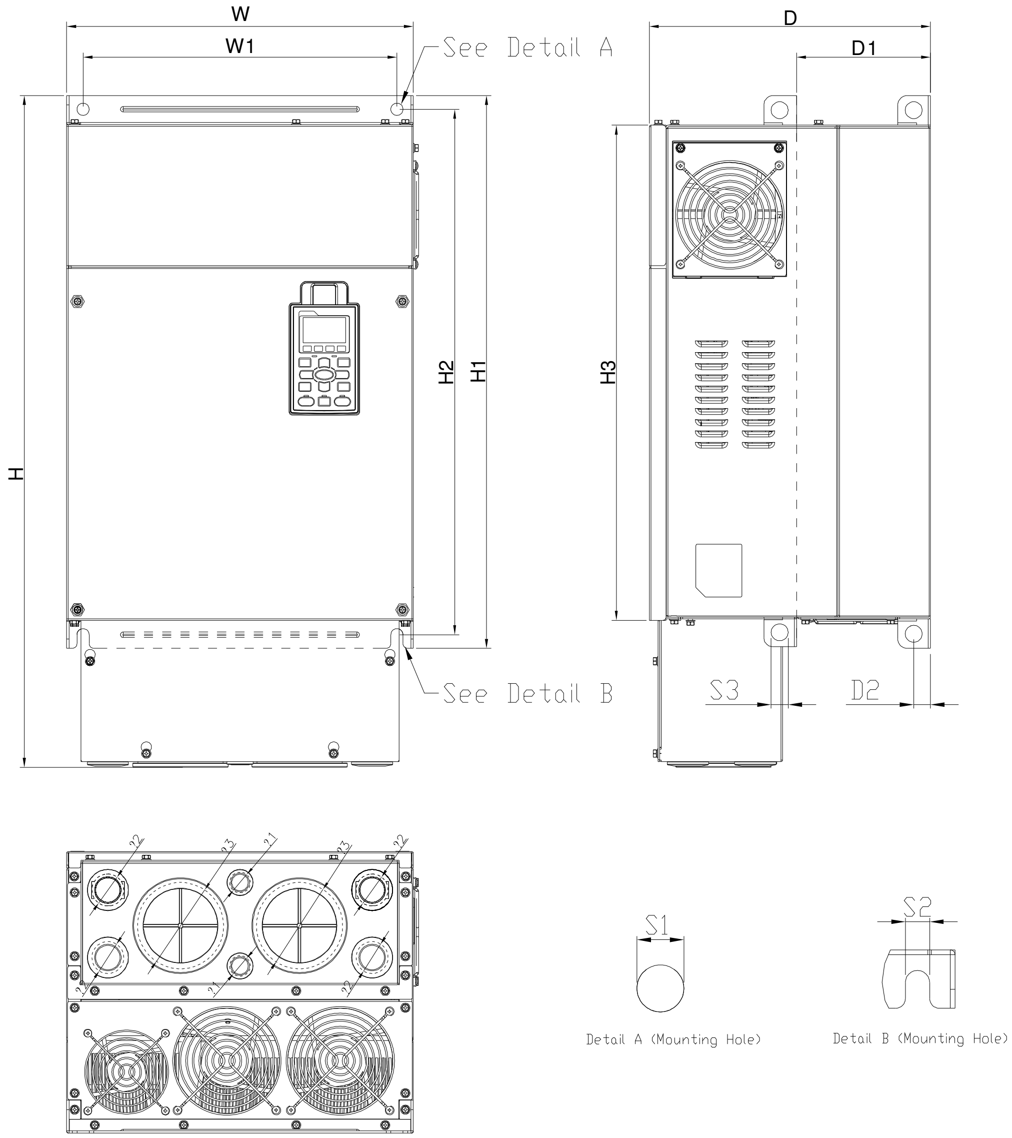
Frame	W	H	D	W1	H1	H2	H3	D1*	D2	S1, S2	S3	Φ1	Φ2	Φ3
E1	370.0 [14.57]	-	300.0 [11.81]	335.0 [13.19]	589 [23.19]	560.0 [22.05]	528.0 [20.80]	143.0 [5.63]	18.0 [0.71]	13.0 [0.51]	18.0 [0.71]	-	-	-

D1*: Flange mounting

Frame E

E2:
VFD550CP23A-21,VFD750CP23A-21,VFD900CP23A-21, VFD1100CP43A-21, VFD1320CP43B-21

FRAME_E2



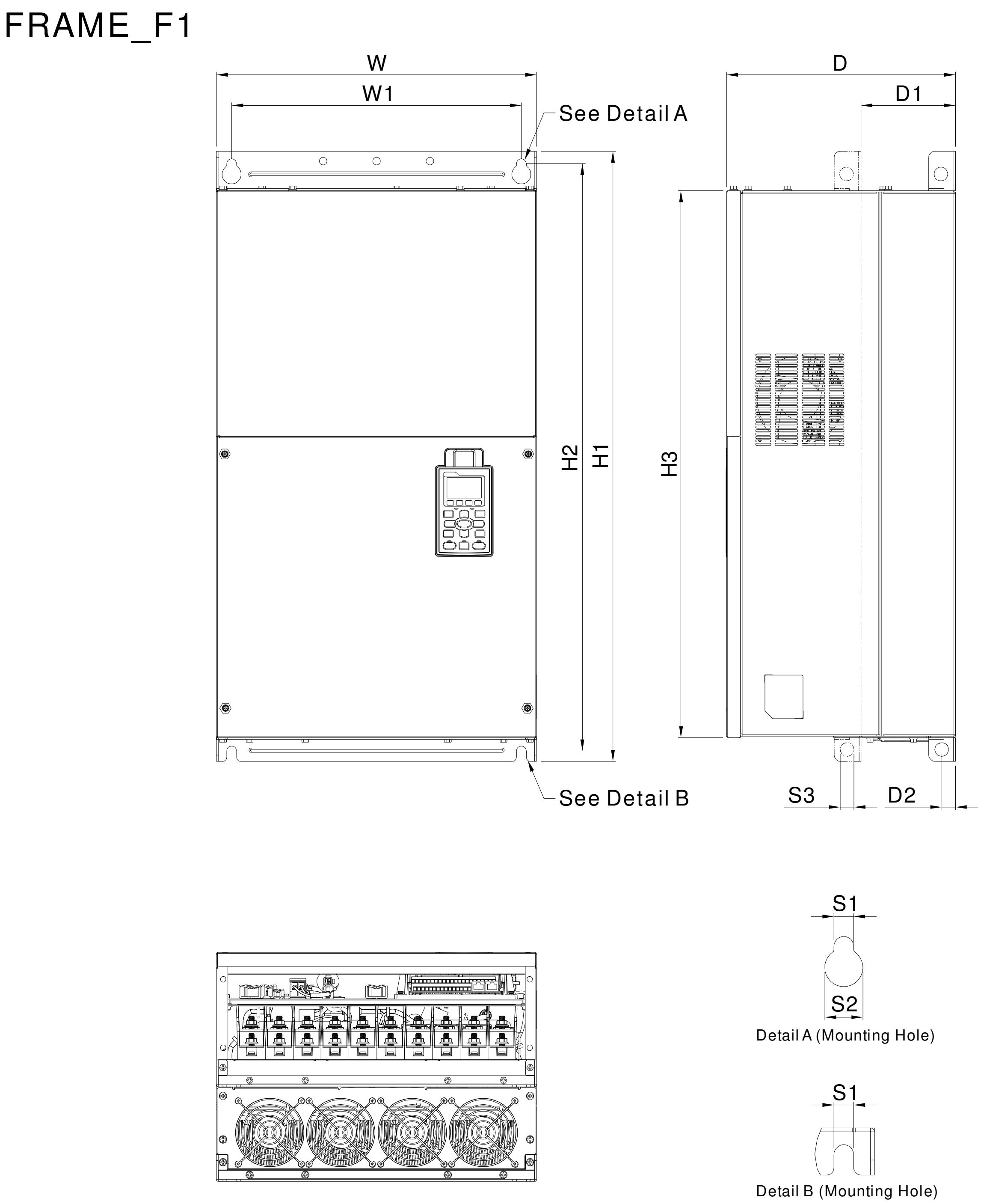
Unit: mm [inch]

Frame	W	H	D	W1	H1	H2	H3	D1*	D2	S1, S2	S3	Φ1	Φ2	Φ3
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

Frame F1: VFD1600CP43A-00,VFD1850CP43B-00



Unit: mm [inch]

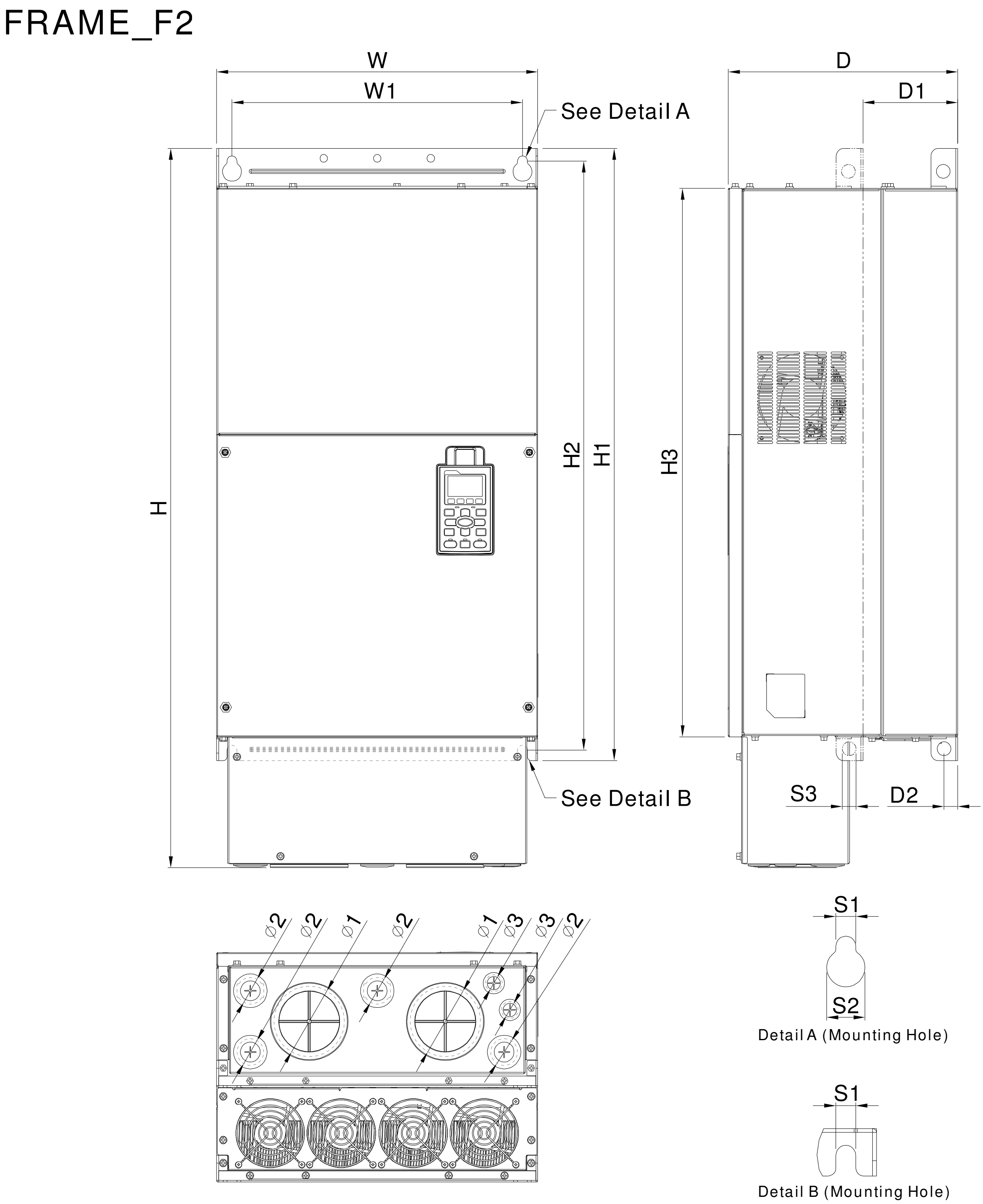
Frame	W	H	D	W1	H1	H2	H3	D1*	D2	S1	S2	S3
F1	420.0 [16.54]	-	300.0 [11.81]	380.0 [14.96]	800.0 [31.50]	770.0 [30.32]	717.0 [28.23]	124.0 [4.88]	18.0 [0.71]	13.0 [0.51]	25.0 [0.98]	18.0 [0.71]

Frame	Φ1	Φ2	Φ3
F1	-	-	-

D1*: Flange mounting

Frame F

Frame F2: VFD1600CP43A-21,VFD1850CP43B-21



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]

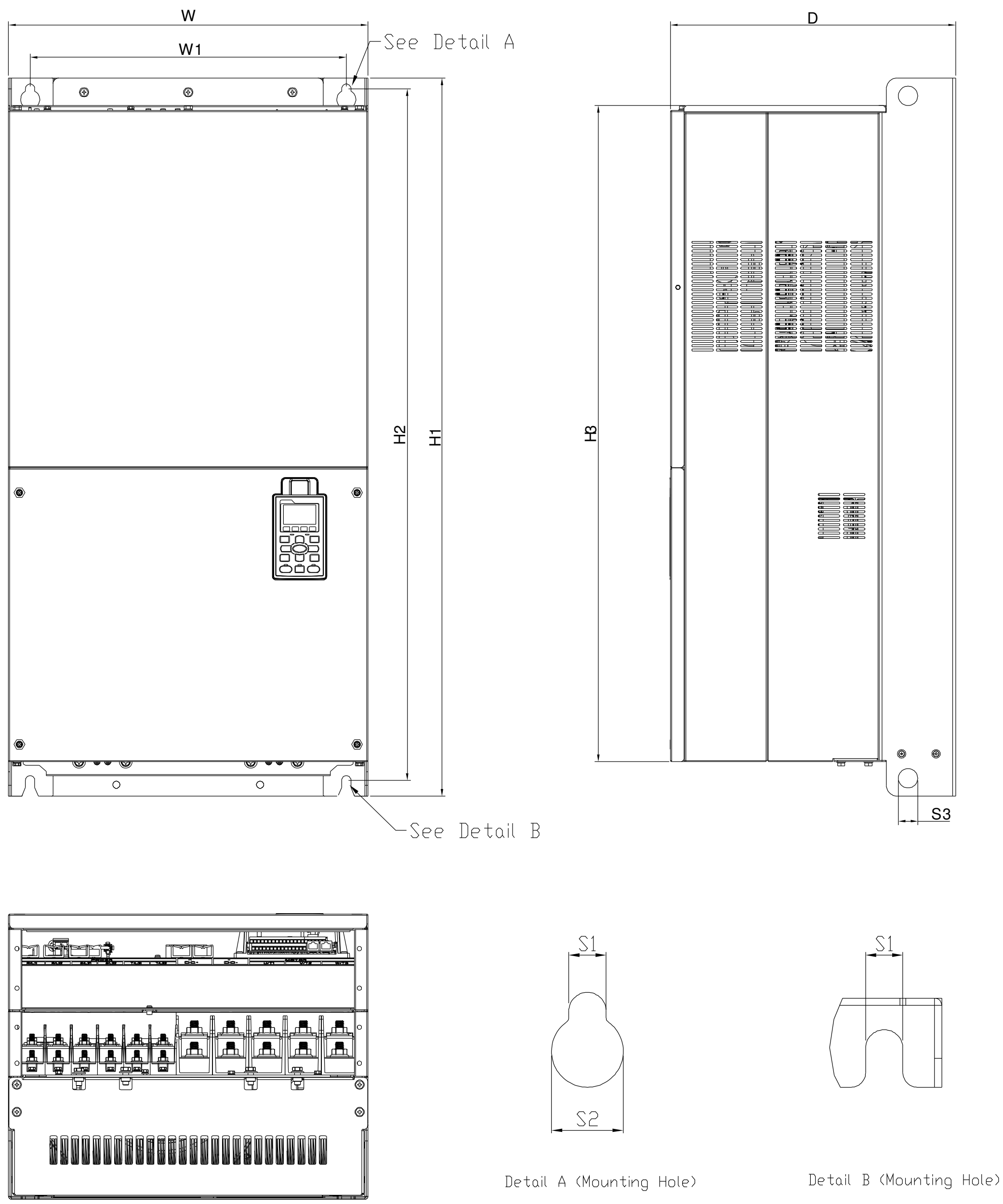
Frame	Φ1	Φ2	Φ3
F1	-	-	-
F2	92.0 [3.62]	35.0 [1.38]	22.0 [0.87]

D1*: Flange mounting

Frame G

Frame G1: VFD2200CP43A-00,VFD2800CP43A-00

FRAME_G1



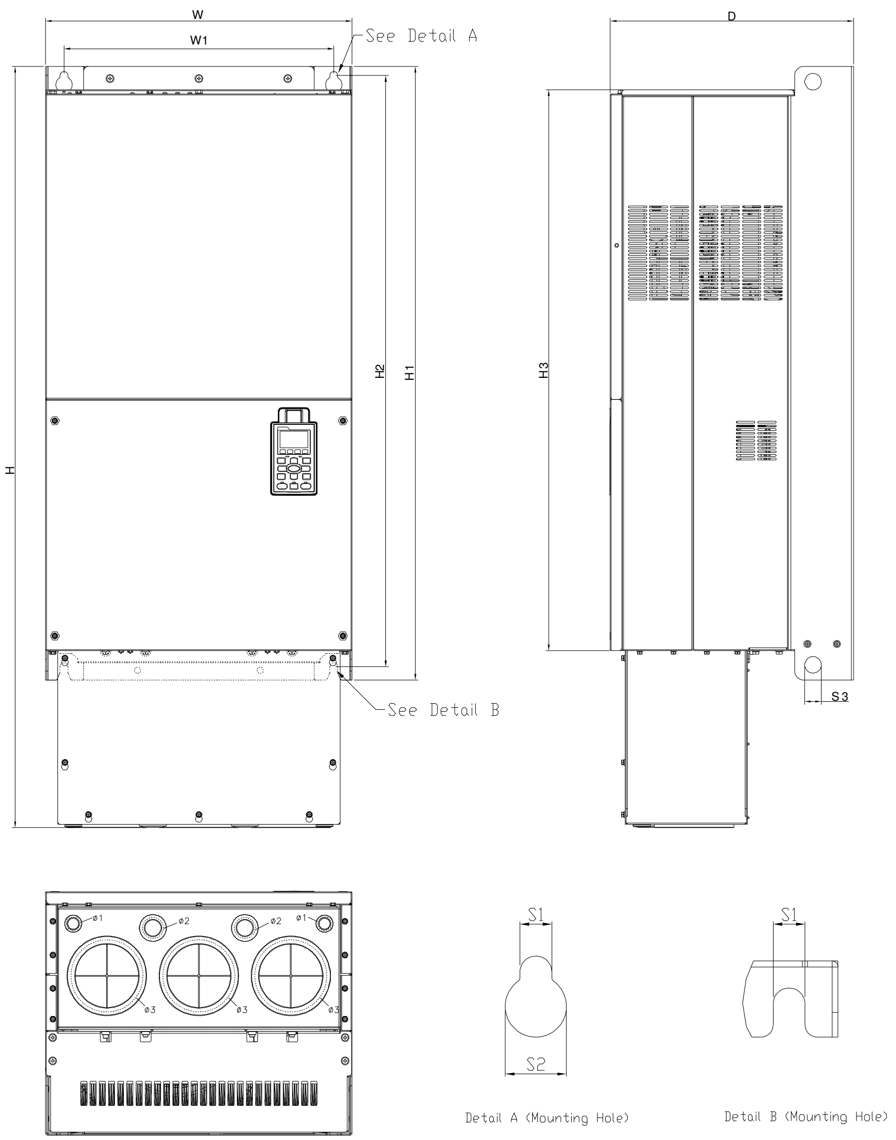
Unit: mm [inch]

Frame	W	H	D	W1	H1	H2	H3	S1	S2	S3	Φ1	Φ2	Φ3
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]	-	-	-

Frame G

Frame G2: VFD2200CP43A-21,VFD2800CP43A-21

FRAME_G2



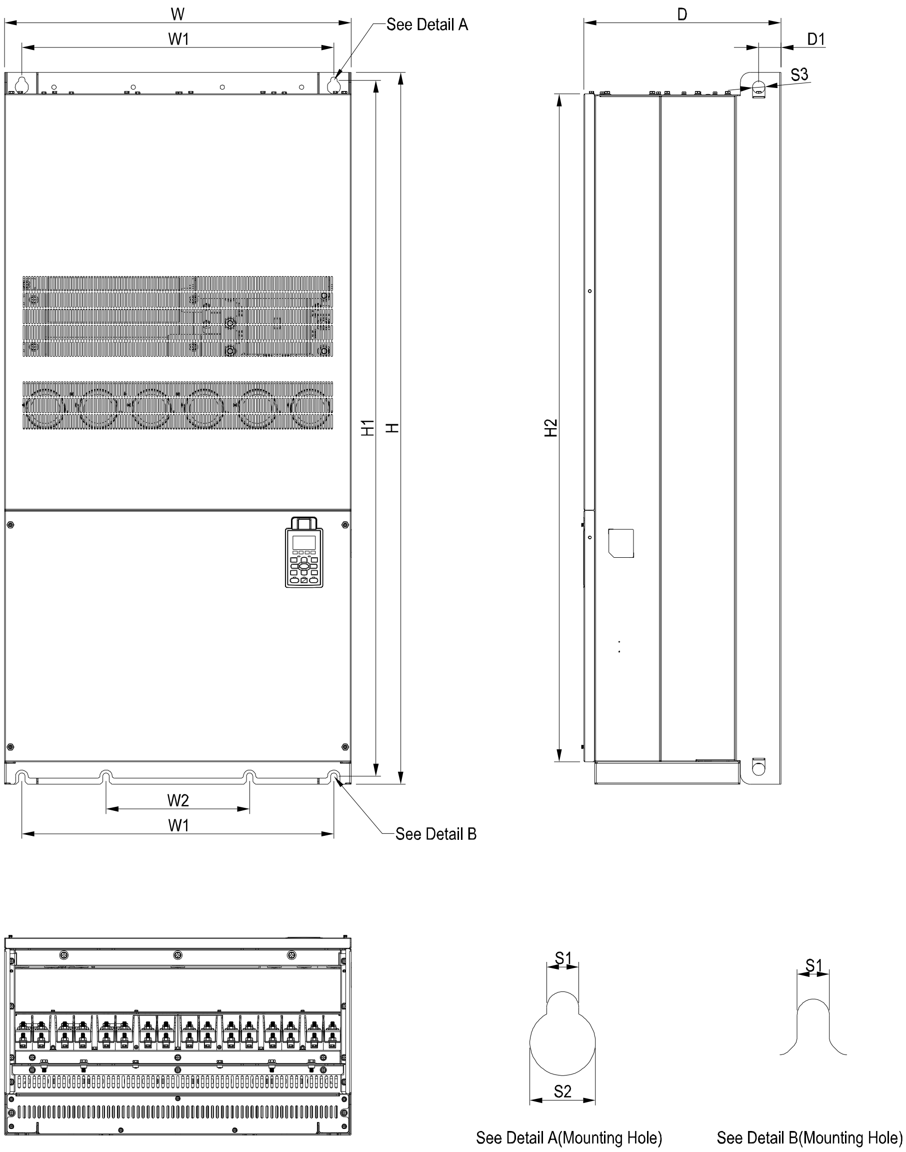
Unit: mm [inch]

Frame	W	H	D	W1	H1	H2	H3	S1	S2	S3	Φ1	Φ2	Φ3
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

Frame H1: VFD3150CP43A-00,VFD3550CP43A-00, VFD4000CP43A-00

FRAME_H1



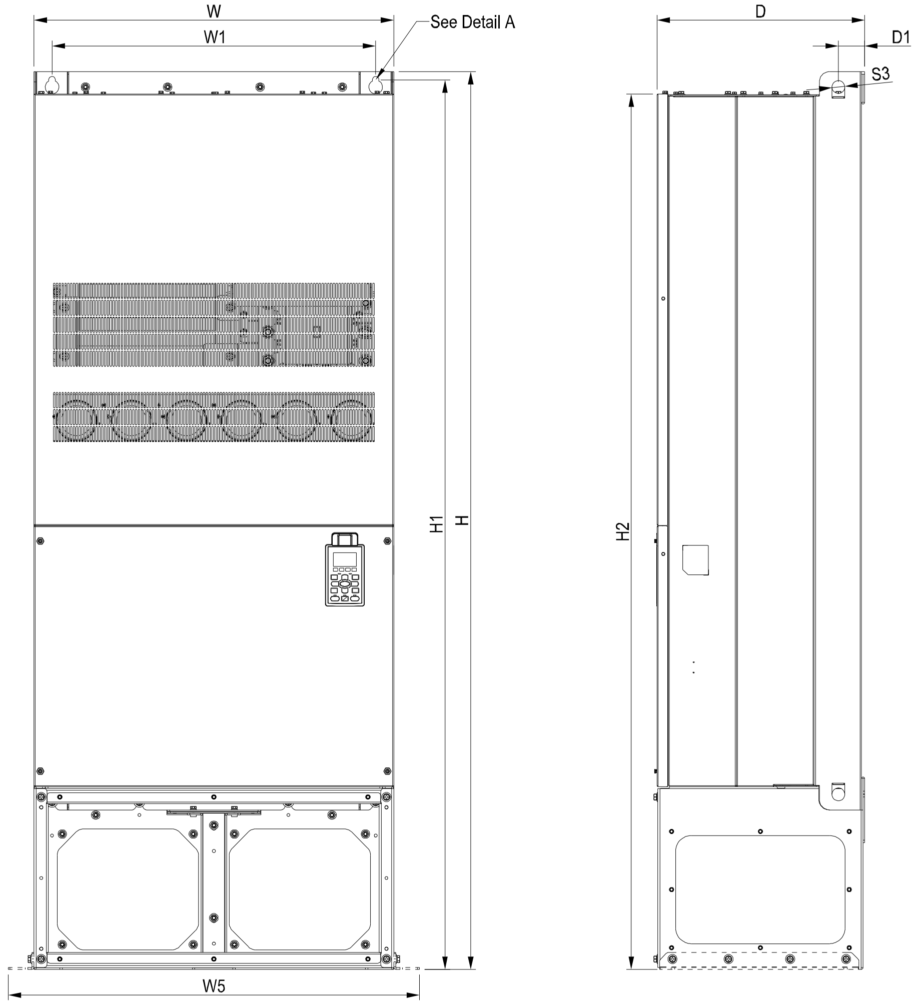
Unit: mm [inch]

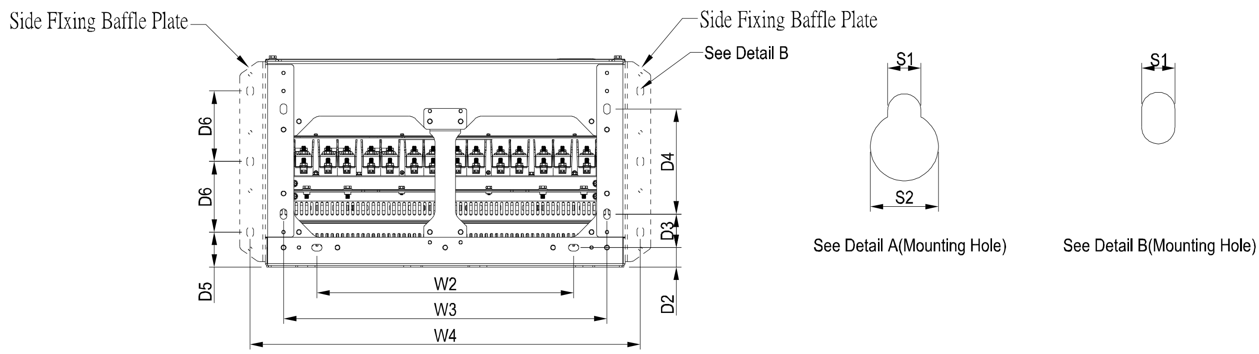
Frame	W	H	D	W1	W2	W3	W4	W5	W6	H1	H2	H3	H4
H1	700.0 [27.56]	1435.0 [56.5]	398.0 [15.67]	630.0 [24.8]	290.0 [11.42]	-	-	-	-	1403.0 [55.24]	1346.6 [53.02]	-	-
Frame	H5	D1	D2	D3	D4	D5	D6	S1	S2	S3	Φ1	Φ2	Φ3
H1	-	45.0 [1.77]	-	-	-	-	-	13.0 [0.51]	26.5 [1.04]	25.0 [0.98]	-	-	-

Frame H

Frame H2: VFD3150CP43C-00, VFD3550CP43C-00, VFD4000CP43C-00

FRAME_H2





Unit: mm [inch]

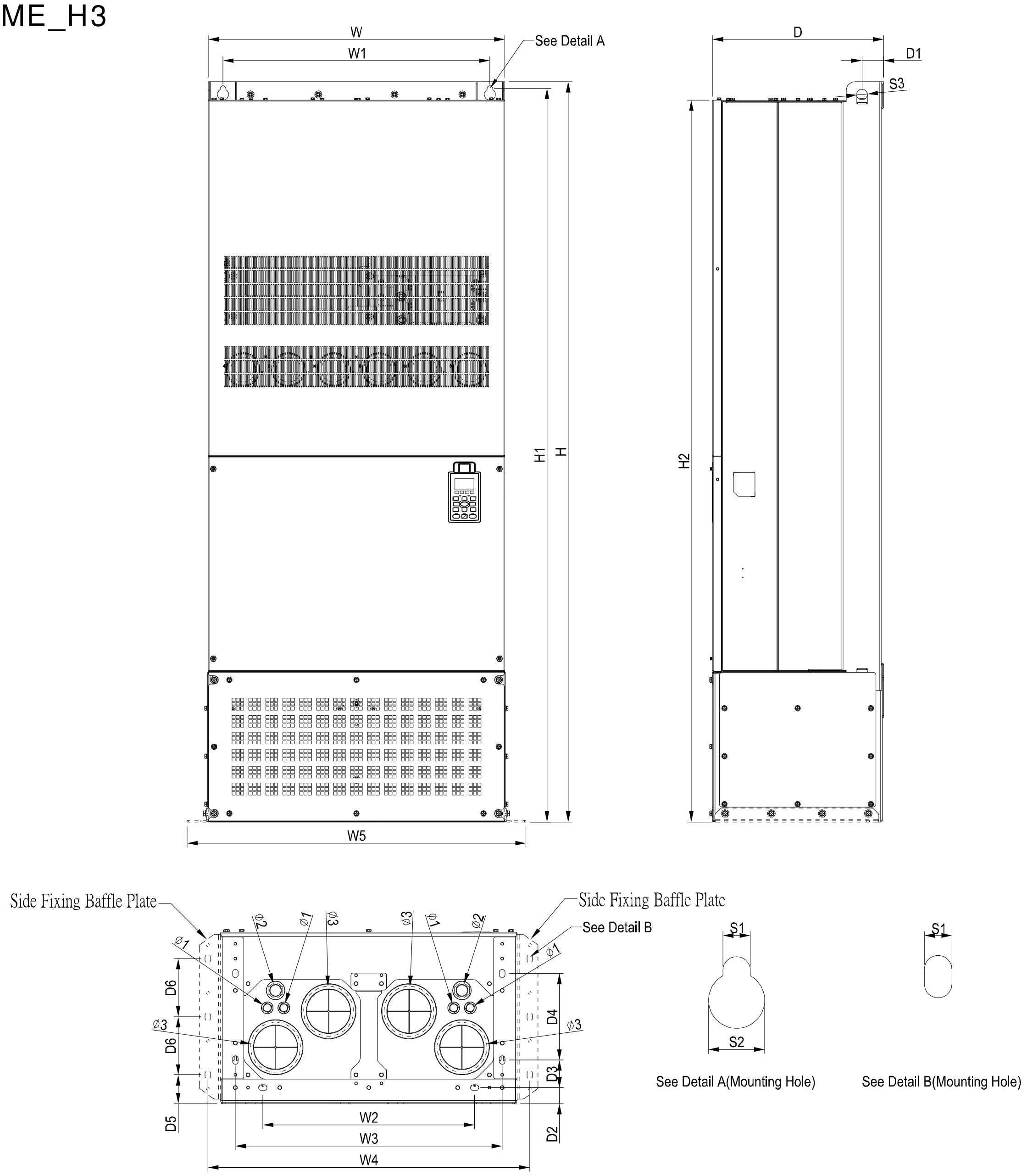
Frame	W	H	D	W1	W2	W3	W4	W5	W6	H1	H2	H3	H4
H2	700.0 [27.56]	1745.0 [68.70]	404.0 [15.90]	630.0 [24.8]	500.0 [19.69]-	630.0 [24.80]	760.0 [29.92]	800.0 [31.5]	-	1729.0 [68.07]	1701.6 [66.99]	-	-

Frame	H5	D1	D2	D3	D4	D5	D6	S1	S2	S3	Φ1	Φ2	Φ3
H2	-	51.0 [2.00]	38.0 [1.50]	65.0 [2.56]	204.0 [8.03]	68.0 [2.68]	137.0 [5.40]	13.0 [0.51]	26.5 [1.04]	25.0 [0.98]	-	-	-

Frame H

Frame H3: VFD3150CP43C-21, VFD3550CP43C-21, VFD4000CP43C-21

FRAME_H3



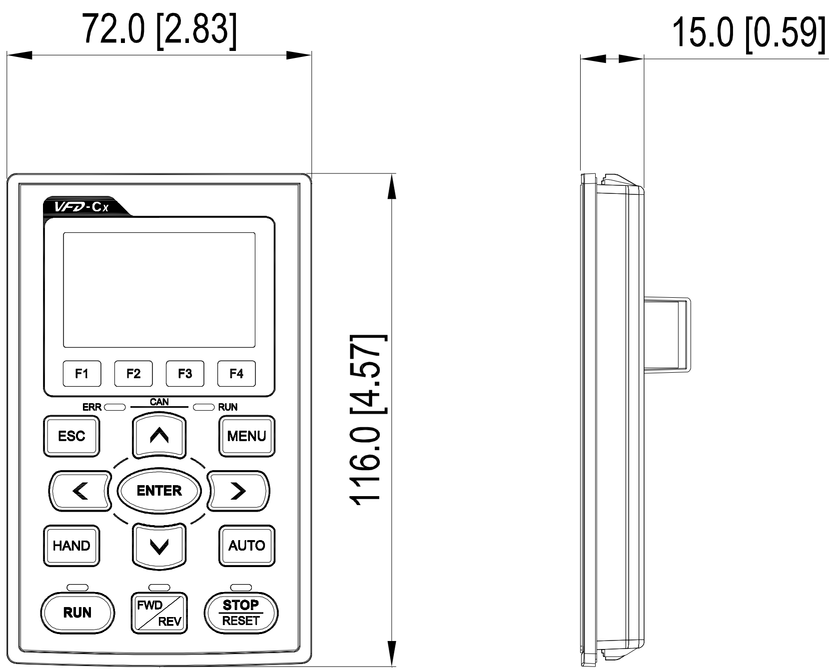
Unit：mm [inch]

Frame	W	H	D	W1	W2	W3	W4	W5	W6	H1	H2	H3	H4
H3	700.0 [27.56]	1745.0 [68.70]	404.0 [15.91]	630.0 [24.80]	500.0 [19.69]	630.0 [24.80]	760.0 [29.92]	800.0 [31.5]	-	1729.0 [68.07]	1701.6 [66.99]	-	-

Frame	H5	D1	D2	D3	D4	D5	D6	S1	S2	S3	Φ1	Φ2	Φ3
H3		51.0 [2.00]	38.0 [1.50]	65.0 [2.56]	204.0 [8.03]	68.0 [2.68]	137.0 [5.40]	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



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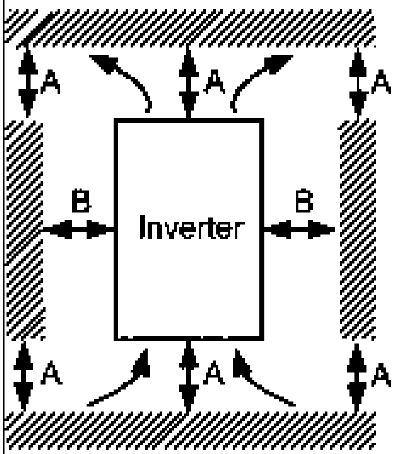
Chapter 2 Installation

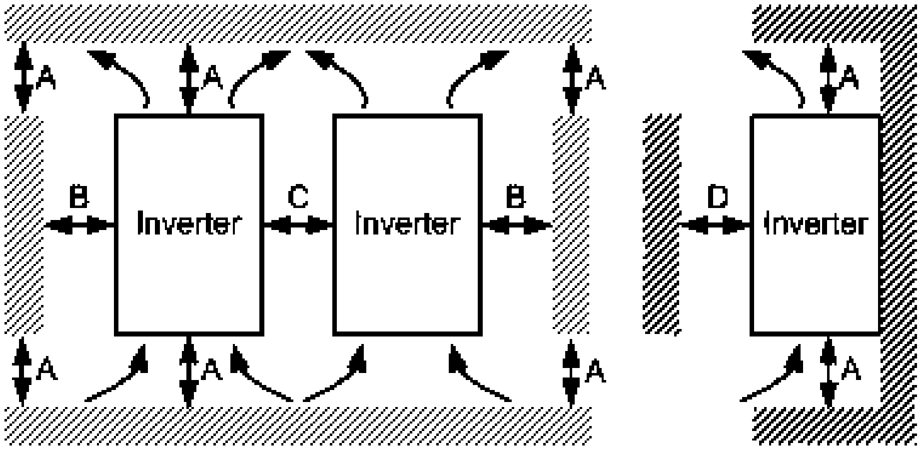
The appearances shown in the following figures are for reference only.

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

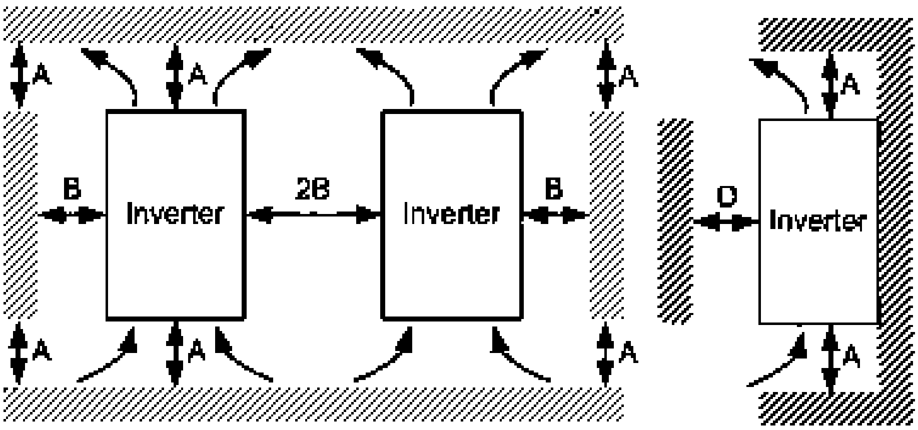
Single drive: installation (Frame A-H)



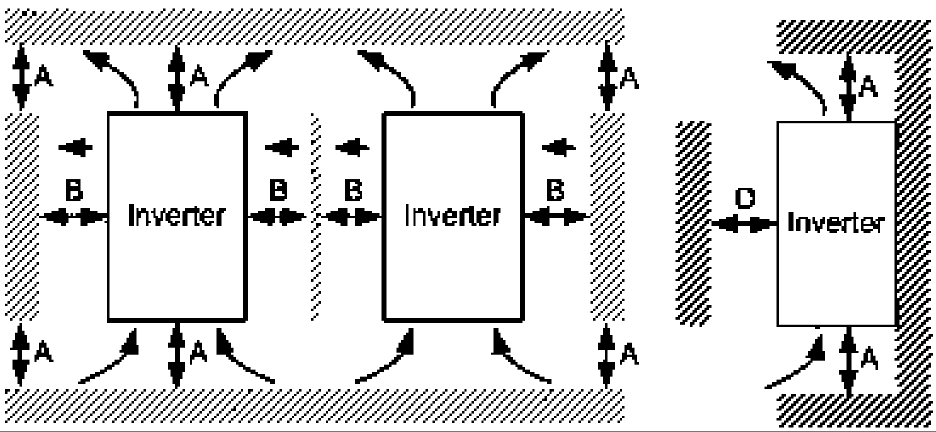
Side-by-side horizontal installation (Frame A~C)



Multiple drives, single side-by-side horizontal installation（Frame A~C, G, H）



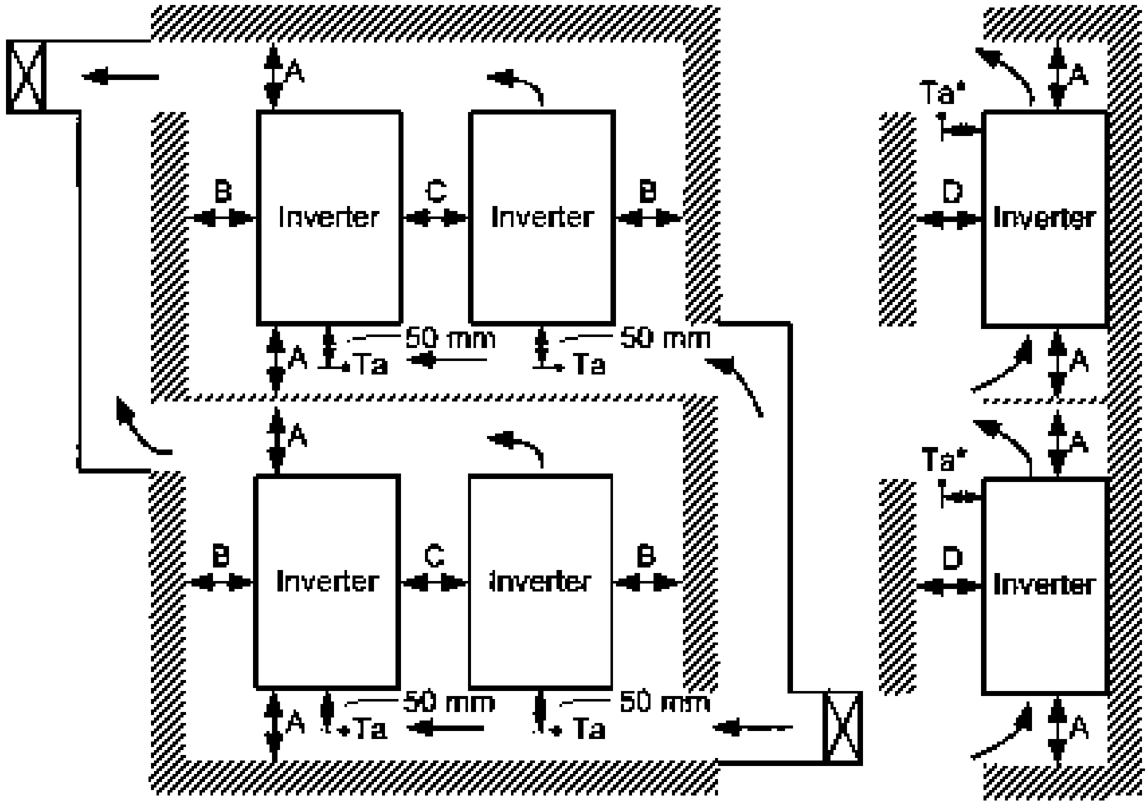
Multiple drives: side-by-side installation (Frame D0, D, E, F) Install a barrier between the drives is required.



Multiple drives side-by-side installation in rows (Frame A~H)

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)



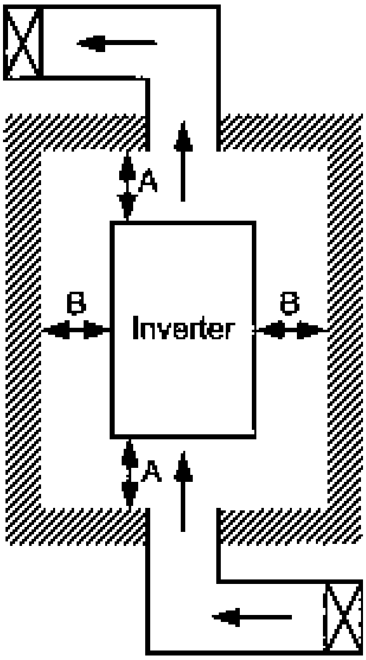
Minimum mounting clearance

Frame	A (mm)	B (mm)	C (mm)	D (mm)
A~C	60	30	10	0
D0, D, E, F	100	50	-	0
G	200	100	-	0
H	350	0	0	200 (100, Ta=Ta*=40℃)

Frame A	VFD007CP23A-21; VFD007CP43A/4EA-21; VFD015CP23A-21; VFD015CP43B/4EB-21; VFD022CP23A-21;VFD022CP43B/4EB-21; VFD037CP23A-21; VFD037CP43B/4EB-21; VFD040CP43A/4EA-21; VFD055CP23A-21; VFD055CP43B/4EB-21; VFD075CP43B/4EB-21
Frame B	VFD075CP23A-21; VFD110CP23A-21; VFD110CP43B/4EB -21; VFD150CP23A-21; VFD150CP43B/4EB -21; VFD185CP43B/4EB -21
Frame C	VFD185CP23A-21; VFD220CP23A-21; VFD220CP43A/4EA -21; VFD300CP23A-21; VFD300CP43B/4EB -21; VFD370CP43B/4EB -21
FrameD0	VFD450CP43S-00; VFD550CP43S-00; VFD450CP43S-21; VFD550CP43S-21
FrameD	VFD370CP23A-00/23A-21; VFD450CP23A-00/23A-21; VFD750CP43B-00/43B-21; VFD900CP43A-00/43A-21
Frame E	VFD550CP23A-00/23A-21; VFD750CP23A-00/23A-21; VFD900CP23A-00/23A-21; VFD1100CP43A-00/43A-21; VFD1320CP43B-00/43B-21
Frame F	VFD1600CP43A-00/43A-21; VFD1850CP43B-00/43B-21
Frame G	VFD2200CP43A-00/43A-21; VFD2800CP43A-00/43A-21
Frame H	VFD3150CP43A-00/43C-00/43C-21; VFD3550CP43A-00/43C-00/43C-21; VFD4000CP43A-00/43C-00/43C-21

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.



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.

※ Different control mode will affect the derating. See Pr06-55 for more information.

※ Ambient temperature derating curve shows the derating status in different temperature in relation to different protection level

※ If UL Type 1 models need side by side installation, please remove top cover of FrameA~C, and please do not install conduit box of Frame D and above.

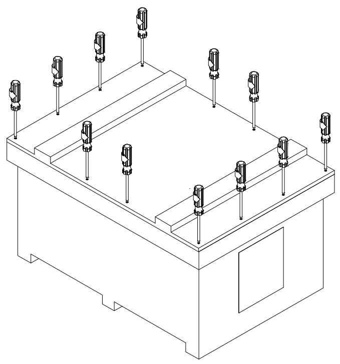
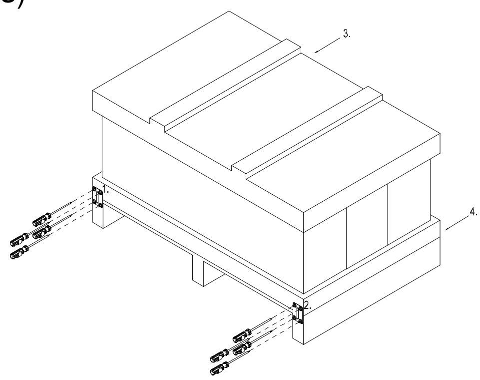
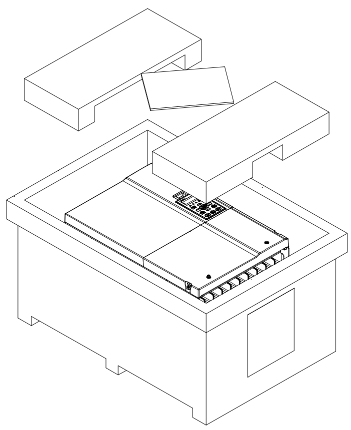
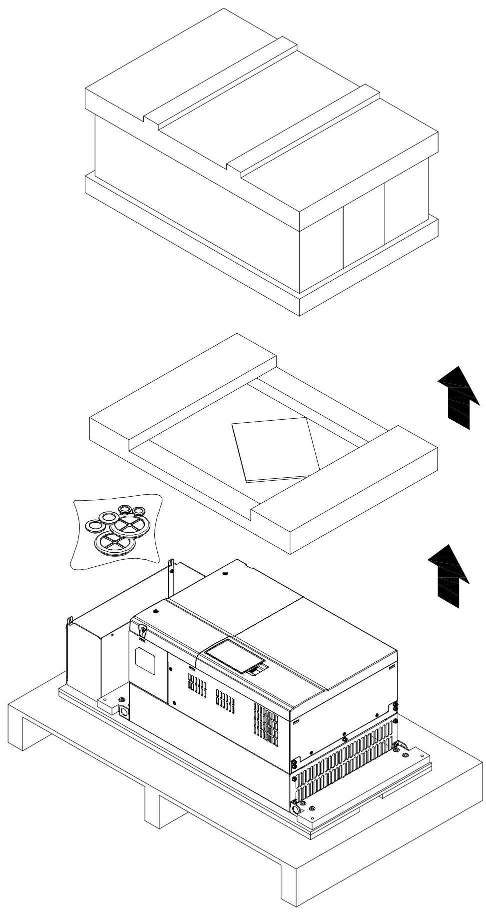
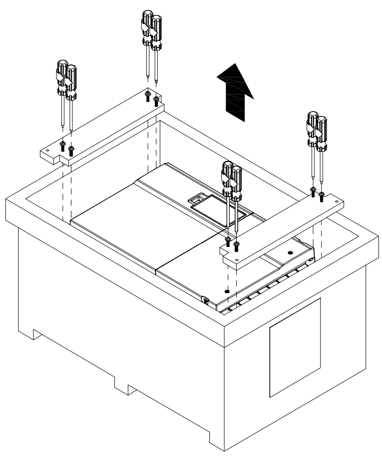
Model No.	Air flow rate for cooling						Power Dissipation		
	Flow Rate (cfm)			Flow Rate (m^3/hr)			Power Dissipation (watt)		
	External	Internal	Total	External	Internal	Total	Loss External (Heat Sink)	Internal	Total
VFD007CP23A-21	-	-	-	-	-	-	40	31	71
VFD015CP23A-21	-	-	-	-	-	-	61	39	100
VFD022CP23A-21	14	-	14	24	-	24	81	45	126
VFD037CP23A-21	14	-	14	24	-	24	127	57	184
VFD055CP23A-21	10	-	10	17	-	17	158	93	251
VFD075CP23A-21	40	14	54	68	24	92	291	101	392
VFD110CP23A-21	66	14	80	112	24	136	403	162	565
VFD150CP23A-21	58	14	73	99	24	124	570	157	727
VFD185CP23A-21	166	12	178	282	20	302	622	218	840
VFD220CP23A-21	166	12	178	282	20	302	777	197	974
VFD300CP23A-21	146	12	158	248	20	268	878	222	1100
VFD370CP23A-00/23A-21	179	30	209	304	51	355	1271	311	1582
VFD450CP23A-00/23A-21	179	30	209	304	51	355	1550	335	1885
VFD550CP23A-00/23A-21	228	73	301	387	124	511	1762	489	2251
VFD750CP23A-00/23A-21	228	73	301	387	124	511	2020	574	2594
VFD900CP23A-00/23A-21	246	73	319	418	124	542	2442	584	3026
VFD007CP43A/4EA-21	-	-	-	-	-	-	35	32	67
VFD015CP43B/4EB-21	-	-	-	-	-	-	48	39	87
VFD022CP43B/4EB-21	-	-	-	-	-	-	64	52	116
VFD037CP43B/4EB-21	14	-	14	24	-	24	103	77	180
VFD040CP43A/4EA-21	10	-	10	17	-	17	124	81	205
VFD055CP43B/4EB-21	10	-	10	17	-	17	142	116	258
VFD075CP43B/4EB-21	10	-	10	17	-	17	205	129	334

Air flow rate for cooling							Power Dissipation		
VFD110CP43B/4EB-21	40	14	54	68	24	92	291	175	466
VFD150CP43B/4EB-21	66	14	80	112	24	136	376	190	566
VFD185CP43B/4EB-21	58	14	73	99	24	124	396	210	606
VFD220CP43A/4EA-21	99	21	120	168	36	204	455	358	813
VFD300CP43B/4EB-21	99	21	120	168	36	204	586	410	996
VFD370CP43B/4EB-21	126	21	147	214	36	250	778	422	1200
VFD450CP43S-00/43S-21	179	30	209	304	51	355	1056	459	1515
VFD550CP43S-00/43S-21	179	30	209	304	51	355	1163	669	1832
VFD750CP43B-00/43B-21	179	30	209	304	51	355	1407	712	2119
VFD900CP43A-00/43A-21	186	30	216	316	51	367	1787	955	2742
VFD1100CP43A-00/43A-21	257	73	330	437	124	561	2112	1084	3196
VFD1320CP43B-00/43B-21	223	73	296	379	124	503	2597	1220	3817
VFD1600CP43A-00/43A-21	224	112	336	381	190	571	3269	1235	4504
VFD1850CP43B-00/43B-21	289	112	401	491	190	681	3814	1570	5384
VFD2200CP43A-00/43A-21			454			771			6358
VFD2800CP43A-00/43A-21			454			771			7325
VFD3150CP43A-00/ VFD3150CP43C-00/43C-21			769			1307			8513
VFD3550CP43A-00/ VFD3550CP43C-00/43C-21			769			1307			9440
VFD4000CP43A-00/ VFD4000CP43C-00/43C-21			769			1307			10642
※ 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.							※ 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.		

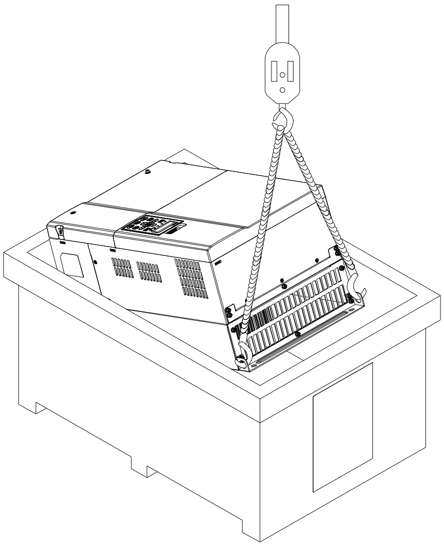
Chapter 3 Unpacking

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.

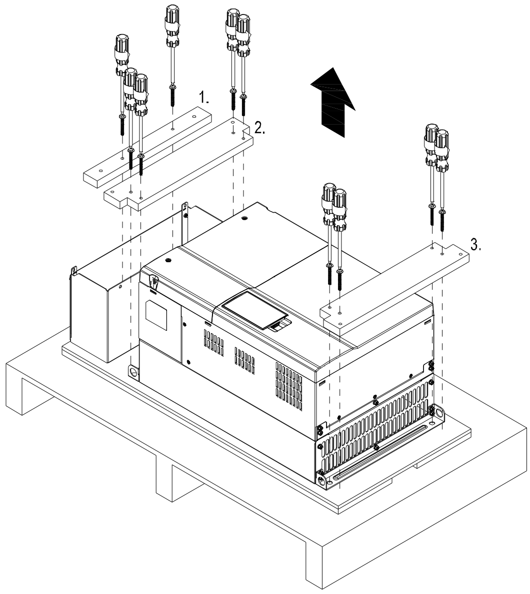
The AC motor drive is packed in the crate. Follows the following step for unpack:

<table>
<tr><th colspan="2">Frame D</th></tr>
<tr><td>Crate 01 (VFDXXXCPXXX-00)
Loosen the 12 cover screws to open the crate.
</td><td>Crate 02 (VFDXXXCPXXX-21)
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 (total 16 screws)
</td></tr>
<tr><td>Remove the EPEs and manual.
</td><td rowspan="2">Remove the crate cover, EPEs, rubber and manual.
</td></tr>
<tr><td>Loosen the 8 screws that fastened on the pallet, remove the wooden plate.
</td></tr>
</table>

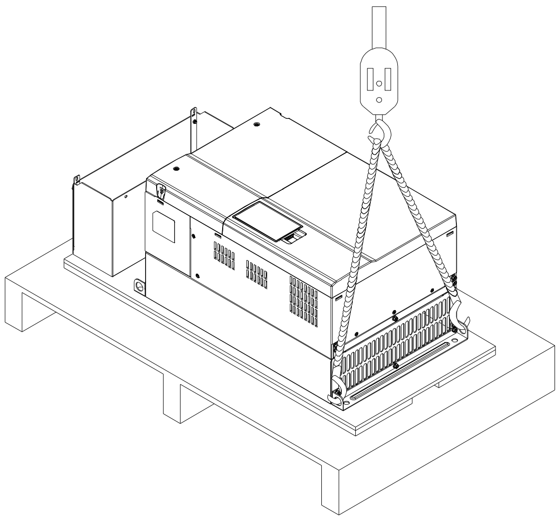
Lift the drive by hooking the lifting hole. It is now ready for installation.



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



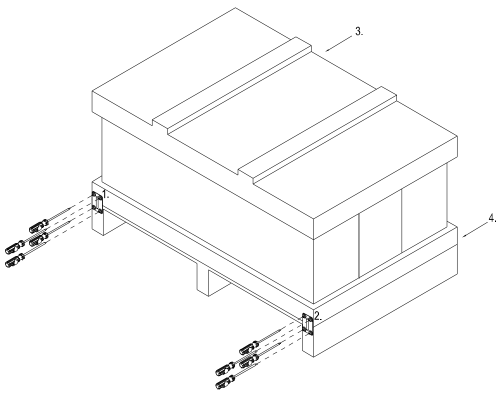
Lift the drive by hooking the lifting hole. It is now ready for installation.



Frame E

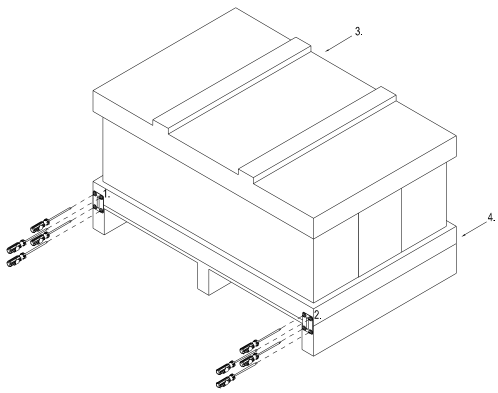
Crate 01 (VFDXXXXCPXXX-00)

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

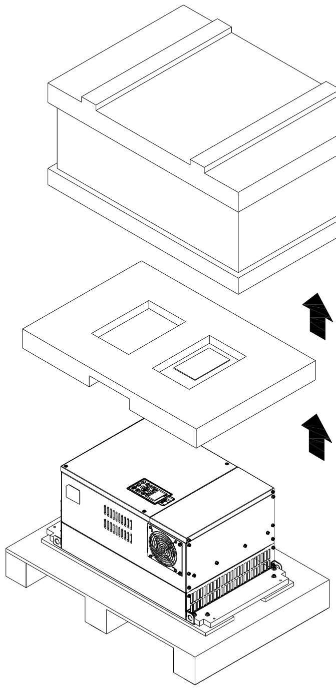


Crate 02 (VFDXXXXCPXXX-21)

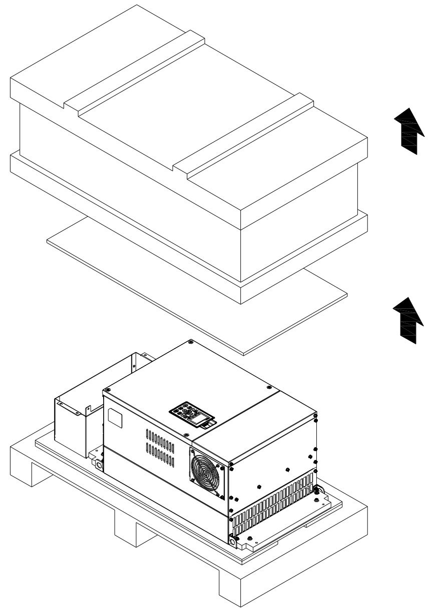
Loosen the 4 screws on the iron plates. There are 4 iron plates and in total of 16 screws.



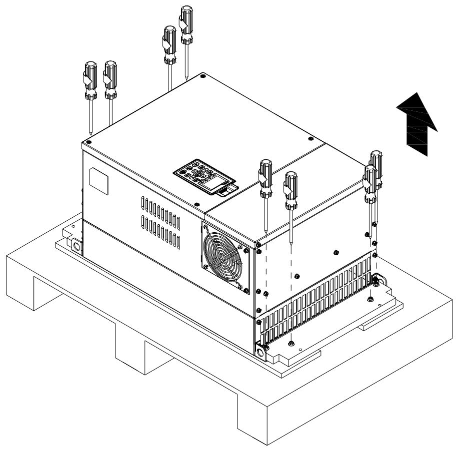
Remove the crate cover, EPEs and manual.



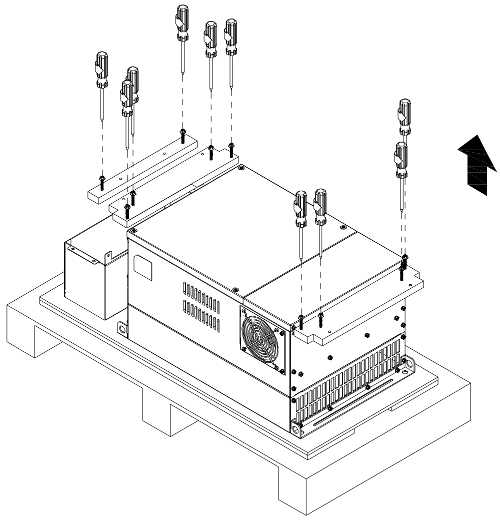
Remove the crate, EPEs, rubbers and manual.



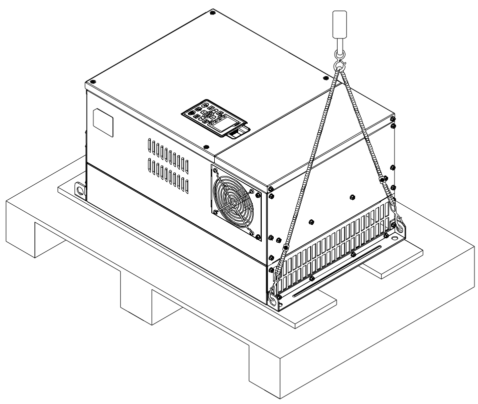
Loosen the 8 screws on the pallet as shown in the following figure.



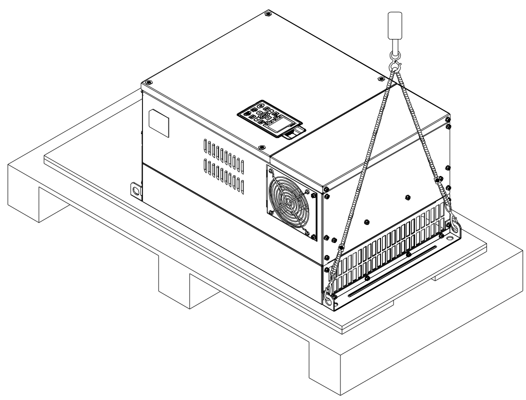
Loosen the 10 screws on the pallet and remove the wooden plate.

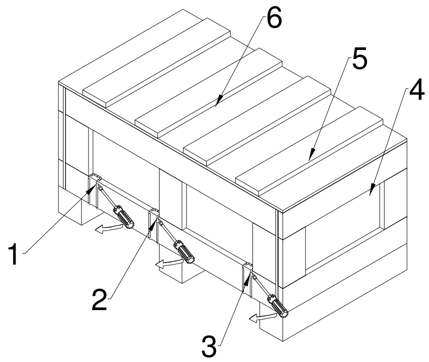
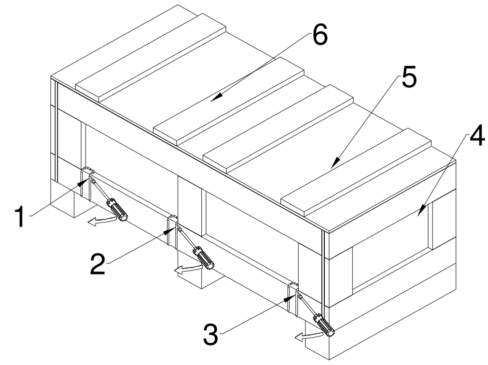
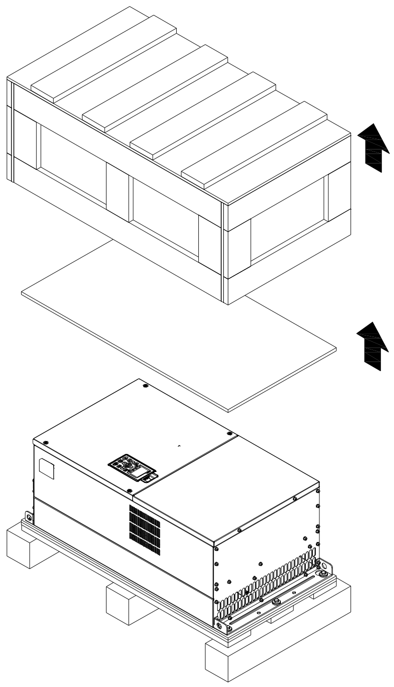
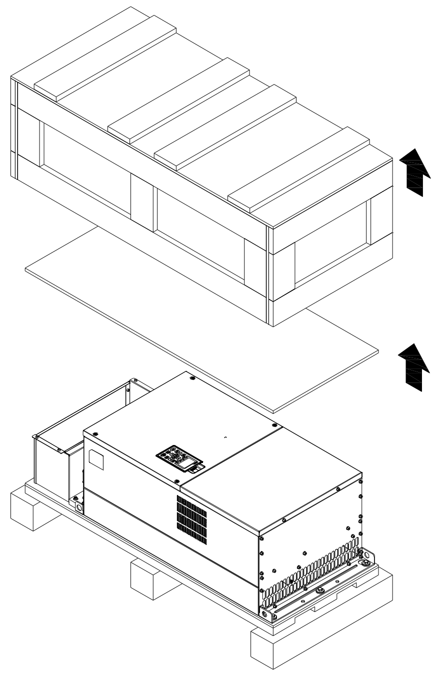
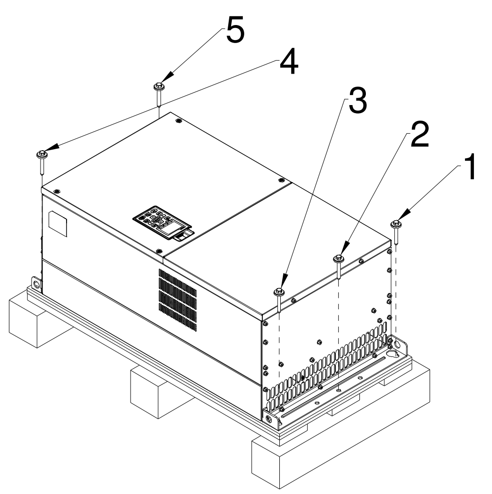
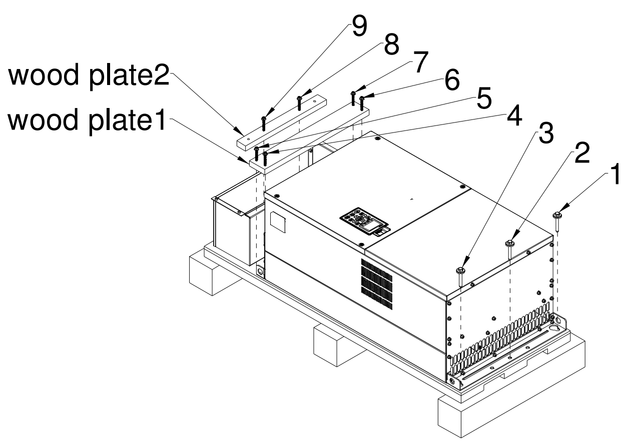


Lift the drive by hooking the lifting hole. It is now ready for installation.

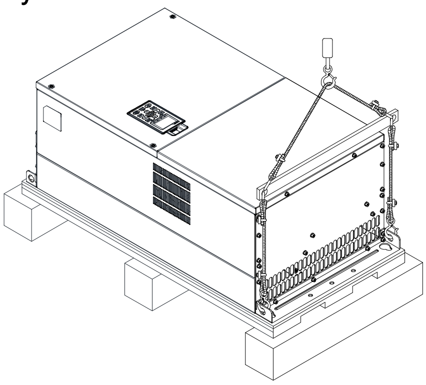


Lift the drive by hooking the lifting hole. It is now ready for installation.

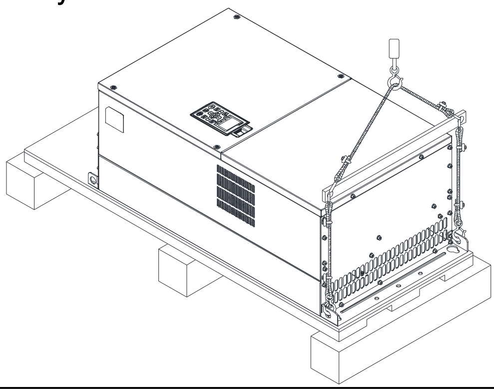


<table>
<tr><th colspan="2">Frame F</th></tr>
<tr><td>Crate 01 (VFDXXXXCPXXX-00)
Remove the 6 clips on the side of the crate with a flat-head screwdriver. (As shown in figure below)

</td>
<td>Crate 02 (VFDXXXXCPXXX-21)
Remove the 6 clips on the side of the crate with a flat-head screwdriver. (As shown in figure below)

</td></tr>
<tr><td>Remove the crate cover, EPEs and manual.
</td>
<td>Remove the crate cover, EPEs, rubber and manual.
</td></tr>
<tr><td>Loosen the 5 screws on the pallet as shown in the following figure.

</td>
<td>Loosen the 9 screws on the pallet and remove the wooden plate.

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

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



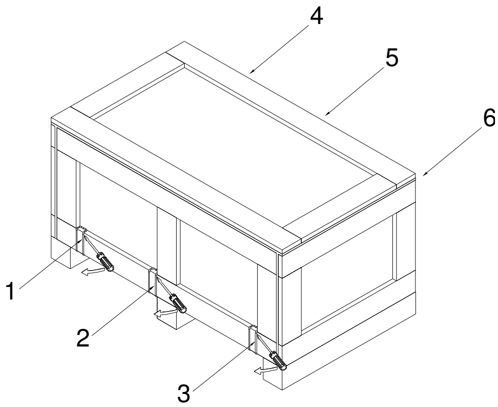
Lift the drive by hooking the lifting hole. It is now ready for installation.



Frame G

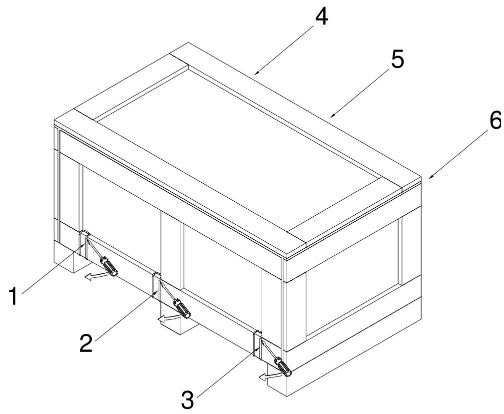
Crate 01 (VFDXXXXCPXXA-00)

Remove the 6 clips on the side of the crate with a flat-head screwdriver. (As shown in figure below.)

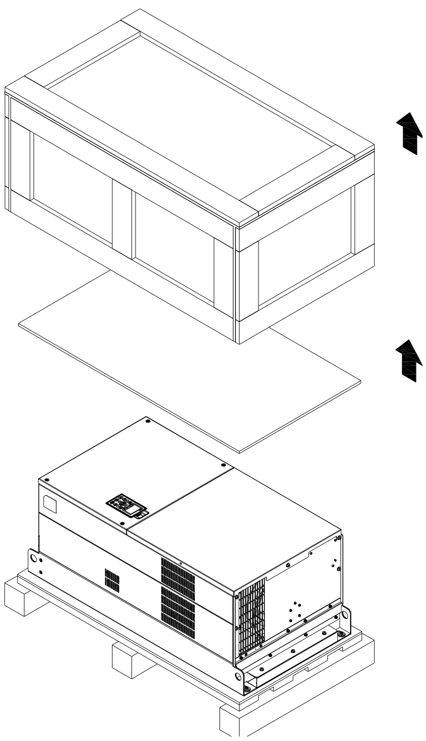


Crate 02 (VFDXXXXCPXXA-21)

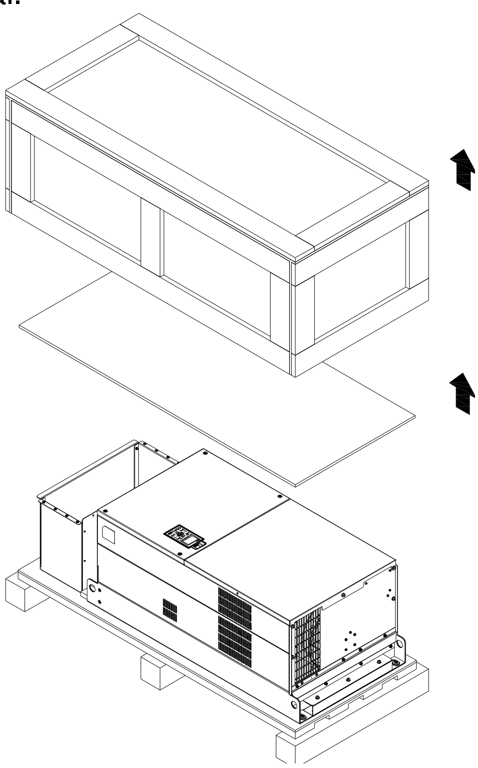
Remove the 6 clips on the side of the crate with a flat-head screwdriver. (As shown in figure below)



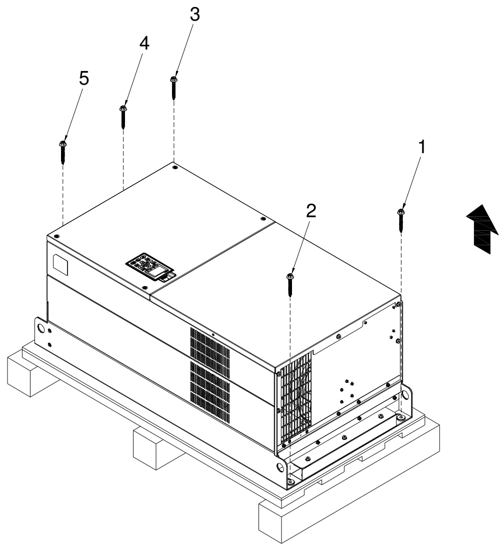
Remove the crate cover, EPEs and manual.



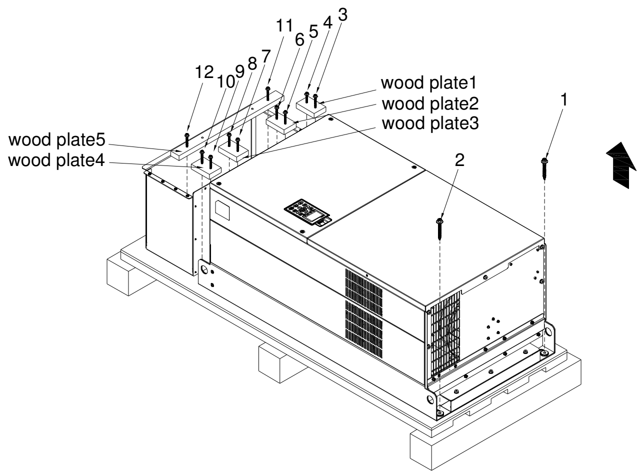
Remove the crate cover, EPEs, rubber and manual.



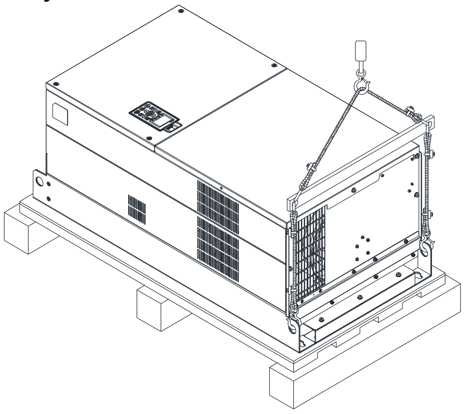
Loosen the 5 screws as shown in following figre.



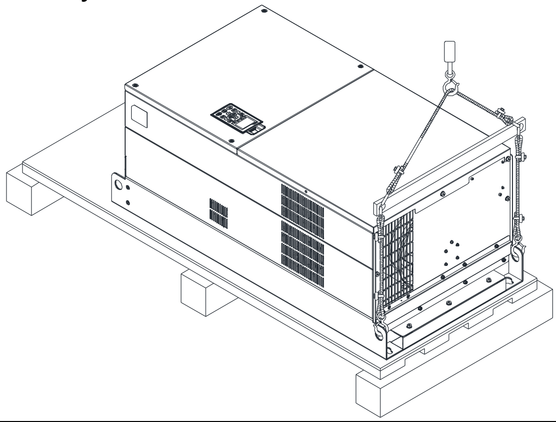
Loosen the 12 screws and remove the wooden plate.



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



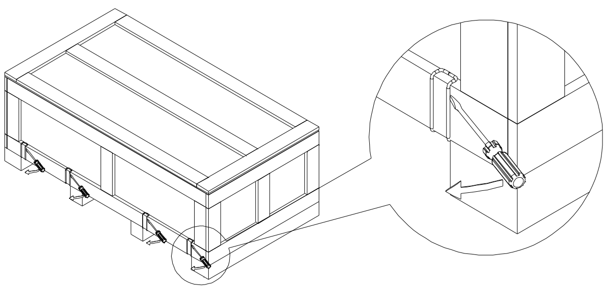
Lift the drive by hooking the lifting hole. It is now ready for installation.



Frame H

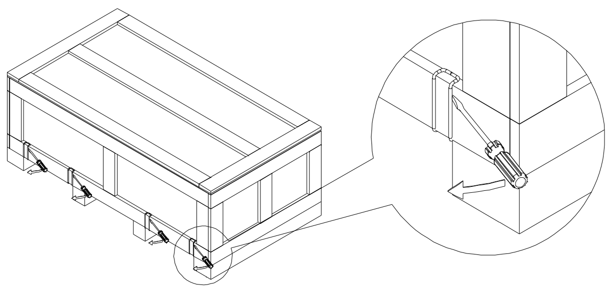
Crate 01 (VFDXXXXCPXXA-00)

Remove the 8 clips on the side of the crate with a flat-head screwdriver. (As shown in figure below)

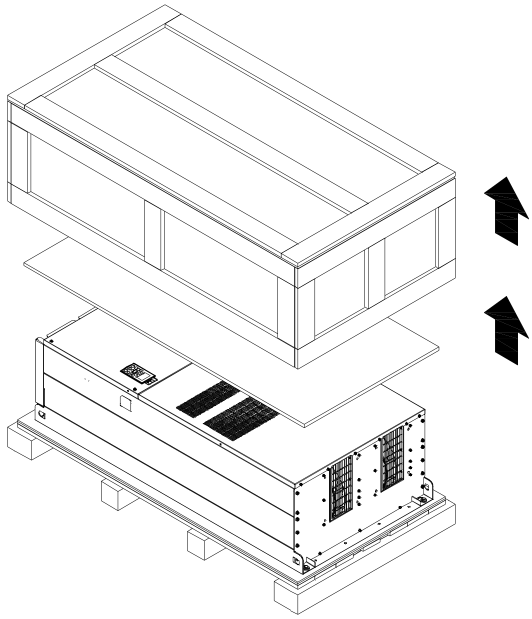


Crate 02 (VFDXXXXCPXXC-00)

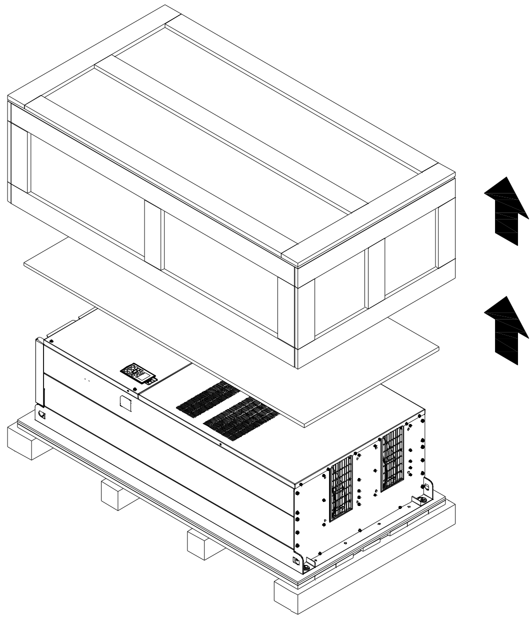
Remove the 8 clips on the side of the crate with a flat-head screwdriver. (As shown in figure below)



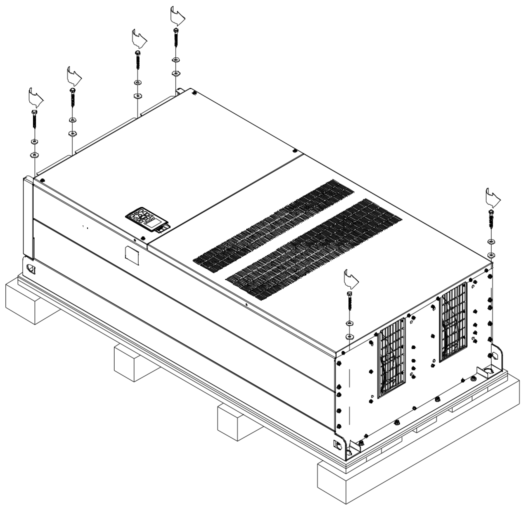
Remove the crate cover, EPEs and manual.



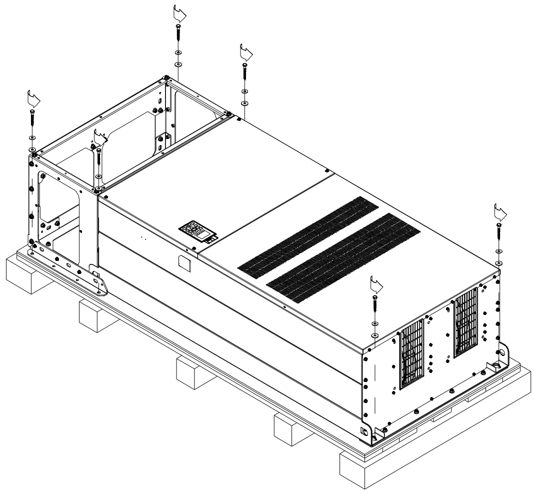
Remove the crate cover, EPEs, rubbers and manual.



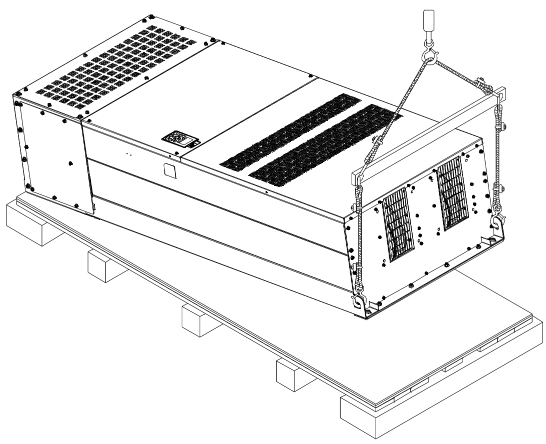
Loosen the 6 screws on the top then remove 6 metal washers and 6 plastic washers as shown in figure below.



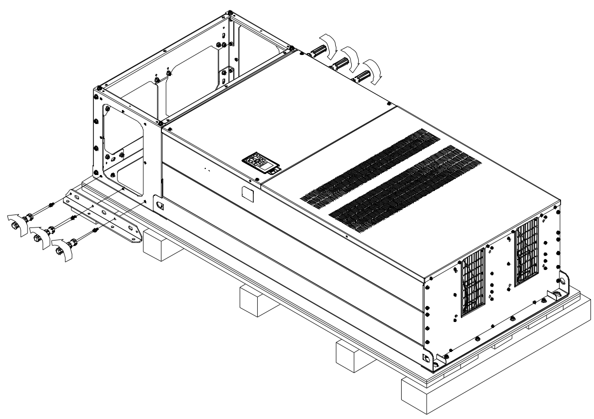
Loosen the 6 screws on the top then remove 6 metal washers and 6 plastic washers as shown in figure below.



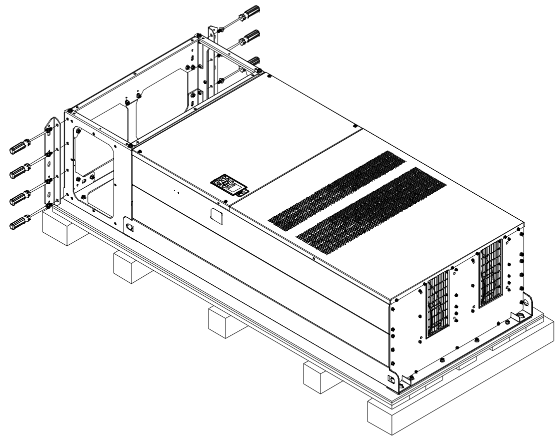
Lift the drive by hooking the lifting hole. It is now ready for installation.



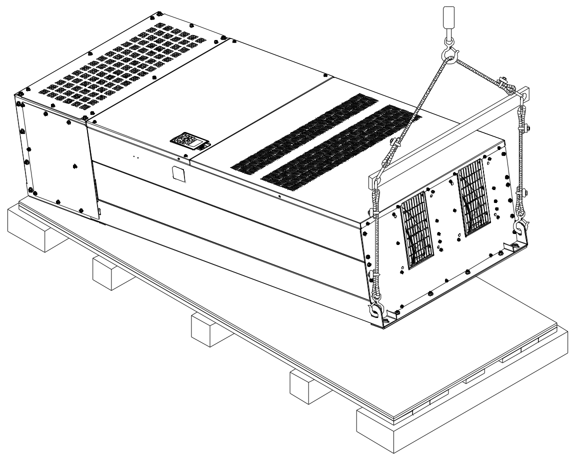
Loosen 6 of the M6 screws on the side and remove the 2 plates, as shown in below. The removed screws and plates can be used to secure the AC motor drive from the external.



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. And then fix the plcates to AC motor drive by fasten 8 of the M8 screws. (As shown in below)
Torque: 150~180kg-cm [130.20~156.24lb-in.]



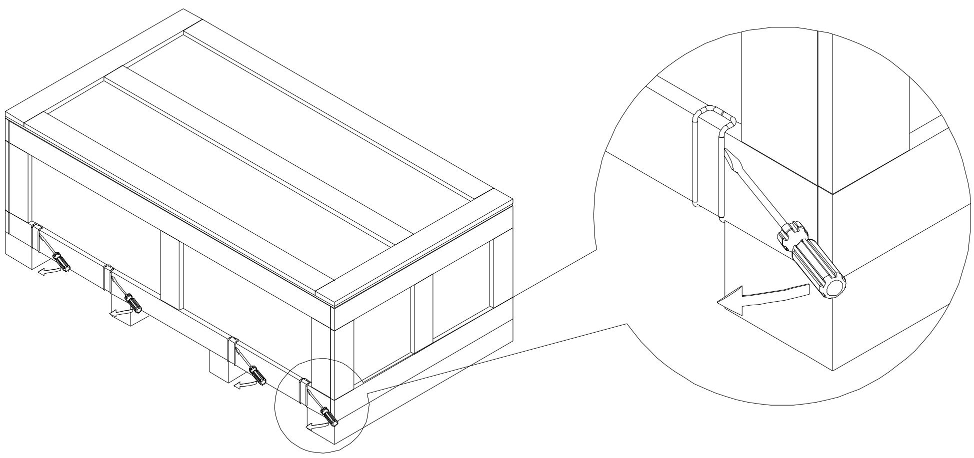
Lift the drive by hooking the lifting hole. It is now ready for installation.



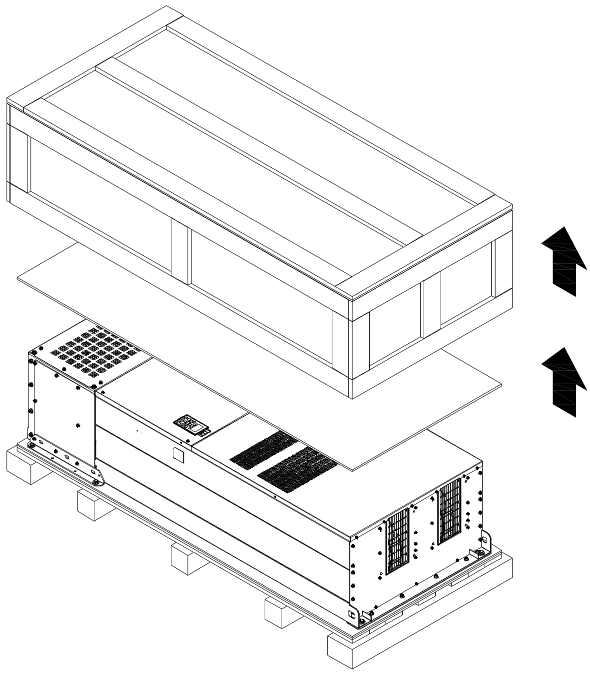
Frame H

Crate 03 (VFDXXXXCPXXC-21)

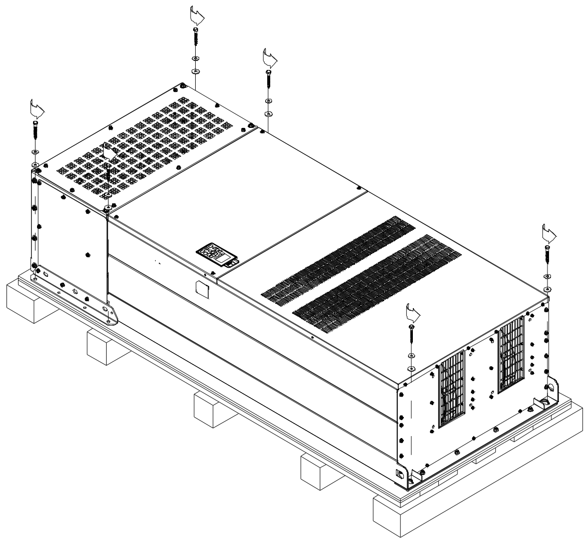
Use flate-head screwdriver to remove the clips on the side of the crte, 8 clips in total.



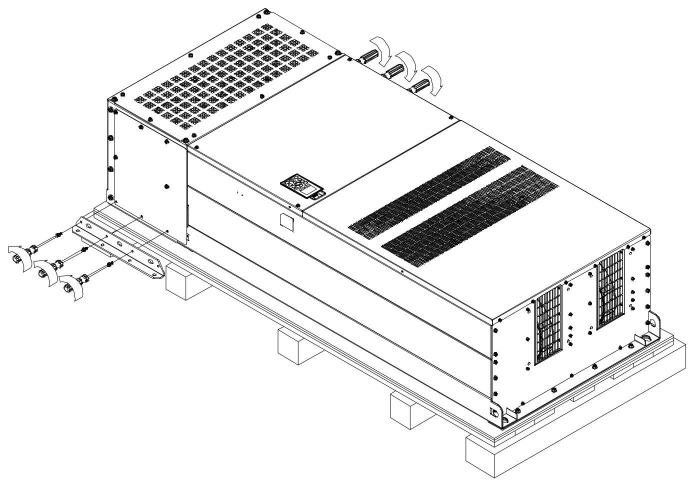
Remoe the crate cover, EPEs, rubber and manual.



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



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



<table>
<tr><th>Secure the drive from the internal</th><th>Secure the drive from the external</th></tr>
<tr><td>
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.]

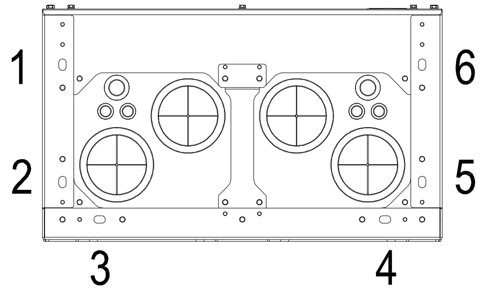


Figure 1. Top cover (use M12 screws)

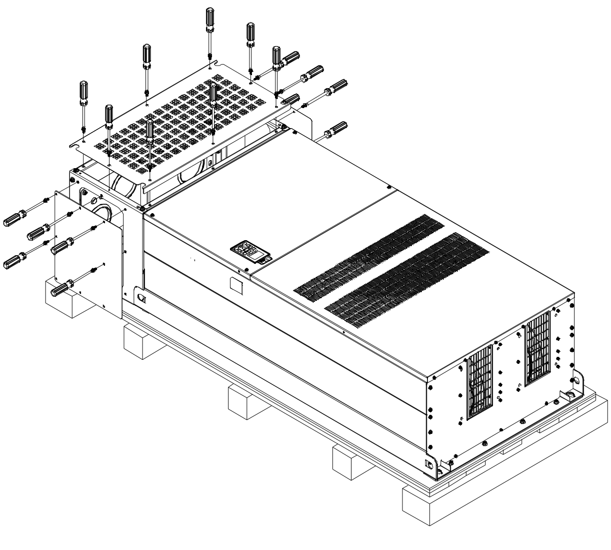
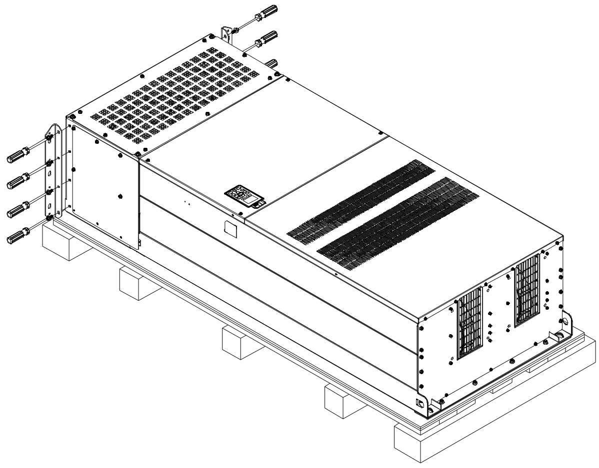
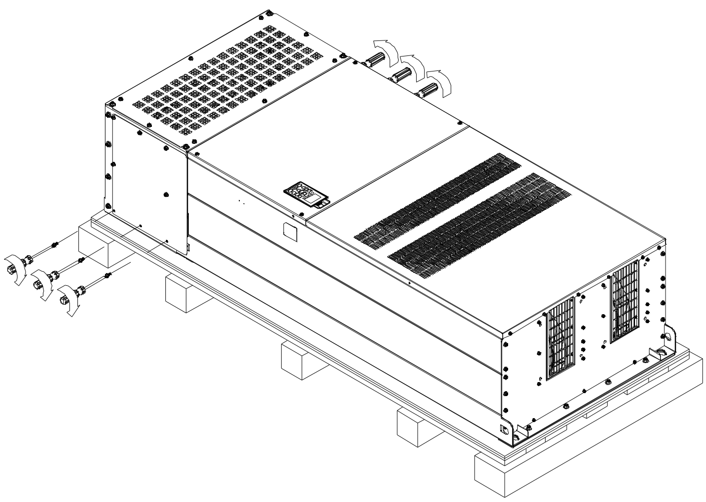
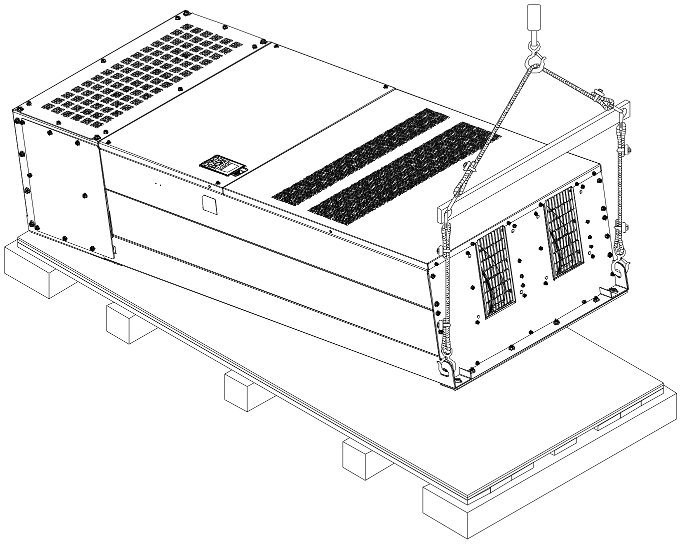


Figure 2
</td><td>
Loosen 8 of the M8 screws on the both sides and place the 2 plates that were removed from the last step. And then fix the plates to drive by fasten 8 of the M8 screws. (As shown in figure below)
Torque: 150~180kg-cm [130.20~156.24lb-in.]


</td></tr>
<tr><td colspan="2">
Fasten 6 of the M6 screws that were removed from last step back to the AC motor drive. As shown in figure below.


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

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

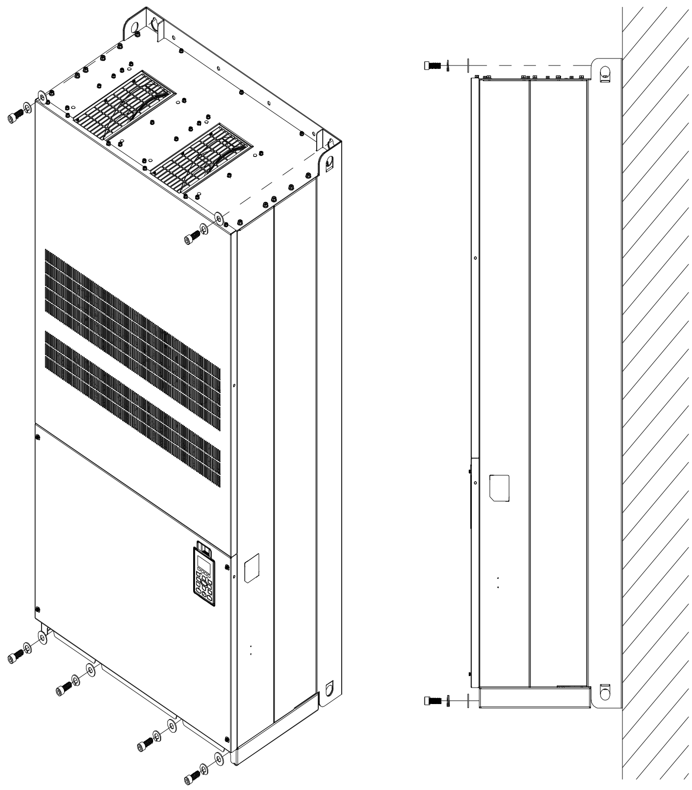


Frame H: Secure the drive

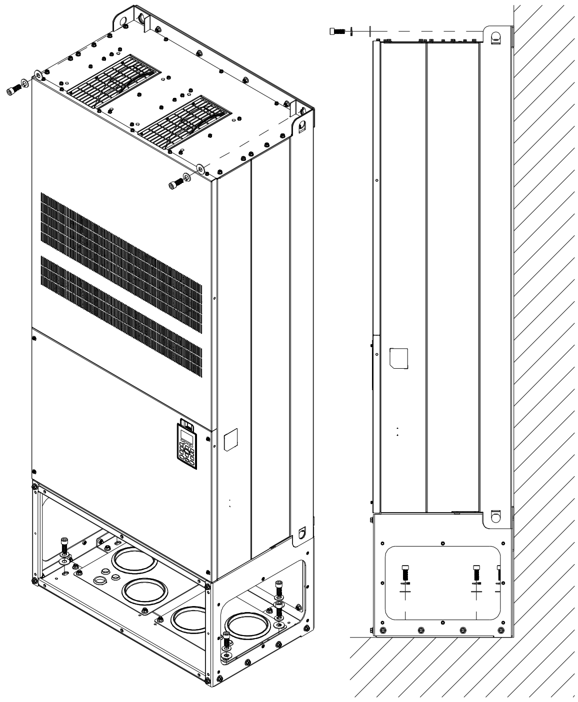
VFDXXXXCPXXA-00

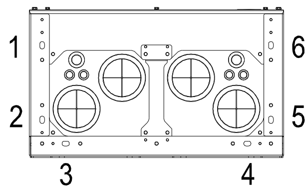
Screw: M12*6

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



VFDXXXXCPXXC-00



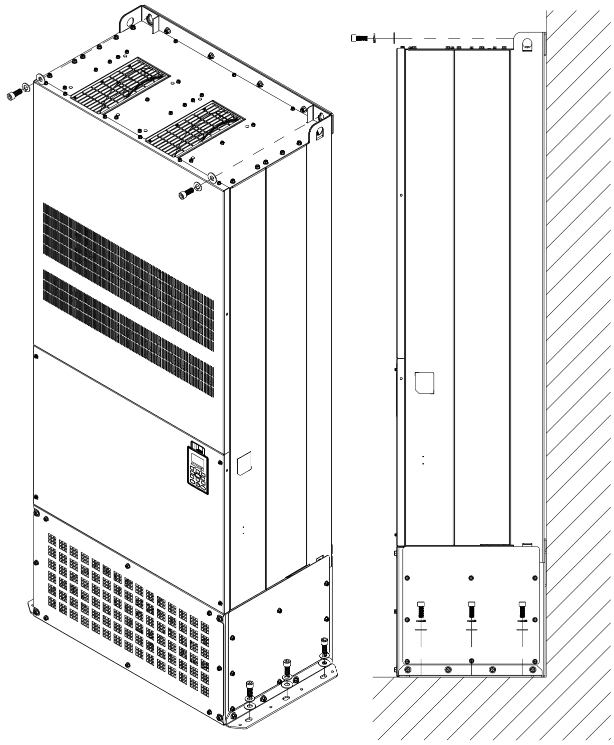


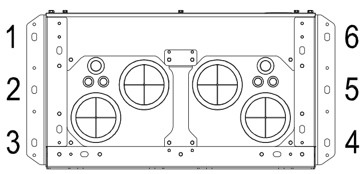
Secure the drive from internal.

Screw: M12*8

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

VFDXXXXCPXXC-21





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 D0~H).

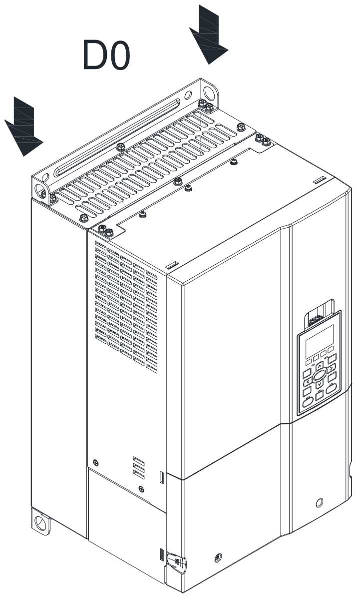


Figure 1

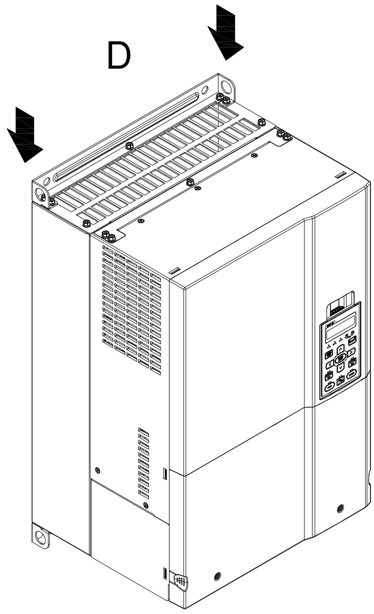


Figure 2

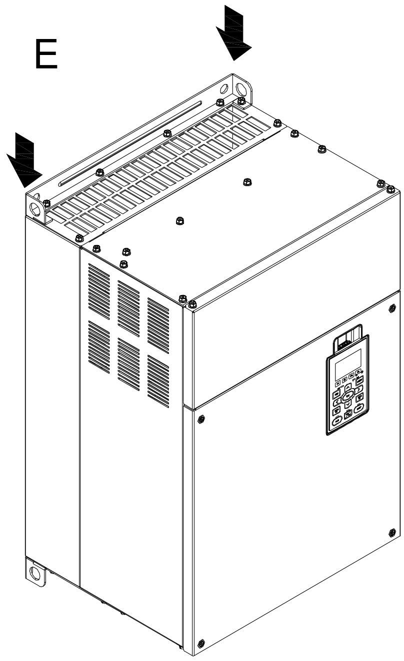


Figure 3

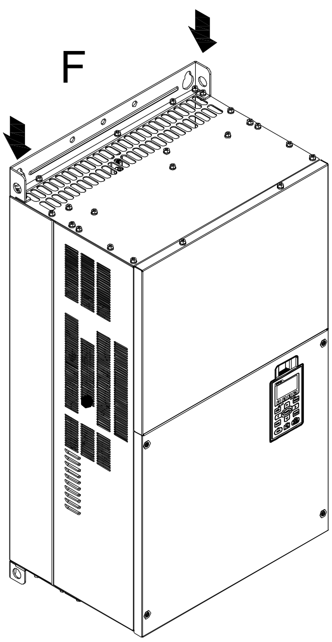


Figure 4

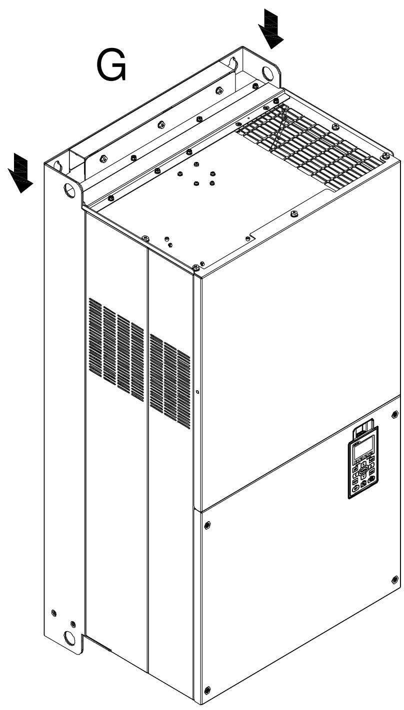


Figure 5

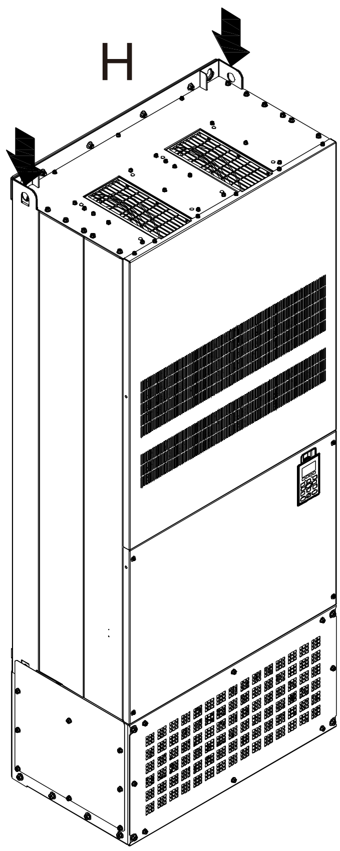
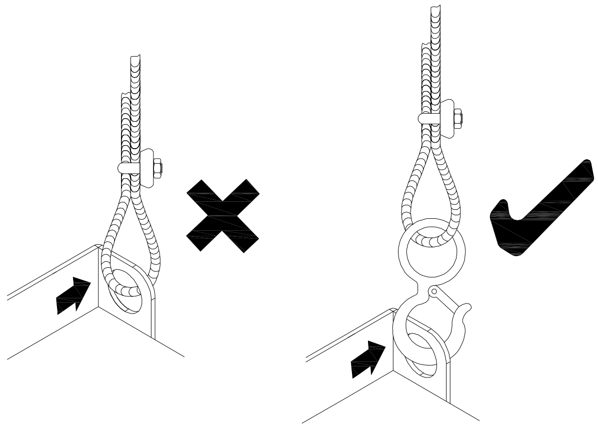
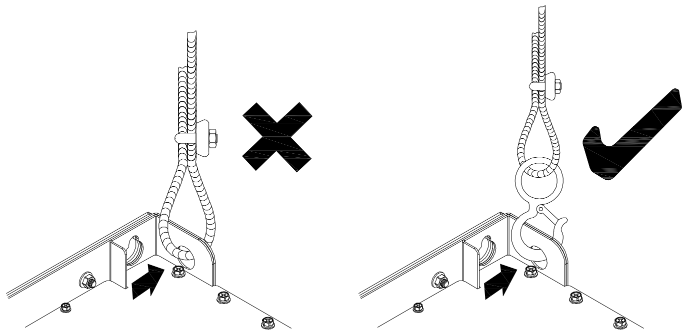


Figure 6

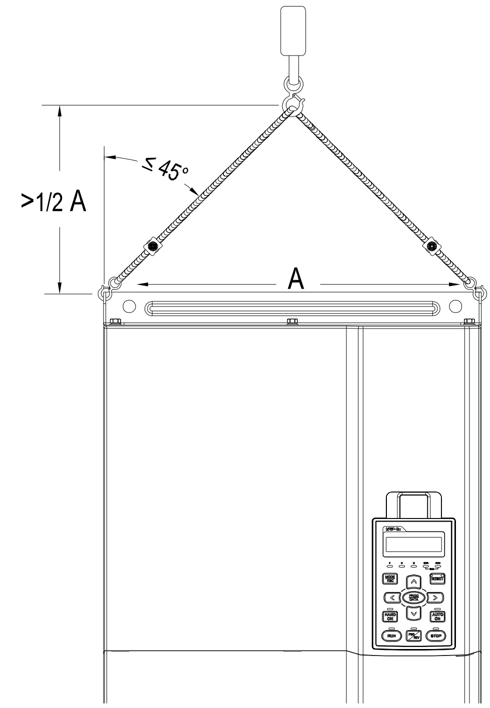
Ensure the lifting hook properly goes through the lifting hole, as shown in the following diagram.
(Applicable for Frame D0~E)

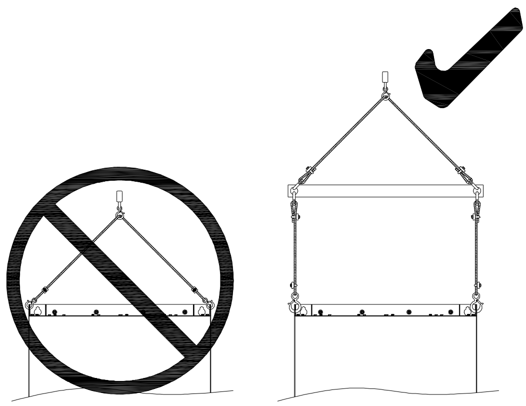


(Applicable to Frame F~H)

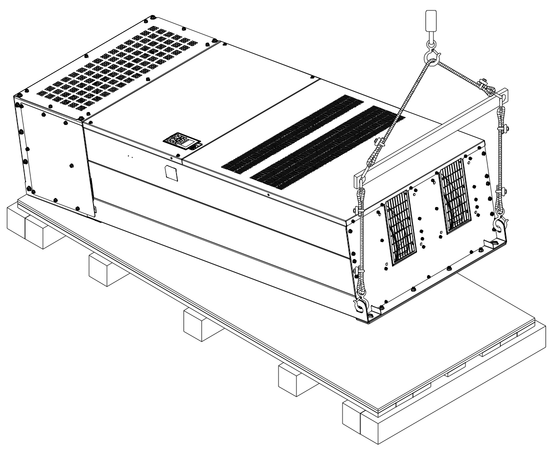


Ensure the angle between the lifting holes and the lifting device is within the specification, as shown in the following diagram.
(Applicable for Frame D0~E)





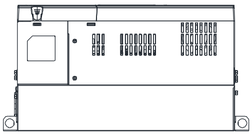
(Applicable from Frame F~H)



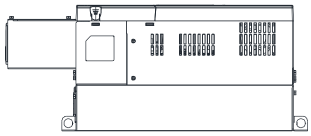
Weight of models

D0

VFDXXXCPXXX-00
27 kg(59.5 lbs.)

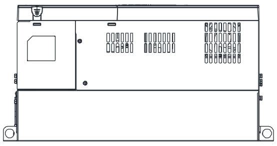


VFDXXXCPXXX-21
29 kg(63.9 lbs.)

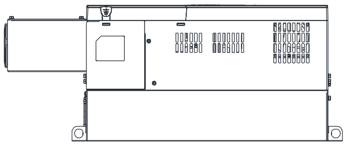


D

VFDXXXCPXXX-00
37.6 kg(82.9 lbs.)

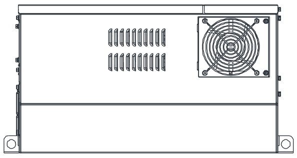


VFDXXXCPXXX-21
40 kg(88.2 lbs.)

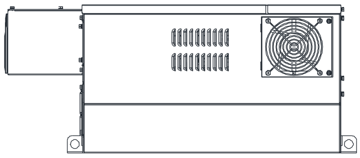


E

VFDXXXXCPXXX-00
63.6 kg(140.2 lbs.)

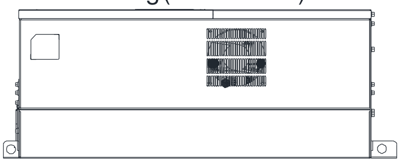


VFDXXXXCPXXX-21
66 kg(145.5 lbs.)

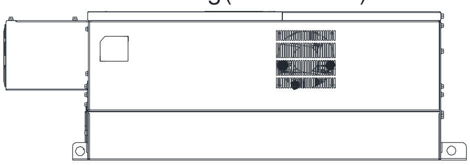


F

VFDXXXXCPXXX-00
85kg(187.2 lbs.)



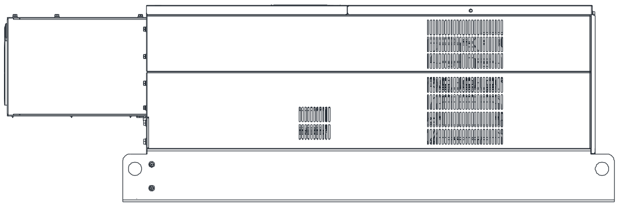
VFDXXXXCPXXX-21
88kg(193.8 lbs.)



G

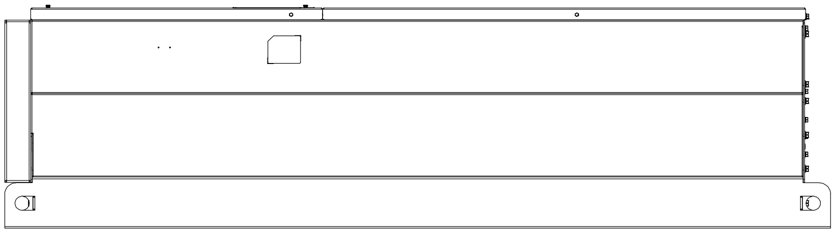
VFDXXXXCPXXA-00
130kg(286.5 lbs.)

VFDXXXXCPXXA-21
138kg(303.9 lbs.)



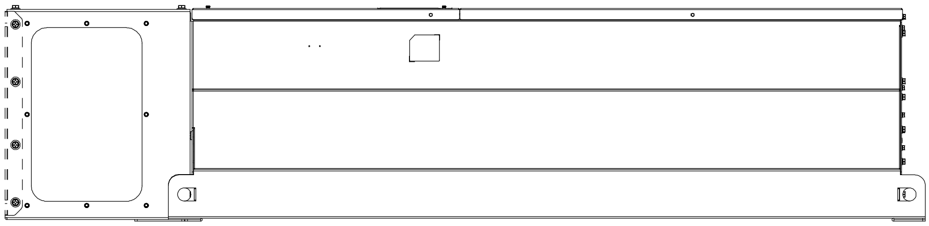
VFD3150CP43A-00; VFD3550CP43A-00; VFD4000CP43A-00 235kg(518.1 lbs)

H1



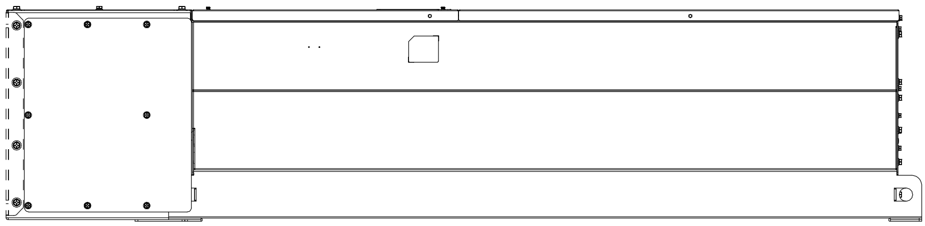
VFD3150CP43C-00; VFD3550CP43C-00; VFD4000CP43C-00 257kg(566.6 lbs)

H2



VFD3150CP43C-21; VFD3550CP43C-21; VFD4000CP43C-21 257kg(566.6 lbs)

H3



Chapter 4 Wiring

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

☑ Make sure that power is only applied to the R/L1, S/L2, T/L3 terminals. Failure to comply may result in damage to the equipments. The voltage and current should lie within the range as indicated on the nameplate (Chapter 1-1).

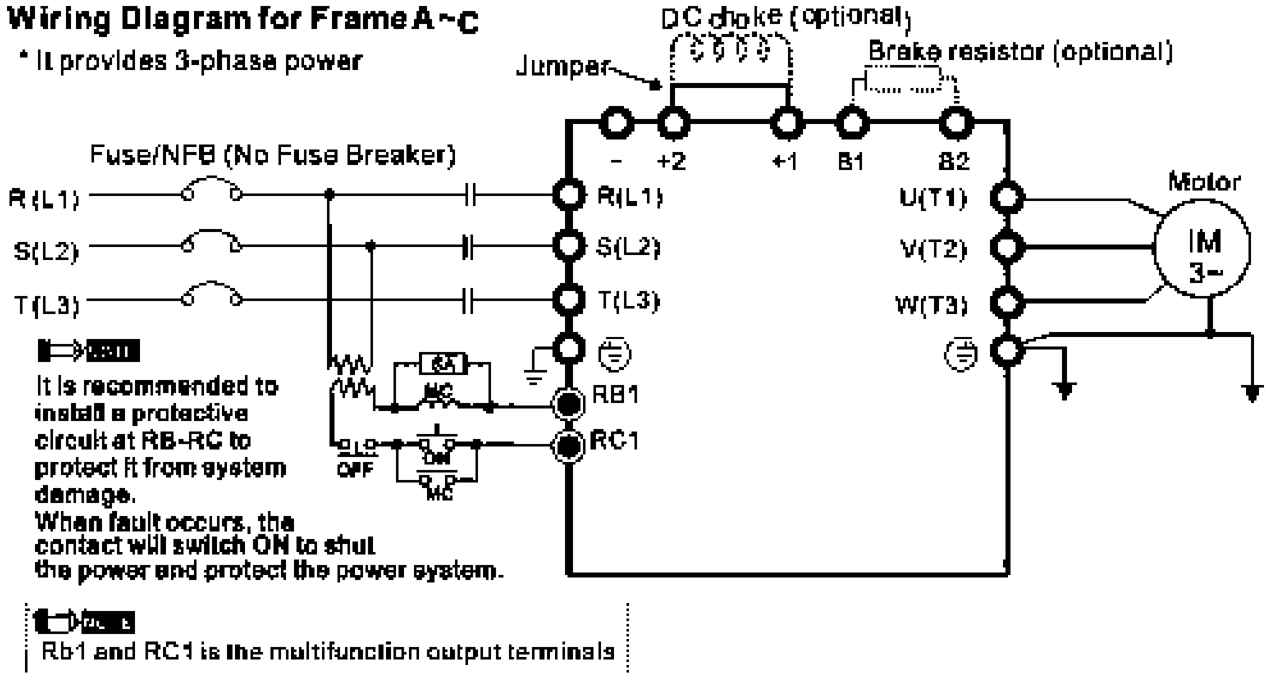
☑ All the units must be grounded directly to a common ground terminal to prevent lightning strike or electric shock.

☑ Please make sure to fasten the screw of the main circuit terminals to prevent sparks which is made by the loose screws due to vibration

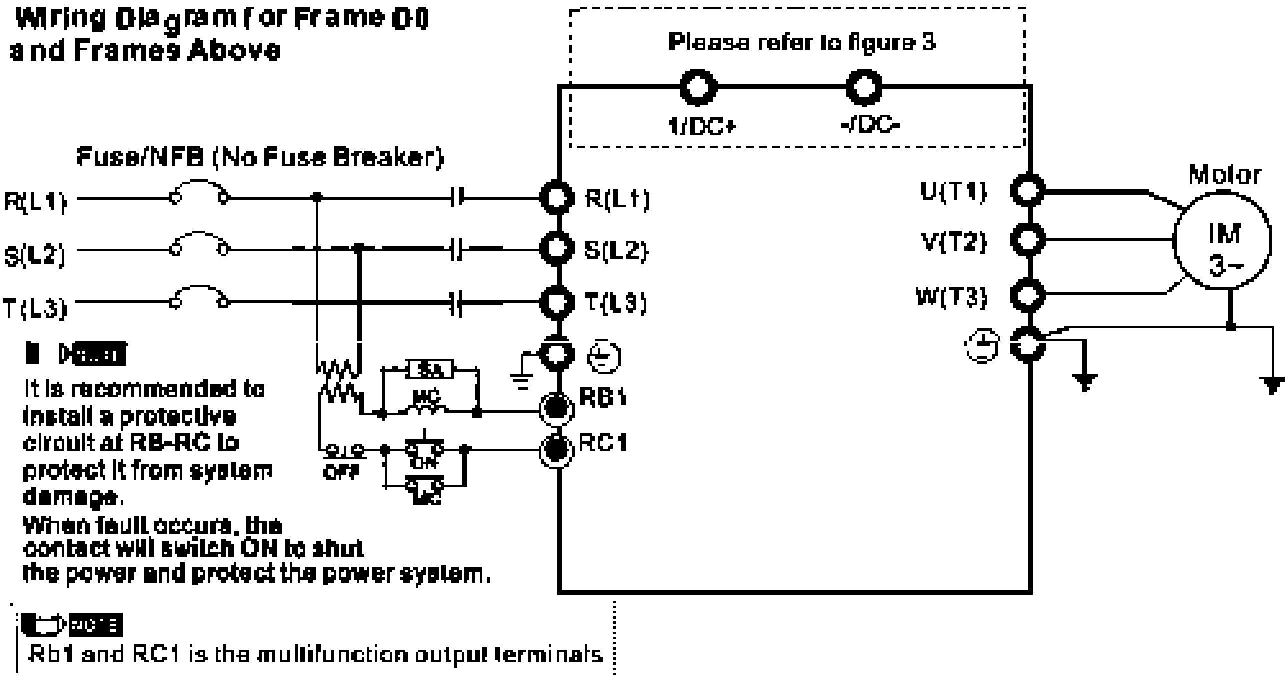
DANGER	☑ It is crucial to turn off the AC motor drive power before any wiring installation are made. A charge may still remain in the DC bus capacitors with hazardous voltages even if the power has been turned off therefore it is suggested for users to measure the remaining voltage before wiring. For your personnel saftery, please do not perform any wiring before the voltage drops to a safe level < 25 Vdc. Wiring installation with remaninig voltage condition may caus sparks and short circuit. ☑ Only qualified personnel familiar with AC motor drives is allowed to perform installation, wiring and commissioning. Make sure the power is turned off before wiring to prevent electric shock.
CAUTION	☑ When wiring, please choose the wires with specification that complys with local regulation for your personnel safety. ☑ Check following items after finishing the wiring: 1. Are all connections correct? 2. Any loosen wires? 3. Any short-circuits between the terminals or to ground?

4-1 Wiring

Wiring Diagram for Frame A~C



Wiring Diagram for Frame D0 and Frames Above



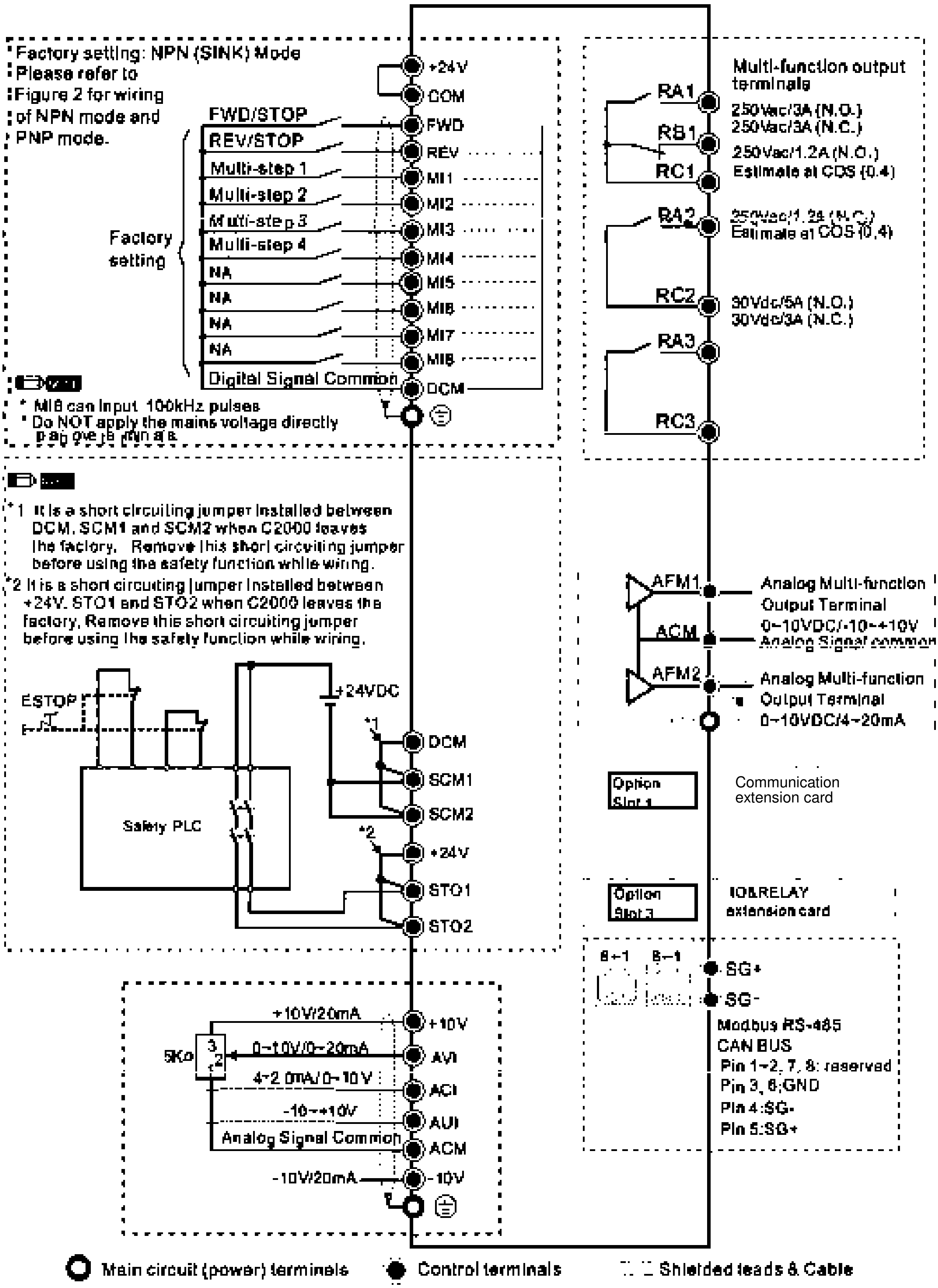

Factory setting: NPN (SINK) Mode
Please refer to
Figure 2 for wiring
of NPN mode and
PNP mode.
Factory setting
FWD/STOP
REV/STOP
Multi-step 1
Multi-step 2
Multi-step 3
Multi-step 4
NA
NA
NA
NA
Digital Signal Common
+24V
COM
FWD
REV
MI1
MI2
MI3
MI4
MI5
MI6
MI7
MI8
DCM
* MI8 can input 100kHz pulses
* Do NOT apply the mains voltage directly
Multi-function output terminals
RA1
RB1
RC1
RA2
RC2
RA3
RC3
250Vac/3A (N.O.)
250Vac/3A (N.C.)
250Vac/1.2A (N.O.)
Estimate at COS (0.4)
Estimate at COS (0.4)
30Vdc/5A (N.O.)
30Vdc/3A (N.C.)
*1 It is a short circuiting jumper installed between DCM, SCM1 and SCM2 when C2000 leaves the factory. Remove this short circuiting jumper before using the safety function while wiring.
*2 It is a short circuiting jumper installed between +24V, STO1 and STO2 when C2000 leaves the factory. Remove this short circuiting jumper before using the safety function while wiring.
ESTOP
+24VDC
*1
*2
Safety PLC
DCM
SCM1
SCM2
+24V
STO1
STO2
AFM1
ACM
AFM2
Analog Multi-function Output Terminal
0~10VDC/-10~+10V
Analog Signal common
Analog Multi-function Output Terminal
0~10VDC/4~20mA
Option Slot 1
Communication extension card
Option Slot 3
IO&RELAY extension card
8~1
8~1
SG+
SG-
Modbus RS-485
CAN BUS
Pin 1~2, 7, 8: reserved
Pin 3, 6:GND
Pin 4:SG-
Pin 5:SG+
+10V/20mA
5KΩ
0~10V/0~20mA
4~20mA/0~10V
-10~+10V
Analog Signal Common
-10V/20mA
+10V
AVI
ACI
AUI
ACM
-10V
Main circuit (power) terminals
Control terminals
Shielded leads & Cable

Figure 1

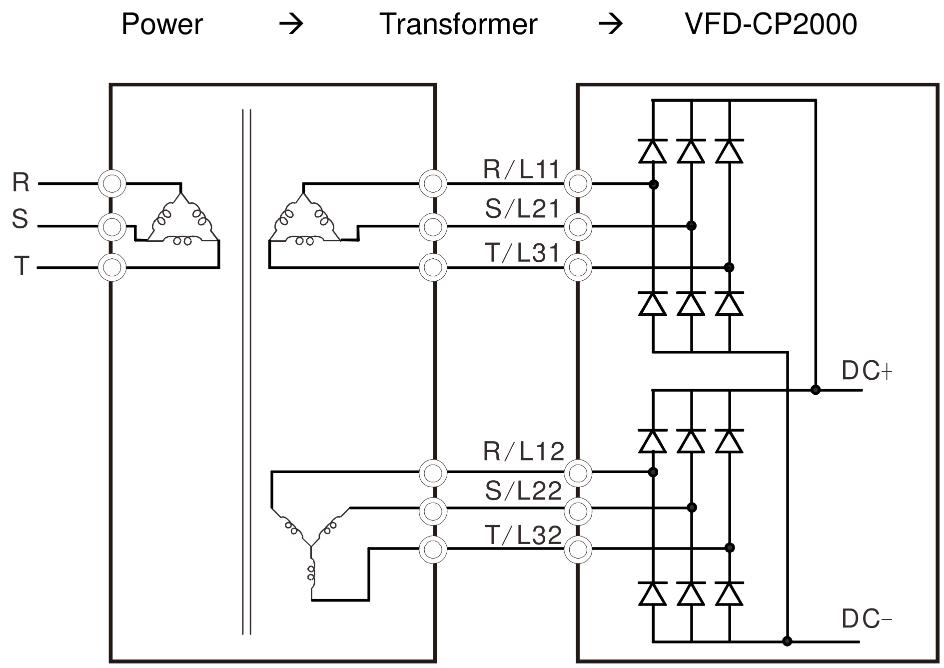


Figure 2

SINK（NPN）/SOURCE（PNP）Mode

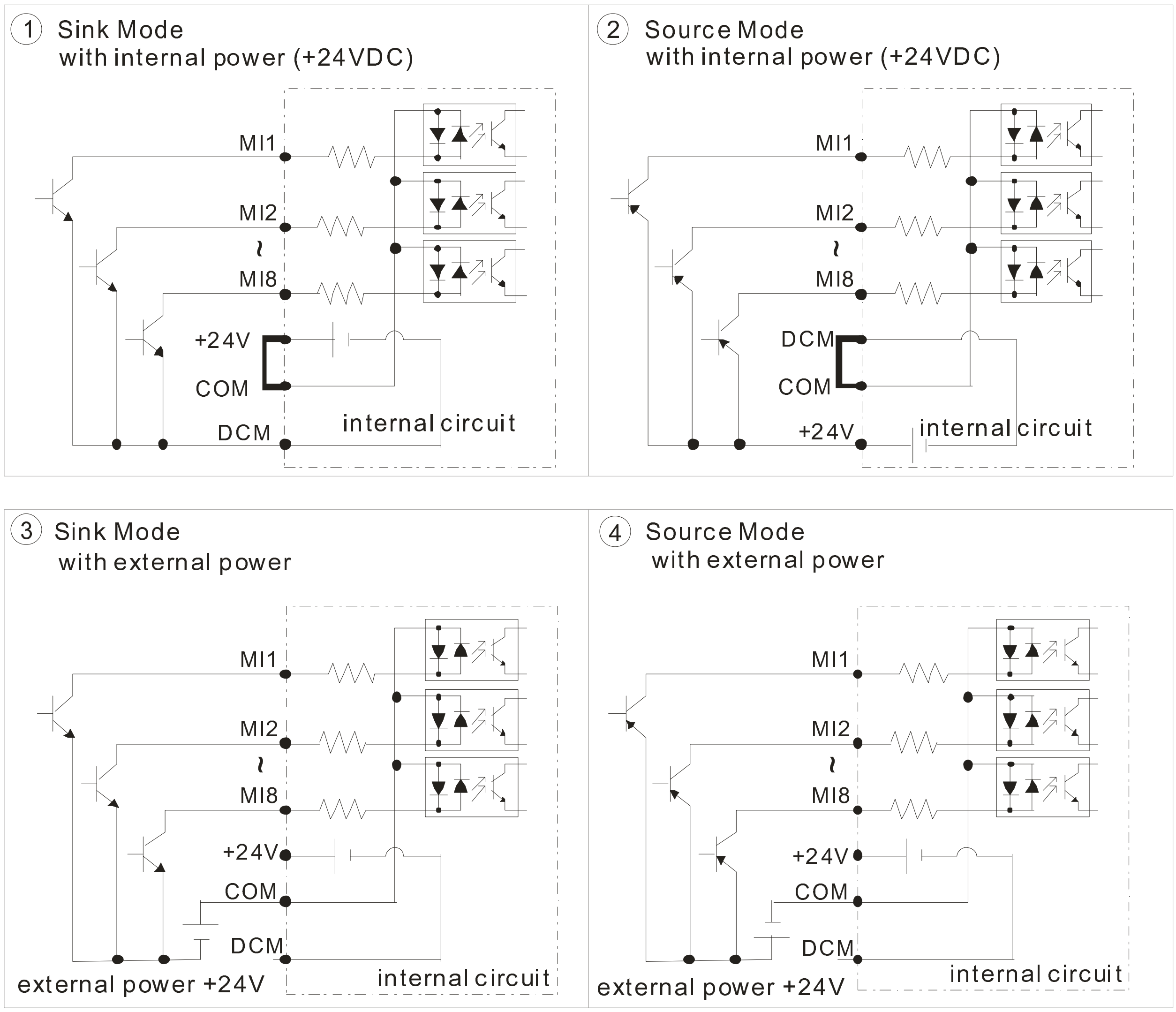


Figure 3

Frame E~H DC Link Check Point (including common DC link or DC power input)

☑ Applicable to Frame E~H

☑ Operation Instruction

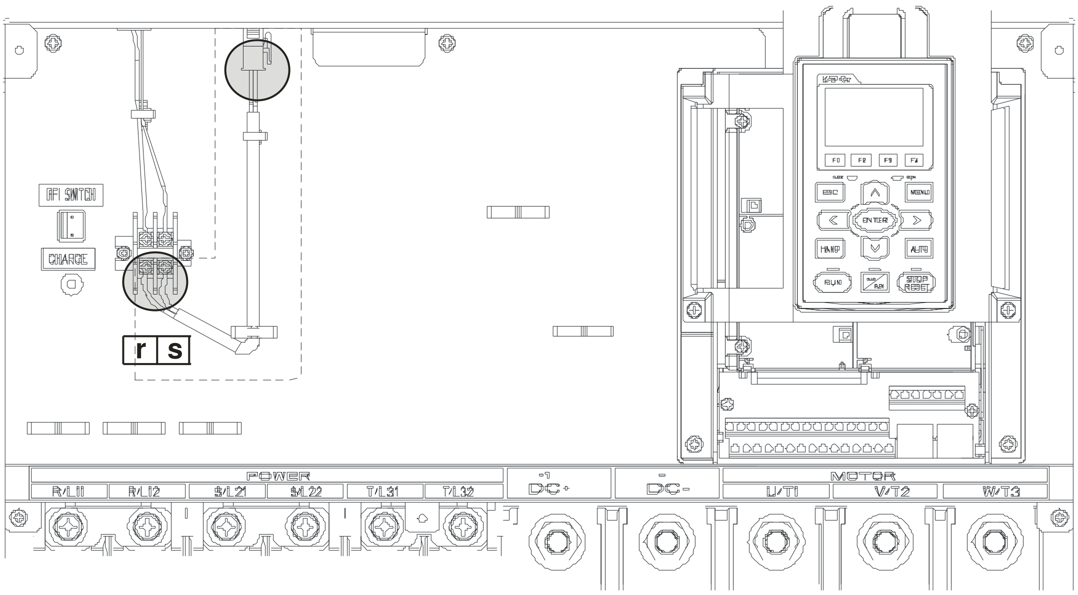
1. When RST power is off, please disconnect terminal r and terminal s. (As circled in dotted line, uninstall the gray section and properly store cable r and cable s. Cable r and cable s are not available in optional accessories, do not dispose them.)

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

   When the drive power is on, if terminal r and terminal s are not connected to new power source (220 Vac for 220V model and 440Vac for 440 V model), the digital keypad will display an error message "ryF".
2. When DC Link is used as a DC Bus connection (RST power is applied), it is not required to remove terminal r and terminal s.

NOTE

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



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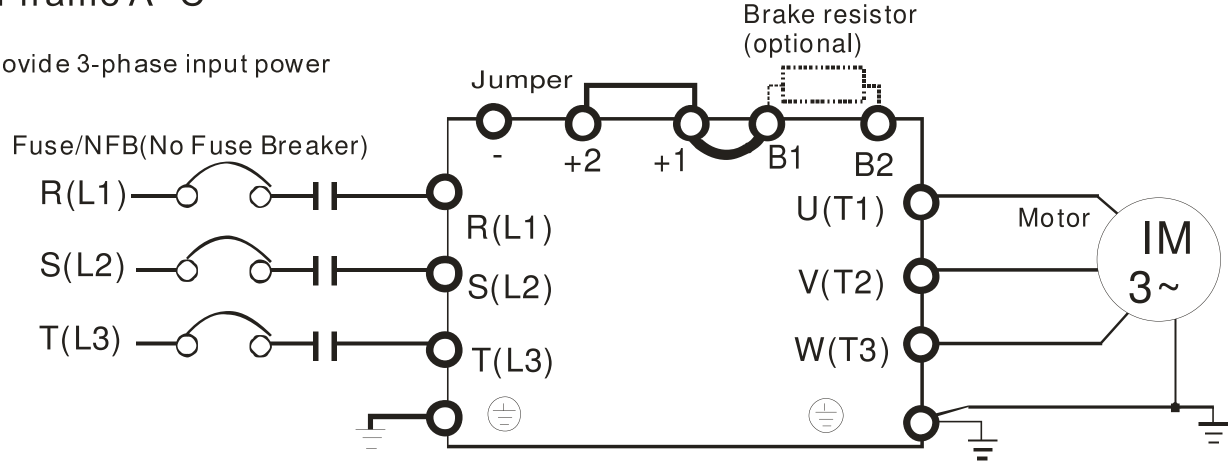
Chapter 5 Main Circuit Terminals

5-1 Main Circuit Diagram

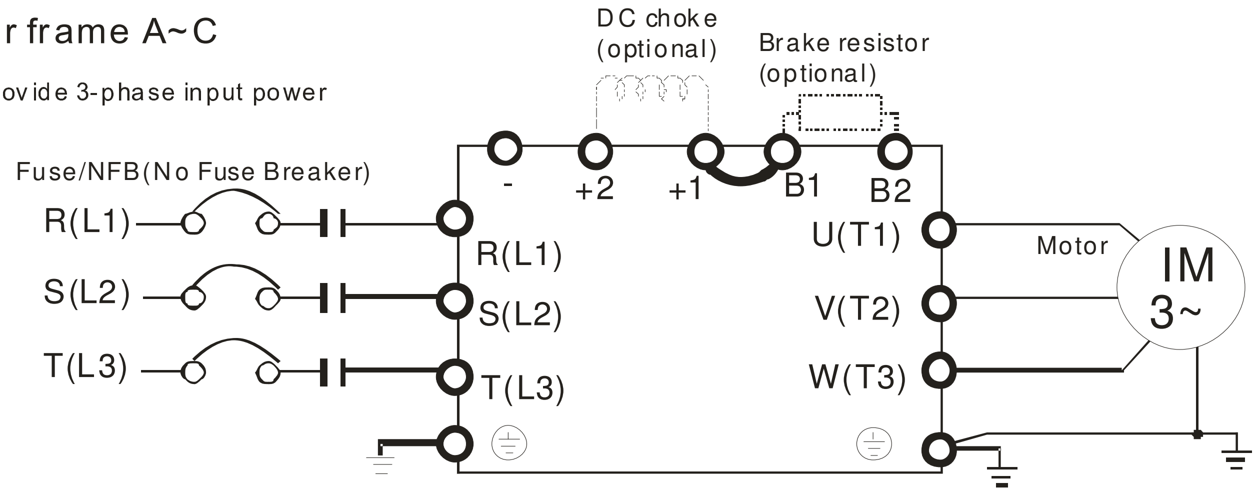
For frame A~C

* Provide 3-phase input power



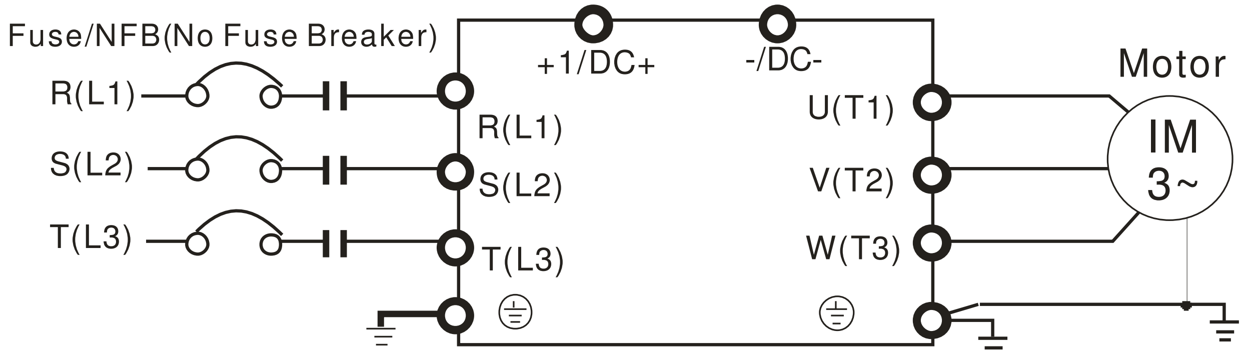
For frame A~C

* Provide 3-phase input power

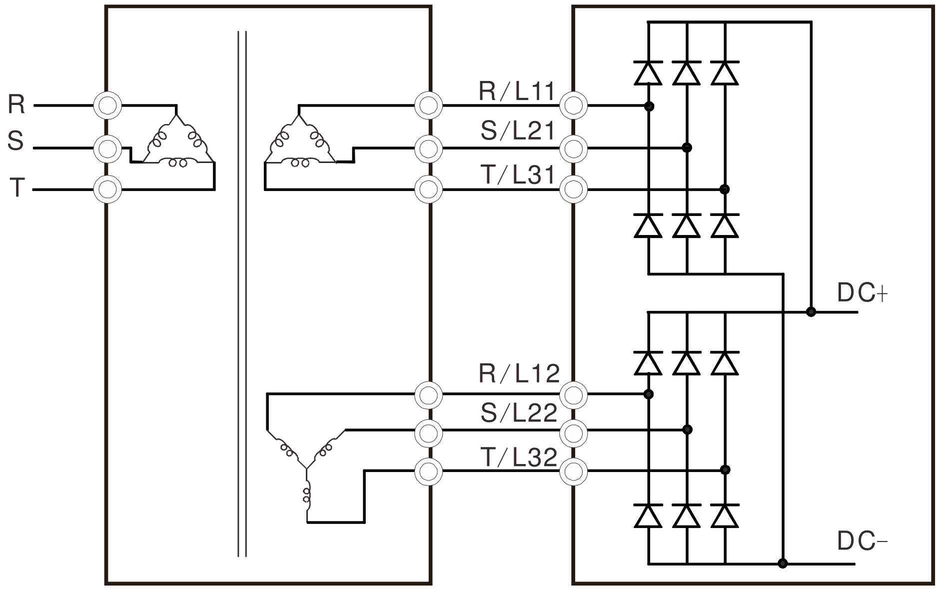


For frame D0 and above D0

* Provide 3-phase input power

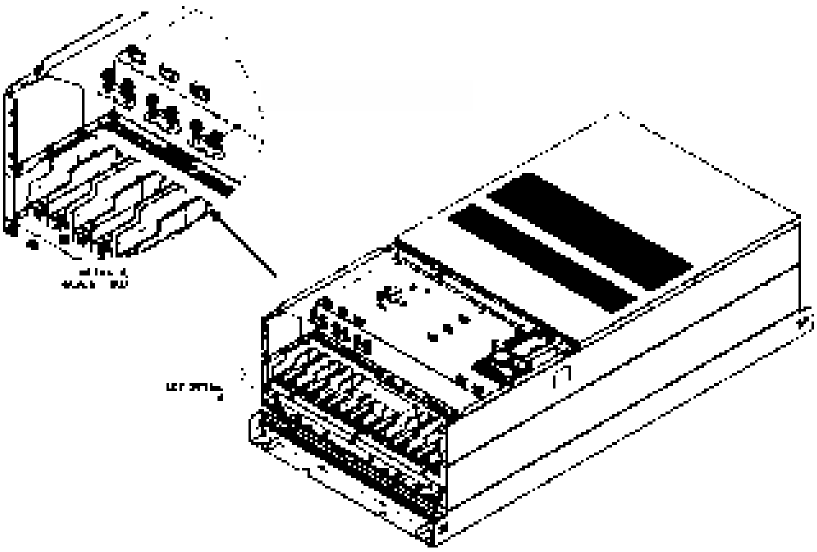


Power → Transformer → VFD-CP2000



NOTE

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



- Before implementing 12 pulse, consult Delta for more detail

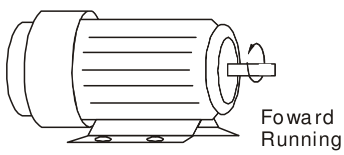
Terminals	Descriptions
R/L1, S/L2, T/L3	AC line input terminals 3-phase
U/T1, V/T2, W/T3	AC drive output terminals for connecting 3-phase induction motor
+1, +2	Applicable to frame A~C Connections for DC reactor to improve the power factor. It needs to remove the jumper for installation.
+1/DC+, -/DC-	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.

Main power terminals

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

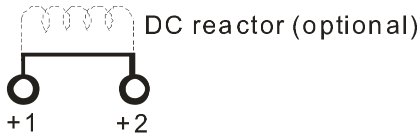
Output terminals for main circuit

- ☑ When it needs to install the filter at the output side of terminals U/T1, V/T2, W/T3 on the AC motor drive. Please use inductance filter. Do not use phase-compensation capacitors or L-C (Inductance-Capacitance) or R-C (Resistance-Capacitance), unless approved by Delta.
- ☑ DO NOT connect phase-compensation capacitors or surge absorbers at the output terminals of AC motor drives.
- ☑ Use well-insulated motor, suitable for inverter operation.
- ☑ Note down the rated data and the torque force of the wiring when the output terminal is below 75℃. This information provides the right wiring method to wire terminals (It corresponds to the terminals of the motor wire and non-motor wire).
- ☑ When the AC drive output terminals U/T1, V/T2, and W/T3 are connected to the motor terminals U/T1, V/T2, and W/T3, respectively, the motor will rotate counterclockwise (as viewed on the shaft end of the motor) when a forward operation command is received. To permanently reverse the direction of motor rotation, switch over any of the two motor leads

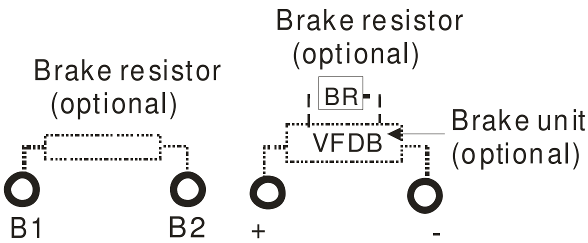


	Terminals for connecting DC reactor, external brake resistor, external brake resistor and DC circuit (brake unit or common DC bus connection)

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



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



☑ The external brake resistor of Frame A, B and C should connect to the terminals (B1, B2) of AC motor drives.

☑ For those models without built-in brake resistor, please connect external brake unit and brake resistor (both of them are optional) to increase brake torque.

☑ When the terminals +1, +2 and - are not used, please leave the terminals open.

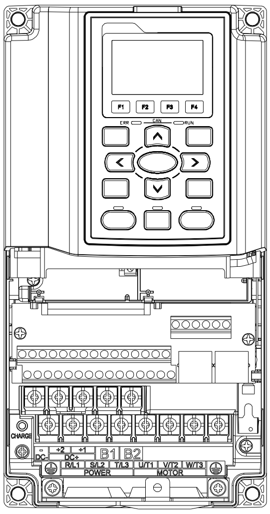
☑ DO NOT connect [+1, -], [+2, -], [+1/DC+, -/DC-] or brake resistor directly to prevent drive damage.

☑ DC+ and DC- are connected by common DC bus, please refer to Chapter 5-1(Main Circuit Terminal) for the wiring terminal specification and the wire gauge information.

☑ Please refer to the VFDB manual for more information on wire gauge when installing the brake unit.

5-2 Main Circuit Terminals

Frame A



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

Models	Max. Wire Gauge	Min. Wire Gauge	Torque
VFD007CP23A-21	8 AWG ($8.4mm^2$)	14 AWG ($2.1mm^2$)	M4 20kg-cm (17.4 lb-in.) (1.962Nm)
VFD015CP23A-21		14 AWG ($2.1mm^2$)	
VFD022CP23A-21		14 AWG ($2.1mm^2$)	
VFD037CP23A-21		10 AWG ($5.3mm^2$)	
VFD055CP23A-21		10 AWG ($5.3mm^2$)	
VFD007CP43A-21		14 AWG ($2.1mm^2$)	
VFD015CP43B-21		14 AWG ($2.1mm^2$)	
VFD022CP43B-21		14 AWG ($2.1mm^2$)	
VFD037CP43B-21		14 AWG ($2.1mm^2$)	
VFD040CP43A-21		14 AWG ($2.1mm^2$)	
VFD055CP43B-21		12 AWG ($3.3mm^2$)	
VFD075CP43B-21		12 AWG ($3.3mm^2$)	
VFD007CP4EA-21		14 AWG ($2.1mm^2$)	
VFD015CP4EB-21		14 AWG ($2.1mm^2$)	
VFD022CP4EB-21		14 AWG ($2.1mm^2$)	
VFD037CP4EB-21		14 AWG ($2.1mm^2$)	
VFD040CP4EA-21		12 AWG ($3.3mm^2$)	
VFD055CP4EB-21		10 AWG ($5.3mm^2$)	
VFD075CP4EB-21		10 AWG ($5.3mm^2$)	
UL installations must use 600V, 75℃ or 90℃ wire. Use copper wire only.			

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

Figure 1

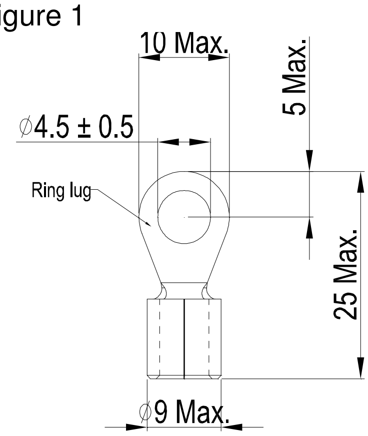
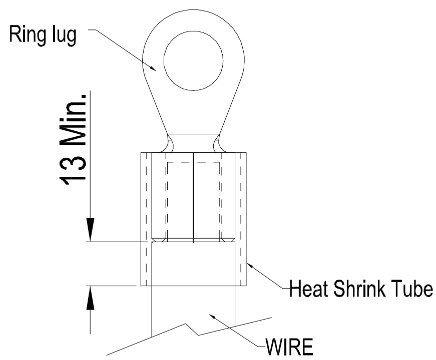
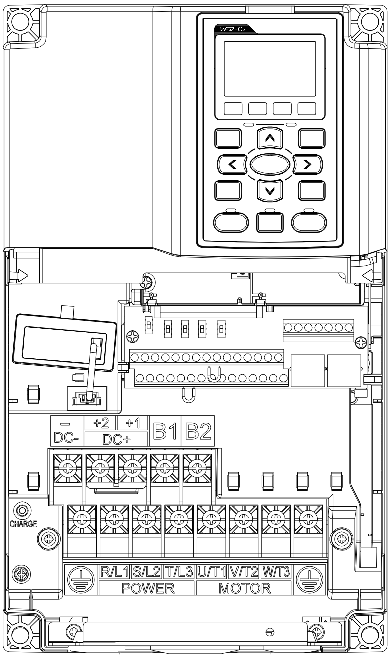


Figure 2



Unit: mm

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
VFD075CP23A-21	4 AWG ($21.2mm^2$)	8 AWG ($8.4mm^2$)	M5 35kg-cm (30.4 lb-in.) (3.434Nm)
VFD110CP23A-21		6 AWG ($13.3mm^2$)	
VFD150CP23A-21		4 AWG ($21.2mm^2$)	
VFD110CP43B-21		8 AWG ($8.4mm^2$)	
VFD150CP43B-21		8 AWG ($8.4mm^2$)	
VFD185CP43B-21		6 AWG ($13.3mm^2$)	
VFD110CP4EB-21		8 AWG ($8.4mm^2$)	
VFD150CP4EB-21		8 AWG ($8.4mm^2$)	
VFD185CP4EB-21		6 AWG ($13.3mm^2$)	
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%)

1. VFD150CP23A-21 must use 600V, 90℃ wire when surrounding temperature exceeds 45℃.
2. Figure 1 shows the terminal specification.
3. Figure 2 shows the specification of insulated heat shrink tubing that comply with UL (600V, YDPU2).

Figure 1

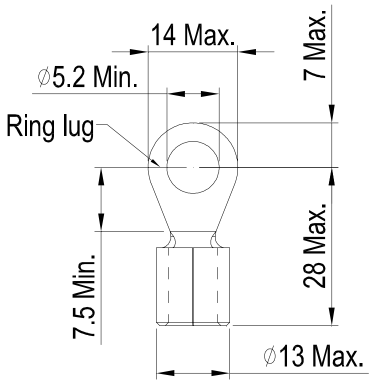
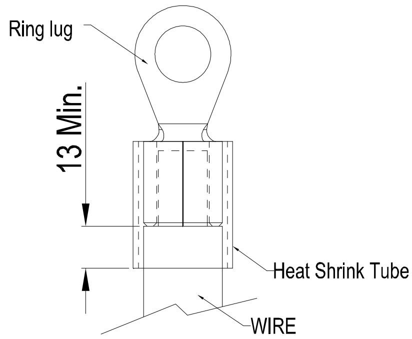
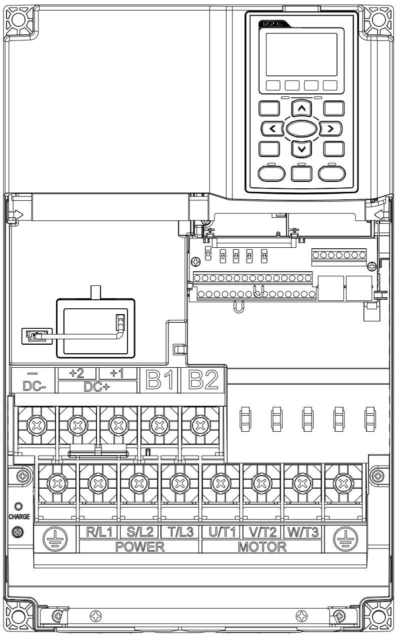


Figure 2



Unit: mm

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
VFD185CP23A -21	1/0 AWG ($53.5mm^2$)	1 AWG ($42.4mm^2$)	M8 80kg-cm (69.4 lb-in.) (7.85Nm)
VFD220CP23A-21		1/0 AWG ($53.5mm^2$)	
VFD300CP23A-21		1/0 AWG ($53.5mm^2$)	
VFD220CP43A-21		4 AWG ($21.2mm^2$)	
VFD300CP43B-21		3 AWG ($26.7mm^2$)	
VFD370CP43B-21		2 AWG ($33.6mm^2$)	
VFD220CP4EB-21		4 AWG ($21.2mm^2$)	
VFD300CP4EB-21		3 AWG ($26.7mm^2$)	
VFD370CP4EB-21		2 AWG ($33.6mm^2$)	
UL installations must use 600V, 75℃ or 90℃ ire. Use copper wire only.			

NOTE

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

1. VFD300CP23A-21 must use 600V, 90℃ wire when surrounding temperature exceeds 40℃.
2. Figure 1 shows the terminal specification.
3. Figure 2 shows the specification of insulated heat shrink tubing that comply with UL (600V, YDPU2).

Figure 1

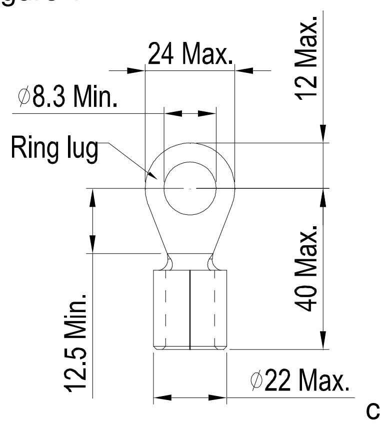
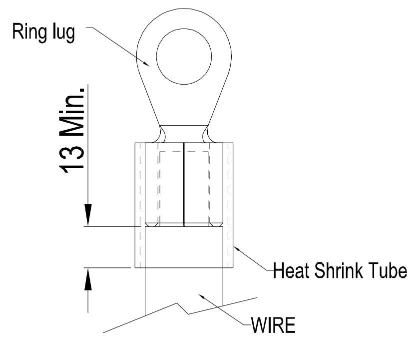
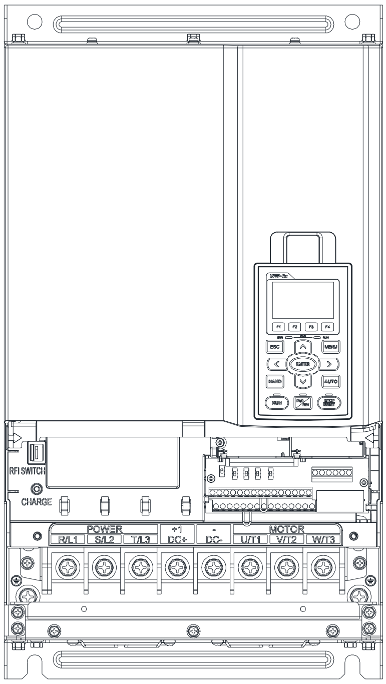


Figure 2



Unit: mm

Frame D0



Main circuit terminals:

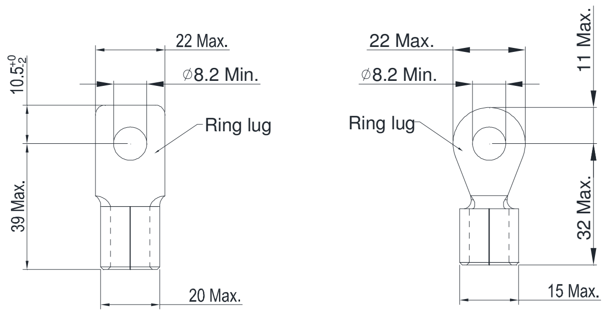
R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, ⏚, +1/DC+, -/DC-

Models	Max. Wire Gauge	Min. Wire Gauge	Torque
VFD450CP43S-00	2/0 AWG (67.4mm²)	1/0 AWG (53.5mm²)	M8 80kg-cm (70 lb-in.) (7.85Nm)
VFD550CP43S-00		2/0 AWG (67.4mm²)	
VFD450CP43S-21		1/0 AWG (53.5mm²)	
VFD550CP43S-21		2/0 AWG (67.4mm²)	

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

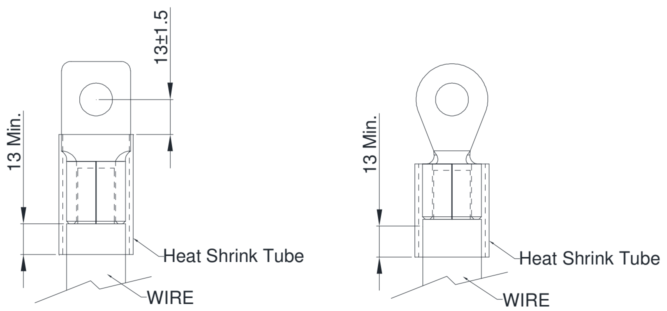
Specification of grounding wire: 2AWG*2(33.6mm²*2)

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



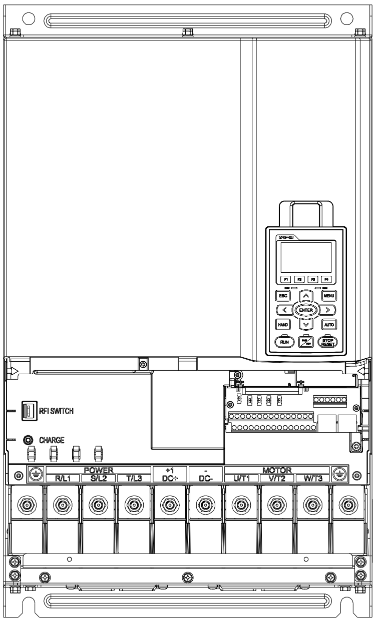
Terminal Size

Terminal Size (Ground)



Unit: mm

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
VFD370CP23A-00	300MCM (152mm^2)	4/0AWG (107mm^2)	M8 200kg-cm (173 lb-in.) (19.62Nm)
VFD450CP23A-00		300MCM(152mm^2)	
VFD750CP43A-00		4/0AWG(107mm^2)	
VFD900CP43A-00		300MCM(152mm^2)	
VFD370CP23A-21	4/0 AWG. (107mm^2)	4/0AWG(107mm^2)	
VFD450CP23A-21		4/0AWG (107mm^2)	
VFD750CP43A-21		4/0AWG(107mm^2)	
VFD900CP43A-21		4/0AWG (107mm^2)	

1. UL installations must use 600V, 75°C or 90 °C wires. Use copper wire only.
2. VFD450CP23A-21, VFD900CP43A-21 must use 600V, 90℃ wire when surrounding temperature exceeds 40℃.
3. Figure 1 shows the terminal specification.
4. Figure 2 shows the specification of insulated heat shrink tubing that comply with UL (600V, YDPU2).

Figure 1

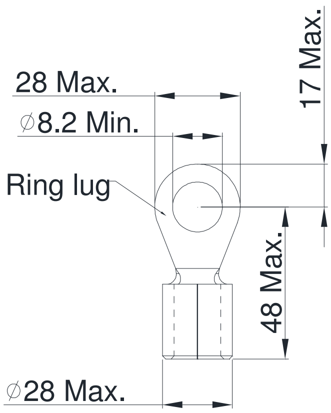
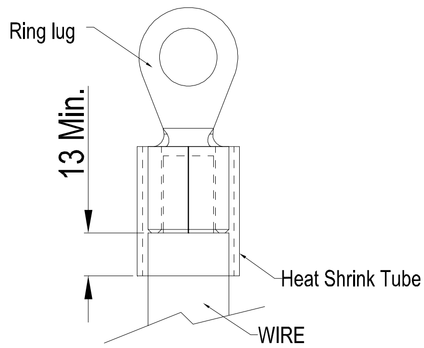
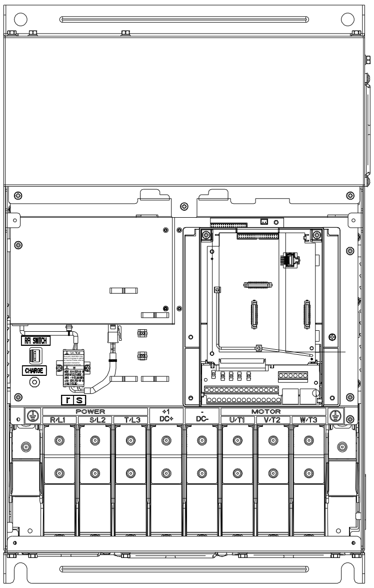


Figure 2



Unit: mm

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
VFD550CP23A-00	300MCM*2 ($152mm^2$*2)	2/0AWG*2 ($67.4mm^2$*2)	M8 200kg-cm (173 lb-in.) (19.62Nm)
VFD750CP23A-00		3/0AWG*2 ($85mm^2$*2)	
VFD900CP23A-00		4/0 AWG*2 ($107mm^2$*2)	
VFD1100CP43A-00		2/0AWG*2 ($67.4mm^2$*2)	
VFD1320CP23A-00		2/0AWG*2 ($67.4mm^2$*2)	
VFD550CP23A-21	4/0 AWG*2 ($107mm^2$*2)	2/0AWG*2 ($67.4mm^2$*2)	
VFD750CP23A-21		3/0AWG*2 ($85mm^2$*2)	
VFD900CP23A-21		4/0 AWG*2 ($107mm^2$*2)	
VFD1100CP43A-21		2/0AWG*2 ($67.4mm^2$*2)	
VFD1320CP23A-21		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

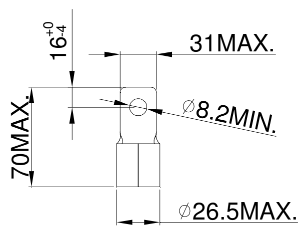


Figure 2 ⏚ E

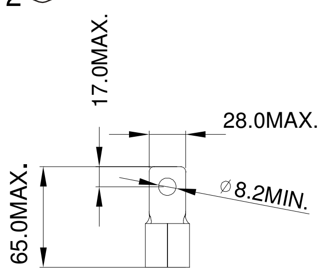
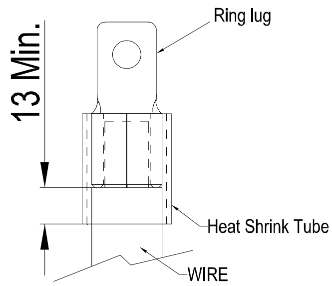
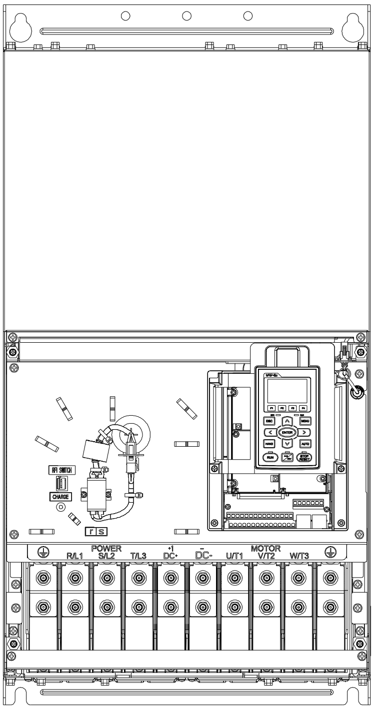


Figure 3



Unit: mm

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
VFD1600CP43A-00	300MCM*2 ($152mm^2$*2)	4/0 AWG*2 ($107mm^2$*2)	M8 200kg-cm (173 lb-in.) (19.62Nm)
VFD1850CP43A-00		300MCM*2 ($152mm^2$)	
VFD1600CP43A-21	4/0 AWG*2 ($107mm^2$*2)	4/0 AWG*2 ($107mm^2$*2)	
VFD1850CP43A-21		4/0 AWG*2 ($107mm^2$*2)	

1. VFD1850CP43A-21 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

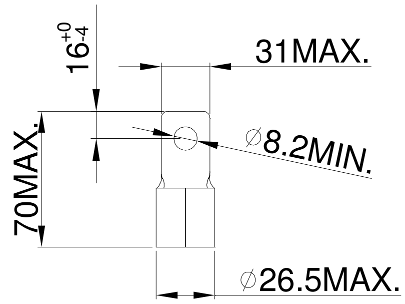
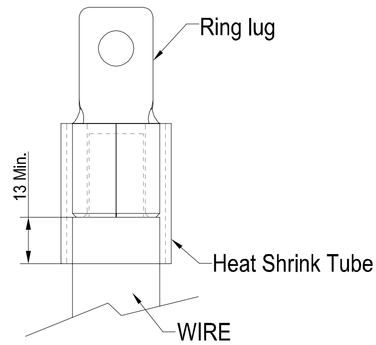
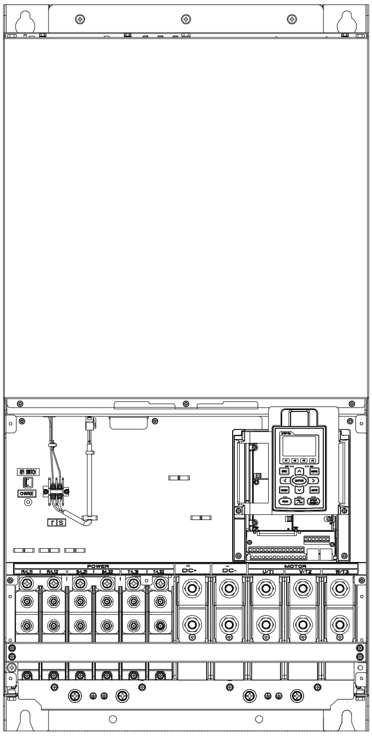


Figure 2



Unit: mm

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
VFD2200C43A-00	300MCM*4 (152mm^2*4)	2/0AWG*4 (67.4mm^2*4)	M8 200kg-cm (173 lb-in.) (19.62Nm)
VFD2800C43A-00		3/0AWG*4 (85mm^2*4)	
VFD2200C43A-21		2/0AWG*4 (67.4mm^2*4)	
VFD2800C43A-21		3/0AWG*4 (85mm^2*4)	

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

Models	Max. Wire Gauge	Min. Wire Gauge	Torque
VFD2200C43A-00	500MCM*2 (253mm^2*2)	400MCM*2 (203mm^2*2)	M12 408kg-cm (354lb-in.) (40Nm)
VFD2800C43A-00		500MCM*2 (253mm^2*2)	
VFD2200C43A-21		400MCM*2 (203mm^2*2)	
VFD2800C43A-21		500MCM*2 (253mm^2*2)	

1. UL installations must use 600V, 75℃ or 90℃ wire. Use copper wire only.
2. Figure 1 and Figure 2 show the specification for using ring lug.
3. Specification for grounding wire ⏚: 300MCM*4 [152 mm^2*4]
   Torque: M8 200kg-cm (173 lb-in.) (19.62Nm) (±10%), as shown in Figure 1
4. 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,

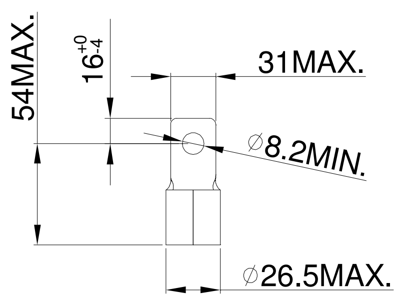


Figure2
U/T1, V/T2, W/T3, +1/DC+, -/DC-

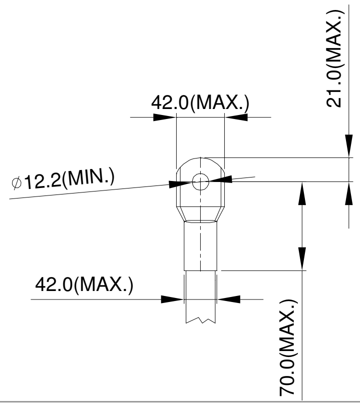


Figure 3

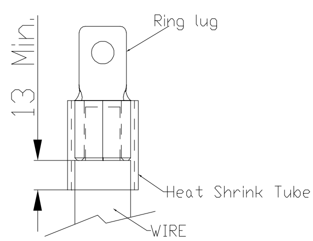
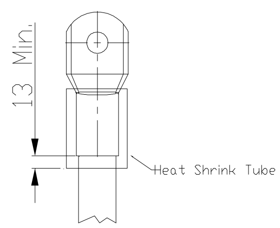
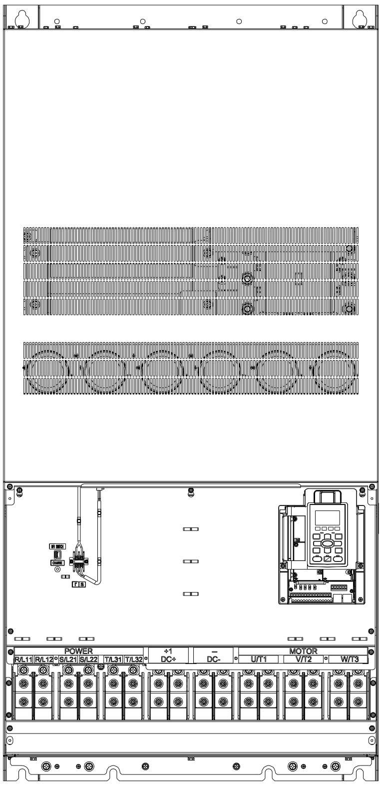


Figure 4



Unit: mm

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
VFD3150CP43A-00	300MCM*4 ($152mm^2$*4)	4/0 AWG*4 ($107mm^2$*4)	M8 200kg-cm (173 lb-in.) (19.62Nm)
VFD3550CP43A-00		250MCM*4 ($127mm^2$*4)	
VFD4000CP43A-00		300MCM*4 ($152mm^2$*4)	
VFD5000CP43A-00		300MCM*4 ($152mm^2$*4)	
VFD3150CP43C-00		4/0 AWG*4 ($107mm^2$*4)	
VFD3550CP43C-00		250MCM*4 ($127mm^2$*4)	
VFD4000CP43C-00		300MCM*4 ($152mm^2$*4)	
VFD5000CP43C-00		300MCM*4 ($152mm^2$*4)	
VFD3150CP43C-21		4/0 AWG*4 ($107mm^2$*4)	
VFD3550CP43C-21		250MCM*4 ($127mm^2$*4)	
VFD4000CP43C-21		300MCM*4 ($152mm^2$*4)	

1. VFD5000CP43A-00, VFD5000CP43C-00 installations must use 90℃ wire.
2. UL installations must use 600V, 75℃ or 90℃ wire. Use copper wire only.
3. Figure 1 shows the specification for using the ring lug.
4. Specification of grounding wire ⏚ : 300MCM*4 [152 mm^2*4], Torque: M8 200kg-cm (173 lb-in.) (19.62Nm) (±10%), as shown in figure 1.
5. Figure 2 shows the specification of heat shrink tubing that comply with UL (600C, YDPU2).

Figure 1

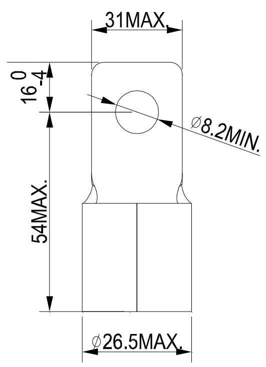
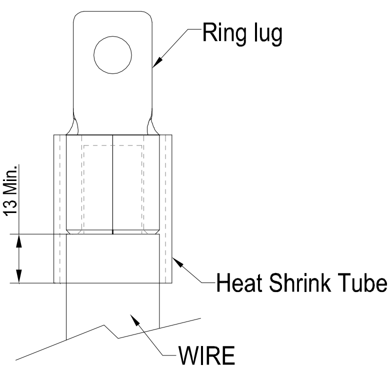


Figure 2



Unit: mm

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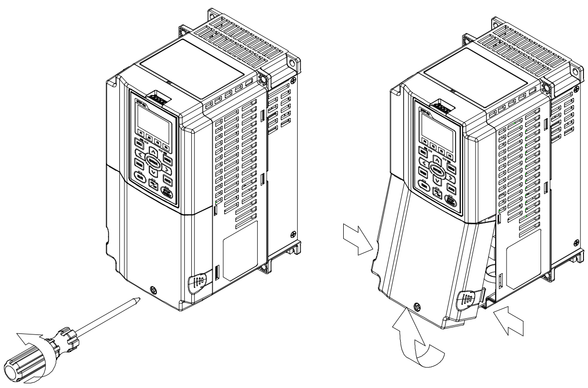
Chapter 6 Control Terminals

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

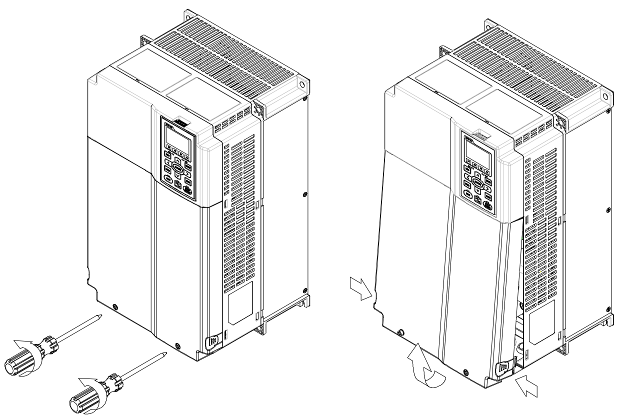
The drive appearances shown in the figures are for reference only, a real drive may look different.

Remove the cover for wiring. Frame A~H

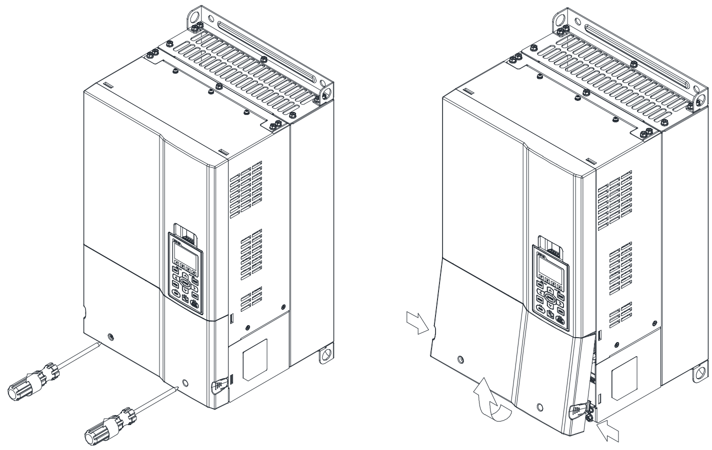
Frame A&B
Loosen the screw and press the tabs on both sides to remove the cover.
Screw torque: 12~15Kg-cm [10.4~13lb-in.]



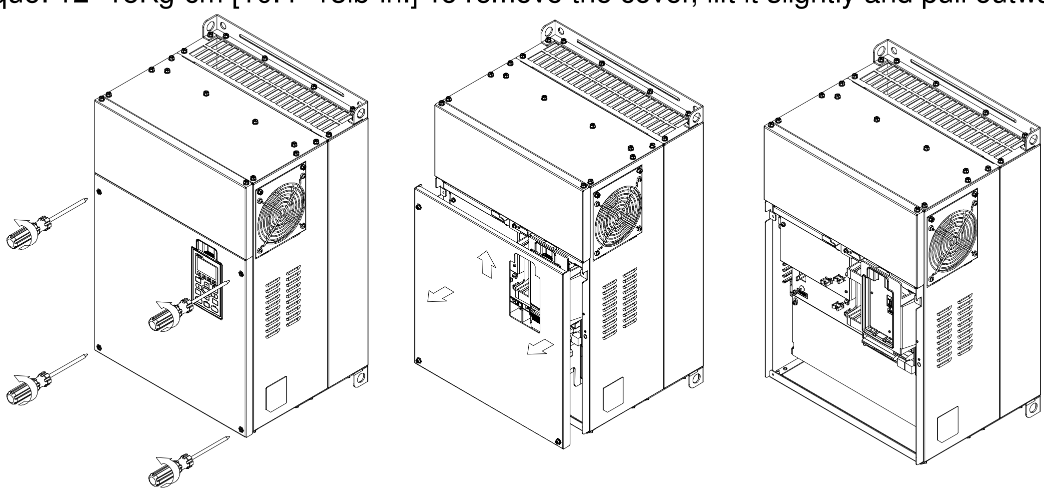
Frame C
Screw torque: 12~15Kg-cm [10.4~13lb-in.]
Loosen the screws and press the tabs on both sides to remove the cover.



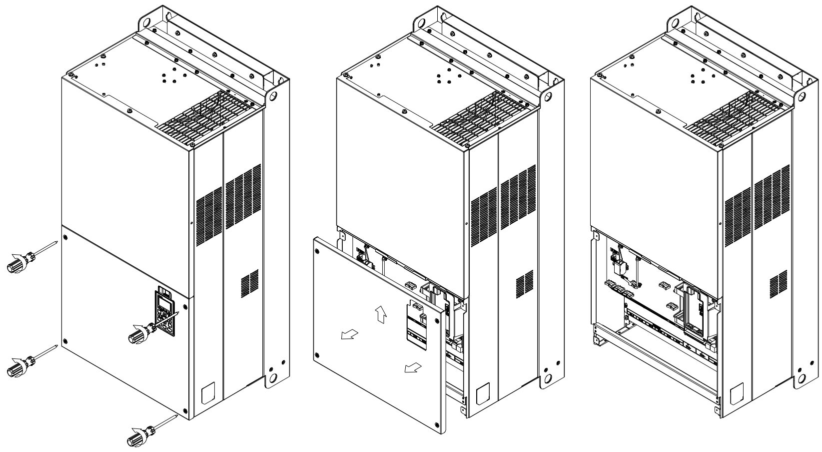
Frame D0&D
Screw torque: 12~15Kg-cm [10.4~13lb-in.]   To remove the cover, lift it slightly and pull outward.
Loosen the screws and press the tabs on both sides to remove the cover.



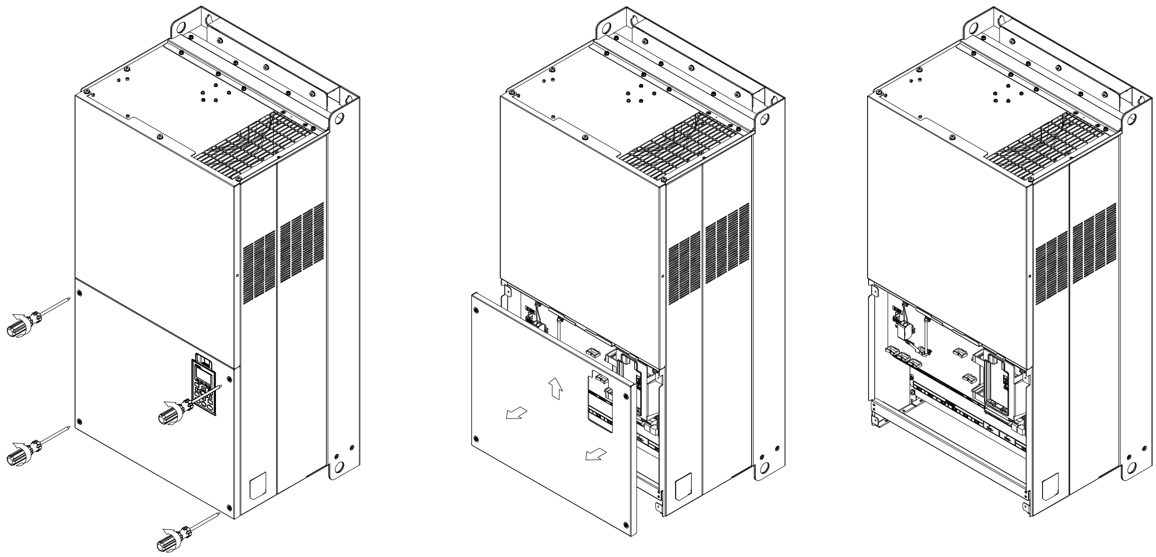
Frame E
Screw torque: 12~15Kg-cm [10.4~13lb-in.] To remove the cover, lift it slightly and pull outward.



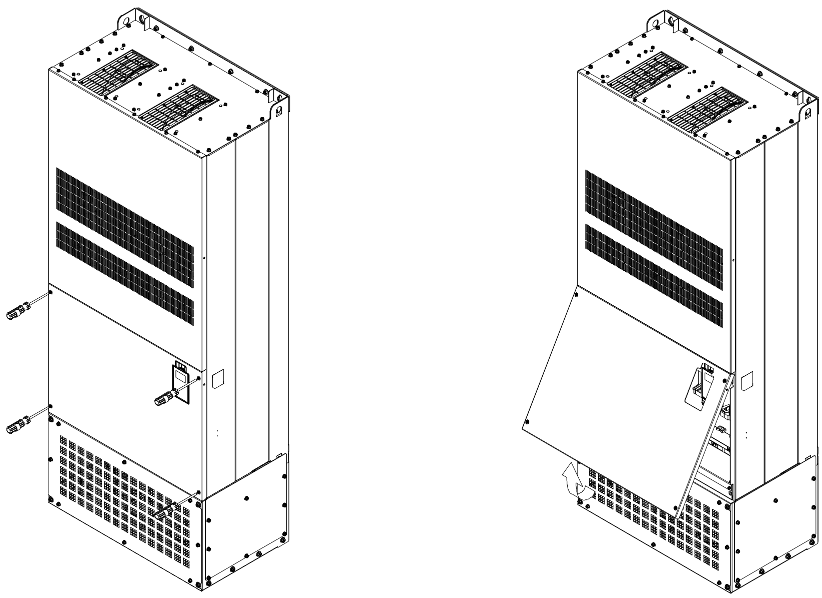
Frame F
Screw torque: 12~15Kg-cm [10.4~13lb-in.] To remove the cover, lift it slightly and pull outward



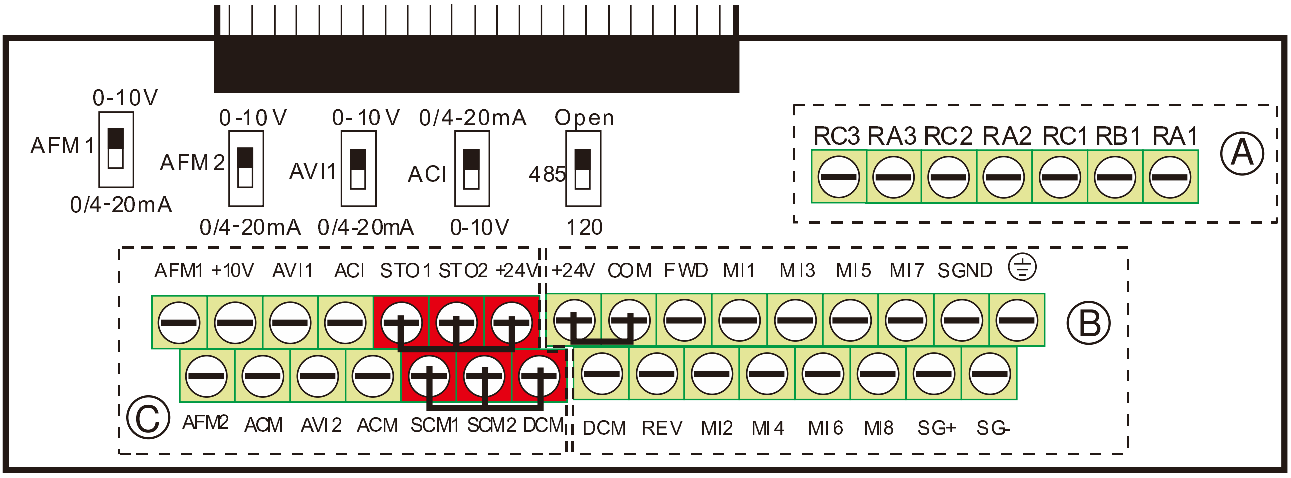
Frame G
Screw torque: 12~15Kg-cm [10.4~13lb-in.] To remove the cover, lift it slightly and pull outward



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



6-1 Specifications of Control Terminal



Removable Terminal Block

Wire Gauge: 26~16AWG（0.1281-1.318mm^2）,

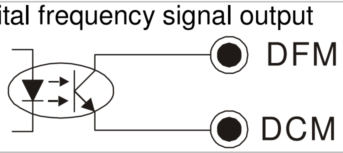
Torque: Ⓐ 5kg-cm [4.3lb-in.] (0.49Nm) (As shown in figure above)

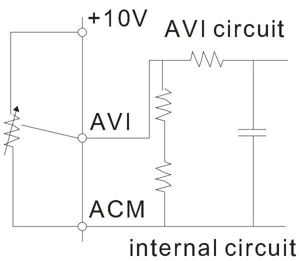
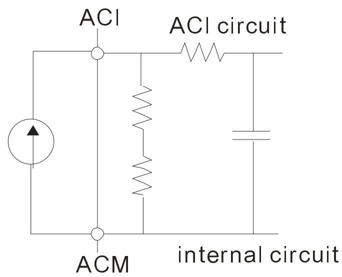
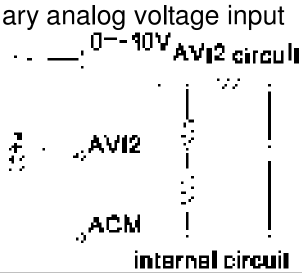
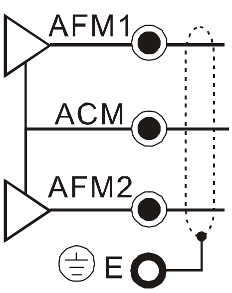
Ⓑ 8kg-cm [6.94lb-in.] (0.78Nm) (As shown in figure above)

Ⓒ 2kg-cm [1.73 lb-in.] (0.19 Nm) (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 STO1, STO2, +24V and SCM1, SCM2, DC 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. Source Mode ON: the activation current is 3.3mA≧11Vdc OFF: leakage current tolerance is ≦11Vdc Sink Mode ON: the activation current is 3.3mA≧13Vdc OFF: leakage current tolerance is ≦19Vdc
DFM	Digital frequency signal output 	Regard the pulse 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)
MCM	Multi-function Output Common	Max 48Vdc 50mA
RA1	Multi-function relay output 1 (N.O.) a	Resistive Load: 3A(N.O.)/3A(N.C.) 250VAC 5A(N.O.)/3A(N.C.) 30VDC Inductive Load (COS 0.4): 1.2A(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. Note: RA1 has N.O. & N.C while RA2 & RA3 have only N.O
RB1	Multi-function relay output 1 (N.C.) b	
RC1	Multi-function relay common	
RA2	Multi-function relay output 2 (N.O.) a	
RC2	Multi-function relay common	
RA3	Multi-function relay output 3 (N.O.) a	
RC3	Multi-function relay common	
+10V	Potentiometer power supply	Analog frequency setting: +10Vdc 20mA
-10V	Potentiometer power supply	Analog frequency setting: -10Vdc 20mA
AVI 1	Analog voltage input 	Impedance: 20kΩ Range: 0~20mA/4~20mA/0~10V =0~Max. Output Frequency (Pr.01-00) AVI1 switch, factory setting is 0~10V
ACI	Analog current input 	Impedance: 250Ω Range: 0~20mA/4~20mA/0~10V = 0 ~ Max. Output Frequency (Pr.01-00) ACI Switch, factory setting is 4~20mA
AVI2	Auxiliary analog voltage input 	Impedance: 20kΩ Range: 0~+10VDC=0 ~ Max. Output Frequency(Pr.01-00)
AFM1		0~10V Max. output current 2mA, Max. load 5kΩ -10~10V maximum output current 2mA, maximum load 5kΩ Output current: 2mA max Resolution: 0~10V corresponds to Max. operation frequency Range: 0~10V → -10~+10V AFM 1 Switch, factory setting is 0~10V
AFM2		0~10V Max. output current 2mA, Max. load 5kΩ 0~20mA Max. load 500Ω Output current: 20mA max Resolution: 0~10V corresponds to Max. operation frequency Range: 0~10V → 4~20mA AFM 2 Switch, factory setting is 0~10V

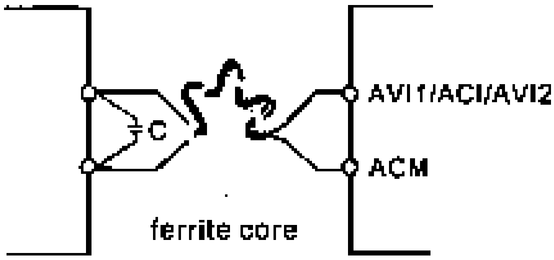
Terminals	Terminal Function	Factory Setting (NPN mode)
ACM	Analog Signal Common	Common for analog terminals
STO1	The factory setting is short-circuit.	
SCM1	Power removal safety function for EN954-1 and IEC/EN61508	
STO2	STO1~SCM1, STO2~SCM2	
SCM2	ON: the activation current is 3.3mA≧11Vdc	
SG+	Modbus RS-485	
SG-		
SGND		
RJ-45	PIN 1,2,7,8 : Reserved PIN 3, 6: SGND PIN 4: SG- PIN 5: SG+	

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

6-2 Analog input terminals (AVI1, ACI, AVI2, ACM)

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

☑ If the analog input signals are affected by noise from the AC motor drive, please connect a capacitor and ferrite core as indicated in the following diagram.



Wind each wires 3 times or more around the core

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

☑ When using contacts or switches to control the digital inputs, please use high quality components to avoid contact bounce.

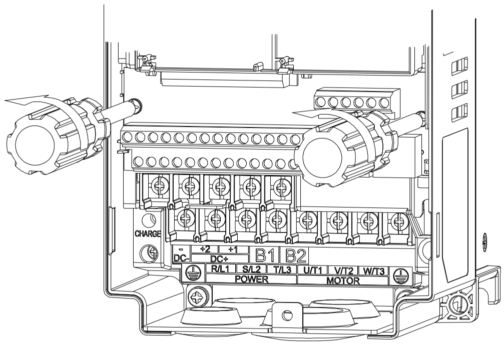
☑ The “COM” terminal is the common side of the photo-coupler. Any of wiring method, the “common point” of all photo-coupler must be the “COM”.

☑ When the photo-coupler is using internal power supply, the switch connection for Sink and Source as below:
MI-DCM: Sink mode
MI-+24V: Source mode

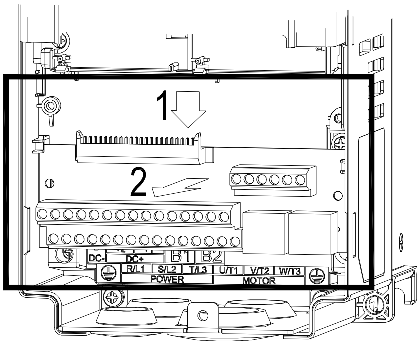
☑ When the photo-coupler is using external power supply, please remove the short circuit cable between the +24V and COM terminals. The connection mode is Sink mode or Source mode is according to the below:
The “+” of 24V connecting to “COM: Sink mode
The “-“ of 24V connecting to COM: Source mode

6-3 Remove the Terminal Block

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



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



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Chapter 7 Optional Accessories

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

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

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	0.5	-	BR080W200*1		80W200Ω	1.9	63.3	6	2.3
3	2.2	1.0	-	BR200W091*1		200W91Ω	4.2	47.5	8	3.0
5	3.7	1.5	-	BR300W070*1		300W70Ω	5.4	38.0	10	3.8
7.5	5.5	2.5	-	BR400W040*1		400W40Ω	9.5	19.0	20	7.6
10	7.5	3.7	-	BR1K0W020*1		1000W20Ω	19	14.6	26	9.9
15	11	5.1	-	BR1K0W020*1		1000W20Ω	19	14.6	26	9.9
20	15	7.5	-	BR1K5W013*1		1500W13Ω	29	13.6	28	10.6
25	18	10.2	-	BR1K0W4P3*2	2 series	2000W8.6Ω	44	8.3	46	17.5
30	22	12.2	-	BR1K5W3P3*2	2 series	2000W8.6Ω	44	8.3	46	17.5
40	30	14.9	-	BR1K0W5P1*2	2 series	3000W6.6Ω	58	5.8	66	25.1
50	37	20.3	2015*2	BR1K2W3P9*2	2 series	4000W5.1Ω	75	4.8	80	30.4
60	45	25.1	2022*2	BR1K5W3P3*2	2 series	4800W3.9Ω	97	3.2	120	45.6
75	55	30.5	2022*2	BR1K2W3P9*2	2 series	6000W3.3Ω	118	3.2	120	45.6
100	75	37.2	2022*3	BR1K2W3P9*2	2 series	7200W2.6Ω	145	2.1	180	68.4
125	90	50.8	2022*4	BR1K5W3P3*2	2 series	9600W2Ω	190	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 Current [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	0.5	-	BR080W750*1		80W750Ω	1	190.0	4	3.0
3	2.2	1.0	-	BR200W360*1		200W360Ω	2.1	126.7	6	4.6
5	3.7	1.5	-	BR300W250*1		300W250Ω	3	108.6	7	5.3
5.5	4.0	2.5	-	BR400W150*1		400W150Ω	5.1	84.4	9	6.8
7.5	5.5	2.7		BR1K0W075*1		1000W75Ω	10.2	54.3	14	10.6
10	7.5	3.7	-	BR1K0W075*1		1000W75Ω	10.2	54.3	14	10.6
15	11	5.1	-	BR1K0W075*1		1000W75Ω	10.2	47.5	16	12.2
20	15	7.5	-	BR1K5W043*1		1500W43Ω	17.6	42.2	18	13.7
25	18	10.2	-	BR1K0W016*2	2 series	2000W32Ω	24	26.2	29	22.0
30	22	12.2	-	BR1K0W016*2	2 series	2000W32Ω	24	23.0	33	25.1
40	30	14.9	-	BR1K5W013*2	2 series	3000W26Ω	29	23.0	33	25.1
50	37	20.3	-	BR1K0W016*4	2 parallel, 2 series	4000W16Ω	47.5	14.1	54	41.0
60	45	25.1	4045*1	BR1K2W015*4	2 parallel, 2 series	4800W15Ω	50	12.7	60	45.6
75	55	30.5	4045*1	BR1K5W013*4	2 parallel, 2 series	6000W13Ω	59	12.7	60	45.6
100	75	37.2	4030*2	BR1K0W5P1*4	4 series	8000W10.2Ω	76	9.5	80	60.8
125	90	50.8	4045*2	BR1K2W015*4	2 parallel, 2 series	9600W7.5Ω	100	6.3	120	91.2
150	110	60.9	4045*2	BR1K5W013*4	2 parallel, 2 series	12000W6.5Ω	117	6.3	120	91.2

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 Current [A]	Min. Resistor Value [Ω]	Max. Total Braking Current [A]	Peak Power [kW]
175	132	74.5	4110*1	BR1K2W015*10	5 parallel, 2 series	12000W6Ω	126	6.0	126	95.8
215	160	89.4	4160*1	BR1K5W012*12	6 parallel, 2 series	18000W4Ω	190	4.0	190	144.4
250	185	108.3	4160*1	BR1K5W012*12	6 parallel, 2 series	18000W4Ω	190	4.0	190	144.4
300	220	125.3	4185*1	BR1K5W012*14	7 parallel, 2 series	21000W3.4Ω	225	3.4	225	172.1
375	280	148.9	4110*2	BR1K2W015*10	5 parallel, 2 series	24000W3Ω	252	3.0	252	190.5
425	315	189.6	4160*2	BR1K5W012*12	6 parallel, 2 series	36000W2Ω	380	2.0	380	288.8
475	355	213.3	4160*2	BR1K5W012*12	6 parallel, 2 series	36000W2Ω	380	2.0	380	288.8
536	400	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).

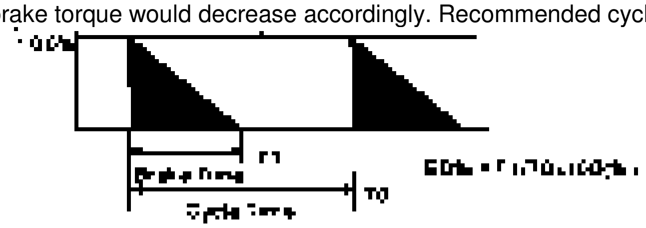
*2 Please refer to the Brake Performance Curve for “Operation Duration & ED” vs. “Braking Current”.

*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℃.

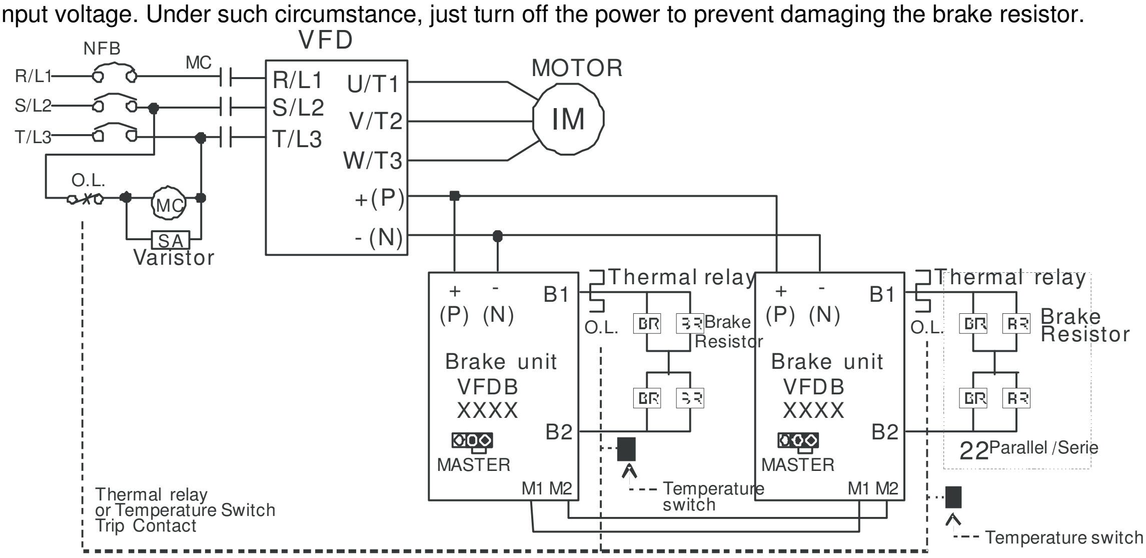
*4 Please refer to VFDB series Braking Module Instruction for more detail on braking resistor.

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.



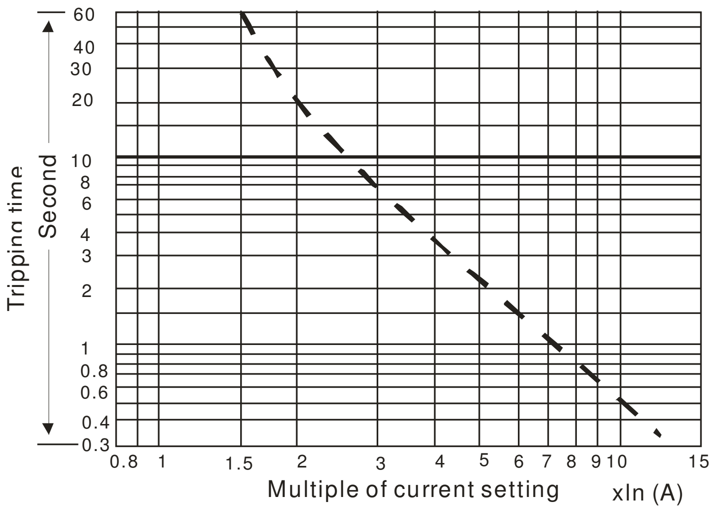
For safety concern, install an overload relay (O.L) between the brake unit and the brake resistor in conjunction with the magnetic contactor (MC) prior to the drive for abnormal protection. The purpose of installing the thermal overload relay is to protect the brake resistor from damage due to frequent 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.



- When AC Drive is equipped with a DC reactor, please read user manual to know th wiring method of input circuit of brake unit +(P).
- Do Not connect input circuit -(N) to the neutral point of the power system.

2. If damage to the drive or other equipment is due to the fact that the brake resistors and brake modules in use are not provided by Delta, the warranty will be void.
3. Take into consideration the safety of the environment when installing the brake resistors. If the minimum resistance value is to be utilized, consult local dealers for the calculation of Watt figures.
4. When using more than 2 brake units, equivalent resistor value of parallel brake unit can't be less than the value in the column "Minimum Equivalent Resistor Value for Each AC Drive" (the right-most column in the table). Please read the wiring information in the user manual of brake unit thoroughly prior to operation
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.



7-2 Non-fuse Circuit Breaker

Comply with UL standard: Per UL 508, paragraph 45.8.4, part a,
The rated current of the breaker shall be 1.6~2.6 times of the maximum rated input current of AC motor drive.

3-phase 230V	
Model	Recommended non-fuse breaker [A]
VFD007CP23A-21	15
VFD015CP23A-21	20
VFD022CP23A-21	30
VFD037CP23A-21	40
VFD055CP23A-21	50
VFD075CP23A-21	60
VFD110CP23A-21	100
VFD150CP23A-21	125
VFD185CP23A-21	150
VFD220CP23A-21	200
VFD300CP23A-21	225
VFD370CP23A-00/23A-21	250
VFD450CP23A-00/23A-21	300
VFD550CP23A-00/23A-21	400
VFD750CP23A-00/23A-21	450
VFD900CP23A-00/23A-21	600

3-phase 460V	
Model	Recommended non-fuse breaker [A]
VFD007CP43A-21/4EA-21	10
VFD015CP43B-21/4EB-21	10
VFD022CP43B-21/4EB-21	15
VFD040CP43A-21/4EA-21	25
VFD037CP43B-21/4EB-21	30
VFD055CP43B-21/4EB-21	40
VFD075CP43B-21/4EB-21	40
VFD110CP43B-21/4EB-21	50
VFD150CP43B-21/4EB-21	60
VFD185CP43B-21/4EB-21	75
VFD220CP43A-21/4EA-21	100
VFD300CP43B-21/4EB-21	125
VFD370CP43B-21/4EB-21	150
VFD450CP43S-00/S-21	175
VFD550CP43S-00/43S-21	250
VFD750CP43B-00/43B-21	300
VFD900CP43A-00/43-21	300
VFD1100CP43A-00/43A-21	400
VFD1320CP43B-00/43B-21	500
VFD1600CP43A-00/43A-21	600
VFD1850CP43B-00/43B-21	600
VFD2200CP43A-00/43A-21	800
VFD2800CP43A-00/43A-21	1000
VFD3150CP43A-00/ VFD43C-00/43C-21	1200
VFD3550CP43A-00/ VFD43C-00/43C-21	1350
VFD4000CP43A-00/ VFD43C-00/43C-21	1500

7-3 Fuse Specification Chart

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

230V Model	Input Current I [A]		Line Fuse	
	Light Duty	Normal Duty	I [A]	Bussmann P/N
VFD007CP23A-21	6.4	3.9	15	JJN-15
VFD015CP23A-21	9.6	6.4	20	JJN-20
VFD022CP23A-21	15	12	30	JJN-30
VFD037CP23A-21	22	16	40	JJN-40
VFD055CP23A-21	25	20	50	JJN-50
VFD075CP23A-21	35	28	60	JJN-60
VFD110CP23A-21	50	36	100	JJN-100
VFD150CP23A-21	65	52	125	JJN-125
VFD185CP23A-21	83	72	150	JJN-150
VFD220CP23A-21	100	83	200	JJN-200
VFD300CP23A-21	116	99	225	JJN-225
VFD370CP23A-00/23A-21	146	124	250	JJN-250
VFD450CP23A-00/23A-21	180	143	300	JJN-300
VFD550CP23A-00/23A-21	215	171	400	JJN-400
VFD750CP23A-00/23A-21	276	206	450	JJN-450
VFD900CP23A-00/23A-21	322	245	600	JJN-600

460VModel	Input Current I [A]		Line Fuse	
	Light Duty	Normal Duty	I [A]	Bussmann P/N
VFD007CP43A-21/4EA-21	4.3	3.5	10	JJS-10
VFD015CP43B-21/4EB-21	6.0	4.3	10	JJS-10
VFD022CP43B-21/4EB-21	8.1	5.9	15	JJS-15
VFD040CP43A-21/4EA-21	12.4	8.7	25	JJS-20
VFD037CP43B-21/4EB-21	16	14	30	JJS-20
VFD055CP43B-21/4EB-21	20	15.5	40	JJS-30
VFD075CP43B-21/4EB-21	22	17	40	JJS-40
VFD110CP43B-21/4EB-21	26	20	50	JJS-50
VFD150CP43B-21/4EB-21	35	26	60	JJS-60
VFD185CP43B-21/4EB-21	42	35	75	JJS-75
VFD220CP43A-21/4EA-21	50	40	100	JJS-100
VFD300CP43B-21/4EB-21	66	47	125	JJS-125
VFD370CP43B-21/4EB-21	80	63	150	JJS-150
VFD450CP43S-00/S-21	91	74	175	JJS-175
VFD550CP43S-00/43S-21	110	101	250	JJS-225
VFD750CP43B-00/43B-21	150	114	300	JJS-300
VFD900CP43A-00/43-21	180	157	300	JJS-300
VFD1100CP43A-00/43A-21	220	167	400	JJS-400
VFD1320CP43B-00/43B-21	260	207	500	JJS-500
VFD1600CP43A-00/43A-21	310	240	600	JJS-600
VFD1850CP43B-00/43B-21	370	300	600	JJS-600
VFD2200CP43A-00/43A-21	460	380	800	JJS-800
VFD2800CP43A-00/43A-21	530	400	1000	KTU-1000
VFD3150CP43A-00/43C-00/43C-21	616	494	1200	KTU-1200
VFD3550CP43A-00/43C-00/43C-21	683	555	1350	KTU-1350
VFD4000CP43A-00/43C-00/43C-21	770	625	1500	KTU-1500

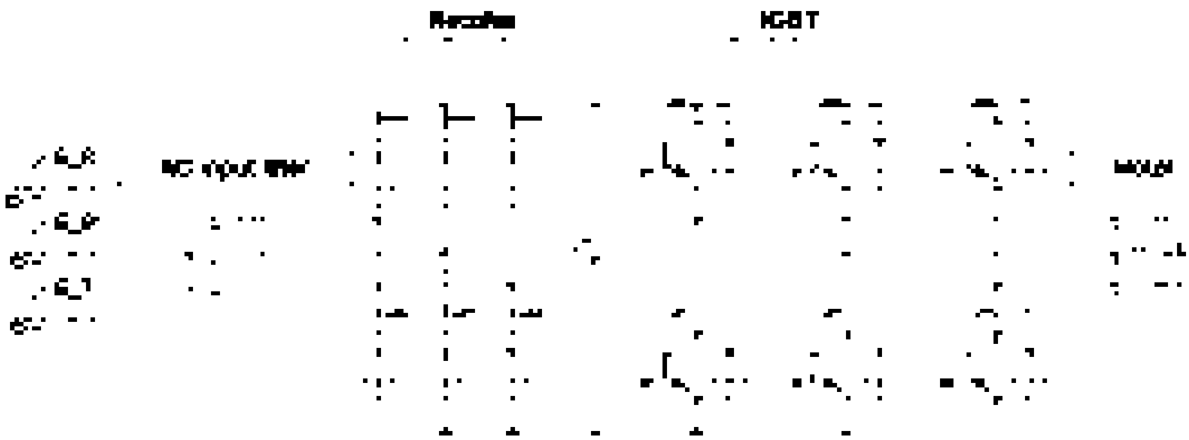
7-4 AC/DC Reactor

AC Input Reactor

When the AC Motor Drive is connected directly to a large-capacity power transformer (500kVA or above) or when a phase lead capacitor is switched, excess peak currents may occur in the power input circuit due to the load changes and the converter section may be damaged. To avoid this, it is recommend using a serial connected AC input reactor at the AC Motor Drive mains input side to reduce the current and improve the input power efficiency.

Method of set up

AC input reactor sets up between electric power and R, S, T which are at three-phase input side of AC motor drive in series-connected way. See the figure below:



AC input reactor setup

Specifications of AC input reactors (standard item)

The following table shows the specifications of AC input reactors (standard items) for Delta CP2000 series products, and their part numbers to choose:

AC Input Reactor

200V~230V/ 50~60Hz

Type	KW [HP]	Rated Amps of AC Reactor (Arms)		Max. continuous Amps (Arms)		3% impedance (mH)		5% impedance (mH)		Built-in DC reactor	3% Input AC reactor Delta part #	
		Normal Duty	Light Duty	Normal Duty	Light Duty	Normal Duty	Light Duty	Normal Duty	Light Duty		Normal Duty	Light Duty
007	0.75 [1]	4.6	5	7.36	6	2.536	2.536	4.227	4.227	X	N/A	N/A
015	1.5 [2]	5	7.5	8	9	2.536	1.585	4.227	2.642	X	N/A	N/A
022	2.2 [3]	8	10	12.8	12	1.585	1.152	2.642	1.922	X	N/A	N/A
037	3.7 [5]	11	15	17.6	18	1.152	0.746	1.922	1.243	X	N/A	N/A

055	5.5 [7.5]	17	21	27.2	25.2	0.746	0.507	1.243	0.845	X	N/A	N/A
075	7.5 [10]	25	31	40	37.2	0.507	0.320	0.845	0.534	X	N/A	DR033AP320
110	11 [15]	33	46	52.8	55.2	0.320	0.216	0.534	0.359	X	DR033AP320	DR049AP215
150	15 [20]	49	61	78.4	73.2	0.216	0.163	0.359	0.282	X	DR049AP215	DR065AP162
185	18.5 [25]	65	75	104	90	0.163	0.147	0.271	0.245	X	DR065AP162	N/A
220	22 [30]	75	90	120	108	0.169	0.141	0.282	0.235	X	N/A	N/A
300	30 [40]	90	105	144	126	0.141	0.106	0.235	0.176	X	N/A	N/A
370	37 [50]	120	146	192	175.2	0.106	0.087	0.176	0.145	O	N/A	N/A
450	45 [60]	146	180	233.6	216	0.087	0.070	0.145	0.117	O	N/A	N/A
550	55 [75]	180	215	288	258	0.070	0.059	0.117	0.098	O	N/A	N/A
750	75 [100]	215	276	344	331.2	0.059	0.049	0.098	0.083	O	N/A	N/A
900	90 [125]	255	322	408	386.4	0.049	0.037	0.083	0.061	O	N/A	N/A

380V~460V/ 50~60Hz

Type	KW [HP]	Rated Amps of AC Reactor (Arms)		Max. continuous Amps (Arms)		3% impedance (mH)		5% impedance (mH)		Built-in DC reactor	3% Input AC reactor Delta part #	
		Normal Duty	Light Duty	Normal Duty	Light Duty	Normal Duty	Light Duty	Normal Duty	Light Duty		Normal Duty	Light Duty
007	0.75 [1]	2.8	3	4.48	3.6	8.102	8.102	13.502	13.502	X	N/A	N/A
015	1.5 [2]	3	4.2	4.8	5.04	8.102	6.077	13.502	10.127	X	N/A	N/A
022	2.2 [3]	4	5.5	6.4	6.6	6.077	4.050	10.127	6.752	X	N/A	N/A
037	3.7 [5]	6	8.5	9.6	10.2	4.050	2.700	6.752	4.501	X	N/A	N/A
040	4 [5]	9	10.5	14.4	12.6	2.700	2.315	4.501	3.858	X	N/A	N/A
055	5.5 [7.5]	10.5	13	16.8	15.6	2.315	2.025	3.858	3.375	X	N/A	N/A
075	7.5 [10]	12	18	19.2	21.6	2.025	1.174	3.375	1.957	X	N/A	DR018A0117
110	11 [15]	18	24	28.8	28.8	1.174	0.881	1.957	1.468	X	DR018A0117	DR024AP880
150	15 [20]	24	32	38.4	38.4	0.881	0.660	1.468	1.101	X	DR024AP880	DR032AP660
185	18.5 [25]	32	38	51.2	45.6	0.660	0.639	1.101	1.066	X	DR032AP660	N/A
220	22 [30]	38	45	60.8	54	0.639	0.541	1.066	0.900	X	N/A	N/A
300	30 [40]	45	60	72	72	0.541	0.405	0.900	0.675	X	N/A	N/A
370	37 [50]	60	73	96	87.6	0.405	0.334	0.675	0.555	X	N/A	N/A
450	45 [60]	73	91	116.8	109.2	0.334	0.267	0.555	0.445	O	N/A	N/A
550	55 [75]	91	110	145.6	132	0.267	0.221	0.445	0.368	O	N/A	N/A
750	75 [100]	110	150	176	180	0.221	0.162	0.368	0.270	O	N/A	N/A
900	90 [125]	150	180	240	216	0.162	0.135	0.270	0.225	O	N/A	N/A
1100	110 [125]	180	220	288	264	0.135	0.110	0.225	0.184	O	N/A	N/A

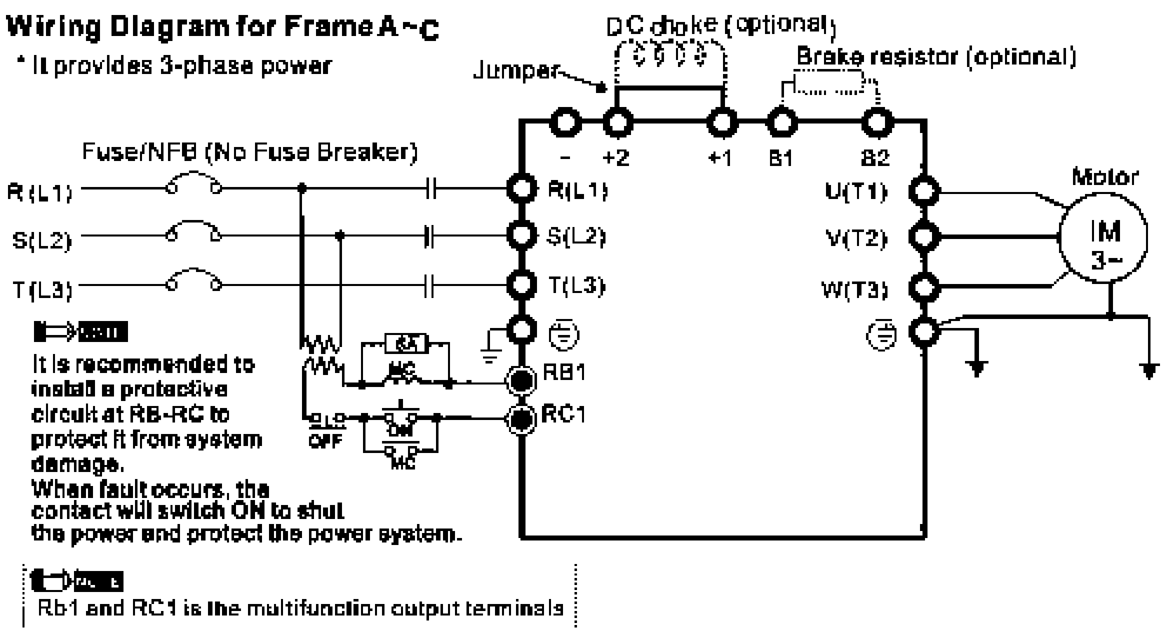
Type	KW [HP]	Rated Amps of AC Reactor (Arms)		Max. continuous Amps (Arms)		3% impedance (mH)		5% impedance (mH)		Built-in DC reactor	3% Input AC reactor Delta part #	
		Normal Duty	Light Duty	Normal Duty	Light Duty	Normal Duty	Light Duty	Normal Duty	Light Duty		Normal Duty	Light Duty
1320	132 [125]	220	260	352	312	0.110	0.098	0.184	0.162	O	N/A	N/A
1600	160 [125]	260	310	416	372	0.098	0.078	0.162	0.131	O	N/A	N/A
1850	185 [125]	310	370	496	444	0.078	0.066	0.131	0.109	O	N/A	N/A
2200	220 [125]	370	460	592	552	0.066	0.054	0.109	0.090	O	N/A	N/A
2800	280 [125]	460	530	736	636	0.054	0.044	0.090	0.074	O	N/A	N/A
3150	315 [125]	550	616	880	739.2	0.044	0.039	0.074	0.066	O	N/A	N/A
3550	355 [125]	616	683	985.6	819.6	0.039	0.036	0.066	0.060	O	N/A	N/A
4500	450 [125]	683	770	1092.8	924	0.036	0.028	0.060	0.047	O	N/A	N/A
5000	500 [125]	866	912	1385.6	1094.4	0.028	0.028	0.047	0.047	O	N/A	N/A

DC Reactor

DC reactor can increase the impedance, improve the power factor, decrease input current, increase system's capacity and decrease harmonic which generates from AC motor drive. Furthermore, DC reactor can steady the DC voltage of AC motor drive. Compare with the reactor which sets up at input side, it is small, lower price, and low pressure drop.

Method of set up

DC reactor sets up between +1 and +2 of the circuit, and the jumper should be removed. See the figure below:



DC reactor setup

Specifications of DC reactors (standard item)

The following table shows the specifications of DC reactors (standard items) for Delta CP2000 series products.

200V~230V/ 50~60Hz

Type	KW	HP	Rated Amps of DC Reactor [Arms]		Max. continuous Amps [Arms]		DC impedance [mH]		DC Reactor Delta part #	
			Normal Duty	Light Duty	Normal Duty	Light Duty	Normal Duty	Light Duty	Normal Duty	Light Duty
007	0.75	1	4.6	5	7.36	6	5.857	5.857	N/A	N/A
015	1.5	2	5	7.5	8	9	5.857	3.660	N/A	N/A
022	2.2	3	8	10	12.8	12	3.660	2.662	N/A	N/A
037	3.7	5	11	15	17.6	18	2.662	1.722	N/A	N/A
055	5.5	7.5	17	21	27.2	25.2	1.722	1.172	N/A	N/A
075	7.5	10	25	31	40	37.2	1.172	0.851	N/A	N/A
110	11	15	33	46	52.8	55.2	0.851	0.574	N/A	N/A
150	15	20	49	61	78.4	73.2	0.574	0.432	N/A	N/A
185	18.5	25	65	75	104	90	0.432	0.391	N/A	N/A
220	22	30	75	90	120	108	0.391	0.325	N/A	N/A
300	30	40	90	105	144	126	0.325	0.244	N/A	N/A

380V~460V/ 50~60Hz

Type	KW	HP	Rated Amps of DC Reactor [Arms]		Max. continuous Amps [Arms]		DC impedance [mH]		DC Reactor Delta part #	
			Normal Duty	Light Duty	Normal Duty	Light Duty	Normal Duty	Light Duty	Normal Duty	Light Duty
007	0.75	1	2.8	3	4.48	3.6	18.709	18.709	N/A	N/A
015	1.5	2	3	4.2	4.8	5.04	18.709	14.031	N/A	N/A
022	2.2	3	4	5.5	6.4	6.6	14.031	9.355	N/A	N/A
037	3.7	5	6	8.5	9.6	10.2	9.355	6.236	N/A	N/A
040	4	5	9	10.5	14.4	12.6	6.236	5.345	N/A	N/A
055	5.5	7.5	10.5	13	16.8	15.6	5.345	4.677	N/A	N/A
075	7.5	10	12	18	19.2	21.6	4.677	3.119	N/A	N/A
110	11	15	18	24	28.8	28.8	3.119	2.338	N/A	N/A
150	15	20	24	32	38.4	38.4	2.338	1.754	N/A	N/A
185	18.5	25	32	38	51.2	45.6	1.754	1.477	N/A	N/A
220	22	30	38	45	60.8	54	1.477	1.247	N/A	N/A
300	30	40	45	60	72	72	1.247	0.935	N/A	N/A
370	37	50	60	73	96	87.6	0.935	0.768	N/A	N/A

The following table is spec. of THDi that Delta AC motor drives use with AC/DC reactors.

AC motor drive	Without built-in DC reactor (Frame A~C)				With built-in DC reactor (Frame D and above)		
Spec. of reactor (series-connected)	Without adding input AC/DC reactor	3% Input AC Reactor	5% Input AC Reactor	4% DC Reactor	Built-in DC reactor, and without adding input AC/DC reactor	3% Input AC Reactor	5% Input AC Reactor
5th	73.3%	38.5%	30.8%	25.5%	31.16%	27.01%	25.5%
7th	52.74%	15.3%	9.4%	18.6%	23.18%	9.54%	8.75%
11th	7.28%	7.1%	6.13%	7.14%	8.6%	4.5%	4.2%
13th	0.4%	3.75%	3.15%	0.48%	7.9%	0.22%	0.17%
THDi	91%	43.6%	34.33%	38.2%	42.28%	30.5%	28.4%
Note:	THDi may have some difference due to different installation conditions and environment						

Spec. of THDi

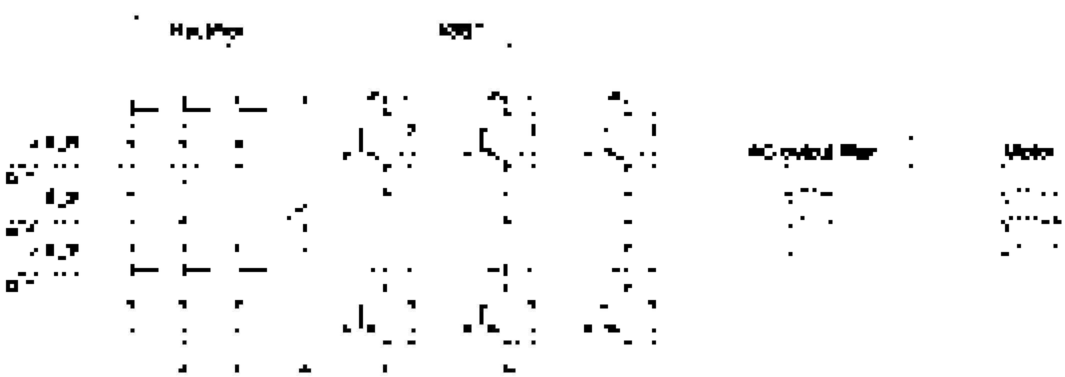
AC Output Reactor

If the length of cable between AC motor drive and motor is too long, it may make AC motor drive trigger protection mechanism for GF (Ground Fault), OV (Over Current) and the AC motor drive stops running. The cause is the over long motor cable will generate extremely large stray capacitance, make common mode current of 3-phase output get too large and then trigger GF protection mechanism; OC protection is triggered which is caused by stray capacitance of cable-cable and cable-ground are getting larger, and its surge current makes AC motor drive output over large current. To prevent from the common mode current that stray capacitance generates, set up AC output reactor between AC motor drive and motor to increase the high frequency impedance.

Power transistor is switched via PWM to control the output voltage and frequency for AC motor drive. During the switch process, impulse voltage (dv/dt) rises and falls rapidly will make inner voltage of motor distribute unequally, and then the isolation of motor will be getting worse, and have interference of bearing current and electromagnet. Especially when AC motor drive and motor are connected by long leading wire, the influence of damping of high frequency resonance and reflected voltage that caused by cable spreading parameters is getting large, and it will generate twice incoming voltage at motor side to be over voltage, destroy the isolation.

Method of set up

AC output reactor sets up between motor and U, V, W which are at output side of AC motor drive in series-connected way. See the figure below:



AC output reactor setup

Specifications of AC output reactors (standard item)

The following table shows the specifications of AC output reactors (standard items) for Delta CP2000 series products, and their part numbers to choose:

200V~230V/ 50~60Hz

Type	KW [HP]	Rated Amps of AC Reactor (Arms)		Max. continuous Amps (Arms)		3% impedance (mH)		5% impedance (mH)		Built-in DC reactor	3% Input AC reactor Delta part #	
		Normal Duty	Light Duty	Normal Duty	Light Duty	Normal Duty	Light Duty	Normal Duty	Light Duty		Normal Duty	Light Duty
007	0.75 [1]	4.6	5	7.36	6	2.536	2.536	4.227	4.227	X	N/A	N/A
015	1.5 [2]	5	7.5	8	9	2.536	1.585	4.227	2.642	X	N/A	N/A
022	2.2 [3]	8	10	12.8	12	1.585	1.152	2.642	1.922	X	N/A	N/A
037	3.7 [5]	11	15	17.6	18	1.152	0.746	1.922	1.243	X	N/A	N/A
055	5.5 [7.5]	17	21	27.2	25.2	0.746	0.507	1.243	0.845	X	N/A	N/A
075	7.5 [10]	25	31	40	37.2	0.507	0.320	0.845	0.534	X	N/A	N/A
110	11 [15]	33	46	52.8	55.2	0.320	0.216	0.534	0.359	X	N/A	N/A
150	15 [20]	49	61	78.4	73.2	0.216	0.163	0.359	0.271	X	N/A	N/A
185	18.5 [25]	65	75	104	90	0.163	0.147	0.271	0.282	X	N/A	N/A
220	22 [30]	75	90	120	108	0.169	0.141	0.282	0.235	X	N/A	N/A
300	30 [40]	90	105	144	126	0.141	0.106	0.235	0.176	X	N/A	N/A
370	37 [50]	120	146	192	175.2	0.106	0.087	0.176	0.145	O	N/A	N/A
450	45 [60]	146	180	233.6	216	0.087	0.070	0.145	0.117	O	N/A	N/A
550	55 [75]	180	215	288	258	0.070	0.059	0.117	0.098	O	N/A	N/A
750	75 [100]	215	276	344	331.2	0.059	0.049	0.098	0.083	O	N/A	N/A
900	90 [125]	255	322	408	386.4	0.049	0.037	0.083	0.061	O	N/A	N/A

380V~460V/ 50~60Hz

Type	KW [HP]	Rated Amps of AC Reactor (Arms)		Max. continuous Amps (Arms)		3% impedance (mH)		5% impedance (mH)		Built-in DC reactor Normal Duty	3% Input AC reactor Delta part #	
		Normal Duty	Light Duty	Normal Duty	Light Duty	Normal Duty	Light Duty	Normal Duty	Light Duty		Light Duty	Normal Duty
007	0.75 [1]	2.8	3	4.48	3.6	8.102	8.102	13.502	13.502	X	N/A	N/A
015	1.5 [2]	3	4.2	4.8	5.04	8.102	6.077	13.502	10.127	X	N/A	N/A
022	2.2 [3]	4	5.5	6.4	6.6	6.077	4.050	10.127	6.752	X	N/A	N/A
037	3.7 [5]	6	8.5	9.6	10.2	4.050	2.700	6.752	4.501	X	N/A	N/A
040	4 [5]	9	10.5	14.4	12.6	2.700	2.315	4.501	3.858	X	N/A	N/A
055	5.5 [7.5]	10.5	13	16.8	15.6	2.315	2.025	3.858	3.375	X	N/A	N/A
075	7.5 [10]	12	18	19.2	21.6	2.025	1.174	3.375	1.957	X	N/A	N/A
110	11 [15]	18	24	28.8	28.8	1.174	0.881	1.957	1.468	X	N/A	N/A
150	15 [20]	24	32	38.4	38.4	0.881	0.660	1.468	1.101	X	N/A	N/A
185	18.5 [25]	32	38	51.2	45.6	0.660	0.639	1.101	1.066	X	N/A	N/A
220	22 [30]	38	45	60.8	54	0.639	0.541	1.066	0.900	X	N/A	N/A
300	30 [40]	45	60	72	72	0.541	0.405	0.900	0.675	X	N/A	N/A
370	37 [50]	60	73	96	87.6	0.405	0.334	0.675	0.555	X	N/A	N/A
450	45 [60]	73	91	116.8	109.2	0.334	0.267	0.555	0.445	O	N/A	N/A
550	55 [75]	91	110	145.6	132	0.267	0.221	0.445	0.368	O	N/A	N/A
750	75 [100]	110	150	176	180	0.221	0.162	0.368	0.270	O	N/A	N/A
900	90 [125]	150	180	240	216	0.162	0.135	0.270	0.225	O	N/A	N/A
1100	110 [150]	180	220	288	264	0.135	0.110	0.225	0.184	O	N/A	N/A
1320	132 [175]	220	260	352	312	0.110	0.098	0.184	0.162	O	N/A	N/A
1600	160 [215]	260	310	416	372	0.098	0.078	0.162	0.131	O	N/A	N/A
1850	185 [250]	310	370	496	444	0.078	0.066	0.131	0.109	O	N/A	N/A
2200	220 [300]	370	460	592	552	0.066	0.054	0.109	0.090	O	N/A	N/A
2800	280 [375]	460	530	736	636	0.054	0.044	0.090	0.074	O	N/A	N/A

Type	KW [HP]	Rated Amps of AC Reactor (Arms)		Max. continuous Amps (Arms)		3% impedance (mH)		5% impedance (mH)		Built-in DC reactor Normal Duty	3% Input AC reactor Delta part #	
		Normal Duty	Light Duty	Normal Duty	Light Duty	Normal Duty	Light Duty	Normal Duty	Light Duty		Light Duty	Normal Duty
3150	315 [420]	550	616	880	739.2	0.044	0.039	0.074	0.066	O	N/A	N/A
3550	355 [475]	616	683	985.6	819.6	0.039	0.036	0.066	0.060	O	N/A	N/A
4500	450 [600]	683	770	1092.8	924	0.036	0.028	0.060	0.047	O	N/A	N/A
5000	500 [675]	866	912	1385.6	1094.4	0.028	0.028	0.047	0.047	O	N/A	N/A

The length of motor cable

1. Never connect phase lead capacitors or surge absorbers to the output terminals of the AC motor drive.
   - If the length is too long, the stray capacitance between cables will increase and may cause leakage current. It will activate the protection of over current, increase leakage current or not insure the correction of current display. The worst case is that AC motor drive may damage.
   - If more than one motor is connected to the AC motor drive, the total wiring length is the sum of the wiring length from AC motor drive to each motor.
   - For the 460V series AC motor drive, when an overload relay is installed between the drive and the motor to protect motor over heating, the connecting cable must be shorter than 50m. However, an overload relay malfunction may still occur. To prevent the malfunction, install an output reactor (optional) to the drive or lower the carrier frequency setting (Pr.00-17).

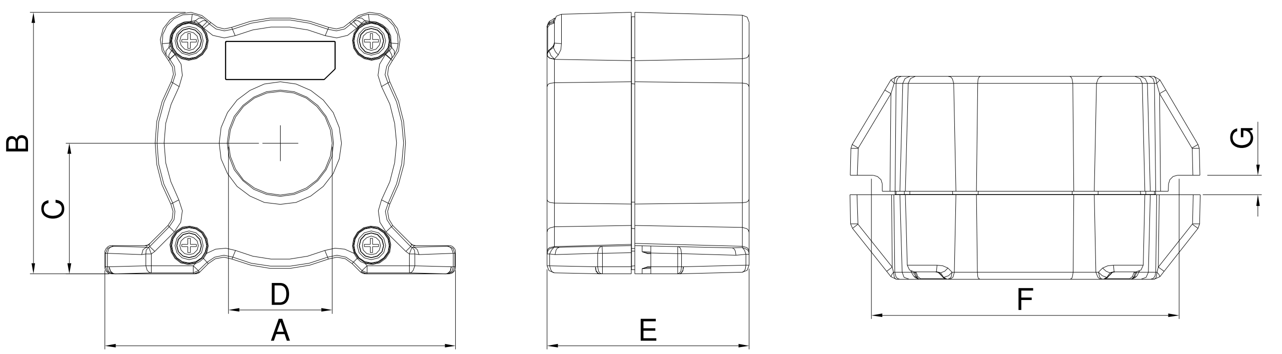
2. When motor is driven by an AC motor drive of PWM type, the motor terminals will experience surge voltages easily due to components conversion of AC motor drive and cable capacitance. When the motor cable is very long (especially for the 460V series), surge voltages may reduce insulation quality. To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

The following table refers to IEC 60034-17 shows specification of the length of shielding cable for CP2000 series motor. It applies to the motors which rated voltage is under 500Vac, peak-peak voltage isolation rating is above (including) 1.35kV:

220V type	KW	HP	Rated Amps of AC Reactor (Arms)		Without output AC reactor		3% output AC reactor	
			Normal Duty	Light Duty	Shielding cable (meter)	Un-shielding cable (meter)	Shielding cable (meter)	Un-shielding cable (meter)
007	0.75	1	4.6	5	50	75	75	115
015	1.5	2	5	7.5	50	75	75	115
022	2.2	3	8	10	50	75	75	115
037	3.7	5	11	15	50	75	75	115
040	4	5	17	21	50	75	75	115
055	5.5	7.5	25	31	100	150	150	225
075	7.5	10	33	46	100	150	150	225
150	15	20	49	61	100	150	150	225
185	18.5	25	65	75	100	150	150	225
220	22	30	75	90	100	150	150	225
300	30	40	90	120	100	150	150	225
370	37	50	120	146	100	150	150	225
450	45	60	146	180	150	225	225	325
550	55	75	180	215	150	225	225	325
750	75	100	215	276	150	225	225	325
900	90	125	255	322	150	225	225	325

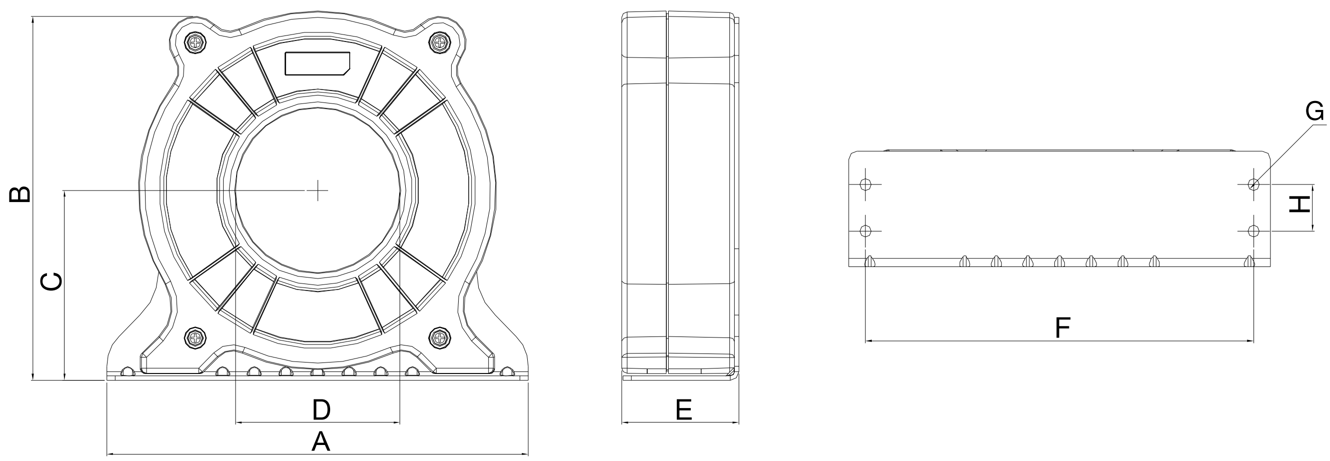
440V type	KW	HP	Rated Amps of AC Reactor (Arms)		Without output AC reactor		3% output AC reactor	
			Normal Duty	Light Duty	Shielding cable (meter)	Un-shielding cable (meter)	Shielding cable (meter)	Un-shielding cable (meter)
007	0.75	1	2.8	3	50	75	75	115
015	1.5	2	3	4.2	50	75	75	115
022	2.2	3	4	5.5	50	75	75	115
037	3.7	5	6	8.5	50	75	75	115
040	4	5	9	10.5	50	75	75	115
055	5.5	7.5	10.5	13	50	75	75	115
075	7.5	10	12	18	100	150	150	225
110	11	15	18	24	100	150	150	225
150	15	20	24	32	100	150	150	225
185	18.5	25	32	38	100	150	150	225
220	22	30	38	45	100	150	150	225
300	30	40	45	60	100	150	150	225
370	37	50	60	73	100	150	150	225
450	45	60	73	91	150	225	225	325
550	55	75	91	110	150	225	225	325
750	75	100	110	150	150	225	225	325
900	90	125	150	180	150	225	225	325
1100	110	150	180	220	150	225	225	325
1320	132	175	220	260	150	225	225	325
1600	160	215	260	310	150	225	225	325
1850	185	250	310	370	150	225	225	325
2200	220	300	370	460	150	225	225	325
2800	280	375	460	530	150	225	225	325
3150	315	420	550	616	150	225	225	325
3550	355	475	616	683	150	225	225	325
4000	400	536	683	770	150	225	225	325
5000	500	675	866	912	150	225	225	325

7-5 Zero Phase Reactors



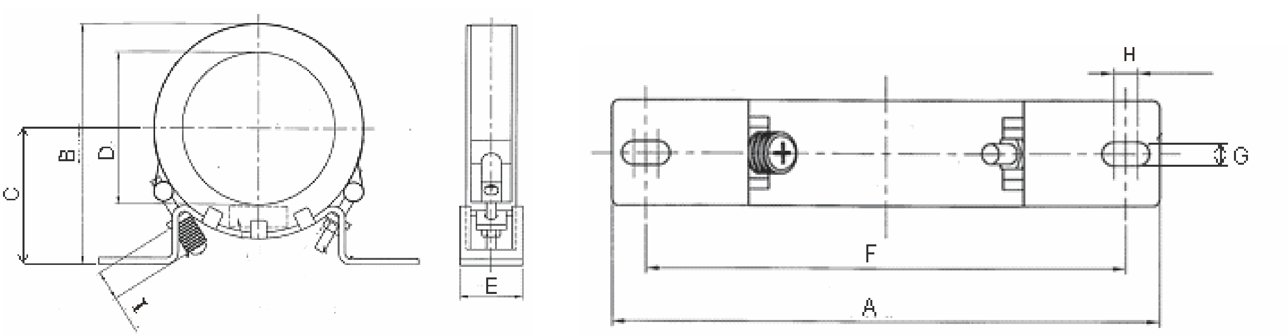
UNIT: mm(inch)

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



UNIT: mm(inch)

model	A	B	C	D	E	F	G(Ø)	H	Torque
RF002X00A	200 (7.874)	172.5 (6.791)	90 (3.543)	78 (3.071)	55.5 (2.185)	184 (7.244)	5.5 (0.217)	22 (0.866)	<45kgf/cm^2



UNIT: mm(inch)

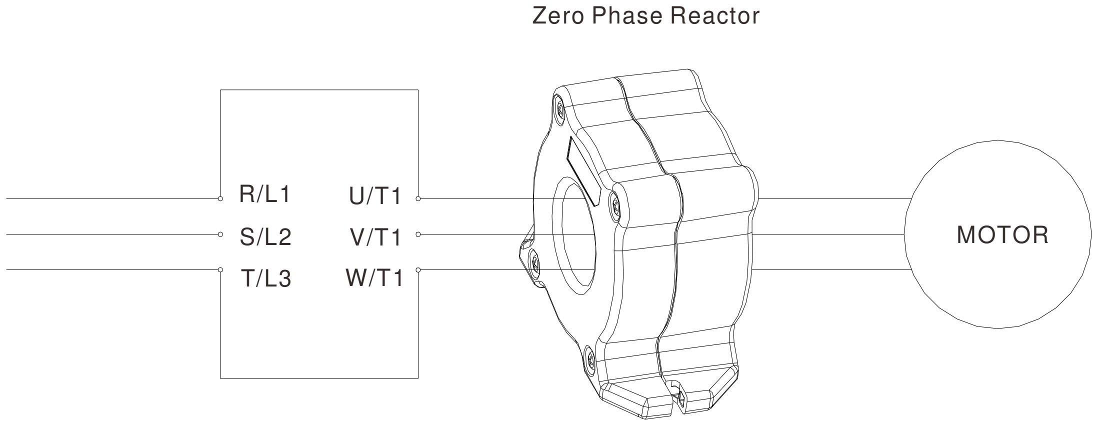
model	A	B	C	D	E	F	G(Ø)	H	I
RF300X00A	241(9.488)	217(8.543)	114(4.488)	155(6.102)	42(1.654)	220(8.661)	6.5(0.256)	7.0(0.276)	20(0.787)

Reactor model (Note)	Recommended Wire Size		Wiring Method	Qty	Corresponding motor drives
RF008X00A	≦8 AWG	≦8.37 mm^2	Diagram A	1	VFD007CP23A; VFD015CP23A; VFD022CP23A; VFD037CP23A; VFD055CP23A; VFD007CP43A; VFD015CP43B; VFD022CP43B; VFD037CP43B; VFD040CP43A; VFD055CP43B; VFD075CP43B; VFD007CP4EA; VFD015CP4EB; VFD022CP4EB; VFD037CP4EB; VFD040CP4EA; VFD055CP4EB; VFD075CP4EB
RF004X00A	≦4 AWG	≦21.15 mm^2	Diagram A	1	VFD075CP23A; VFD110CP23A; VFD150CP23A; VFD110CP43B; VFD150CP43B; VFD185CP43B; VFD110CP4EB; VFD150CP4EB; VFD185CP4EB
RF002X00A	≦2 AWG	≦33.62 mm^2	Diagram A	1	VFD185CP23A; VFD220CP23A; VFD300CP23A; VFD370CP23A; VFD450CP23A; VFD220CP43A; VFD300CP43B; VFD370CP43B; VFD450CP43S; VFD550CP43S; VFD750CP43B; VFD900CP43A; VFD220CP4EA; VFD300CP4EB; VFD370CP4EB
RF300X00A	≦300 MCM	≦152 mm^2	Diagram A	1	VFD550CP23A; VFD750CP23A; VFD900CP23A; VFD1100CP43A; VFD1320CP43B; VFD1600CP43A; VFD1850CP43B; VFD2200CP43A; VFD2800CP43A; VFD3150CP43A/C; VFD3550CP43A/C; VFD4000CP43A/C

Note: 600V insulated cable wire

Diagram A

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



Note 1: The table above gives approximate wire size for the zero phase reactors but the selection is ultimately governed by the type and diameter of cable fitted i.e. the cable must fit through the center hole of zero phase reactors.

Note 2: Only the phase conductors should pass through, not the earth core or screen.

Note3: When long motor output cables are used an output zero phase reactor may be required to reduce radiated emissions from the cable.

7-6 EMI Filter

The following table shows external EMI filter models for each CP2000 series AC motor drive. Users can choose corresponding zero phase reactor and applicable shielding cable according to required noise emission and electromagnetic disturbance rating, to make the best assembly and restrain electromagnetic disturbance. If radiation emission (RE) is ignored, and only needs conducted emission (CE) to reach Class C2 or C1 on site, zero phase reactor does not need to add at input side, and it can reach the standard of EMC.

Model	input Current	Applicable EMI Filter	Zero Phase* Reactor (See statements below the table)	CE Cable Length		Radiation Emission
				default carrier frequency		
				EN61800-3 C1	EN61800-3 C2	EN61800-3 C2
VFD007CP23A	6.4A	EMF021A23A	RF008X00A	50m	100m	Pass
VFD015CP23A	9.6A			50m	100m	Pass
VFD022CP23A	15A			50m	100m	Pass
VFD037CP23A	22A			50m	100m	Pass
VFD055CP23A	25A	EMF056A23A		50m	100m	Pass
VFD075CP23A	35A		RF004X00A	50m	100m	Pass
VFD110CP23A	50A			50m	100m	Pass
VFD150CP23A	65A	KMF3100A		50m	100m	Pass
VFD185CP23A	83A		RF002X00A	50m	100m	Pass
VFD220CP23A	100A			50m	100m	Pass
VFD300CP23A	116A	B84143D0150R127		50m	100m	Pass
VFD370CP23A	146A			50m	100m	Pass
VFD450CP23A	180A	B84143B0250S020		50m	100m	Pass
VFD550CP23A	215A		RF300X00A	50m	100m	Pass
VFD750CP23A	276A	B84143B0400S020		50m	100m	Pass
VFD900CP23A	322A			50m	100m	Pass
VFD007CP43A	4.3A	EMF014A43A	RF008X00A	50m	100m	Pass
VFD015CP43B	6A			50m	100m	Pass
VFD022CP43B	8.1A			50m	100m	Pass
VFD037CP43B	12.4A			50m	100m	Pass
VFD040CP43A	16A	EMF039A43A		50m	100m	Pass
VFD055CP43B	20A			50m	100m	Pass
VFD075CP43B	22A			50m	100m	Pass
VFD110CP43B	26A		RF004X00A	50m	100m	Pass
VFD150CP43B	35A			50m	100m	Pass
VFD185CP43B	42A	KMF370A		50m	100m	Pass
VFD220CP43A	50A		RF002X00A	50m	100m	Pass
VFD300CP43B	66A			50m	100m	Pass
VFD370CP43B	80A	B84143D0150R127		50m	100m	Pass

Model	input Current	Applicable EMI Filter	Zero Phase* Reactor (See statements below the table)	CE Cable Length		Radiation Emission
				default carrier frequency		
				EN61800-3 C1	EN61800-3 C2	EN61800-3 C2
VFD450CP43A	91A	B84143D0200R127	RF300X00A	50m	100m	Pass
VFD550CP43A	110A			50m	100m	Pass
VFD750CP43B	150A			50m	100m	Pass
VFD900CP43A	180A			50m	100m	Pass
VFD1100CP43A	220A			50m	100m	Pass
VFD1320CP43B	260A	MIF3400B	RF300X00A	50m	100m	Pass
VFD1600CP43A	310A			50m	100m	Pass
VFD1850CP43B	370A			50m	100m	Pass
VFD2200CP43A	460A	MIF3800		50m	100m	Pass
VFD2800CP43A	530A			50m	100m	Pass
VFD3150CP43A	616A			50m	100m	Pass
VFD3550CP43A	683A			50m	100m	Pass
VFD4000CP43A	770A			50m	100m	Pass

*For models of Frame A, B and C: On both input and output side, a zero phase reactor is required to be wired to the motor drive. There should be in total 2 zero phase reactors.
For models of Frame D to H: Only 1 zero phase reactor is required to be wired on the output side of the motor drive.

The following table shows CP2000 series AC motor drives which have built-in EMI filters and specification of their corresponding shielding cable. Users can choose applicable shielding cable according to required noise emission and electromagnetic disturbance rating.

AC motor drives of built-in EMI Filter		Rated current (ND)	EMC standard (IEC 61800-3) Class C3	EMC standard (IEC 61800-3) Class C2
Frame size	Models		The length of shielding cable	The length of shielding cable
A	VFD007C43E	4.3	30m≤8kHz	10m≤8kHz
	VFD015C43E	5.9	30m≤8kHz	10m≤8kHz
	VFD022C43E	8.7	30m≤8kHz	10m≤8kHz
	VFD037C43E	14	30m≤8kHz	10m≤8kHz
	VFD040C43E	15.5	30m≤8kHz	10m≤8kHz
	VFD055C43E	17	30m≤8kHz	10m≤8kHz
B	VFD075C43E	20	30m≤8kHz	10m≤8kHz
	VFD110C43E	26	30m≤8kHz	10m≤8kHz
	VFD150C43E	35	30m≤8kHz	10m≤8kHz
C	VFD185C43E	40	30m≤6kHz	10m≤6kHz
	VFD220C43E	47	30m≤6kHz	10m≤6kHz
	VFD300C43E	63	30m≤6kHz	10m≤6kHz

* to prevent over long shielding cable from increasing stray capacitance, causing leakage current, and making built-in EMI filter be over-heating and inactive, for frame size A models, the length of shielding cable do not exceed over 30 m; for frame size B and C models, the length of shielding cable do not exceed over 50 m.

EMI Filter Installation

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

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

- **EN61000-6-4**
- **EN61800-3: 1996**
- **EN55011 (1991) Class A Group 1 (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.

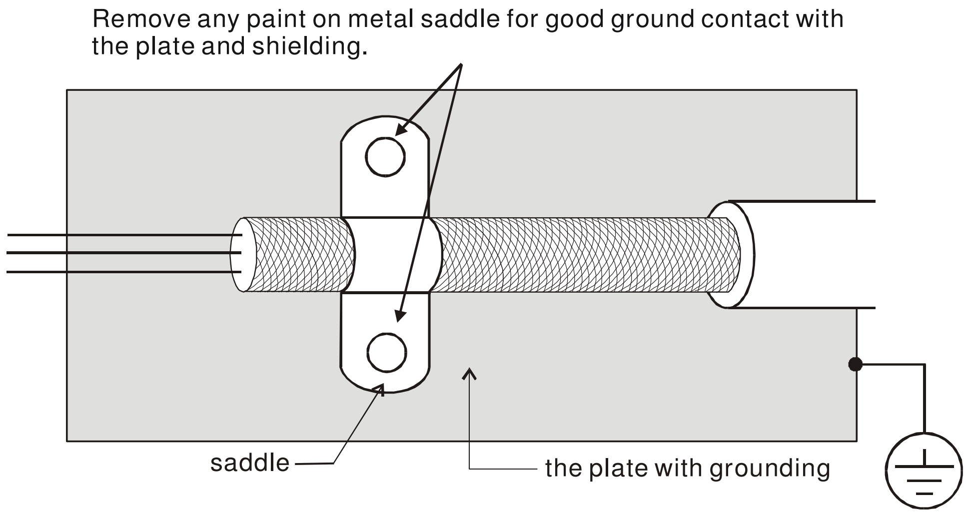


Figure 1

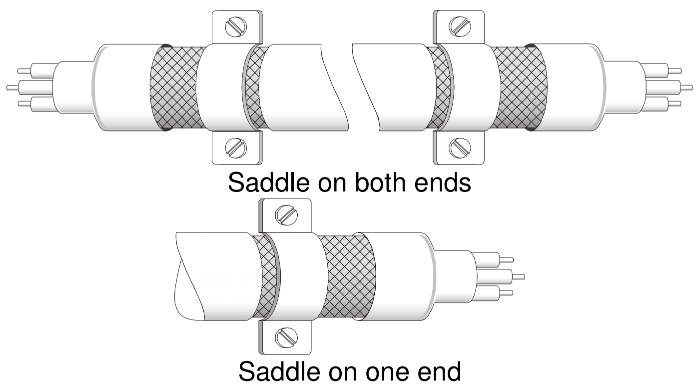


Figure 2

7-7 Digital Keypad

7-7-1 KPC-CE01

A: Main Display

Display frequency, current, voltage and error etc.

B: Status Indicator

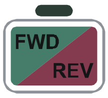
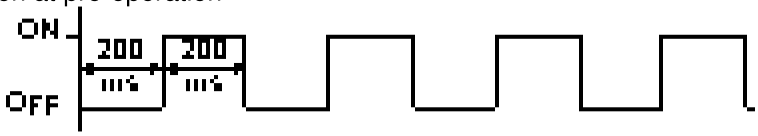
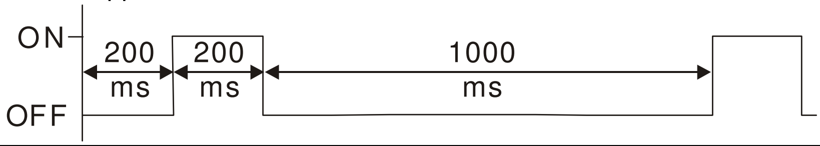
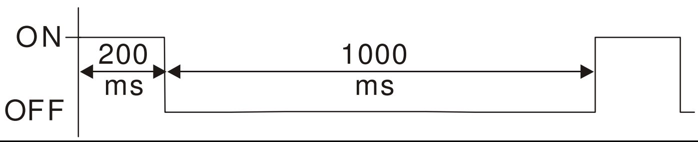
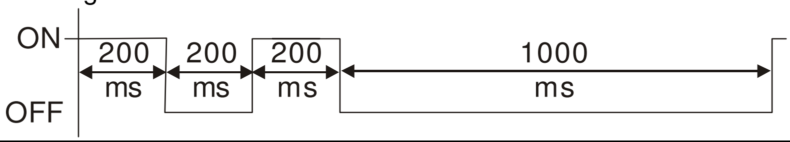
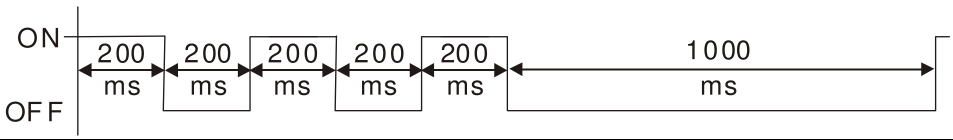
F: Frequency Command
H: Output Frequency
U: User Defined Units
ERR: CAN Error Indicator
RUN: CAN Run Indicator

C: Function

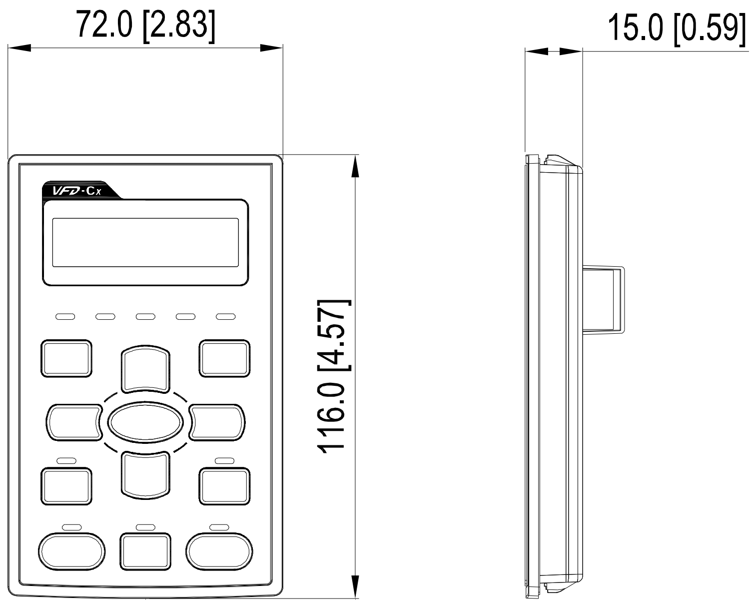
(Refer to the chart follows for detail description)

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

Descriptions of LED Functions

<table>
<tr><th>LED</th><th>Descriptions</th></tr>
<tr><td></td><td>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</td></tr>
<tr><td></td><td>Steady ON: stop indicator of the AC motor drive.
Blinking: drive is in the standby status.
Steady OFF: drive doesn’t execute “STOP” command.</td></tr>
<tr><td></td><td>Operation Direction LED 『Green light= Forward』;『Red light= Reversely』
Steady ON: the drive is running forward.
Blinking: the drive is changing direction.
Steady Off: the drive is running reversely.</td></tr>
<tr><td>CANopen ~”RUN”</td><td>RUN (Green light):
<table>
<tr><th>LED status</th><th>Condition/State</th></tr>
<tr><td>OFF</td><td>CANopen at initial
LED steady off</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
LED steady on</td></tr>
</table></td></tr>
<tr><td>CANopen ~”ERR”</td><td>ERR (Red light):
<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>

7-7-2 Dimension



7-7-3 RJ45 Extension Lead for Digital Keypad

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

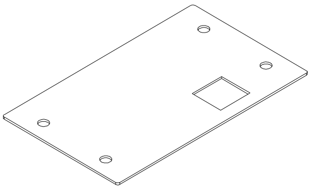
7-8 Panel Mounting (MKC-KPPK)

For MKC-KPPK model, user can choose wall mounting or embedded mounting, protection level is IP66.

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

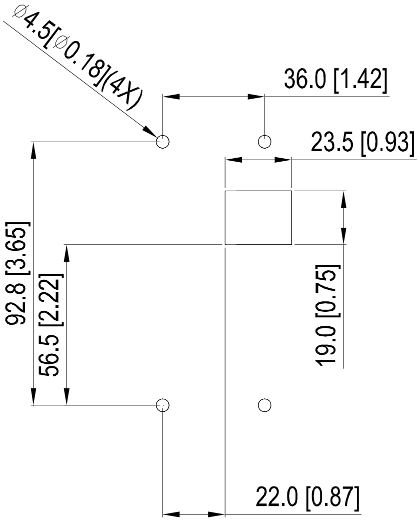
Wall Mounting

accessories*1



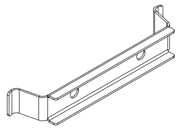
Screw *4 ~M4*p 0.7 *L8mm
Torque: 10-12kg-cm (8.7-10.4lb-in.)

Panel cutout dimension Unit: mm [inch]



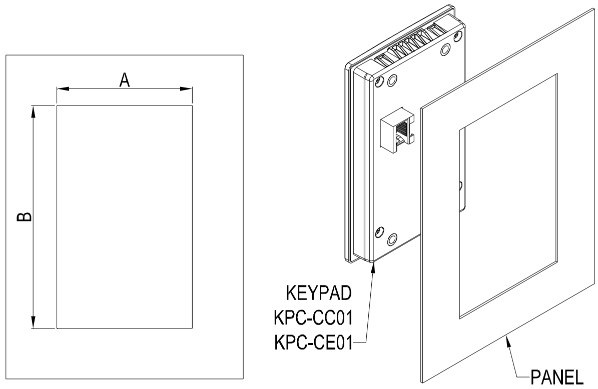
Embedded Mounting

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

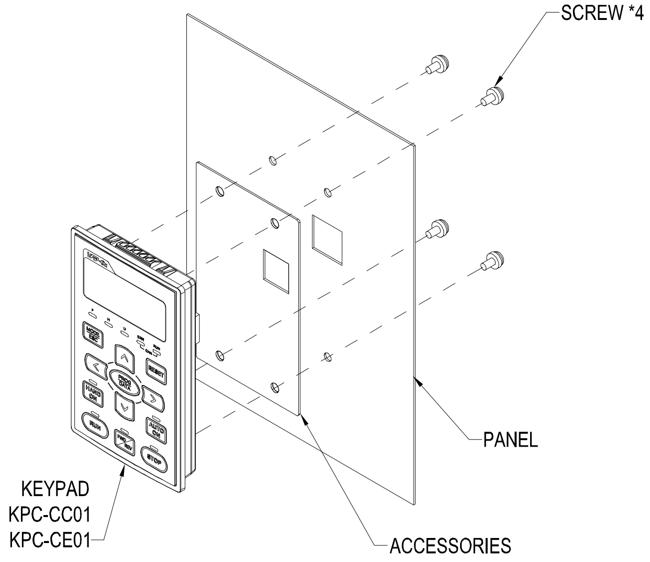
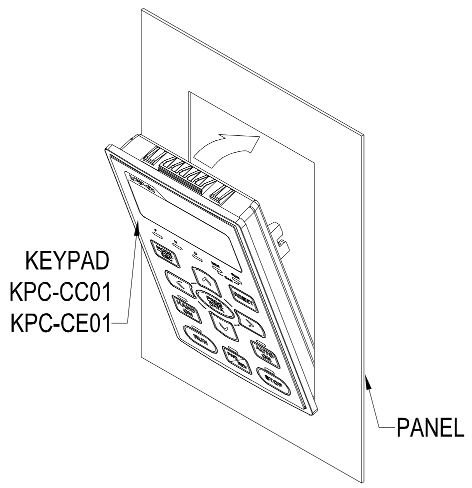
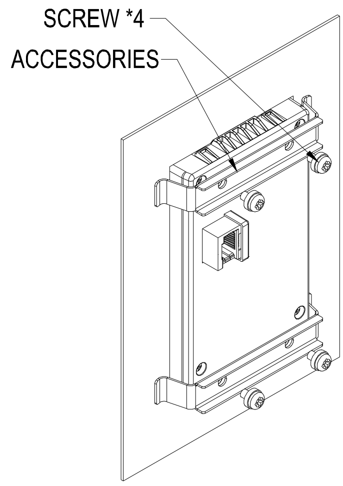
Panel thickness	1.2mm	1.6mm	2.0mm
A	66.4 [2.614]		
B	110.2 [4.339]	111.3 [4.382]	112.5 [4.429]

*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

Wall Mounting	Embedded Mounting
	 

7-9 Conduit Box Kit

- Appearance

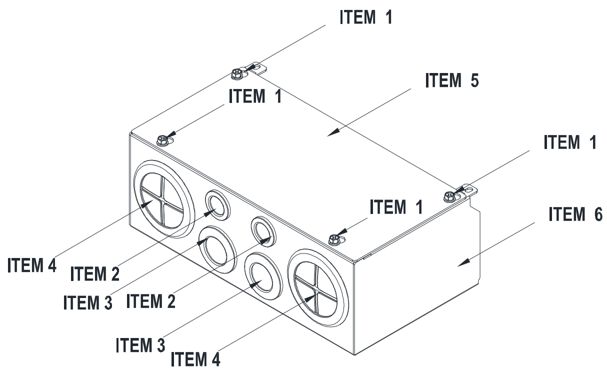
Frame D0

Applicable models

VFD450CP43S-00; VFD550CP43S-00;
VFD450CP43S-21; VFD550CP43S-21

Model number『MKC-D0N1CB』

ITEM	Description	Qty.
1	Screw M5*0.8*10L	4
2	Bushing Rubber 28	2
3	Bushing Rubber 44	2
4	Bushing Rubber 73	2
5	Conduit box cover	1
6	Conduit box base	1



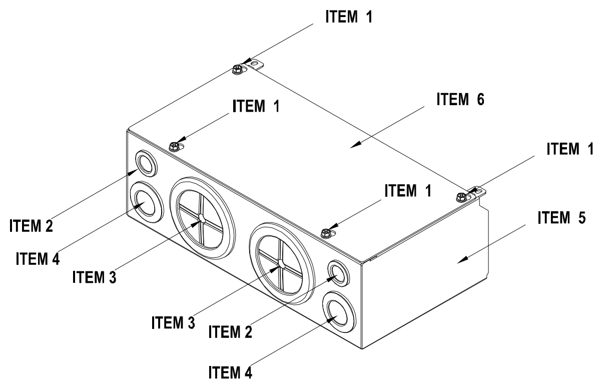
Frame D

Applicable models

VFD370CP23A-00; VFD450CP23A-00;
VFD750CP43B-00; VFD900CP43A-00;
VFD370CP23A-21; VFD450CP23A-21;
VFD750CP43B-21; VFD900CP43A-21

Model number『MKC-DN1CB』

ITEM	Description	Qty.
1	Screw M5*0.8*10L	4
2	Bushing Rubber 28	2
3	Bushing Rubber 44	2
4	Bushing Rubber 88	2
5	Conduit box cover	1
6	Conduit box base	1



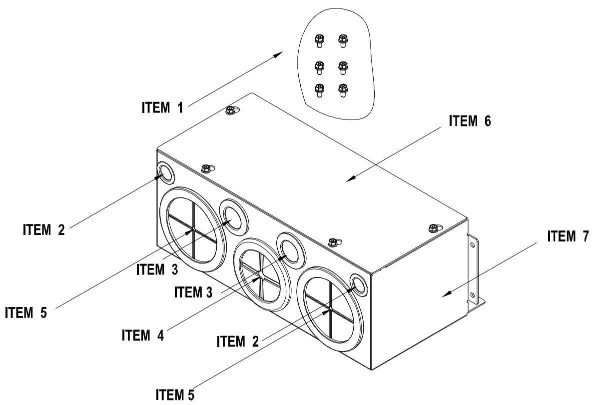
Frame E

Applicable models

VFD550CP23A-00; VFD750CP23A-00;
VFD900CP23A-00; VFD1100CP43A-00;
VFD1320CP43B-00; VFD550CP23A-21;
VFD750CP23A-21; VFD900CP23A-21;
VFD1100CP43A-21; VFD1320CP43B-21

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



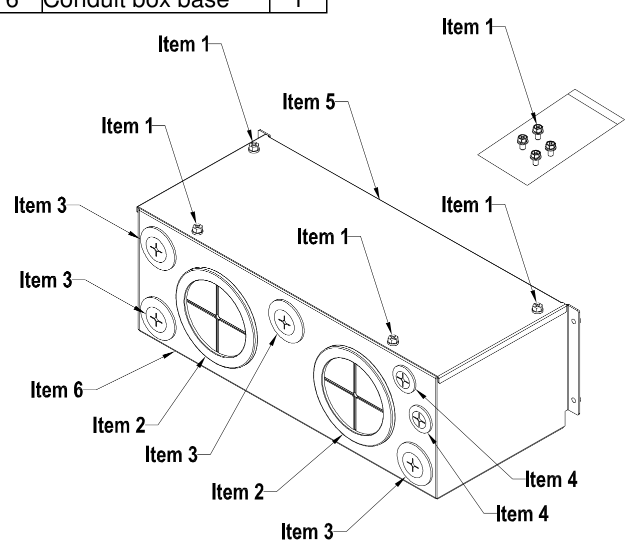
Frame F

Applicable models

VFD1600CP43A-00; VFD1850CP43B-00;
VFD1600CP43A-21; VFD1850CP43B-21

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



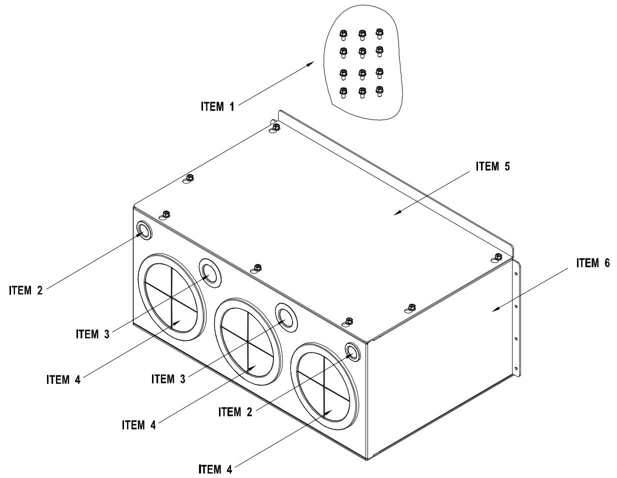
Frame G

Applicable models

VFD2200CP43A-00；VFD2800CP43A-00；
VFD2200CP43A-21；VFD2800CP43A-21

Model number『MKC-GN1CB』

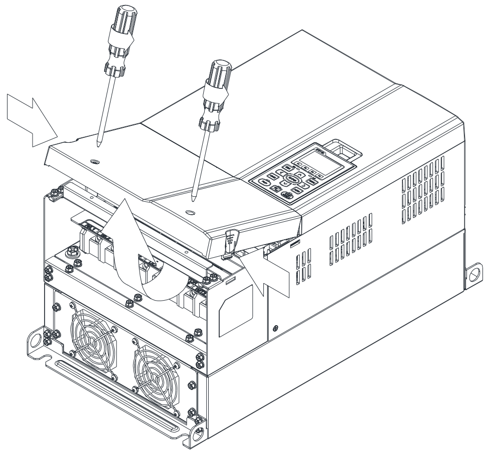
ITEM	Description	Qty.
1	Screw M *0.8*10L	12
2	Bushing Rubber 28	2
3	Bushing Rubber 44	2
4	Bushing Rubber 130	3
5	Conduit box cover	1
6	Conduit box base	1



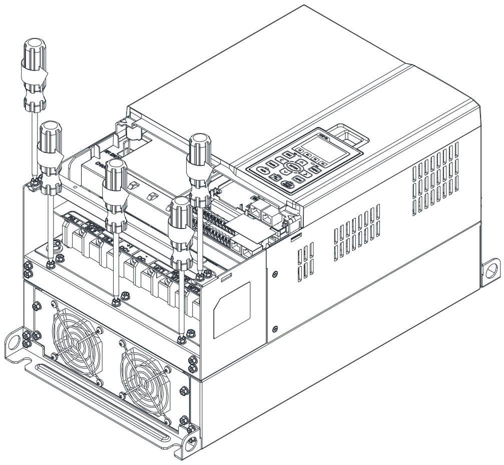
■ Conduit Box Installation

Frame D0

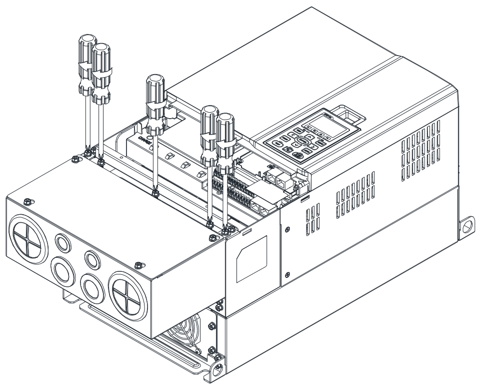
1. Loosen the cover screws and press the tabs on each side of the cover to remove the cover, as shown in the following figure. Screw torque: 12~15kg-cm (10.4~13 Ib-in)



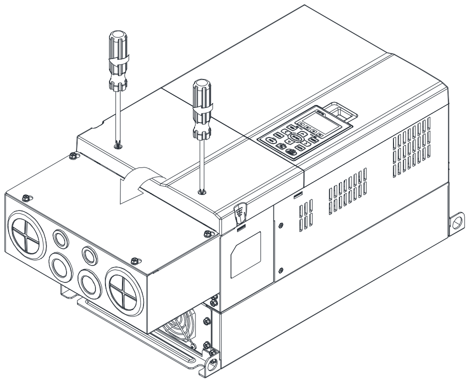
2. Remove the 5 screws shown in the following figure. Screw torque:24~26kg-cm (20.8~22.6Ib-in)



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

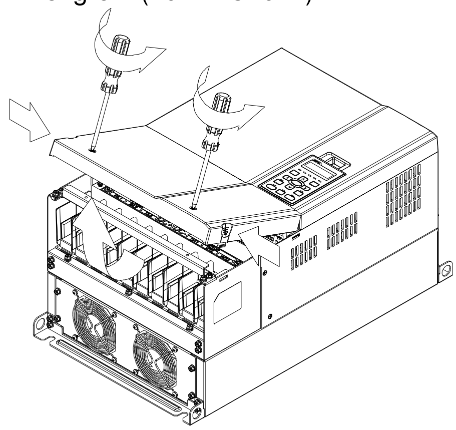


4. Fasten the 2 screws shown in the following figure. Screw torque: 12~15kg-cm (10.4~13 Ib-in)

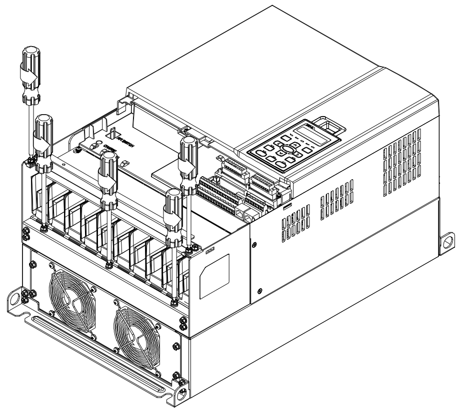


Frame D

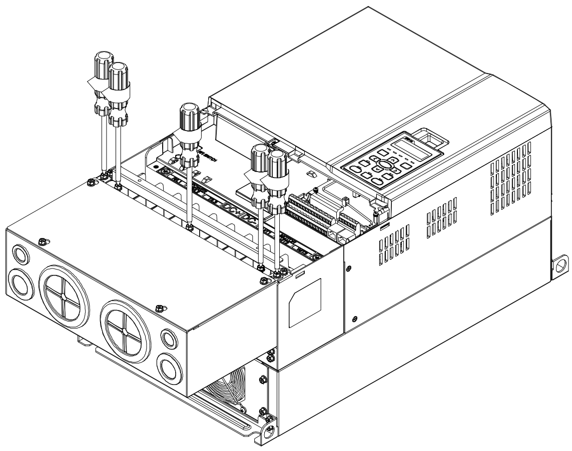
1. Loosen the cover screws and press the tabs on each side of the cover to remove the cover, as shown in the following figure. Screw torque: 12~15kg-cm (10.4~13 Ib-in)



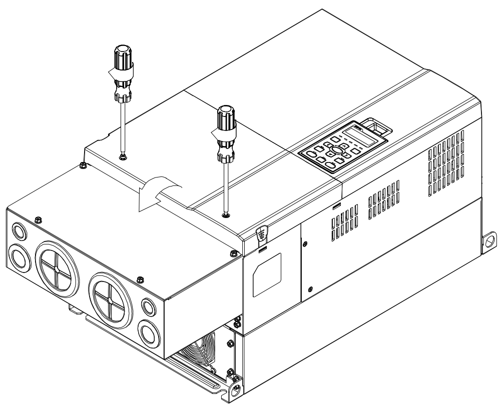
2. Remove the 5 screws shown in the following figure. Screw torque:24~26kg-cm (20.8~22.6Ib-in)



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

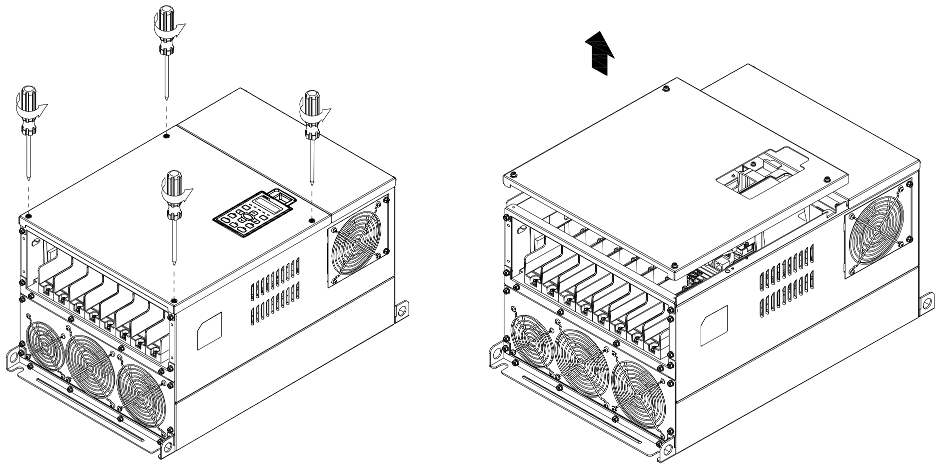


4. Fasten the 2 screws shown in the following figure. Screw torque: 12~15kg-cm (10.4~13 Ib-in)

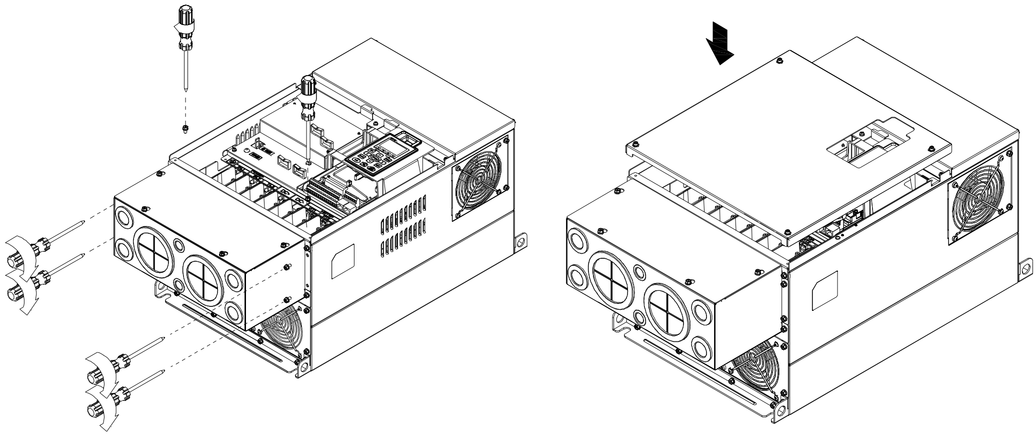


Frame E

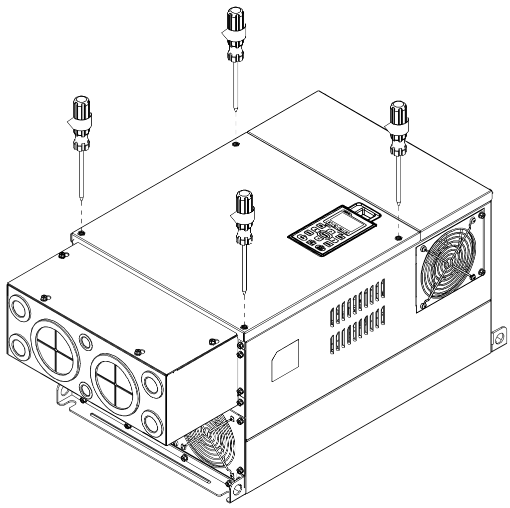
1. Loosen the 4 cover screws and lift the cover; Screw torque: 12~ 15 kg-cm (10.4~13Ib-in).



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).

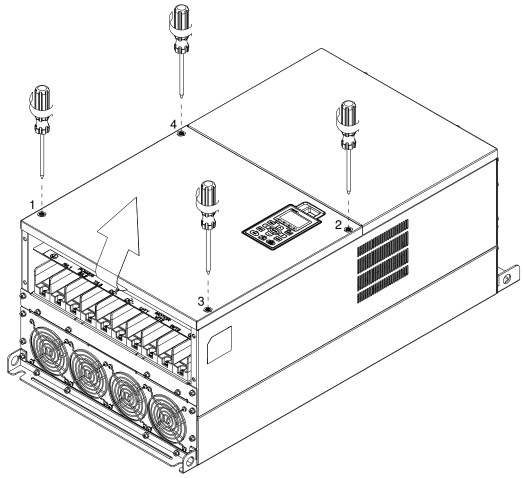


3. Fasten the 4 screws shown in the following figure. Screw torque:12~15kg-cm (10.4~13Ib-in)」

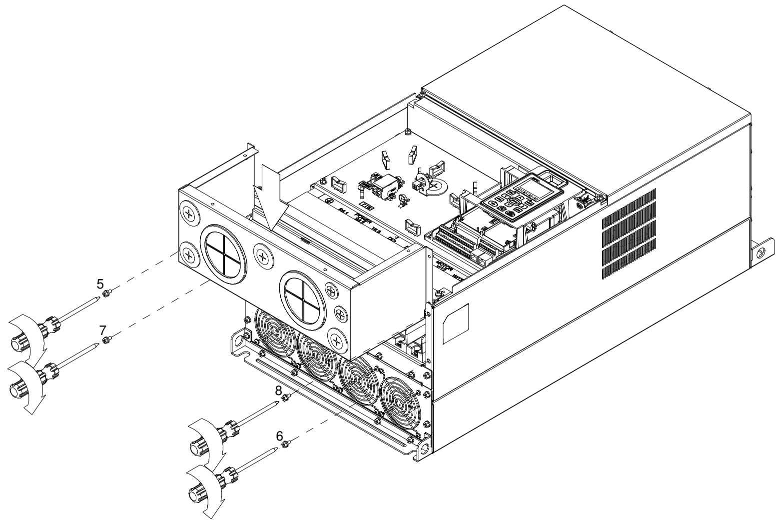


Frame F

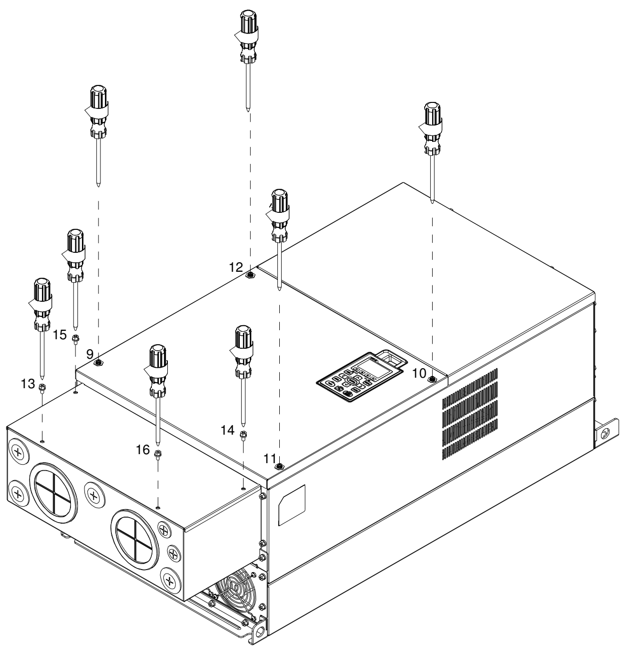
1. Loosen the cover screws and press the tabs on each side of the cover to remove the cover, as shown in the following figure. Screw torque: 12~15kg-cm (10.4~13 Ib-in).



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).

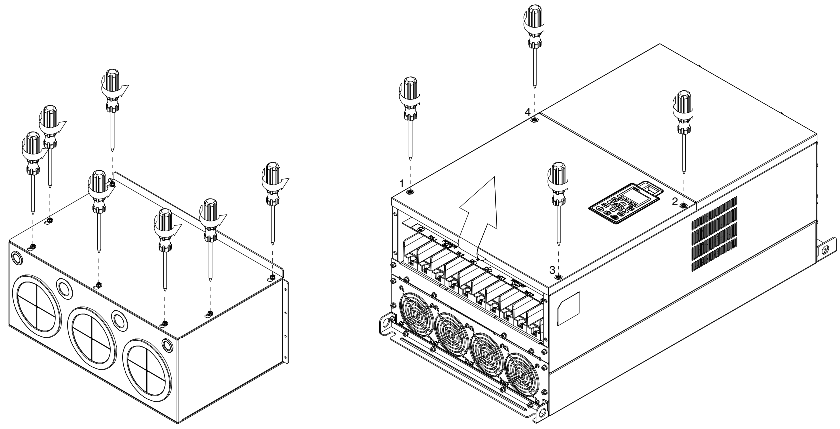


3. Install the conduit box by fasten all the screws shown in the following figure
Screw 9~12 torque: 12~15kg-cm (10.4~13.6Ib-in)
Screw 13~16 torque: 24~26kg-cm (20.8~22.6Ib-in)

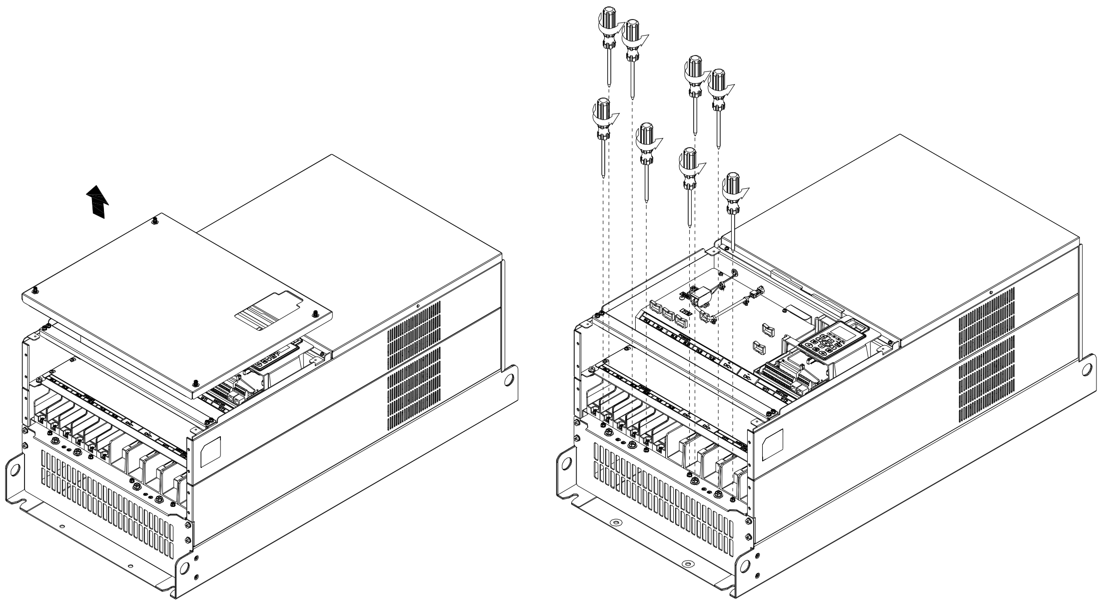


Frame G

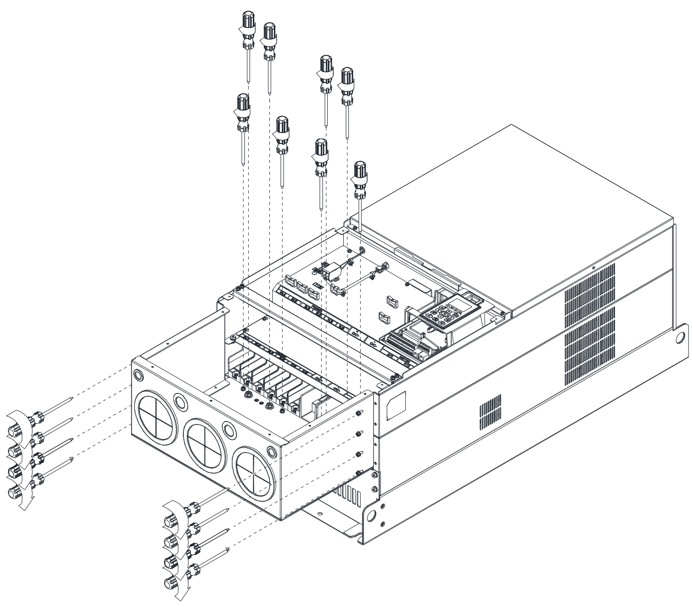
1. On the conduit box, loosen 7 of the cover screws and remove the cover「Screw torque: 24~26kg-cm (20.8~22.6lb-in)」. On the drive, loosen 4 of the cover screws and press the tabs on each side of the cover to remove the cover, as shown in the following figure. Screw torque: 12~15kg-cm (10.4~13lb-in).



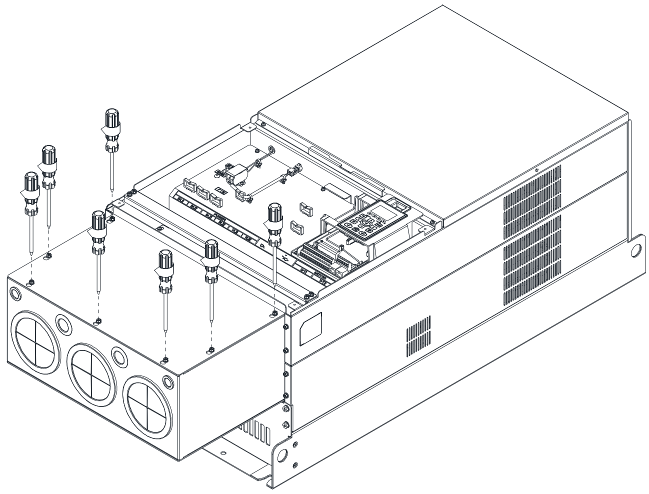
Remove the top cover and loosen the screws.
M5 Screw torque: 24~26kg-cm (20.8~22.6lb-in)
M8 Screw torque: 100~120kg-cm (86.7~104.1lb-in)



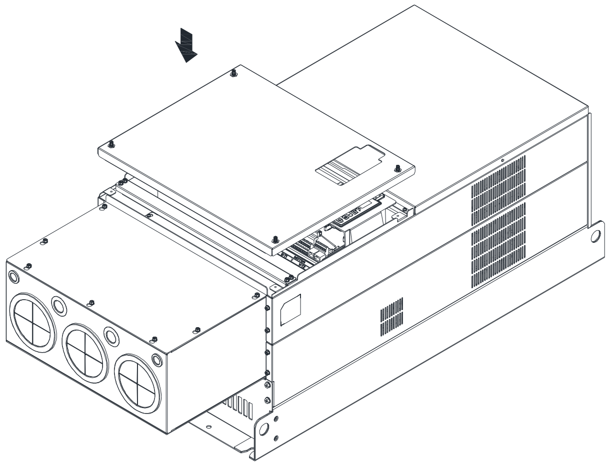
2. Install the conduit box by fastening all the screws shown in the following figure.
M5 Screw torque: 24~26kg-cm (20.8~22.6lb-in)
M8 Screw torque: 100~120kg-cm (86.7~104.1lb-in)

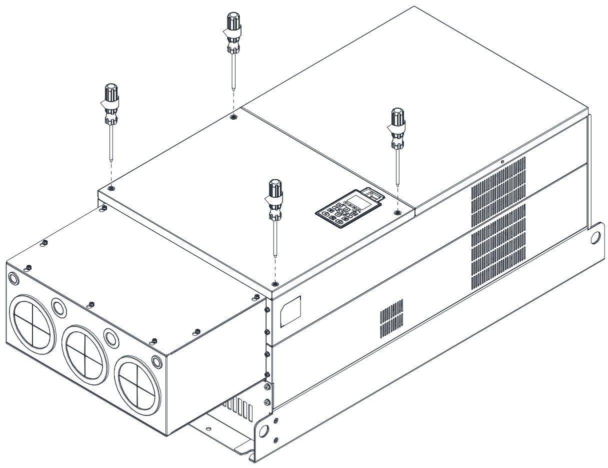


Fasten all the screws. Screw torque: 24~26kg-cm (20.8~22.6lb-in).



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

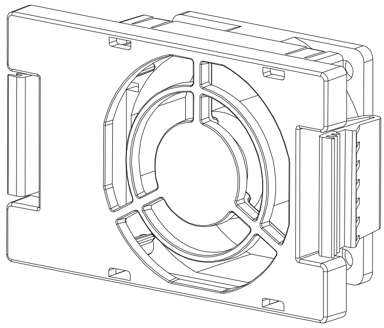




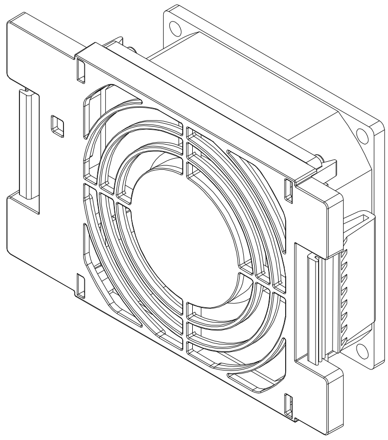
7-10 Fan Kit

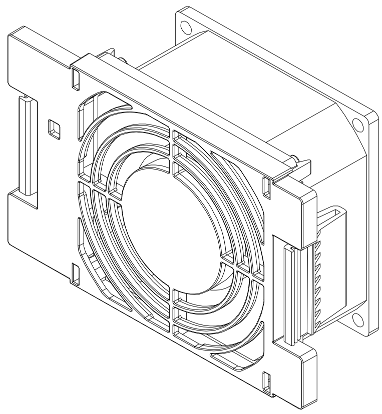
- Frames of the fan kit

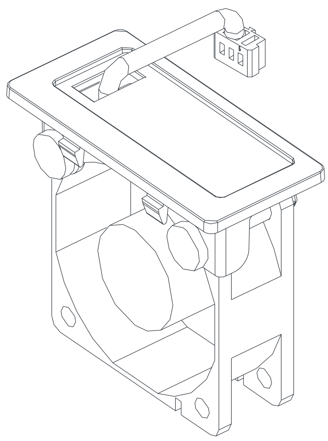
<table>
<tr><td>Frame A

Applicable Model
VFD022CP23A-21 uses MKC-AFKM
VFD037CP23A-21 uses MKC-AFKM
VFD055CP23A-21 uses MKC-AFKM
VFD022CP43B/4EB-21 uses MKC-AFKM
VFD037CP43B/4EB-21 uses MKC-AFKM
VFD040CP43A/4EA-21 uses MKC-AFKM
VFD055CP43B/4EB-21 uses MKC-AFKM
VFD075CP43B/4EB-21 uses MKC-AFKM2</td><td>Heat sink Fan Model『MKC-AFKM』
</td></tr>
<tr><td>Frame B

Applicable Model

VFD075CP23A-21
VFD110CP43B-21
VFD110CP4EB-21</td><td>Heat sink Fan Model『MKC-BFKM1』
</td></tr>
<tr><td>Frame B

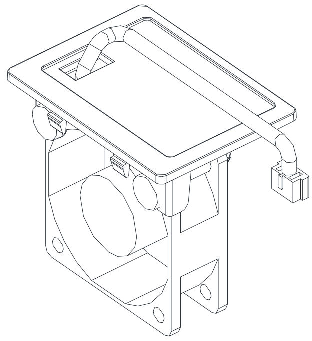
Applicable Model
VFD110CP23A-21 uses MKC-BFKM2
VFD150CP23A-21 uses MKC-BFKM3
VFD150CP43B-21 uses MKC-BFKM2
VFD150CP4EB-21 uses MKC-BFKM2
VFD185CP43B-21 uses MKC-BFKM2
VFD185CP4EB-21 uses MKC-BFKM2
(The MKC-BFKM2 and MKC-BFKM 3 have the same shape)</td><td>Heat sink Fan Model 『MKC-BFKM2』
</td></tr>
<tr><td>Frame B

Applicable Model
VFD075CP23A-21
VFD110CP23A-21
VFD110CP43B-21
VFD110CP4EB-21
VFD150CP23A-21
VFD150CP43B-21
VFD150CP4EB-21
VFD185CP43B-21
VFD185CP4EB-21</td><td>Capacitor Fan Model 『MKC-BFKB』
</td></tr>
</table>

Frame C

Applicable Model
VFD185CP23A-21
VFD220CP23A-21
VFD300CP23A-21

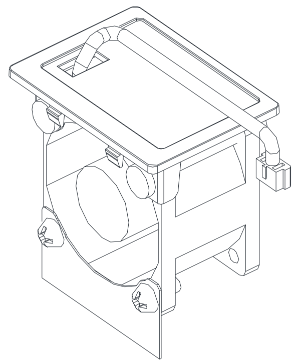
Capacitor Fan Model 『MKC-CFKB1』



Frame C

Applicable Model
VFD185C43A/43E; VFD220C43A/43E;VFD300C43A/43E

Capacitor Fan Model 『MKC-CFKB2』

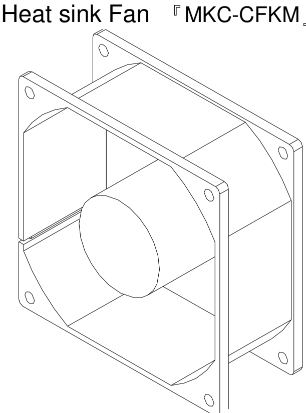


Frame C

Following Model use one set of MKC-CFKM:
VFD220CP43A/4EA-21; VFD300CP43B/4EB-21;
VFD370CP43B-21

Following Model use two sets of MKC-CFKM
VFD185CP23A-21; VFD220CP23A-21; VFD300CP23A-21;
VFD370CP4EB-21

Heat sink Fan 『MKC-CFKM』

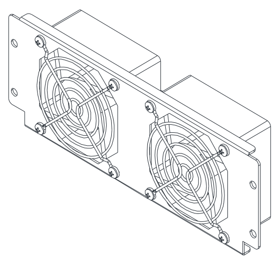


Frame D0

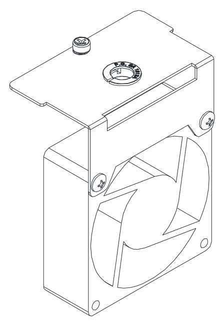
Applicable Model

VFD450CP43S-00/21; VFD550CP43S-00/21

Heat sink Fan Model
『MKC-D0FKM』



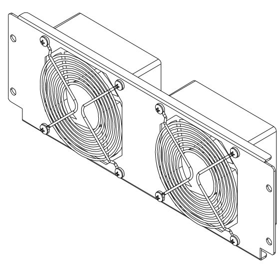
Capacitor Fan Model
『MKC-DFKB』



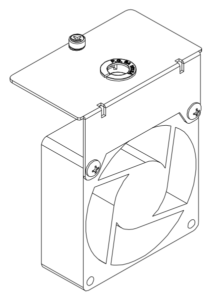
Frame D

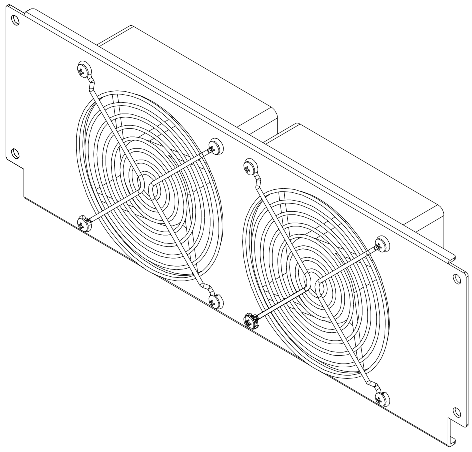
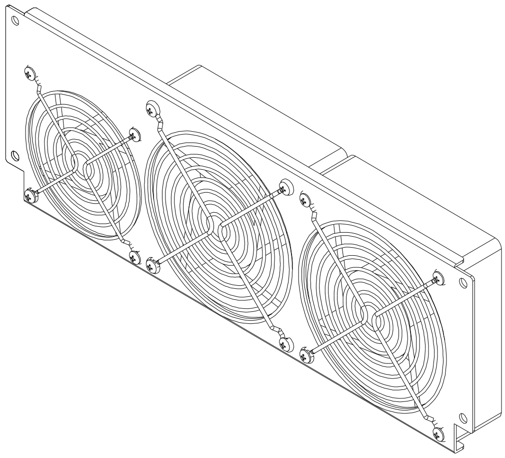
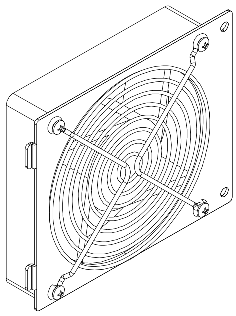
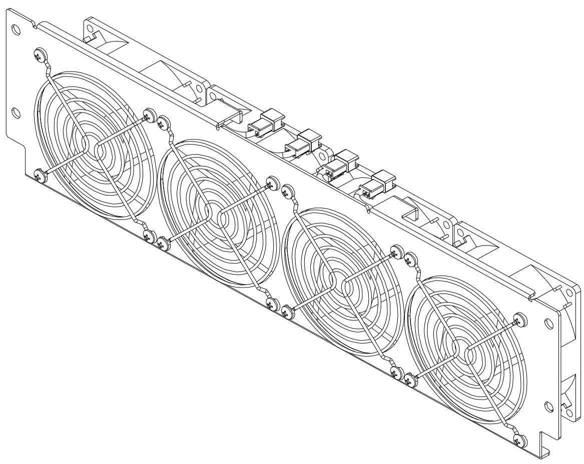
Applicable Model
VFD370CP23A-00/21;VFD450CP23A-00/21;
VFD750CP43B-00/21; VFD900CP43A-00/21

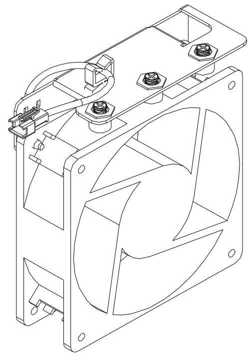
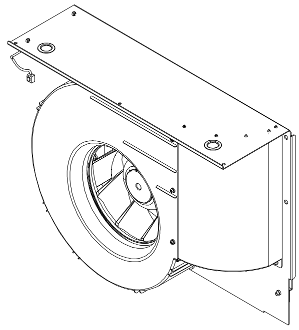
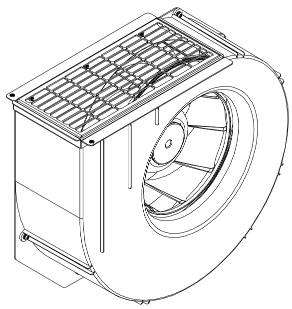
Heat sink Fan Model
『MKC-DFKM』



Capacitor Fan Model
『MKC-DFKB』



Frame E Applicable Model VFD550CP23A-00/21; VFD750CP23A-00/21	Heat sink Fan Model 『MKC-EFKM1』 
Frame E Applicable Model VFD900CP23A-00/21; VFD1100CP43A-00/21 VFD1320CP43B-00/21;	Heat sink Fan Model『MKC-EFKM2』 
Frame E Applicable Model VFD900CP23A-00/21; VFD1100CP43A-00/21; VFD1320CP43B-00/21	Capacitor Fan Model 『MKC-EFKB』 
Frame F Applicable Model VFD1600CP43A-00/21; VFD1850CP43B-00/21 ;	Heat sink Fan Model 『MKC-FFKM』 

Frame F Applicable Model VFD1600CP43A-00/21; VFD1850CP43B-00/21	Capacitor Fan Model 『MKC-FFKB』 
Frame G Applicable Model VFD2200CP43A-00/21; VFD2800CP43A-00/21	Heat sink Fan Model 『MKC-GFKM』 
Frame H Applicable Model VFD3150CP43A-00; VFD3150CP43C-00/21; VFD3550CP43A-00; VFD3550CP43C-00/21; VFD4000CP43A-00; VFD4000CP43C-00/21; VFD5000CP43A-00; VFD5000CP43C-00/21	Heat sink Fan Model 『MKC-HFKM』 

■ Fan Removal

Frame A

Model『MKC-AFKM』: Heat Sink Fan

Applicable model

VFD022CP23A-21; VFD037CP23A-21; VFD055CP23A-21; VFD022CP43B/4EB-21; VFD037CP43B/4EB-21; VFD040CP43A/4EA-21;
VFD055CP43B/4EB-21

Model『MKC-AFKM2』: Heat Sink Fan

Applicable model

VFD075CP43B/4EB-21

1. Refer to Figure 1, press the tabs on both side of the fan to successfully remove the fan.
2. Disconnect the power terminal before removing the fan. (As shown below.)

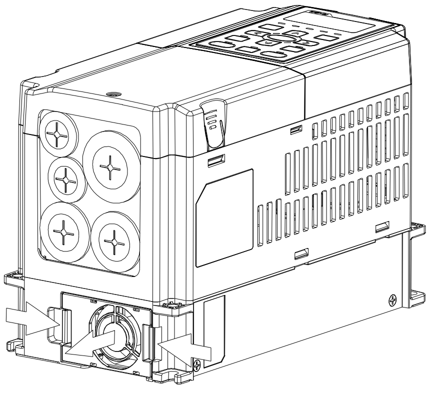


Figure 1

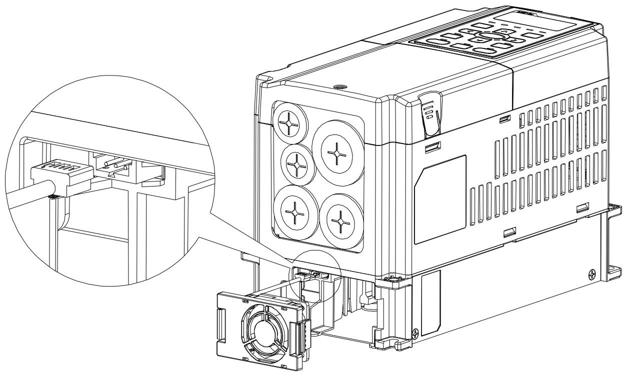


Figure 2

Frame B

Model『MKC-BFKM1』Heat Sink Fan

Applicable model

VFD075CP23A-21; VFD110CP43B/4EB-21

Model『MKC-BFKM2』Heat Sink Fan

Applicable model

VFD110CP23A-21; VFD150CP43B/4EB-21; VFD185CP43B/4EB-21

Model『MKC-BFKM3』Heat Sink Fan

Applicable model

VFD150CP23A-21

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

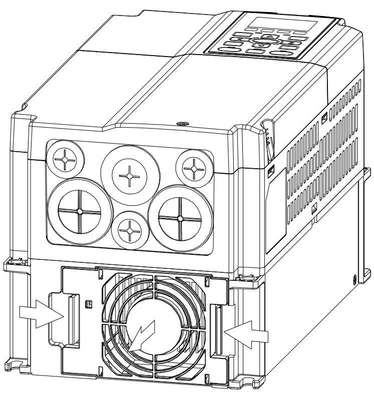


Figure 1

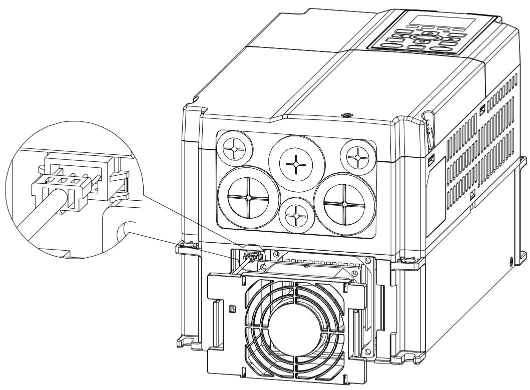


Figure 2

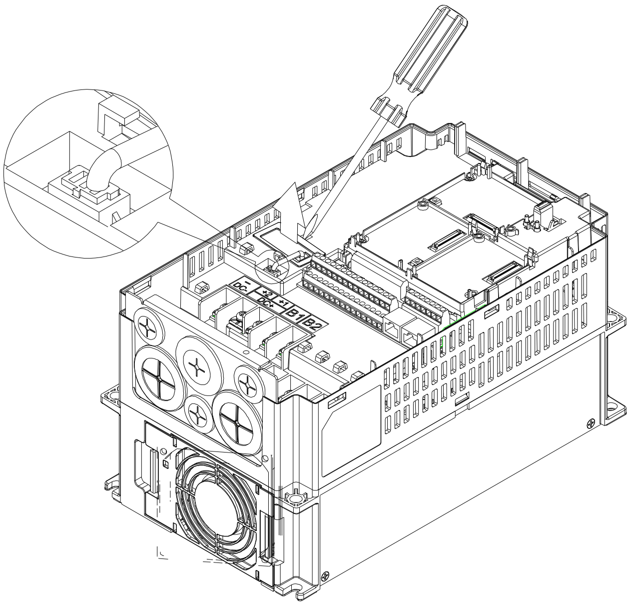
Frame B

Model『MKC-BFKB』Capacitor Fan

Applicable model

VFD075CP23A-21; VFD110CP23A-21; VFD110CP43B/4EB-21; VFD150CP23A-21; VFD150CP43B/4EB-21; VFD185CP43B/4EB-21

Disconnect fan power and pull out the fan by using flathead screwdriver. (As shown in the larger picture)



Frame C

Model『MKC-CFKM』Heat Sink Fan

Applicable model

Single fan kit applicable models (only fan kit 1 is required to be installed): VFD220CP43A/4EA-21;

VFD300CP43B/4EB-21; VFD370CP43B-21

Duo fan kit applicable models (both fan kit 1 and 2 are required to be installed): VFD185CP23A-21;

VFD220CP23A-21; VFD300CP23A-21; VFD370CP4EB-21

1. (As shown Figure 1) Before removing the fan, remove the cover by using a slotted screwdriver.

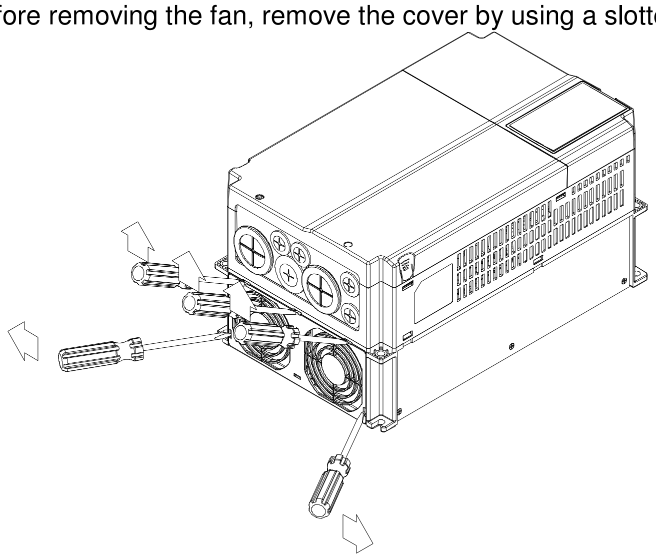


Figure 1

2. (As shown in Figure 2), remove the power connector, loosen the screw and remove the fan kit. When installing the fan kit, have the label on the fan kit facing inside of the motor drive.
Screw's torque force: 10~12kgf-cm (8.7~10.4(lb-in)

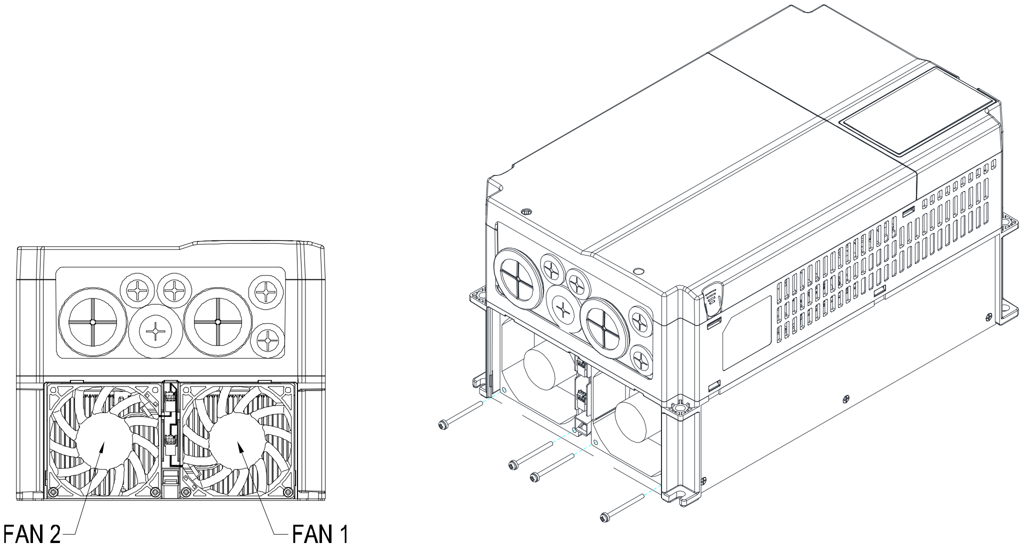


Figure 2

Frame C

Model『MKC-CFKB1』Capacitor Fan

Applicable model
VFD185CP23A-21; VFD220CP23A-21; VFD300CP23A-21

Model『MKC-CFKB2』Capacitor Fan

Applicable model
VFD220CP43A/4EA-21; VFD300CP43B/4EB-21; VFD370CP43B/4EB-21

Disconnect fan power and pull out the fan by using flathead screwdriver. (As shown in the larger picture)

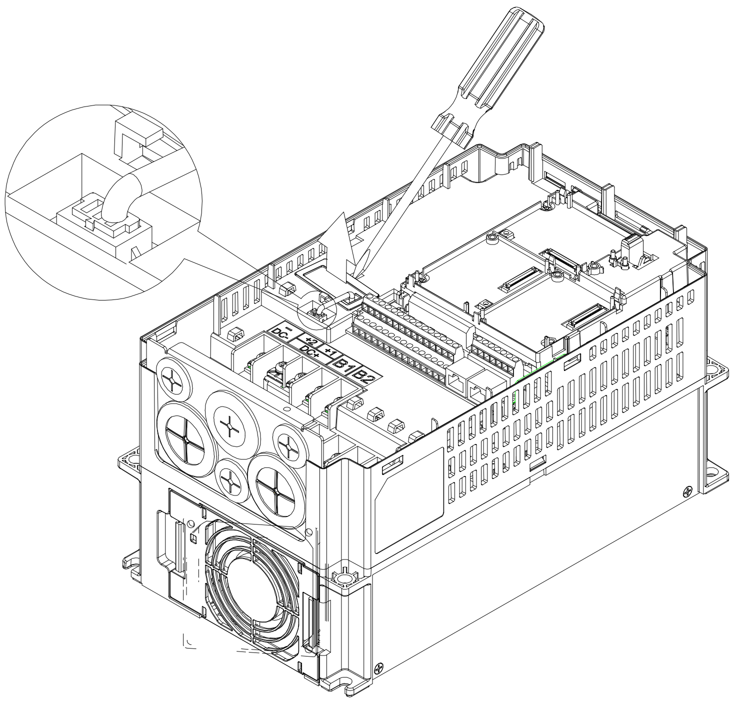


Figure 1

Frame D0

Model 『MKC-DFKB』Capacitor Fan

Applicable model
VFD450CP43S-00/21; VFD550CP43S-00/21

1. Loosen screw 1 and screw 2, press the tab on the right and left to remove the cover, follow the direction the arrows indicate. Press on top of digital keypad to properly remove it. Screw 1, 2 『Torque :12~15kgf-cm (8.6~10.4lb-in)』

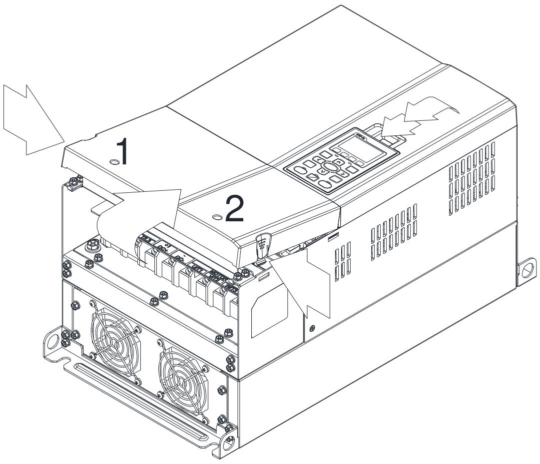


Figure 1

2. (Figure 2) Loosen screw 3, press the tab on the right and the left to remove the cover. Screw 3『Torque : 6~8kgf-cm (5.2~6.9lb-in)』

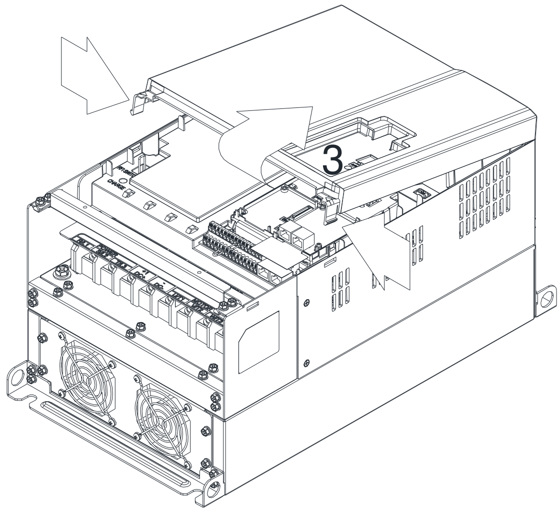


Figure 2

3. Loosen screw 4 (figure 3) and disconnect fan power and pull out the fan. (As shown in the enlarged picture 3) Screw 4『Torque : 10~12kgf-cm (8.6~10.4lb-in)』

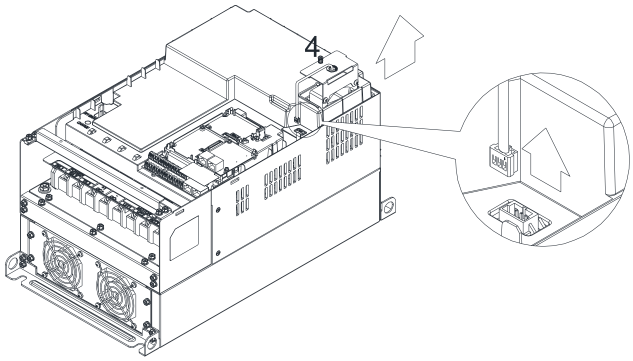


Figure 3

Frame D0

Model 『MKC-D0FKM』Heat Sink Fan

Applicable model
VFD450CP43S-00/21; VFD550CP43S-00/21

1. Loosen the screw and remove the fan kit. 『Screw torque: 24~26kgf-cm (20.8~22.6lb-in)』
2. (As shown Figure 1) Before removing the fan, remove the cover by using a slotted screwdriver.

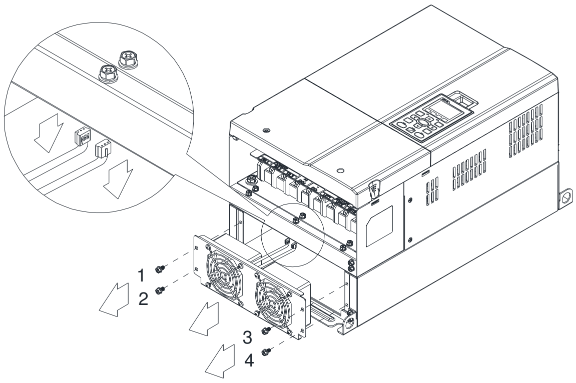


Figure 1

Frame D

Model 『MKC-DFKB』Capacitor Fan

Applicable model
VFD370CP23A-00/21; VFD450CP23A-00/21; VFD450CP43A-00/21; VFD550CP43A-00/21; VFD750CP43B-00/21; VFD900CP43A-00/21

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 to properly remove it. Screw 1, 2
『Torque :12~15kgf-cm (10.4~13lb-in)』

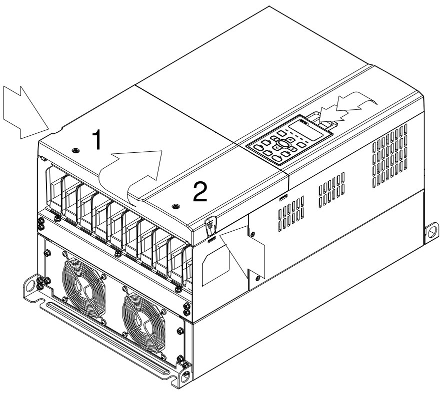


Figure 1

2. (Figure 2) Loosen screw 3, press the tab on the right and the left to remove the cover.
Screw 3, 4『Torque : 6~8kgf-cm (5.2~6.9lb-in)』

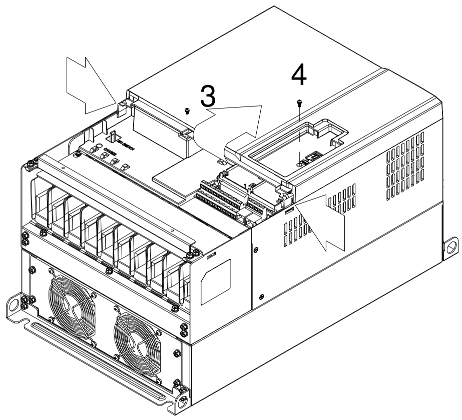


Figure 2

3. Loosen screw 5 (figure 3) and disconnect fan power and pull out the fan. (As shown in the enlarged picture 3)
Screw 5『Torque :10~12kgf-cm (8.6~10.4lb-in)』

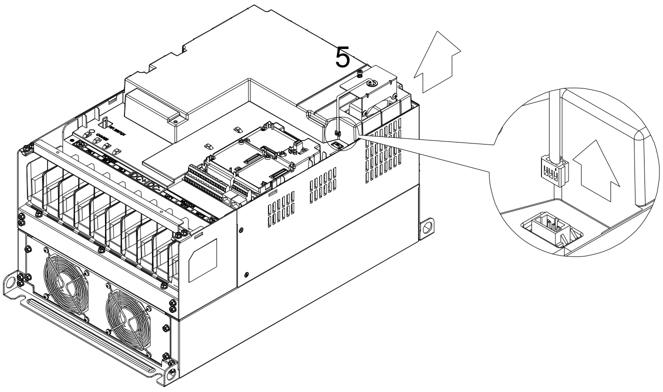


Figure 3

Frame D

Model『MKC-DFKM』Heat Sink Fan

Applicable model

VFD370CP23A-00/21; VFD450CP23A-00/21; VFD450CP43A-00/21; VFD550CP43A-00/21; VFD750CP43B-00/21; VFD900CP43A-00/21;

1. Loosen the screw and remove the fan kit. 『Screw torque: 24~26kgf-cm (20.8~22.6lb-in)』
2. (As shown Figure 1) Before removing the fan, remove the cover by using a slotted screwdriver.

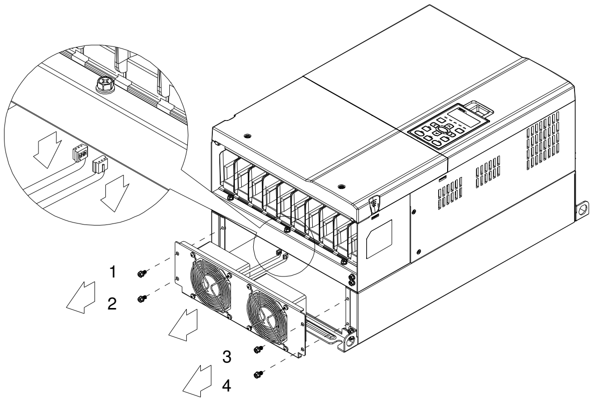


Figure 1

Frame E

Model『MKC-EFKM1』Heat Sink Fan

Applicable model

VFD550CP23A-00/21; VFD750CP23A-00/21

1. Loosen screw 1~4 (figure 1) and disconnect fan power and pull out the fan. (As shown in the enlarged picture 1) Screw1~4『Torque : 24~26kgf-cm (20.8~22.6lb-in)』

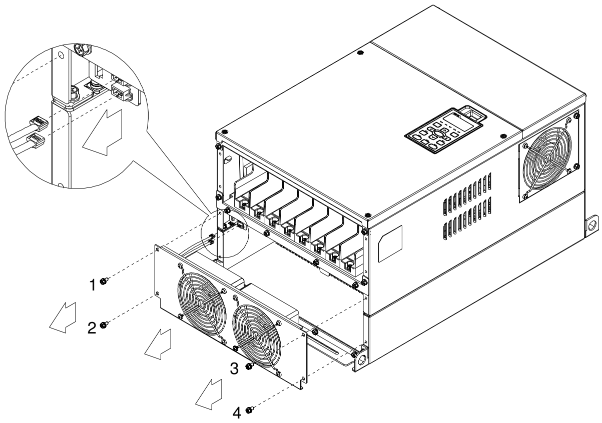


Figure 1

Model『MKC-EFKM2』Heat Sink Fan

Applicable model

VFD900CP23A-00/21; VFD1100CP43A-00/21; VFD1320CP43B-00/21

1. Loosen screw 1~4 (figure 2) and disconnect fan power and pull out the fan. (As shown in the enlarged picture 2) Screw1~4『Torque : 24~26kgf-cm (20.8~22.6lb-in)』

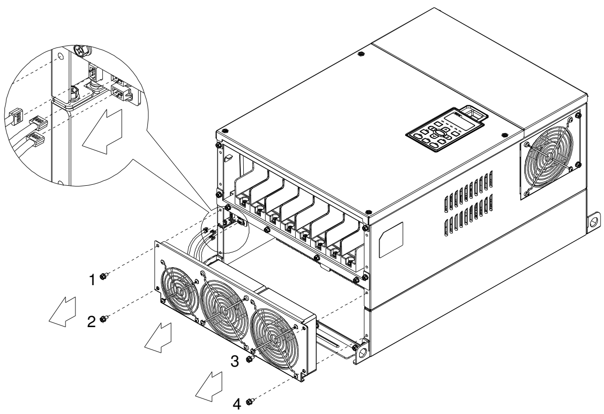


Figure 2

Model『MKC-EFKB』Capacitor Fan

Applicable model

VFD550CP23A-00/21; VFD750CP23A-00/21; VFD900CP23A-00/21; VFD1100CP43A-00/21; VFD1320CP43B-00/21

1. Loosen screw 1~2 (figure 3) and disconnect fan power and pull out the fan. (As shown in the enlarged picture 3) Screw1~2『Torque : 24~26kgf-cm (20.8~22.6lb-in)』

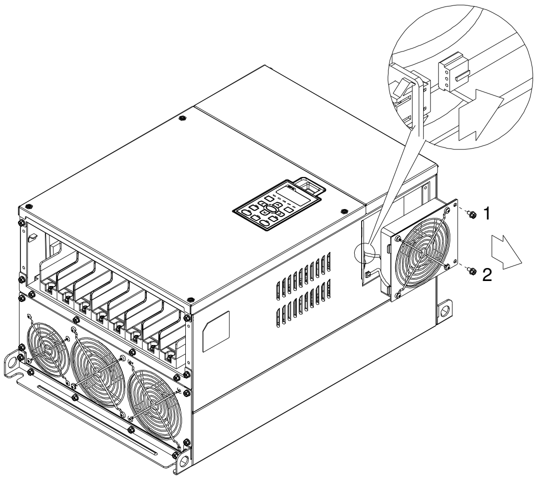


Figure 3

Frame F

Applicable model

VFD1600CP43A-00/21; VFD1850CP43B-00/21;

Fan model『MKC-FFKM』Heat Sink Fan

Loosen the screws and plug out the power of fan before removing (figure 1). Screw torque: 12~15kg-cm (10.4~13lb-in)』

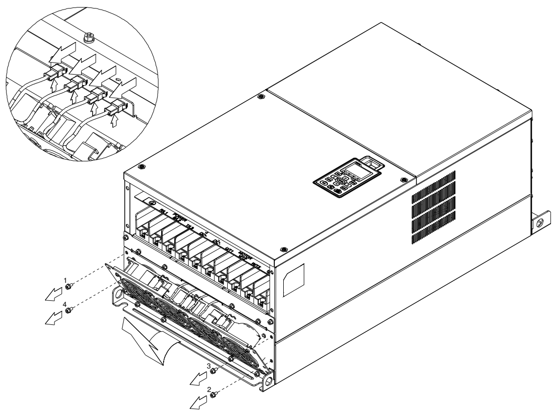


Figure 1

Fan model 『MKC-FFKB』Capacitor Fan

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

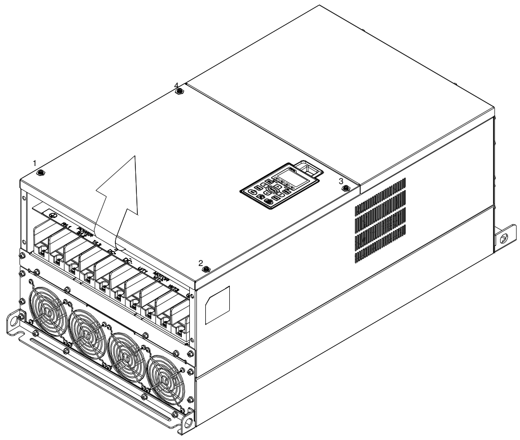


Figure 1

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

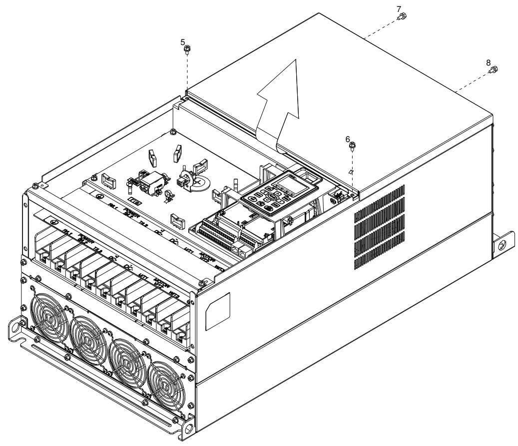


Figure 2

(3) Loosen the screws and remove the fan. (figure 3 and figure 4) Screw torque: 24~26kg-cm (20.8~22.6Ib-in).

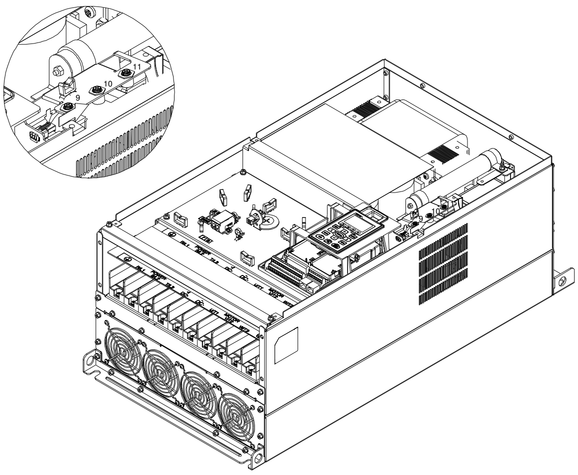


Figure 3

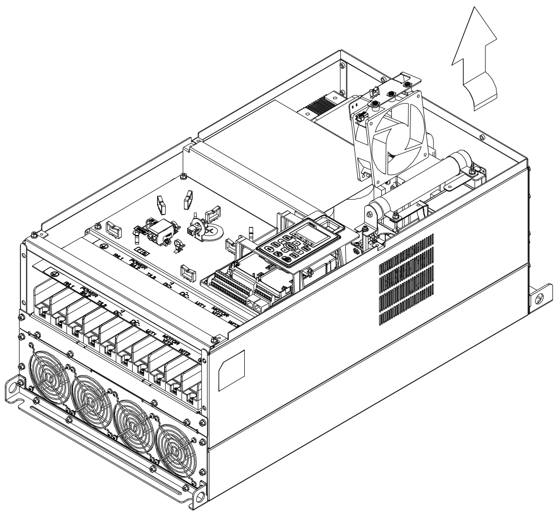


Figure 4

Frame G

Applicable model

VFD2200CP43A-00/21; VFD2800CP43A-00/21;

Fan model『MKC-GFKM』Heat Sink Fan

(1) Loosen the screw (figure 1) and remove the cover. Screw torque: 12~15kg-cm (10.4~13Ib-in).

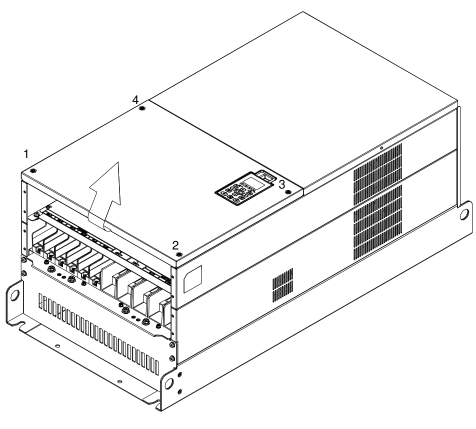


Figure 1

(2) For 1~8 shown in the figure 2: Loosen the screws
Screw torque:35~40kg-cm (30.4~34.7lb-in)

For 9~10 shown in the figure 2: Loosen the screws and removes the cover.
Screw M4 torque: 14~16kg-cm (12.2~13.9 lb-in).

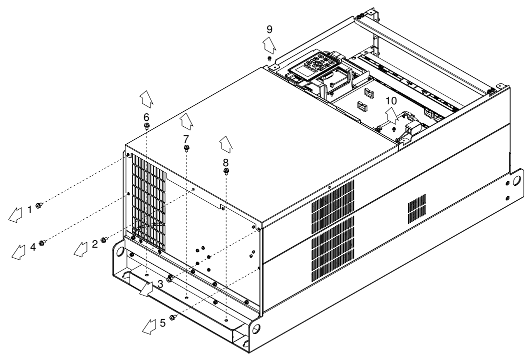


Figure 2

(3) Loosen screw 1,2,3 and remove the protective ring (as shown in figure 3) Screw torque: 14~16kg-cm (12.2~13.9 lb-in).

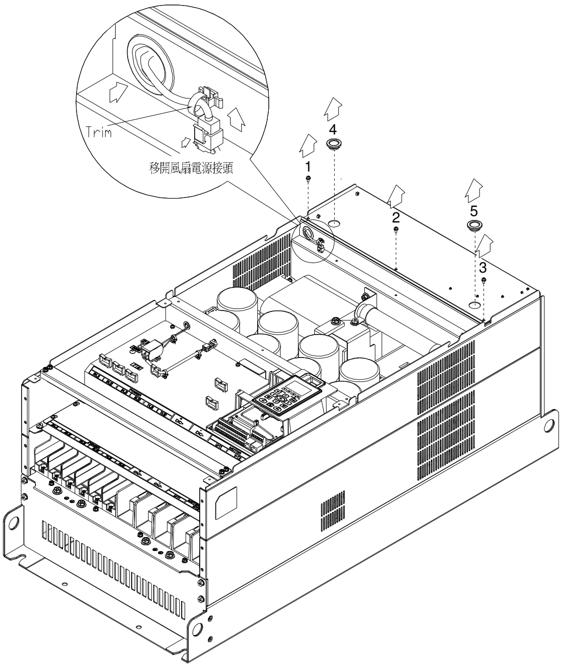
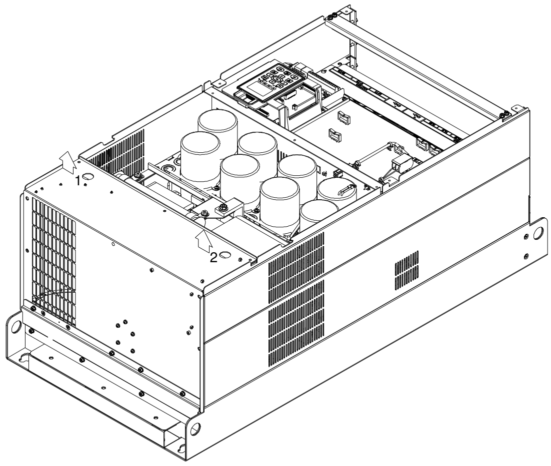


Figure 3

(4) Lift the fan by putting your finger through the protective holes, as indicates in 1 and 2 on the figure 4.



.

Figure 4

Frame H

Applicable model

VFD3150CP43A-00; VFD3150CP43C-00/21; VFD3550CP43A-00; VFD3550CP43C-00/21; VFD4000CP43A-00; VFD4000CP43C-00/21; VFD5000CP43A-00; VFD5000CP43C-00/21

Fan model 『MKC-HFKM』Heat Sink Fan

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

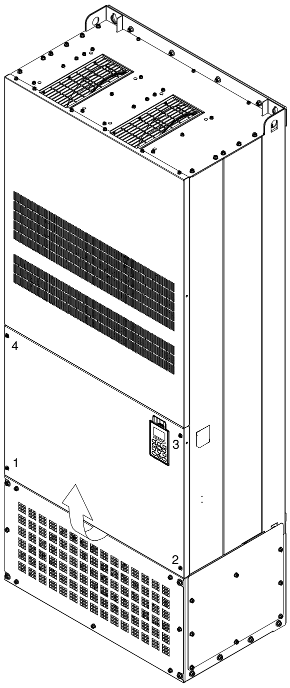


Figure 1

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

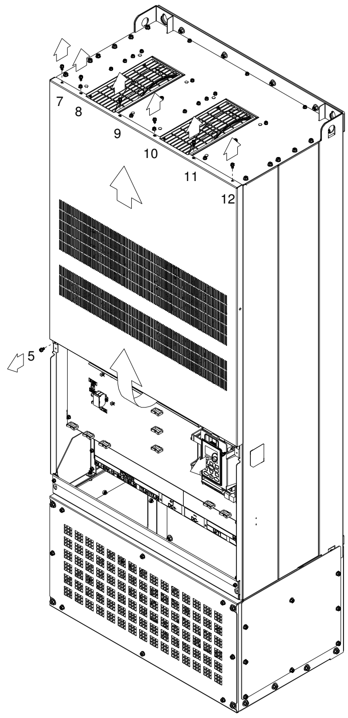


Figure 2

<table>
<tr>
<td>(3) Disconnect the fan (figure 3).

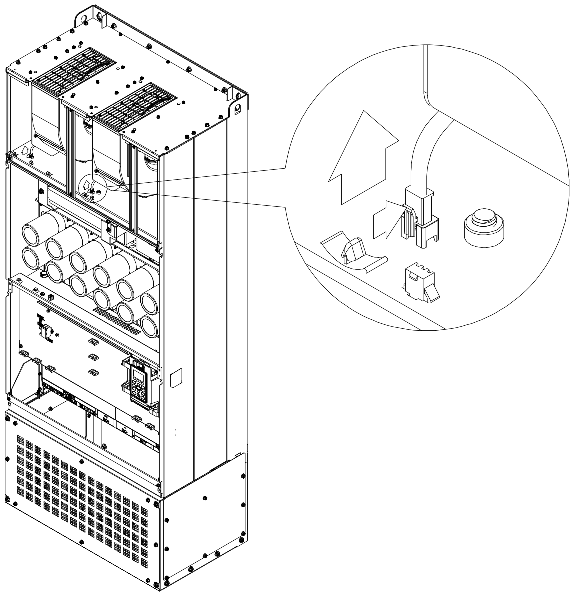



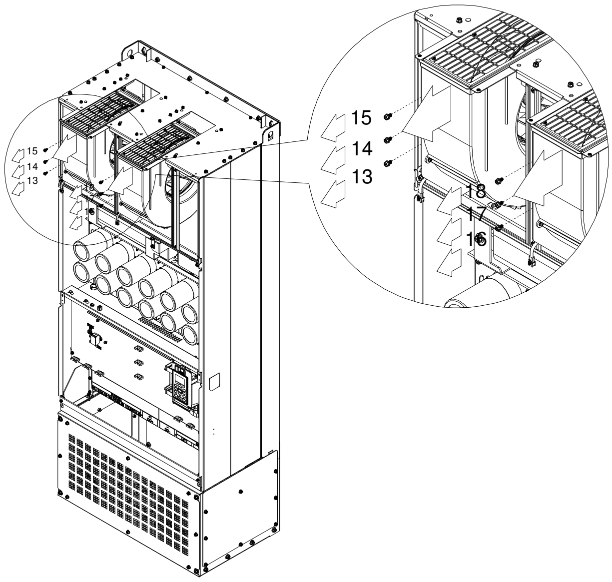
Figure 3</td>
<td>(4) Loosen the screw and remove the fan. Make sure fan power is properly disconnected before removal. Screw torque: 24~26kg-cm (20.8~22.6lb-in). (figure 4)


Figure 4</td>
</tr>
</table>

7-11 Flange Mounting Kit

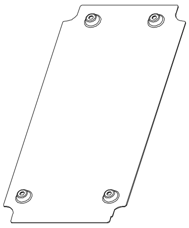
Applicable Models, Frame A~F

Frame A

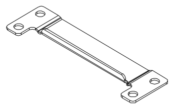
『MKC-AFM1』

Applicable model

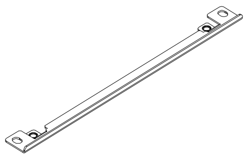
VFD022CP23A-21; VFD022CP43B/4EB-21; VFD037CP23A-21;



Accessories 1*1



Accessories　2*2



Accessories 3*2

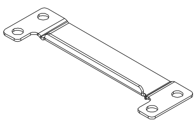
Screw 1 *4
M3*P 0.5;　L=6mm

Screw 2*8
M6*P 1.0;　L=16mm

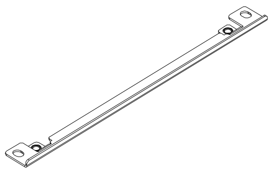
『MKC-AFM』

Applicable model

VFD007CP4EA-21; VFD015CP23A-21; VFD015CP43B/4EB-21; VFD022CP23A-21; VFD037CP43B/4EB-21; VFD055CP23A-21; VFD040CP43A/4EA-21; VFD055CP43B/4EB-21; VFD075CP43B/4EB-21



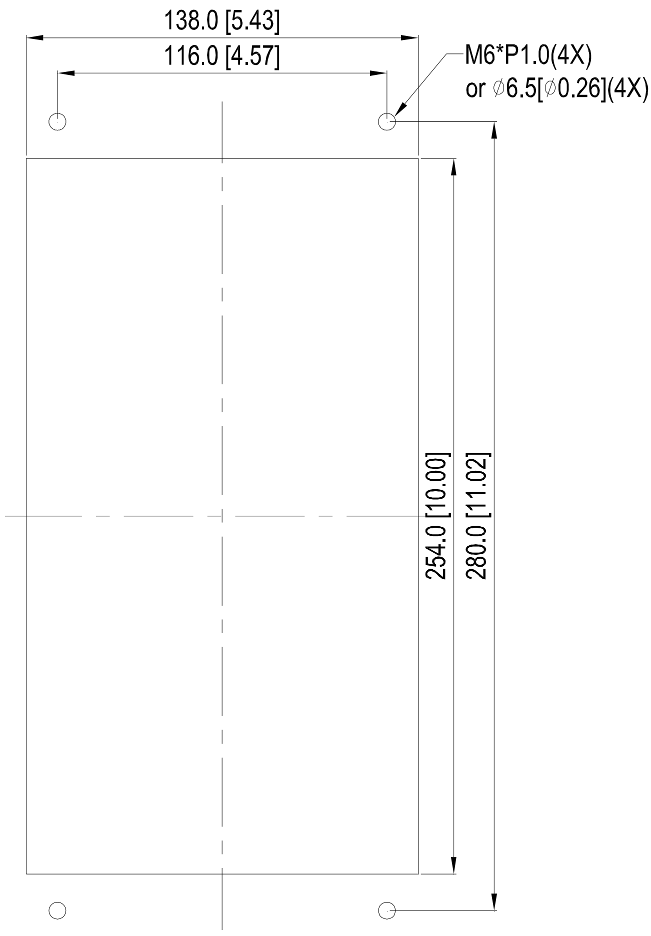
Accessory 2*2



Accessory t 3*2

Screw *8
M6*P 1.0;　L=16mm

Cutout dimension　　　　Unit: mm [inch]



『MKC-AFM1』Installation

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

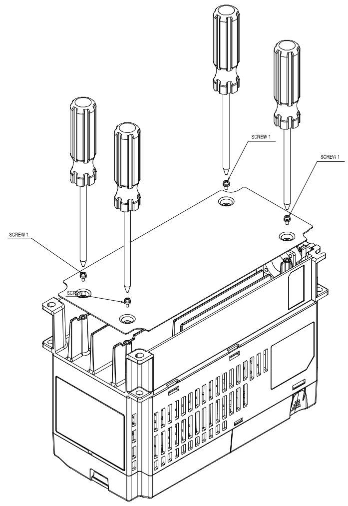


Figure 1

2. Install accessory 2&3 by fastening 2 of the screw 2(M6) (figure 2). Screw torque: 25~30kg-cm (21.7~26Ib-in).

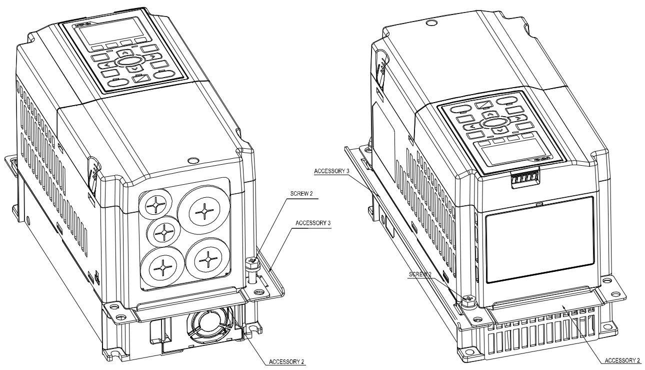


Figure 2

3. Install accessory 2&3 by fastening 2 of the screw 2(M6) (figure 3). Screw torque: 25~30kg-cm (21.7~26Ib-in).

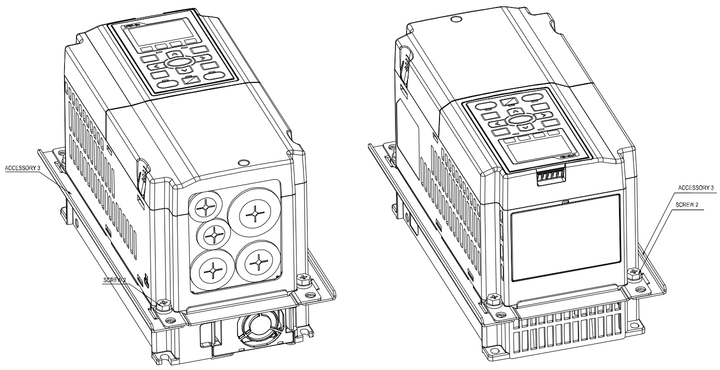


Figure 3

4. Plate installation, place 4 of the screw 2 (M6) (figure 4) through accessory 2&3 and the plate then fasten the screws. Screw torque: 25~30kg-cm (21.7~26lb-in).

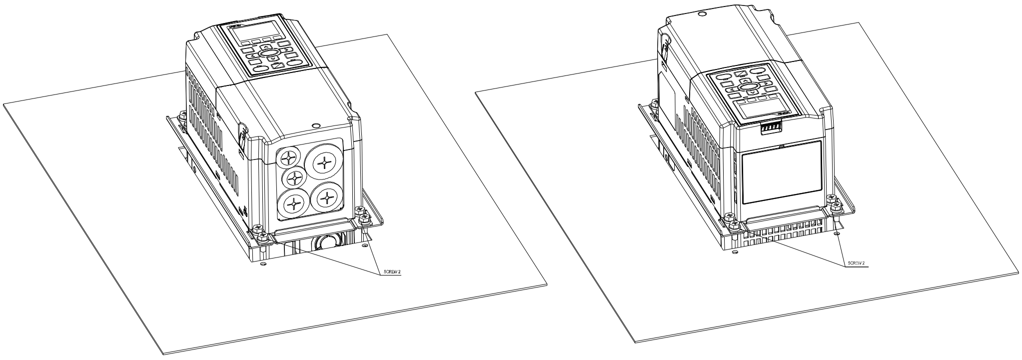


Figure 4

『MKC-AFM』 Installation

1. Fasten screw*2(M6) and accessory 2 &3. Screw torque: 25~30kg-cm (21.7~26lb-in). (figure 1)

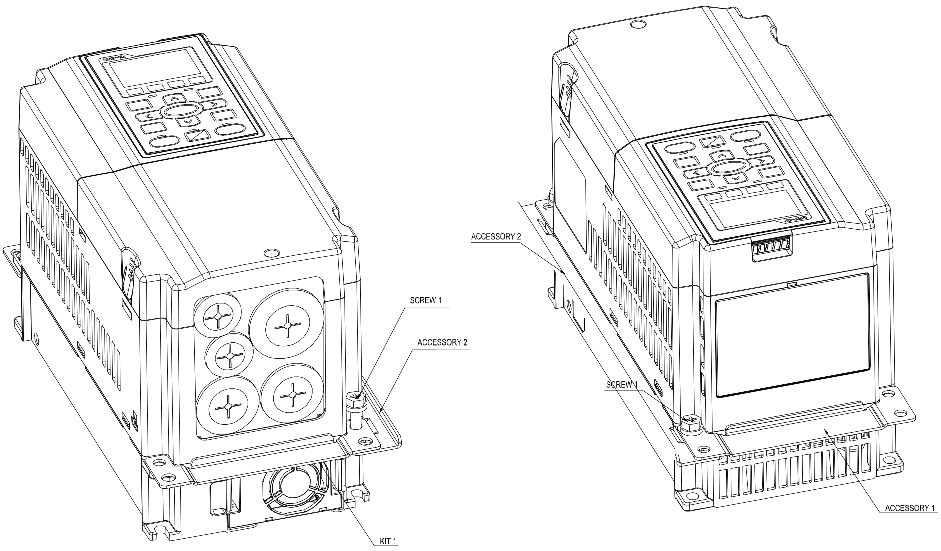


Figure 1

2. Fasten screw*2(M6) and accessory 2 &3. Screw torque: 25~30kg-cm (21.7~26lb-in). (figure 2)

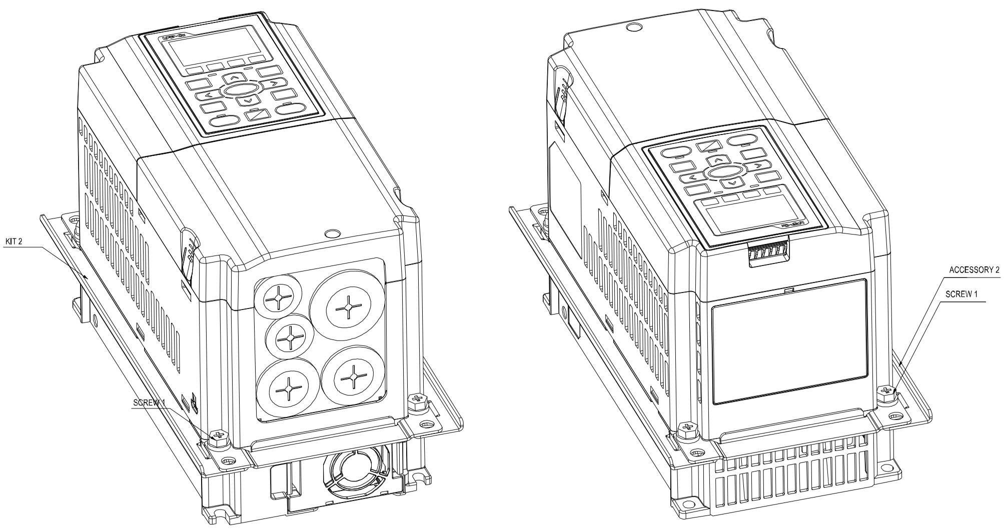


Figure 2

3. Plate installation, place 4 of the screw *4 (M6) through accessory 2&3 and the plate then fasten the screws. Screw torque: 25~30kg-cm (21.7~26Ib-in). (figure 3)

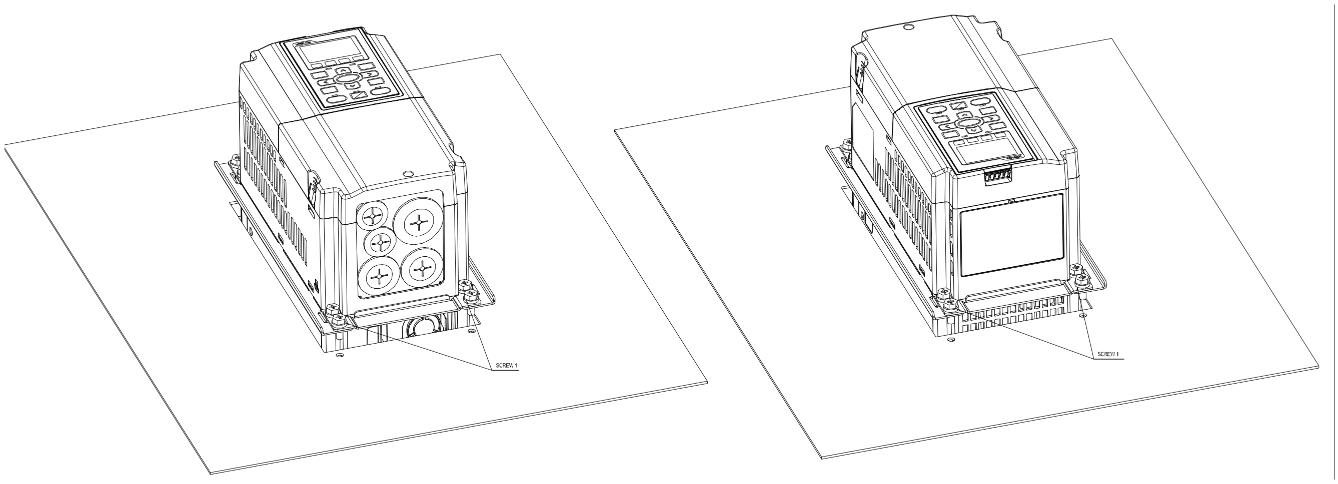


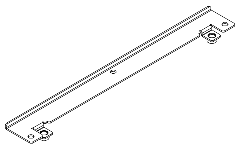
Figure 3

Frame B

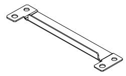
『MKC-BFM』

Applicable model

VFD075CP23A-21; VFD110CP23A-21; VFD110CP43B/4EB-21; VFD150CP23A-21; VFD150CP43B/4EB-21; VFD185CP43B/4EB-21;



Accessory 1*2

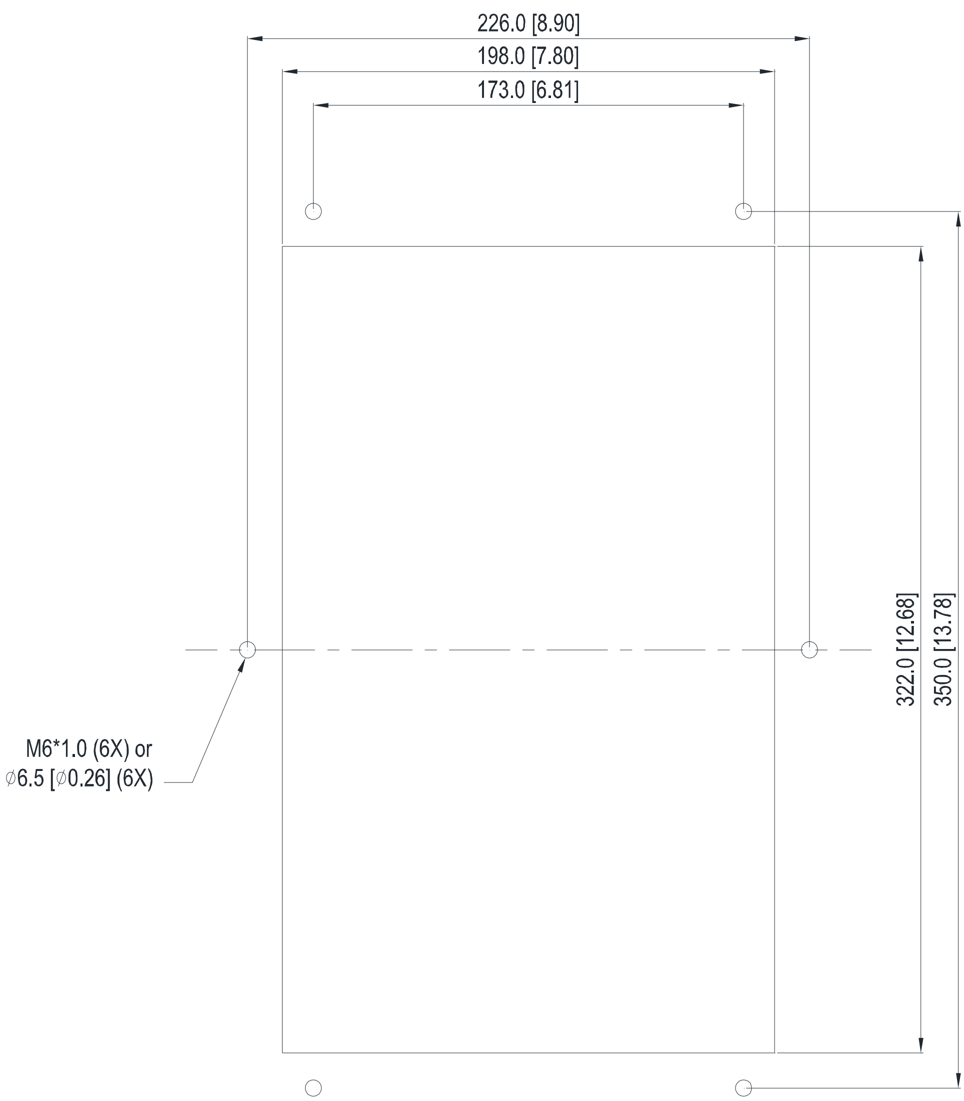


Accessory 2*2

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

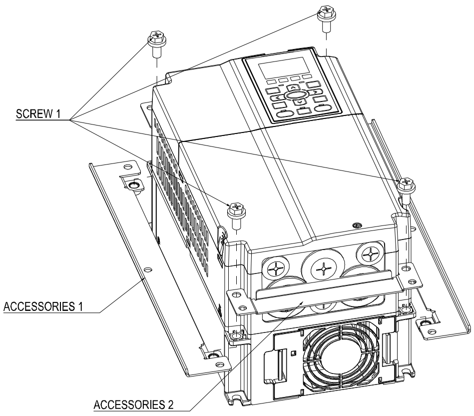
Cutout dimension

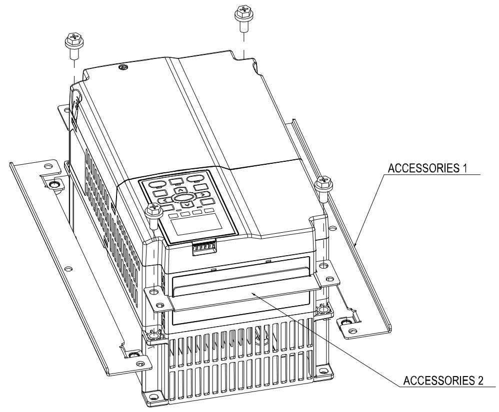
Unit: mm [inch]



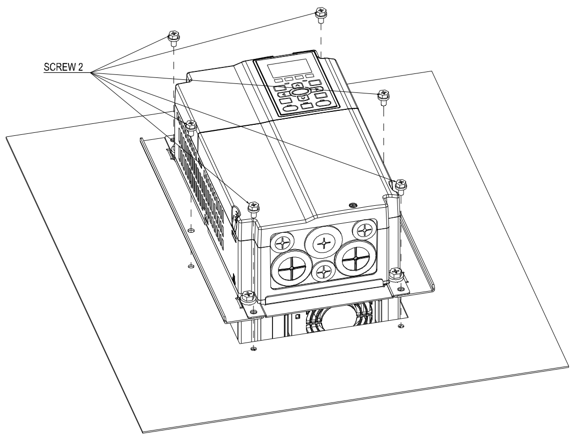
『MKC-BFM』Installation

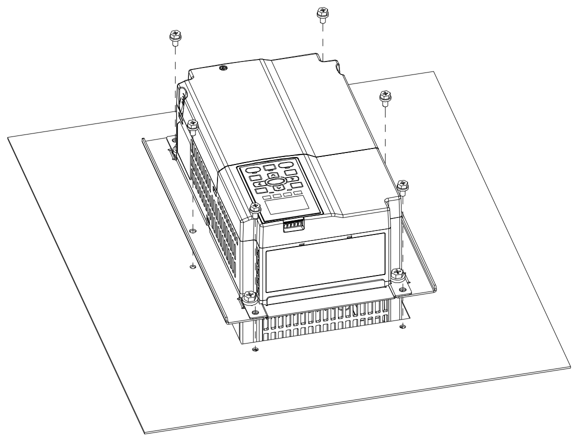
1. Install accessory 1& 2 by fastening 4 of the screw 1(M8). Screw torque: 40~45kg-cm (34.7~39.0Ib-in). (As shown in the following figure)





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 (21.7~26Ib-in). (As shown in the following figure)



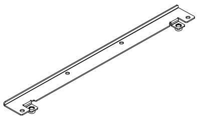


Frame C

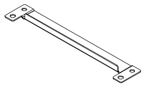
『MKC-CFM』

Applicable model

VFD185CP23A-21; VFD220CP23A-21; VFD220CP43A/4EA-21; VFD300CP23A-21; VFD300CP43B/4EB-21; VFD370CP43B/4EB-21;



Accessory 1*2

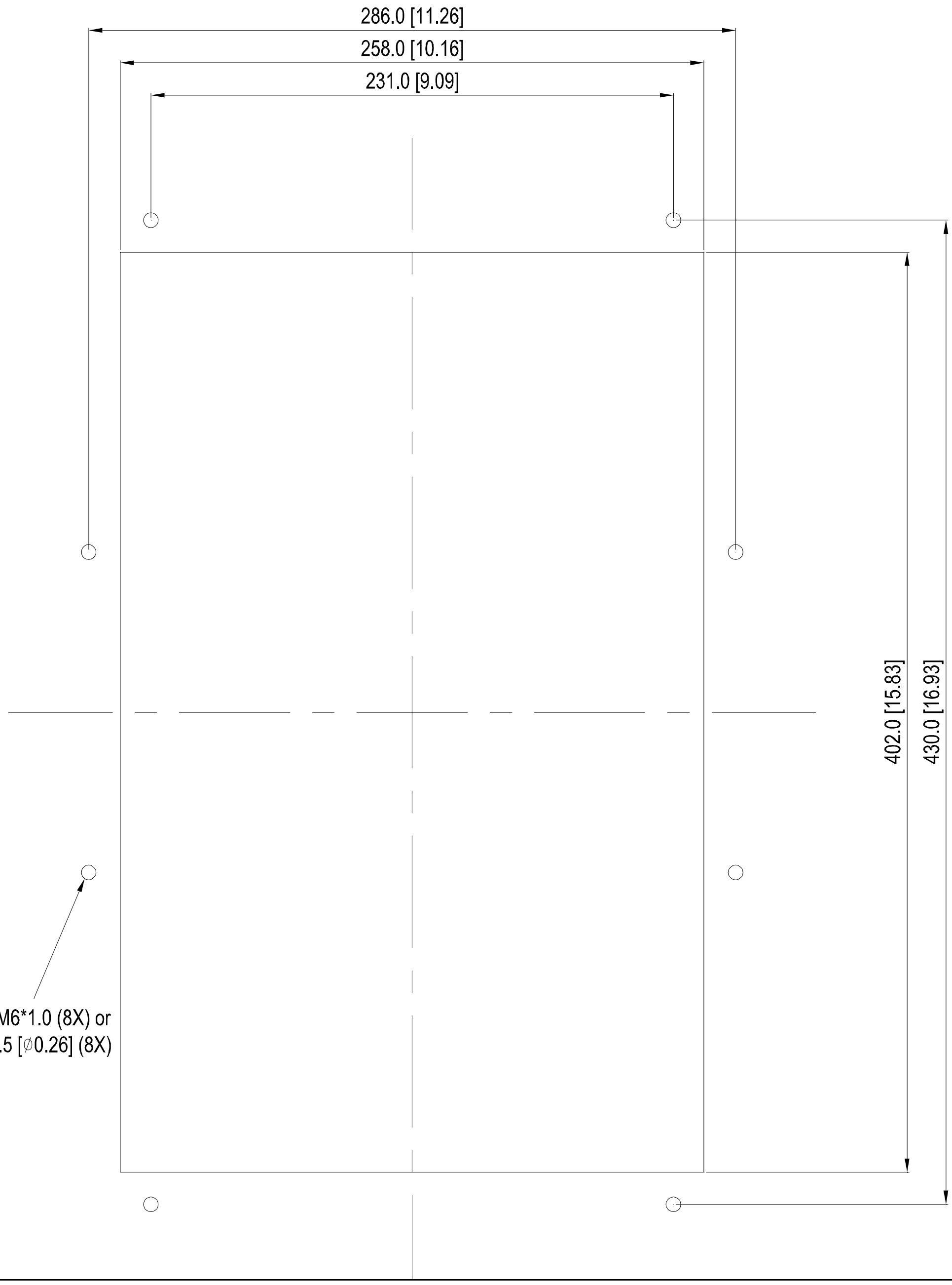


Accessory 2*2

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

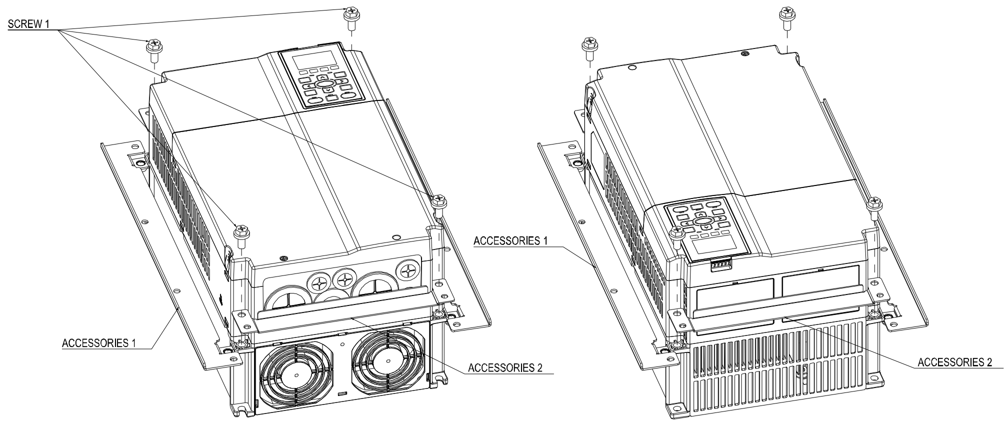
Cutout dimension

Unit: mm [inch]

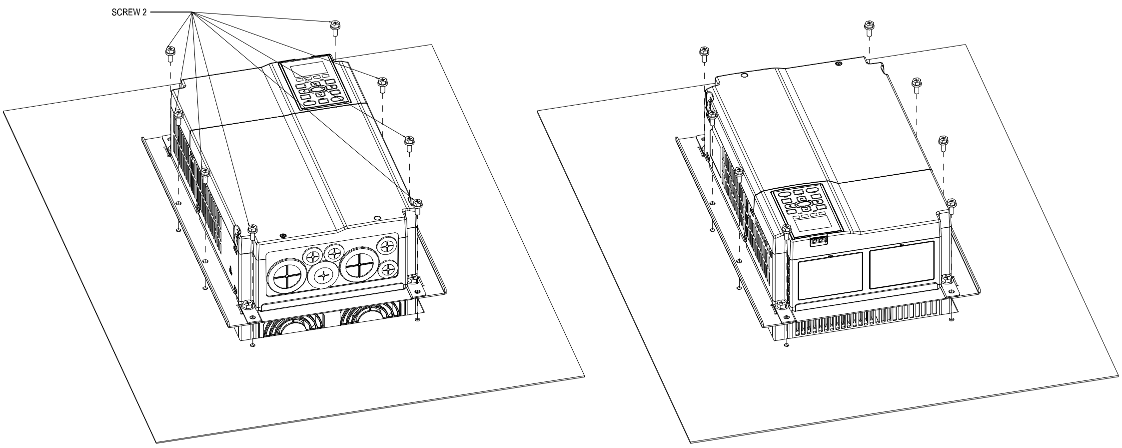


『MKC-CFM』 Installation

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 Accessory 1&2 and the plate then fasten the screws. Screw torque: 25~30kg-cm (21.7~26lb-in). (As shown in the following figure)



Frame D0

Applicable model

VFD450CP43S-00/21; VFD550CP43S-00/21

Cutout dimension Unit: mm [inch]

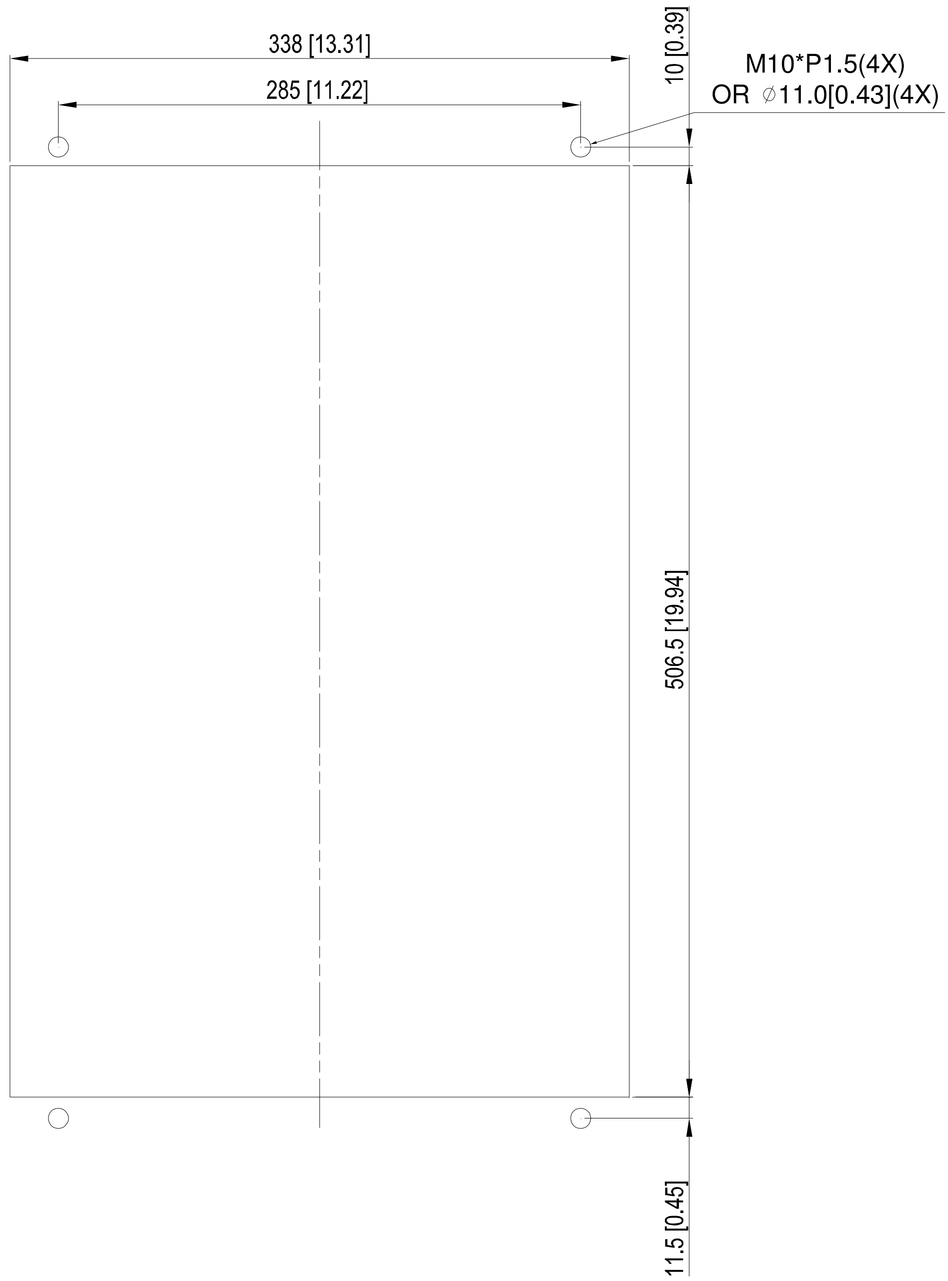
Frame D

Applicable model

VFD370CP23A-00/21; VFD450CP23A-00/21; VFD750CP43B-00/21; VFD900CP43A-00/21

Cutout dimension

Unit: mm [inch]



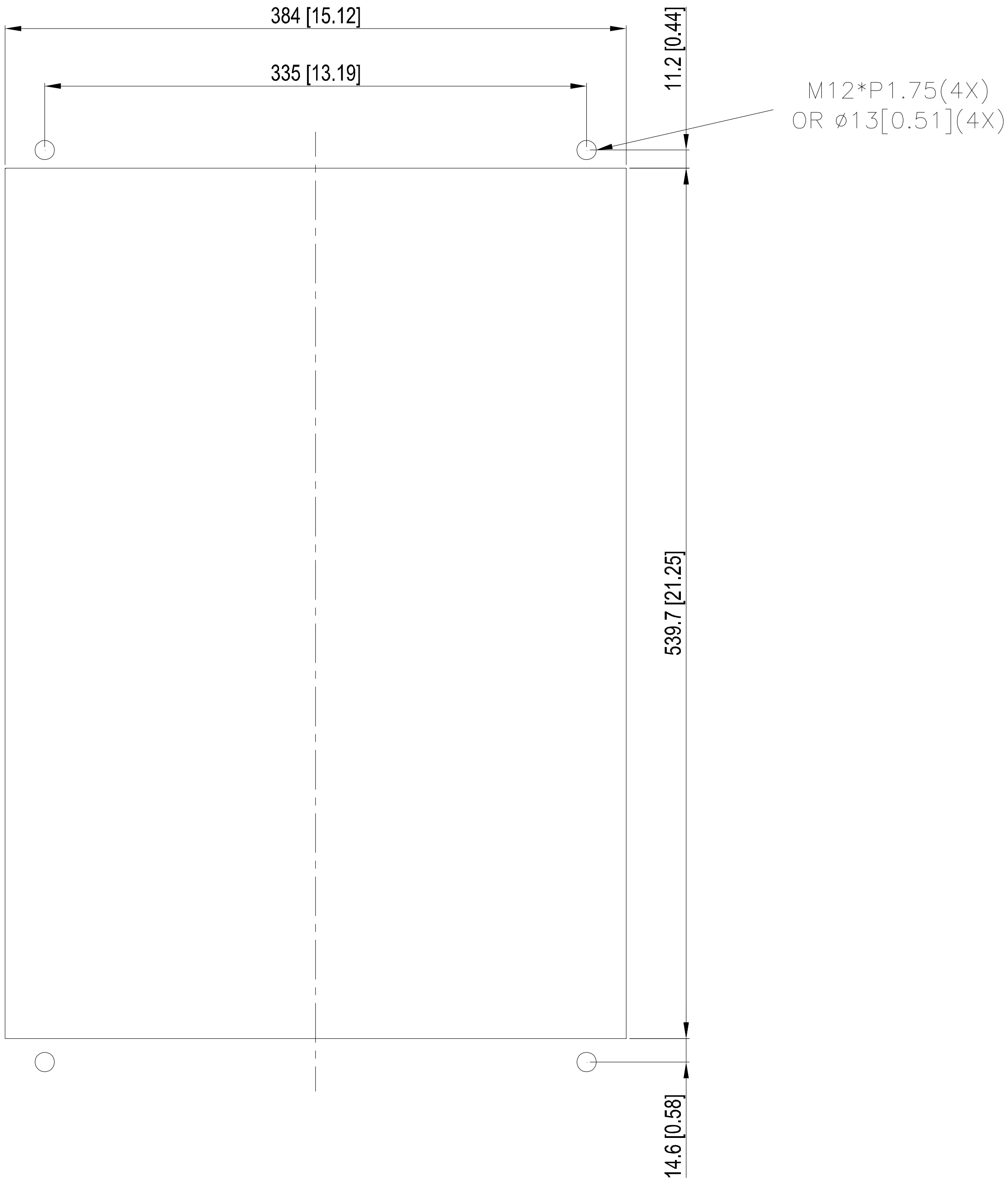
Frame E

Applicable model

VFD550CP23A-00/21; VFD750CP23A-00/21; VFD900CP23A-00/21; VFD1100CP43A-00/21; VFD1320CP43B-00/21;

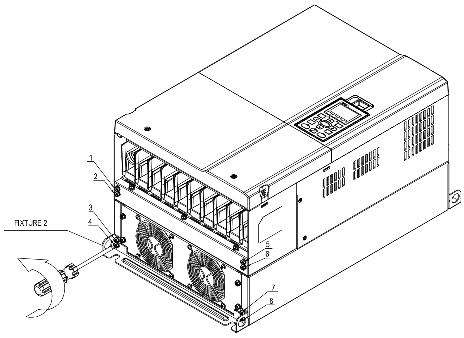
Cutout dimension

Unit: mm [inch]

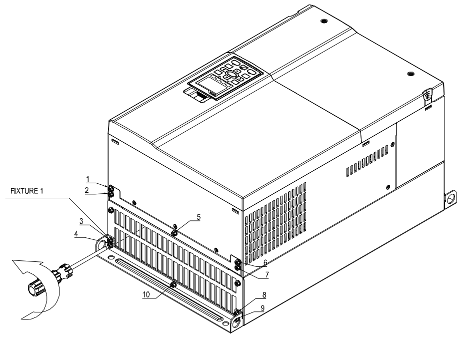


Frame D0 & D & E

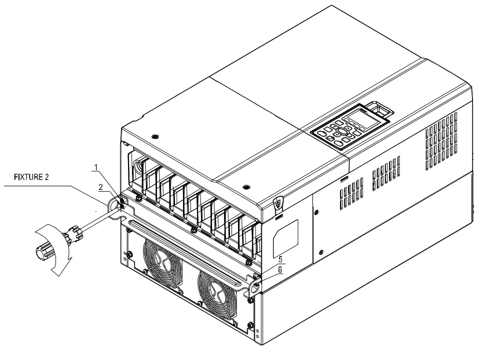
1. Loosen 8 screws and remove Fixture 2 (as shown in the following figure).



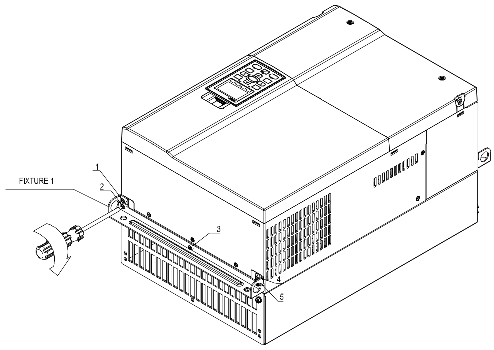
2. Loosen 10 screws and remove Fixture 1 (as shown in the following figure).



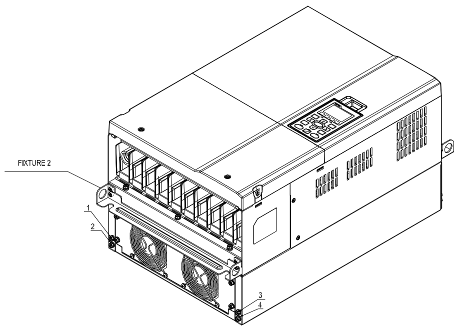
3. Fasten 4 screws (as shown in the following figure). Screw torque: 30~32kg-cm (26.0~27.8lb-in).



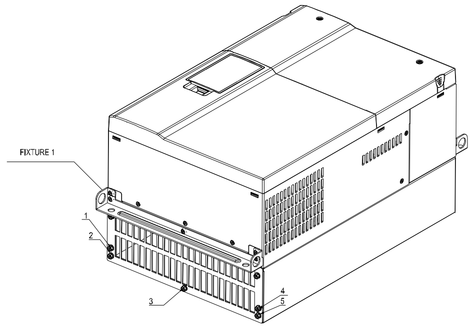
4. Fasten 5 screws (as shown in the following figure). Screw torque: 30~32kg-cm (26.0~27.8lb-in).



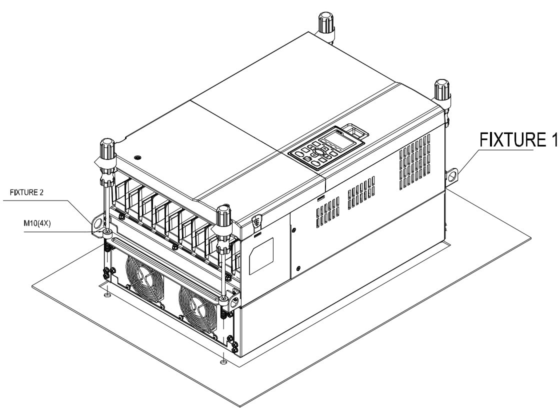
5. Fasten 4 screws (as shown in the following figure). Screw torque: 24~26kg-cm (20.8~22.6lb-in).



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



7. Place 4 screws (M10) through Fixture 1&2 and the plate then fasten the screws. (as shown in the following figure)
   Frame D0/D M10*4
   Screw torque: 200~240kg-cm (173.6~208.3lb-in).
   Frame E M12*4
   Screw torque: 300~400kg-cm (260~347lb-in).



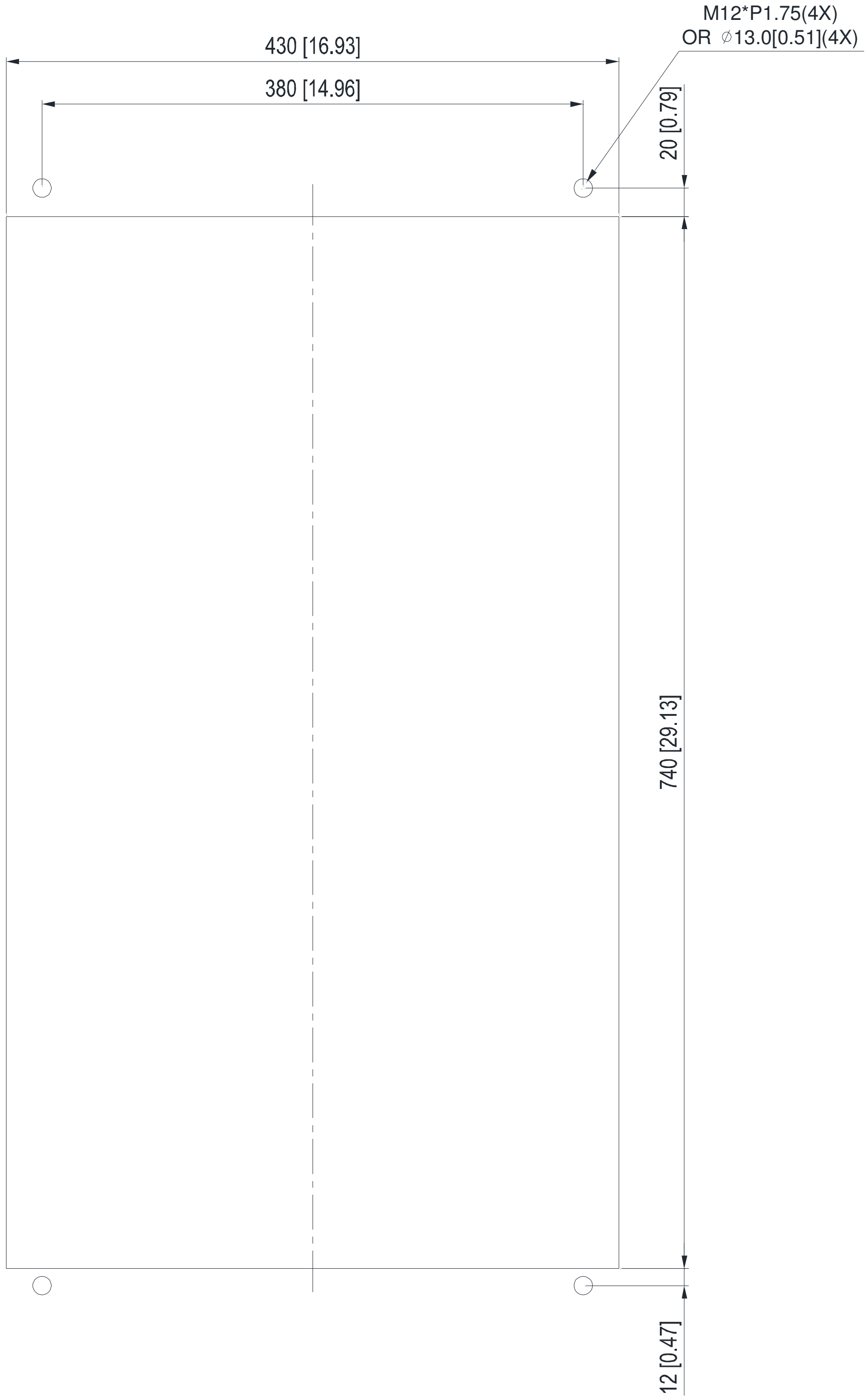
Frame F

Applicable model

VFD1600CP43A-00/21; VFD1850CP43B-00/21

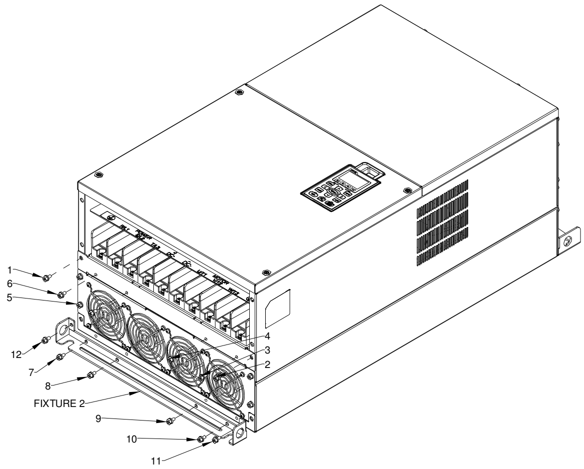
Cutout dimension

Unit: mm [inch]

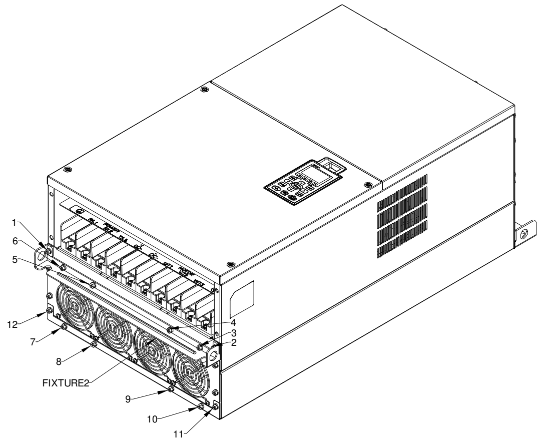


Frame F

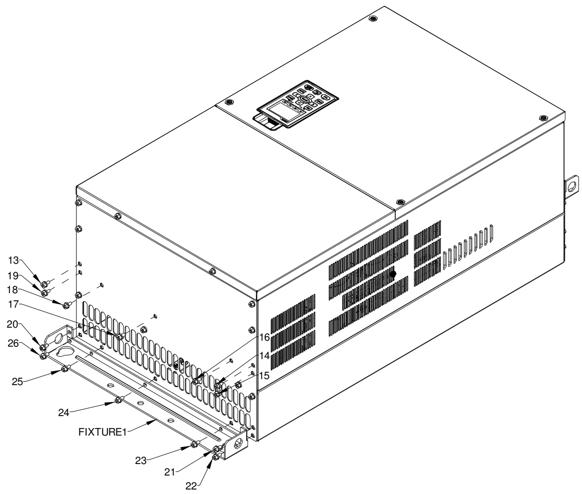
1. Loosen 12 screws and remove Fixture 2.



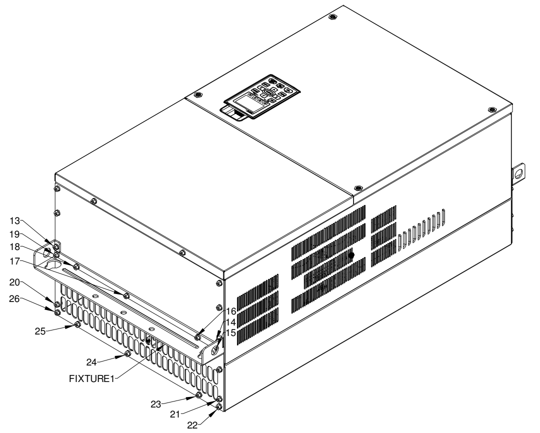
2. Loosen 12 screws and remove Fixture 2.
   Screw torque: 24~26kg-cm (20.8~22.6lb-in).



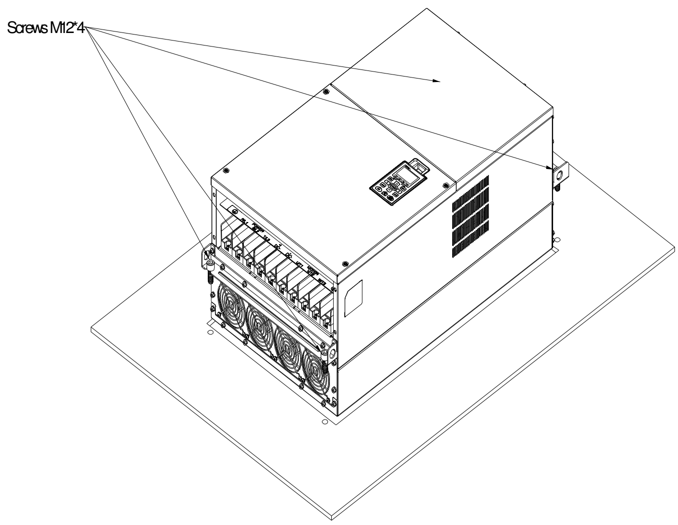
3. Loosen screw 13 ~26 and remove Fixture 1.



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



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



7-12 USB/RS-485 Communication Interface IFD6530

⚠ Warning

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

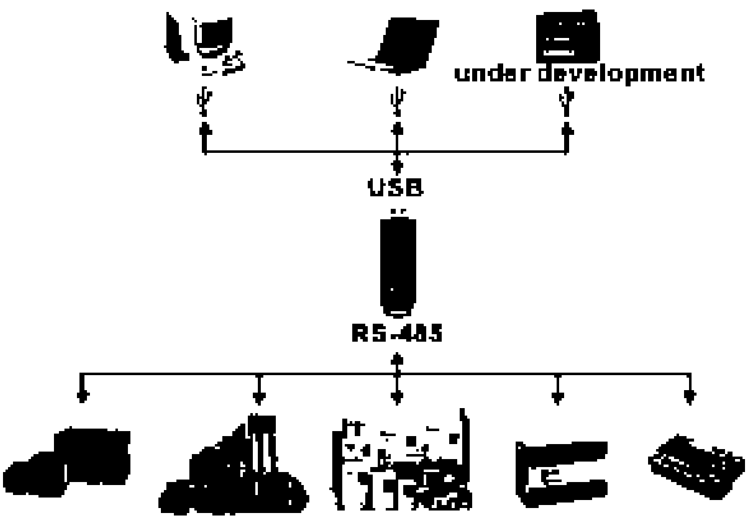
✓ *The content of this instruction sheet and the driver file may be revised without prior notice. Please consult our distributors or download the most updated instruction/driver version at http://www.delta.com.tw/product/em/control/cm/control_cm_main.asp*

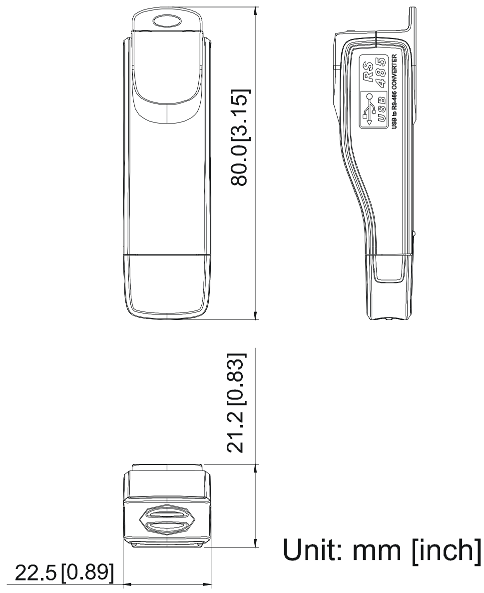
1. Introduction

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)

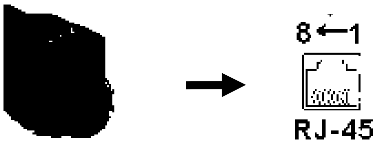




2. Specifications

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-

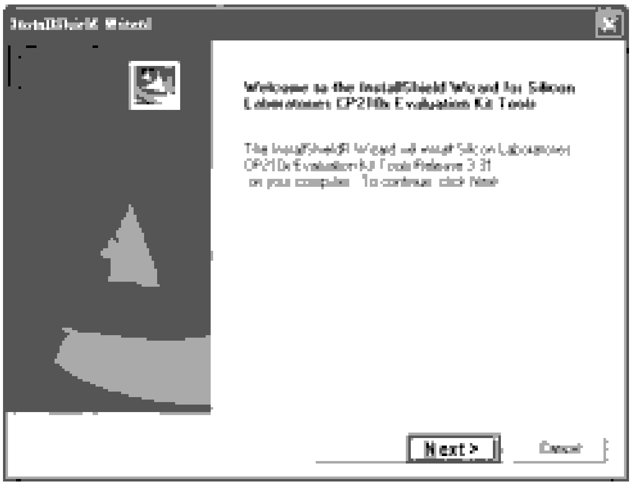
PIN	Description
5	SG+
6	GND
7	Reserved
8	+9V

3. Preparations before Driver Installation

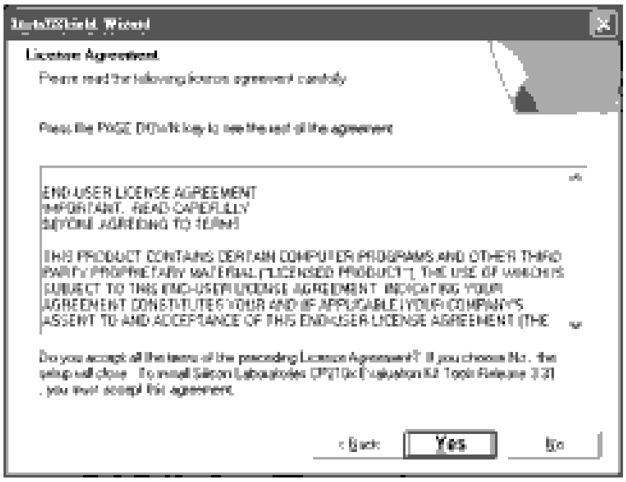
Please extract the driver file (IFD6530_Drivers.exe) by following steps. You could find driver file (IFD6530_Drivers.exe) in the CD supplied with IFD6530.

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

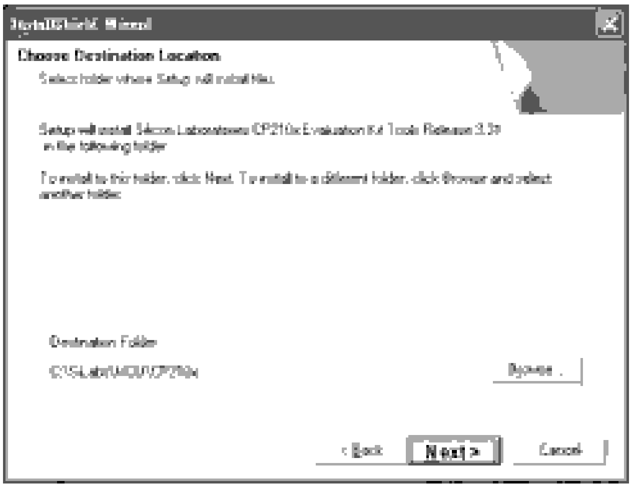
STEP 1



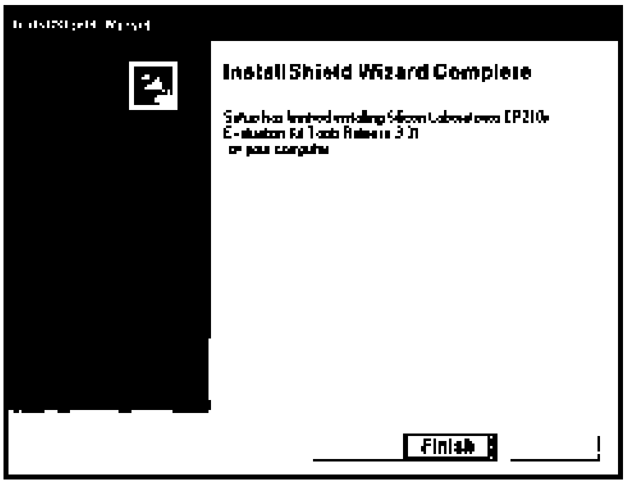
STEP 2



STEP 3



STEP 4

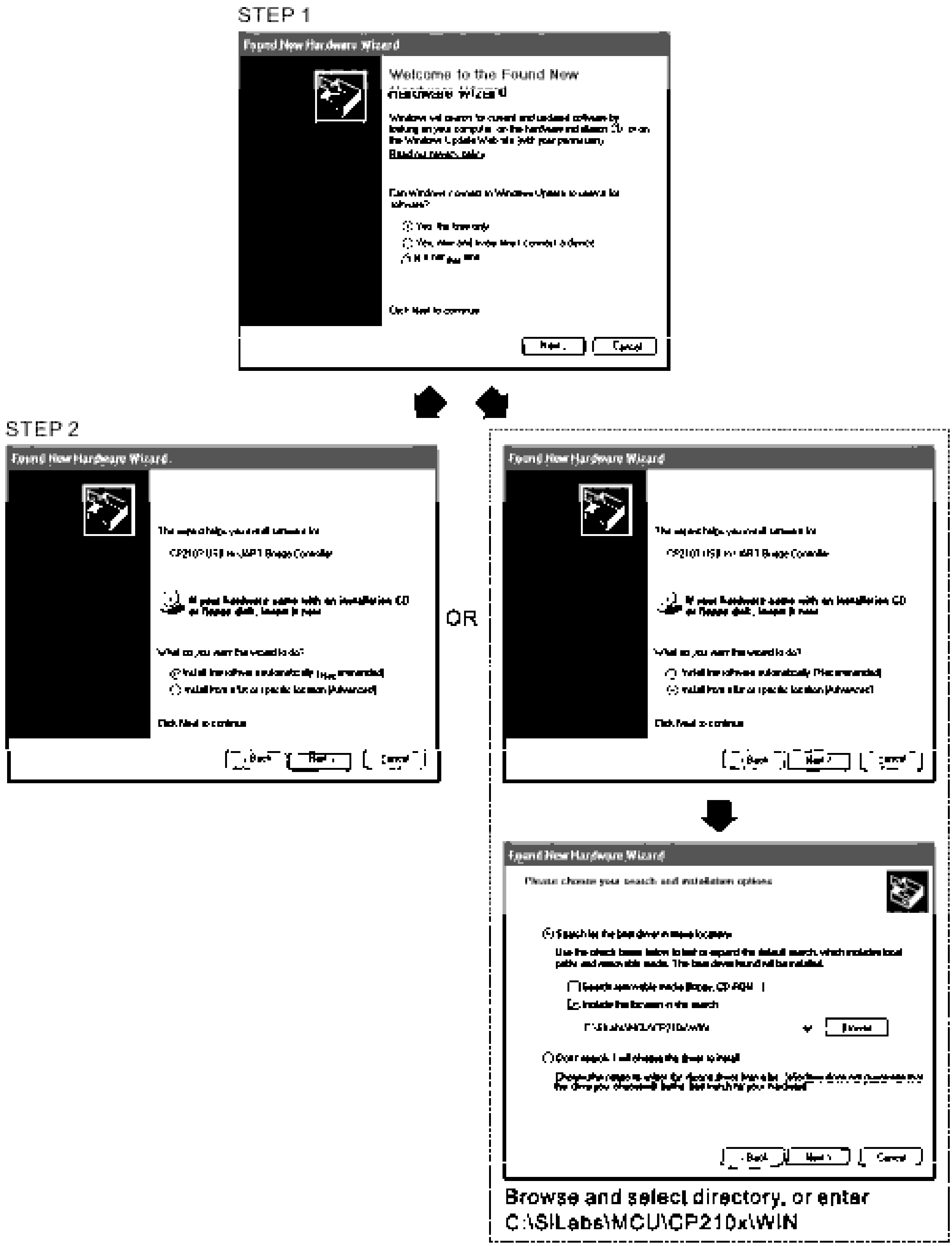


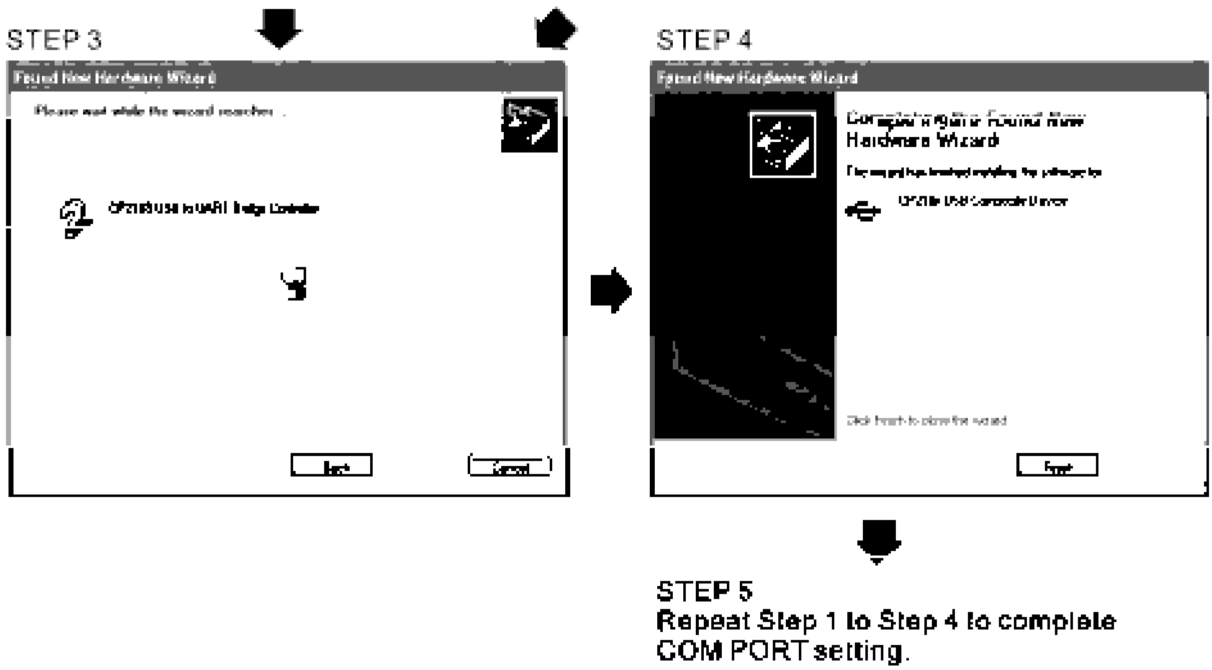
STEP 5

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

4. Driver Installation

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





5. LED Display

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

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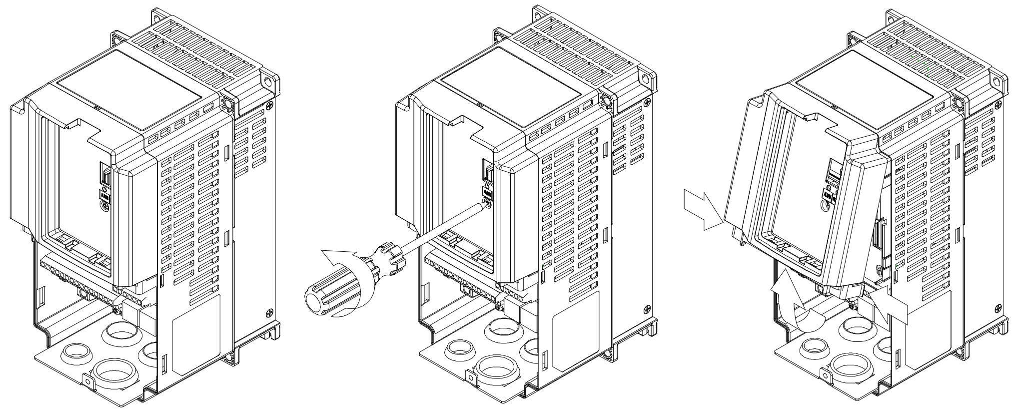
Chapter 8 Option Cards

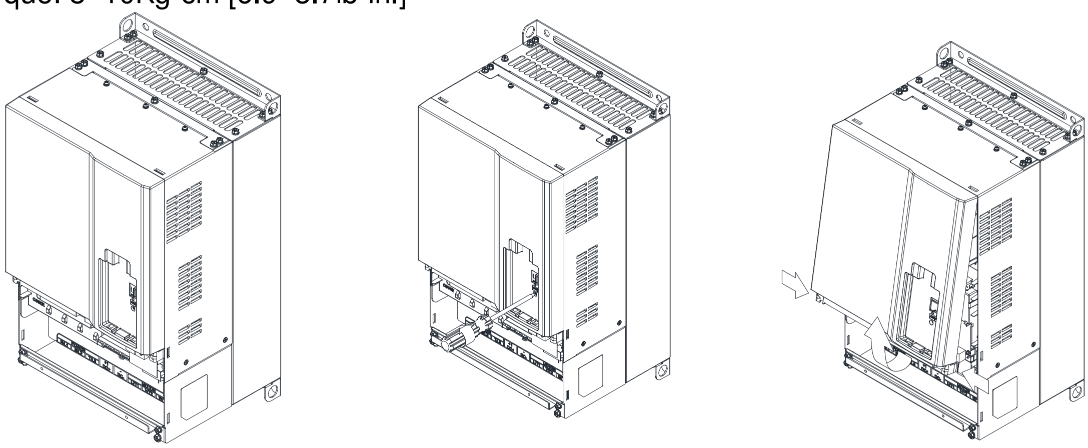
Please select applicable option cards for your drive or contact local distributor for suggestion. To prevent drive damage during installation, please removes the digital keypad and the cover before wiring. Refer to the following instruction.

8-1 Removed key cover

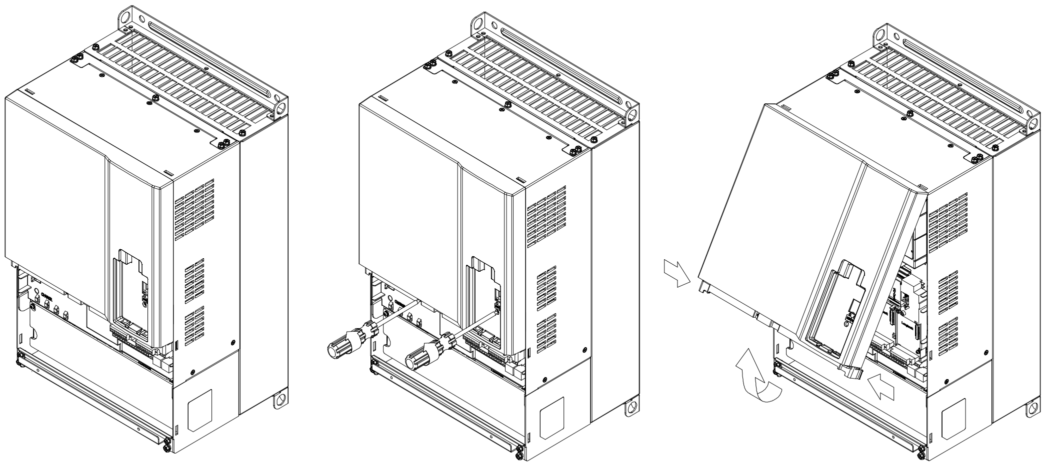
Frame A & B & C
Screw Torque: 8~10Kg-cm [6.9~8.7lb-in.]



Frame D0
Screw Torque: 8~10Kg-cm [6.9~8.7lb-in.]

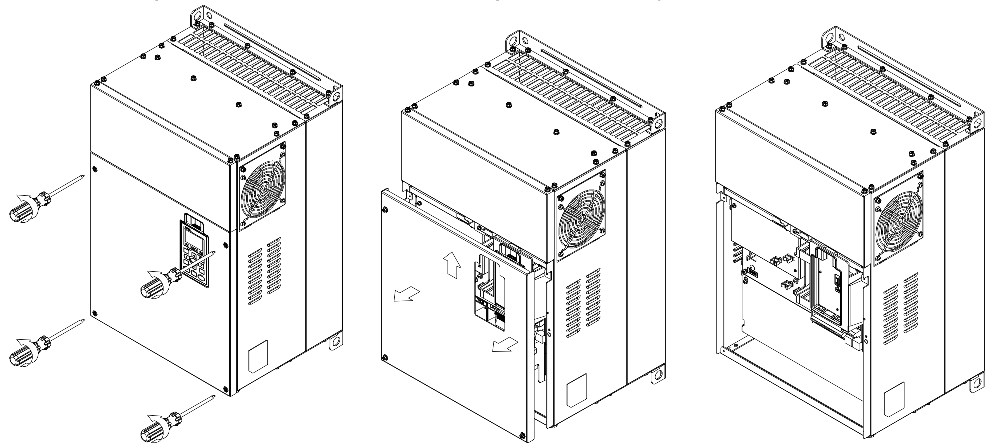


Frame D
Screw Torque: 8~10Kg-cm [6.9~8.7lb-in.]



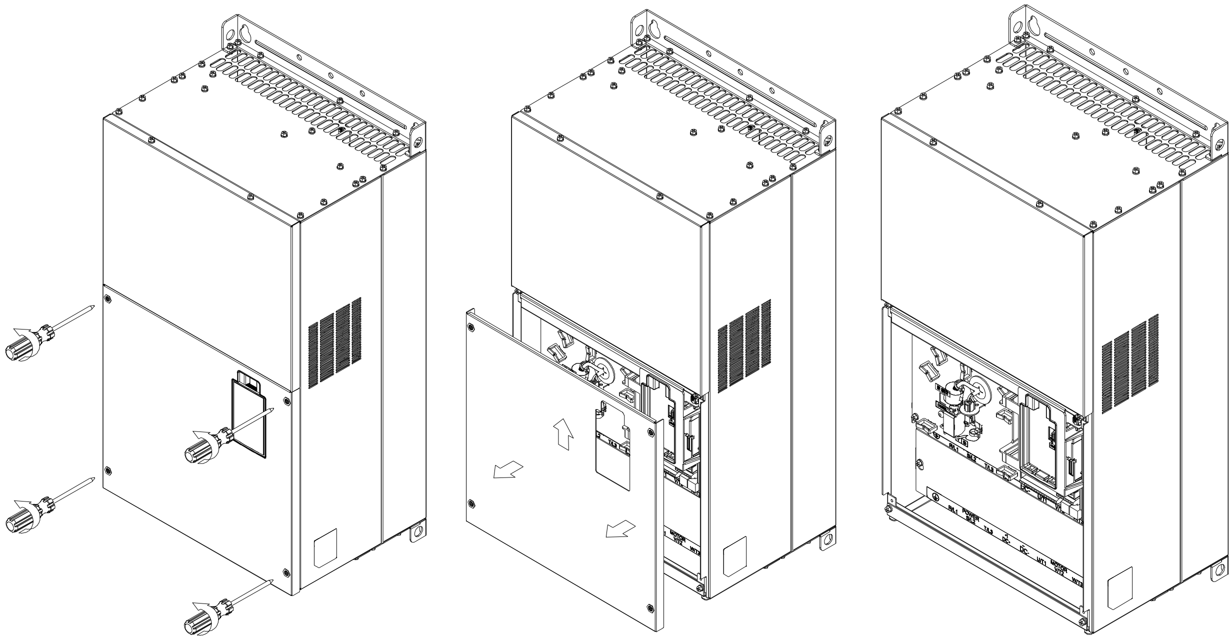
Frame E

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



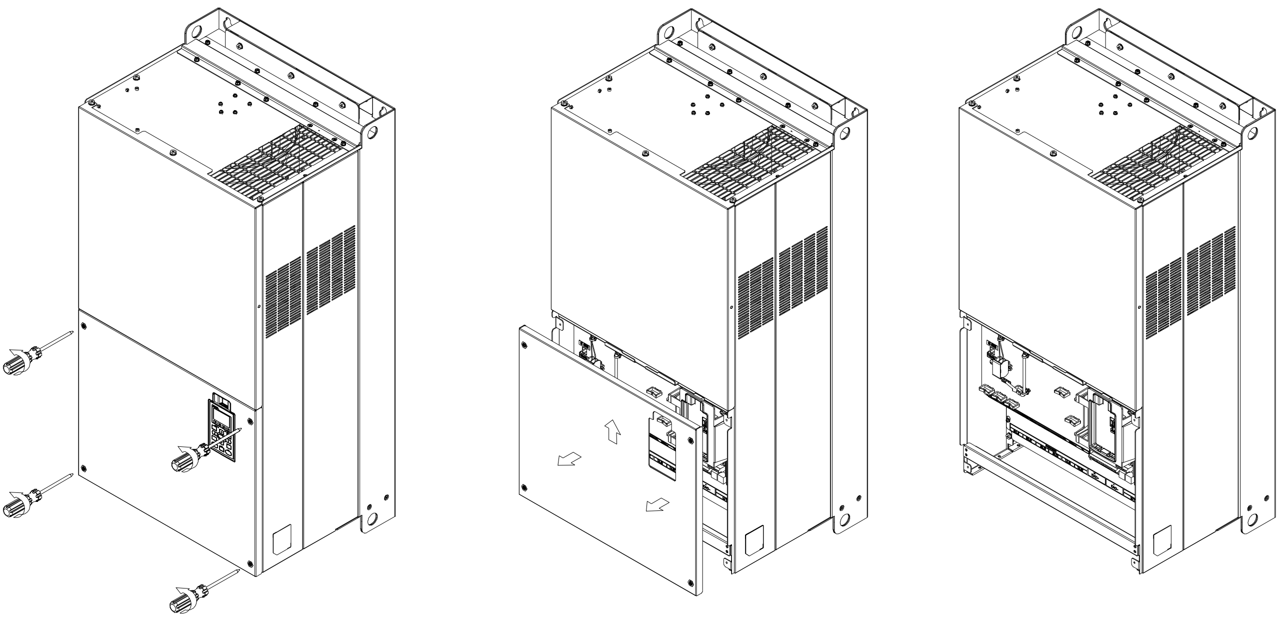
Frame F

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

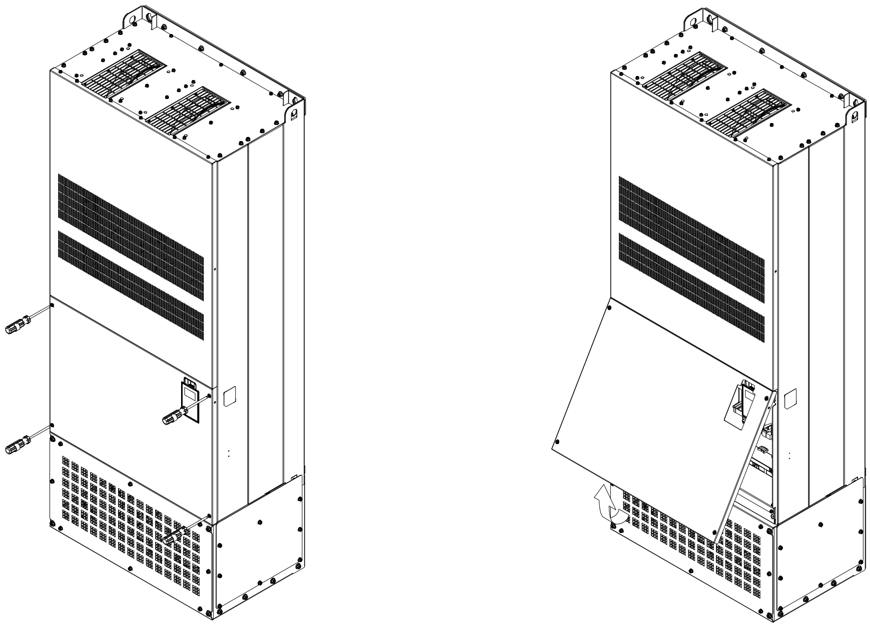


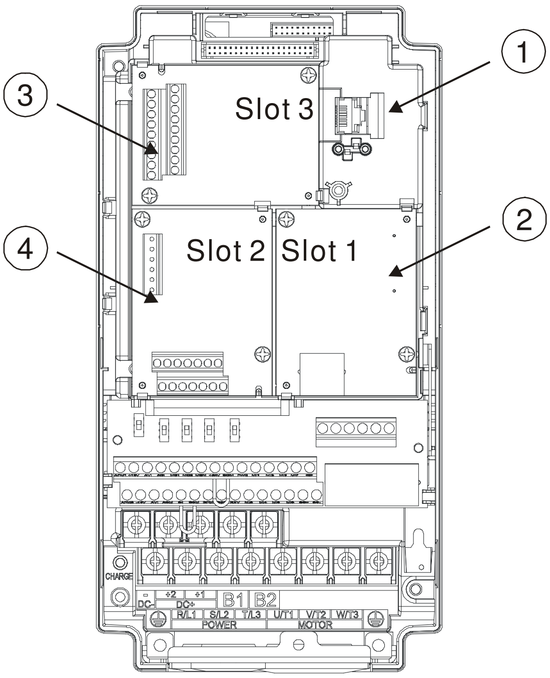
Frame G

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



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





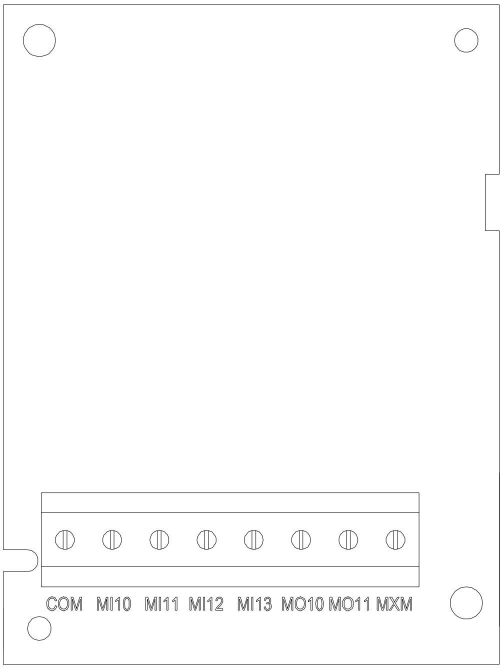
1	RJ45 (Socket) for digital keypad KPC-CC01; KPC-CE01 Please refer to CH10 Digital Keypad for more details on KPC-CE01. Please refer to CH10 Digital Keypad for more details on optional accessory RJ45 extension cable.
2	Communication extension card (Slot 1) CMC-MOD01; CMC-PD01; CMC-DN01; CMC-EIP01; EMC-COP01;
3	I/O & Relay extension card (Slot 3) EMC-D42A; EMC-D611A; EMC-R6AA; EMC-BPS01;
4	PG Card (Slot 2) No function

8-2 Screws Specification for option card terminals:

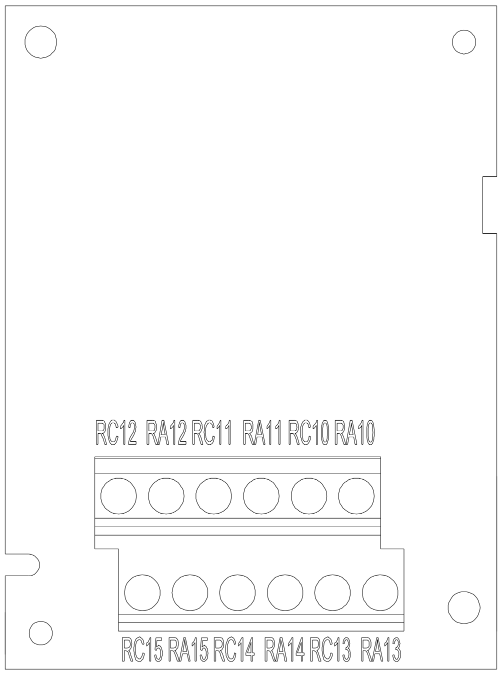
EMC-D42A EMC-D611A EMC-BPS01	Wire gauge	24~12AWG（0.205~3.31mm^2）
	Torque	5Kg-cm [4.34lb-in]
EMC-R6AA	Wire gauge	26~16AWG（0128~1.31mm^2）
	Torque	8Kg-cm [6.94lb-in]

I/O & Relay extension card (Slot 3)

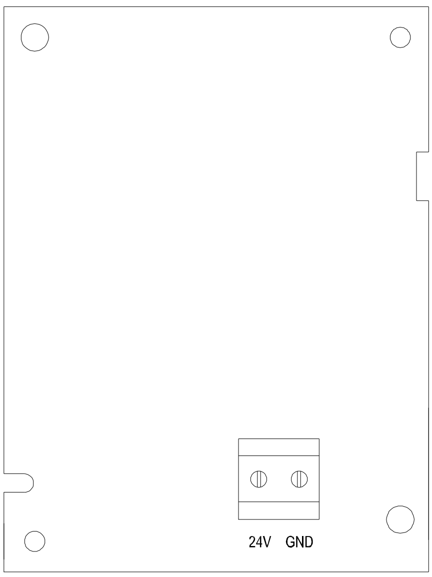
EMC-D42A



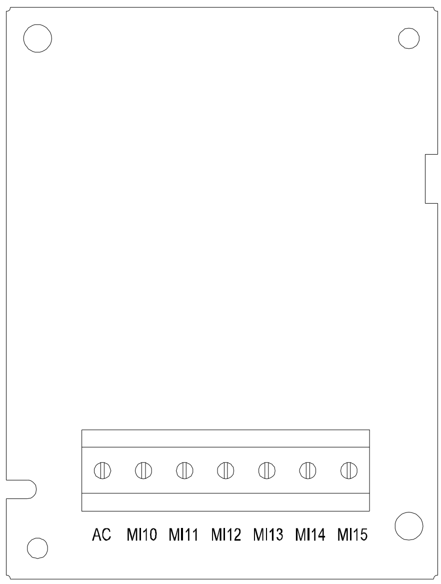
EMC-R6AA



EMC-BPS01

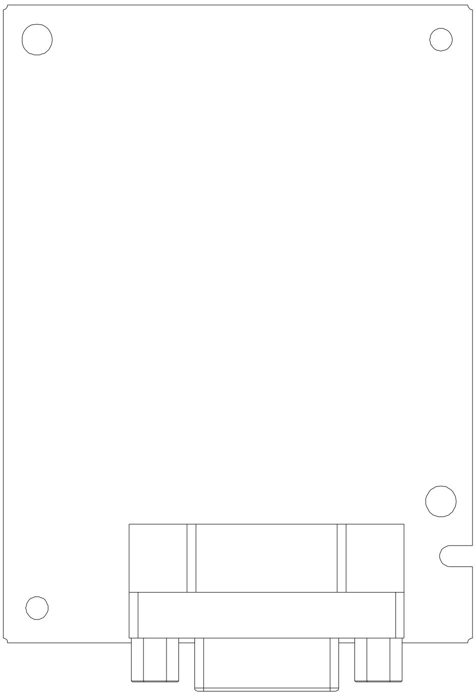


EMC-D611A

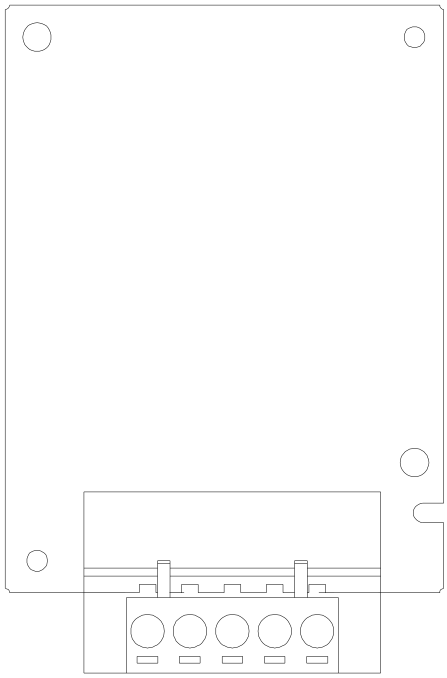


Communication extension card (Slot 1)

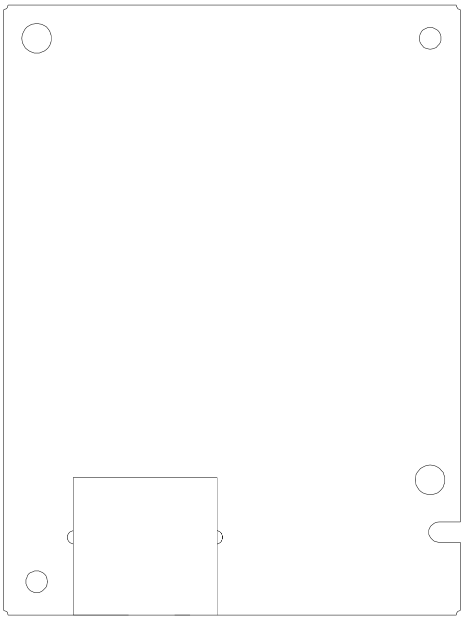
CMC-PD01



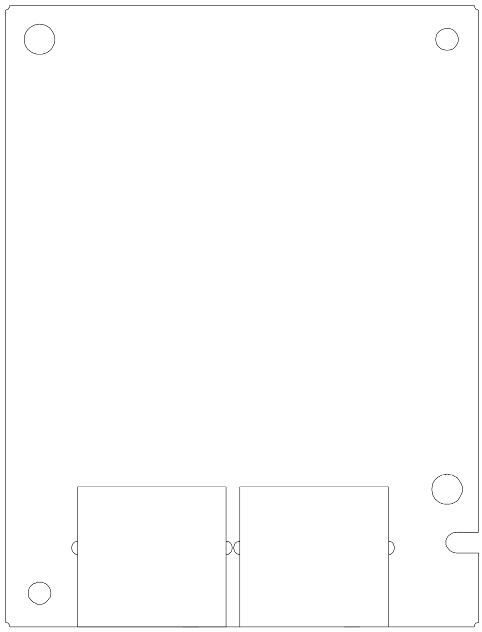
CMC-DN01



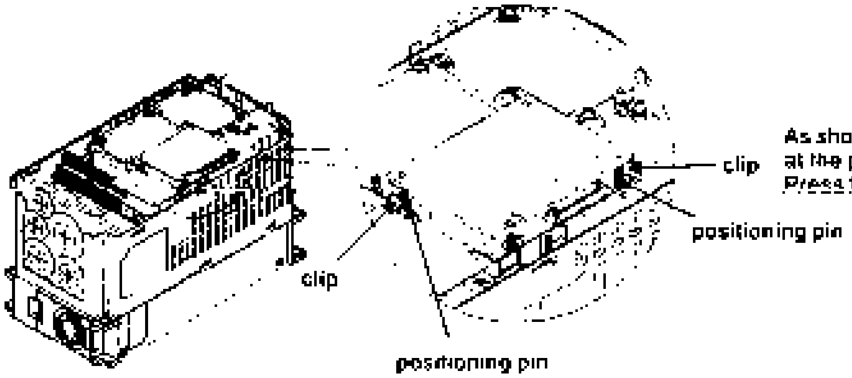
CMC-MOD01/ CMC-EIP01



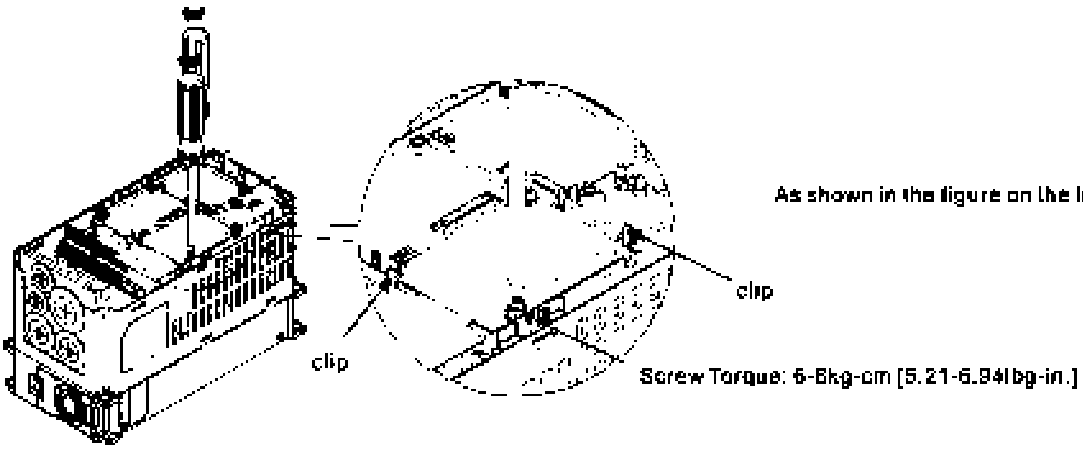
EMC-COP01



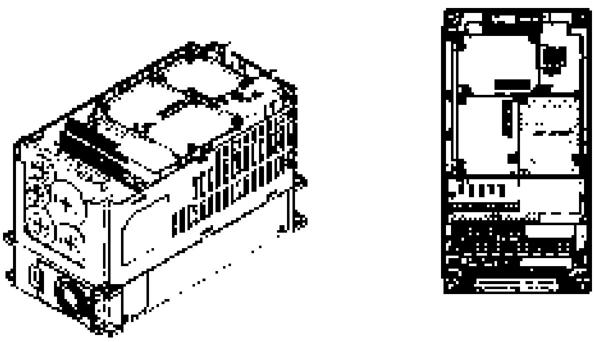
Extension Card intallation



As shown in the figure on the left, aim the two holes at the positioning pin
Press the pin to clip the holes with the PCB.

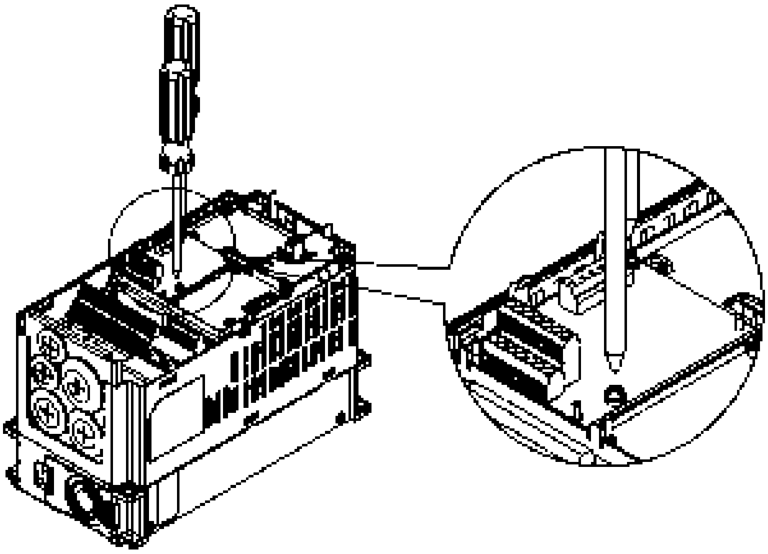


As shown in the figure on the left.

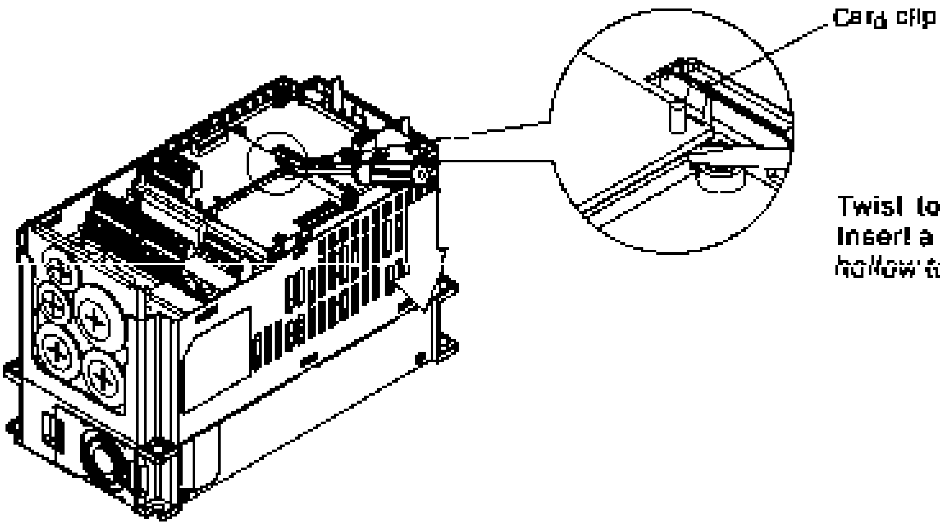


As shown in the figure on the left, installation is completed

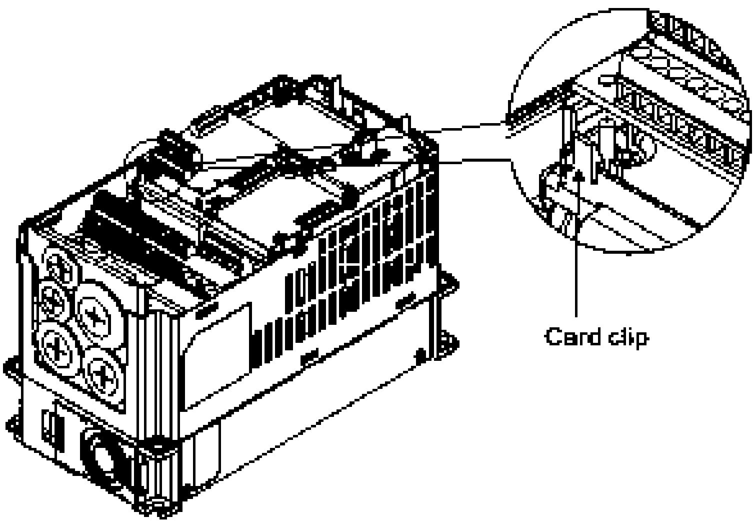
Disconneting the extension card



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

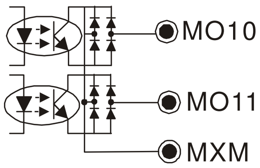


Twist to open the card clip.
Insert a slot type screwdriver into the *hollow to prize the PCB off the card clip*



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

8-3 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) The AC motor drive releases various monitor signals, such as drive in operation, frequency attained and overload indication, via transistor (open collector). 
	MXM	Common for multi-function output terminals MO10, MO11(photocoupler) Max 48VDC 50mA

8-4 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: 47~63Hz Input impedance: 27Kohm Terminal response time: ON: 10ms OFF: 20ms

8-5 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.) 250VAC 5A(N.O.) 30VDC Inductive load (COS 0.4) 2.0A(N.O.) 250VAC 2.0A(N.O.) 30VDC It is used to output each monitor signal, such as drive is in operation, frequency attained or overload indication.

8-6 EMC-BPS01

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

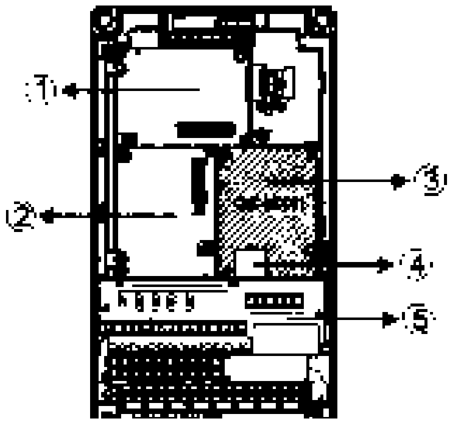
Note: Refer to I/O & Rlay extension card installation/ disconnecting method for PG Card installation/ disconnecting.

8-7 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

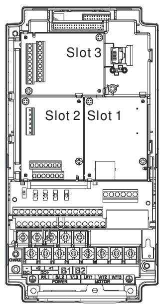
Power supply voltage	5VDC (supply by the AC motor drive)
Insulation voltage	2KV
Power consumption	0.8W
Weight	25g

Environment

Noise immunity	ESD (IEC 61800-5-1, IEC 61000-4-2) EFT (IEC 61800-5-1, IEC 61000-4-4) Surge Test (IEC 61800-5-1, IEC 61000-4-5) Conducted Susceptibility Test (IEC 61800-5-1, IEC 61000-4-6)
Operation/storage	Operation: -10℃ ~ 50℃ (temperature), 90% (humidity) Storage: -25℃ ~ 70℃ (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-CP2000**

1. Switch off the power supply of VFD-CP2000.
2. Open the front cover of VFD-CP2000.
3. Place the insulation spacer into the positioning pin at Slot 1 (shown in Figure 3), and aim the two holes on the PCB at the positioning pin. Press the pin to clip the holes with the PCB (shown in Figure 4).
4. Screw up at torque 6 ~ 8 kg-cm (5.21 ~ 6.94 in-lbs) after the PCB is clipped with the holes (shown in Figure 5).



[Figure 3]


[Figure 4]


[Figure 5]

■ **Communication Parameters for VFD-CP2000 Connected to Ethernet**

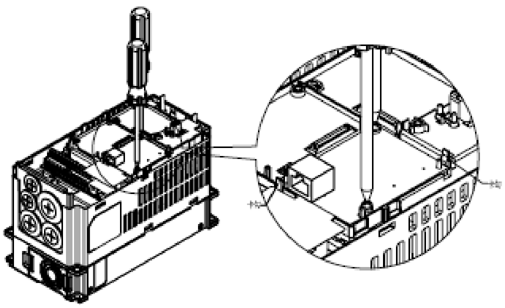
When VFD-CP2000 is link to Ethernet, please set up the communication parameters base on the table below. Ethernet master will be able to read/write the frequency word and control word of VFD-CP2000 after communication parameters setup.

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

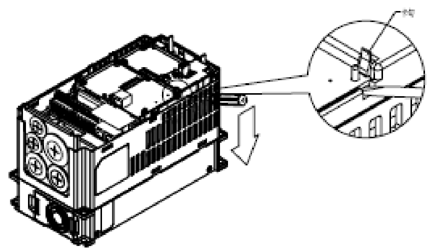
P09-30	Decoding method for communication	0	Decoding method for Delta AC motor drive
P09-75	IP setting	0	Static IP(0) / Dynamic distribution IP(1)
P09-76	IP address -1	192	IP address 192.168.1.5
P09-77	IP address -2	168	IP address 192.168.1.5
P09-78	IP address -3	1	IP address 192.168.1.5
P09-79	IP address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

■ **Disconnecting CMC- MOD01 from VFD-CP2000**

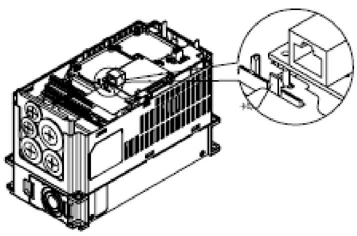
1. Switch off the power supply of VFD-CP2000.
2. Remove the two screws (shown in Figure 6).
3. Twist opens the card clip and inserts the slot type screwdriver to the hollow to prize the PCB off the card clip (shown in Figure 7).
4. Twist opens the other card clip to remove the PCB (shown in Figure 8).



[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 it?
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

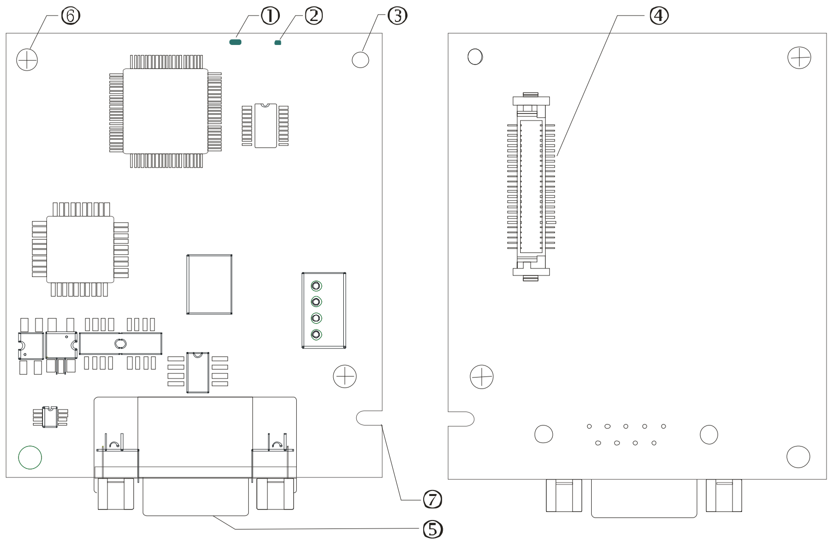
Abnormality	Cause	How to correct it?
POWER LED off	AC motor drive not powered	Check if AC motor drive is powered, and if the power supply is normal.
	CMC-MOD01 not connected to AC motor drive	Make sure CMC-MOD01 is connected to AC motor drive.
LINK LED off	CMC-MOD01 not connected to network	Make sure 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.

8-8 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 (bit per second)

Electrical Specification

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

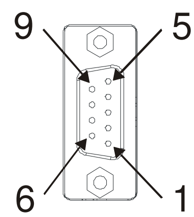
Environment

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

- **Installation**

PROFIBUS DP Connector

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



- **LED Indicator & Troubleshooting**

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

POWER LED

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

NET LED

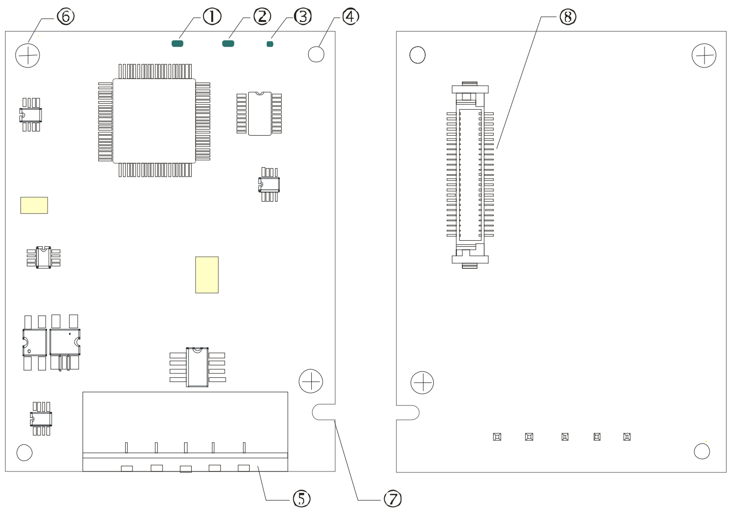
LED status	Indication	How to correct it?
Green light on	Normal status	--
Red light on	CMC-PD01 is not connected to PROFIBUS DP bus.	Connect CMC-PD01 to PROFIBUS DP bus.
Red light flashes	Invalid PROFIBUS communication address	Set the PROFIBUS address of CMC-PD01 between 1 ~ 125 (decimal)
Orange light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

8-9 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

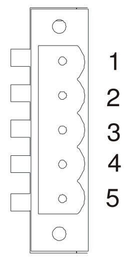
Power supply voltage	5VDC (supplied by AC motor drive)
Insulation voltage	500VDC
Communication wire power consumption	0.85W
Power consumption	1W
Weight	23g

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) Storage: -25ºC ~ 70ºC (temperature), 95% (humidity)
Shock / vibration resistance	International standards: IEC61131-2, IEC68-2-6 (TEST Fc)/IEC61131-2 & IEC 68-2-27 (TEST Ea)

DeviceNet Connector

PIN	Signal	Color	Definition
1	V+	Red	DC24V
2	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 it?
Off	Power supply in abnormal status.	Check the power supply of CMC-DN01.
Green light on	Power supply in normal status	--

NS LED

LED status	Indication	How to correct it?
Off	No power supply or CMC-DN01 has not completed MAC ID test yet.	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

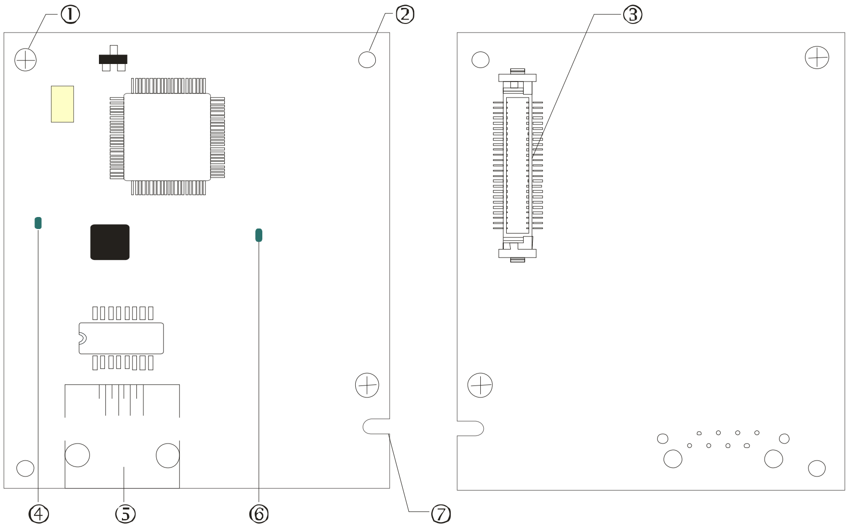
LED status	Indication	How to correct it?
Off	No power supply or being off-line	Check the power supply of CMC-DN01 and see of the connection is normal.
Green light flashes	Waiting for I/O data	Switch the master PLC to RUN status
Green light on	I/O data are normal	--
Red light flashes	Mapping error	1. 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.

8-10 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

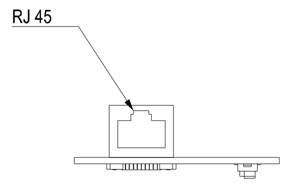
Environment

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℃ ~ 50℃ (temperature), 90% (humidity) Storage: -25℃ ~ 70℃ (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).

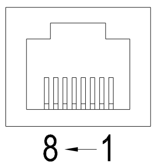


[Figure 2]

RJ-45 PIN Definition

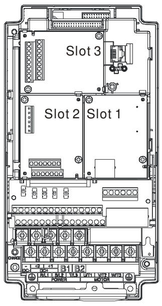
PIN	Signal	Definition
1	Tx+	Positive pole for data transmission
2	Tx-	Negative pole for data transmission
3	Rx+	Positive pole for data receiving
4	--	N/C

PIN	Signal	Definition
5	--	N/C
6	Rx-	Negative pole for data receiving
7	--	N/C
8	--	N/C



■ Connecting CMC-EIP01 to VFD-CP2000

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]

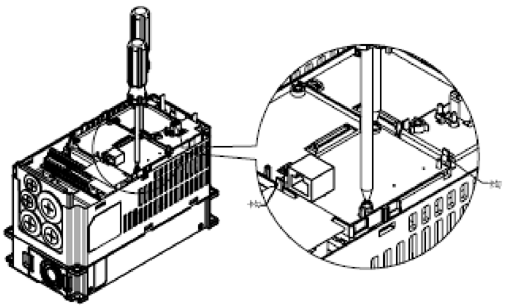
- **Communication Parameters for VFD-CP2000 Connected to Ethernet**

When VFD-CP2000 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-CP2000 after the communication parameters are set.

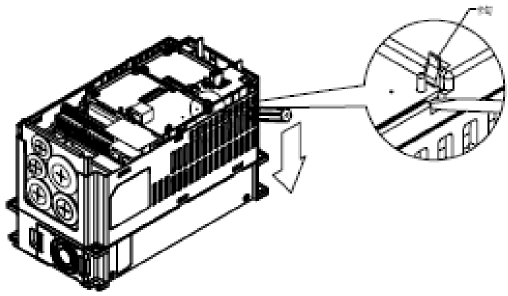
Parameter	Function	Set value (Dec)	Explanation
P00-20	Source of frequency command setting	8	The frequency command is controlled by communication card.
P00-21	Source of operation command setting	5	The operation command is controlled by communication card.
P09-30	Decoding method for communication	0	The 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-CP2000

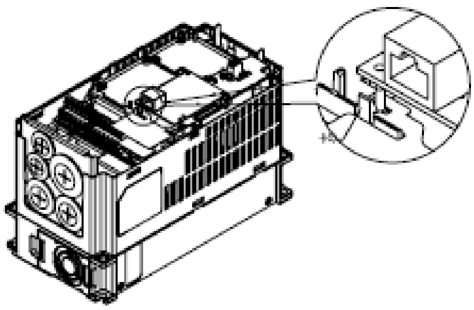
1. Switch off the power supply of VFD-CP2000.
2. Remove the two screws (see Figure 6).
3. Twist opens the card clip and inserts the slot type screwdriver to the hollow to prize the PCB off the card clip (see Figure 7).
4. Twist opens the other card clip to remove the PCB (see Figure 8).



[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 it?
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

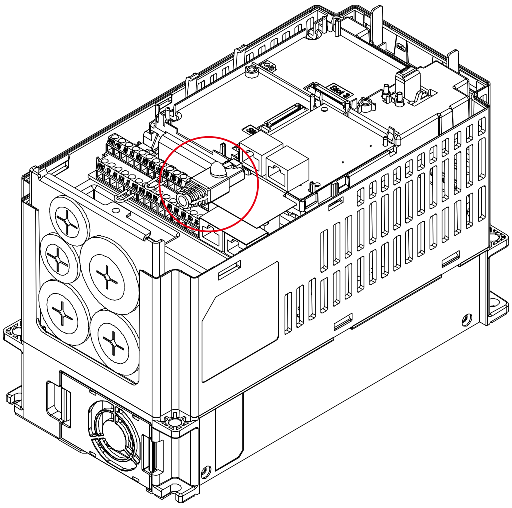
Abnormality	Cause	How to correct it?
POWER LED off	AC motor drive not powered	Check if AC motor drive is powered, and if the power supply is normal.
	CMC-EIP01 not connected to AC motor drive	Make sure CMC-EIP01 is connected to AC motor drive.
LINK LED off	CMC-EIP01 not connected to network	Make sure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

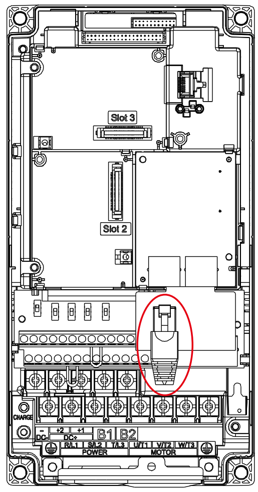
Abnormality	Cause	How to correct it?
	Poor contact to RJ-45 connector	Make sure RJ-45 connector is connected to Ethernet port.
No communication card found	CMC-EIP01 not connected to network	Make sure CMC-EIP01 is connected to network.
	PC and CMC-EIP01 in different networks and blocked by network firewall.	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.

8-11 EMC-COP01

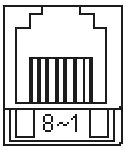
Built-in EMC-COP01 card are available in VFDXXXC23E/VFDXXXC43E series.

■ **Position of terminal resistance**





■ **RJ-45 Pin definition**



RS485 socket

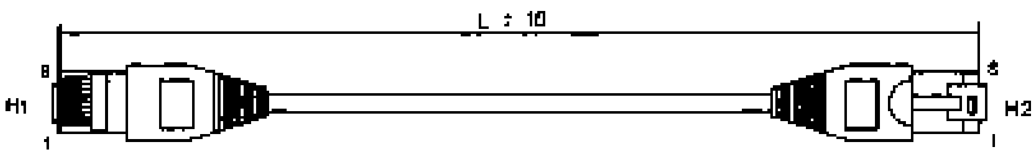
Pin	Pin name	Definition
1	CAN_H	CAN_H bus line (dominant high)
2	CAN_L	CAN_L bus line (dominant low)
3	CAN_GND	Ground/0V/V-
7	CAN_GND	Ground/0V/V-

■ **Specifications**

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

■ **CANopen Communication Cable**

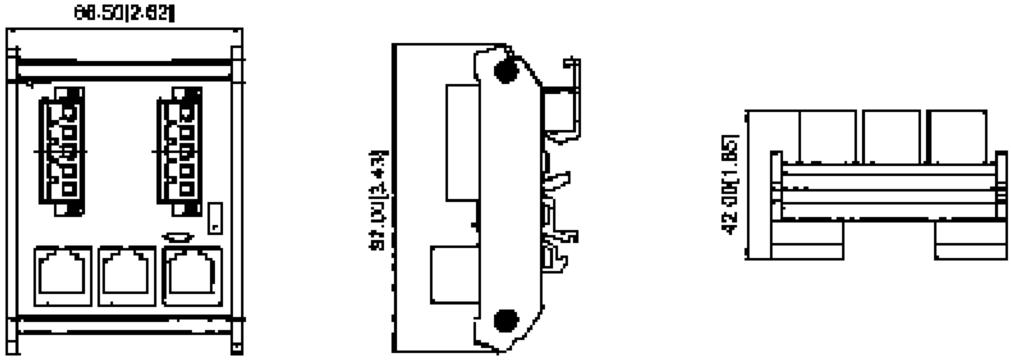
Model: TAP-CB03, TAP-CB04



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

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

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Chapter 9 Specifications

9-1 230V Series

		Frame	A					B			C			D		E		
		Model: VFD_ _ _CP23_-_ _	007	015	022	037	055	075	110	150	185	220	300	370	450	550	750	900
Output Rating	Light Duty	Rated output capacity (kVA)	2	3	4	6	8.4	12	18	24	30	36	42	58	72	86	110	128
		Rated output current (A)	5	7.5	10	15	21	31	46	61	75	90	105	146	180	215	276	322
		Applicable motor output (kW)	0.8	1.5	2.2	3.7	5.5	7.5	11	15	19	22	30	37	45	55	75	90
		Applicable motor output (HP)	1	2	3	5	7.5	10	15	20	25	30	40	50	60	75	100	125
		Overload tolerance	120% of rated current for 1 minute furing every 5 minutes															
		Max. output frequency (Hz)	600.00Hz													400.00Hz		
		Carrier frequency (kHz)	2~15kHz (8kHz)								2~10kHz(6kHz)					2~9kHz(4kHz)		
	Normal Duty	Rated output capacity (kVA)	1.2	2	3.2	4.4	6.8	10	13	20	26	30	36	48	58	72	86	102
		Rated output current (A)	4.6	5	8	11	17	25	33	49	65	75	90	120	146	180	215	255
		Applicable motor output (kW)	0.4	0.8	1.5	2.2	3.7	5.5	7.5	11	15	19	22	30	37	45	55	75
		Applicable motor output (HP)	0.5	1	2	3	5	7.5	10	15	20	25	30	40	50	60	75	100
		Overload tolerance	120% of rated current for 1 minute furing every 5 minutes; 160% of rated current for 3 seconds during every 25 seconds															
		Max. output frequency (Hz)	600.00Hz													400.00Hz		
		Carrier frequency (kHz)	2~15kHz (8kHz)								2~10kHz(6kHz)					2~9kHz(4kHz)		
Input Rating		Input current (A) Light duty	6.4	9.6	15	22	25	35	50	65	83	100	116	146	180	215	276	322
		Input current (A) Normal duty	3.9	6.4	12	16	20	28	36	52	72	83	99	124	143	171	206	245
		Rated voltage / Frequency	3 phase, AC 200V~240V (-15% ~ +10%), 50/60Hz															
		Operating voltage range	170~265Vac															
		Frequency tolerance	47~63Hz															
Efficiency (%)			96	96	96	96	96	96.5	96.5	96.5	96.5	96.5	96.5	97	97	97	97	97
Weight			2.6± 0.3Kg					5.4± 1Kg			9.8± 1.5Kg			38.5± 1.5Kg		64.8± 1.5Kg		
Cooling method			Natural cooling		Fan cooling													
Braking chopper			Built-in											Optional				
DC choke			Optional											Built-in, 3%				
EMI Filter			Optional															

9-2 460V Series

		Frame	A							B			C		
		Model: VFD_ _ _CP43_-_ _ VFD_ _ _CP4E_-_ _	007	015	022	037	040	055	075	110	150	185	200	300	370
Output rating	Light duty	Rated output capacity (kVA)	2.4	3.3	4.4	6.8	8.4	10.4	14.3	19	25	30	36	48	58
Output rating	Light duty	Rated output current (A)	3	4.2*	5.5*	8.5*	10.5	13*	18*	24*	32*	38*	45	60*	73*
Output rating	Light duty	Applicable motor output (kW)	0.75	1.5	2.2	3.7	4	5.5	7.5	11	15	18.5	22	30	37
Output rating	Light duty	Applicable motor output (HP)	1	2	3	5	5	7.5	10	15	20	25	30	40	50
Output rating	Light duty	Overload tolerance	120% of rated current for 1 minute furing every 5 minutes												
Output rating	Light duty	Max.output frequency (Hz)	600.00Hz												
Output rating	Light duty	Carrier frequency (kHz)	2~15kHz (8kHz)										2~10kHz(6kHz)		
Output rating	Normal duty	Rated output capacity (kVA)	2.2	2.4	3.2	4.8	7.2	8.4	10.4	14.3	19	25	30	36	48
Output rating	Normal duty	Rated output current (A)	2.8	3	4	6	9	10.5	12	18	24	32	38	45	60
Output rating	Normal duty	Applicable motor output (kW)	0.4	0.75	1.5	2.2	3.7	4	5.5	7.5	11	15	18.5	22	30
Output rating	Normal duty	Applicable motor output (HP)	0.5	1	2	3	5	5	7.5	10	15	20	25	30	40
Output rating	Normal duty	Overload tolerance	120% of rated current for 1 minute furing every 5 minutes; 160% of rated current for 3 seconds during every 25 seconds												
Output rating	Normal duty	Max.output frequency (Hz)	600.00Hz												
Output rating	Normal duty	Carrier frequency (kHz)	2~15kHz (8kHz)										2~10kHz(6kHz)		
Input rating		Input current (A) Light duty	4.3	6	8.1	12.4	16	20	22	26	35	42	47	66	80
Input rating		Input current (A) Normal duty	3.5	4.3	5.9	8.7	14	15.5	17	20	26	35	40	47	63
Input rating		Rated voltage / Frequency	3 phase, AC 380V~480V (-15% ~ +10%), 50/60Hz												
Input rating		Operating voltage range	323~528Vac												
Input rating		Frequency tolerance	47~63Hz												
Efficiency (%)			96	96	96	96	96	96	96	96.5	96.5	96.5	96.5	96.5	96.5
Weight			2.6± 0.3Kg							5.4± 1Kg			9.8± 1.5Kg		
Cooling method			Natural cooling			Fan cooling									
Braking chopper			Built-in												
DC choke			Optional												
EMI Filter			Frame A, B, C of VFD_ _ _ _CP4EA-_ _: Built-in; Frame A, B, C of VFD_ _ _ _CP43A-_ _, no built-in												

		Frame	D0		D		E		F		G		H		
		Model: VFD_ _ _ _CP43_-_ _	450	550	750	900	1100	1320	1600	1850	2200	2800	3150	3550	4000
Output rating	Light duty	Rated output capacity (kVA)	73	88	120	143	175	207	247	295	367	422	491	544	613
		Rated output current (A)	91	110	150*	180	220	260*	310	370*	460	530	616	683	770
		Applicable motor output (kW)	45	55	75	90	110	132	160	185	220	280	315	355	400
		Applicable motor output (HP)	60	75	100	125	150	175	215	250	300	375	425	475	536
		Overload tolerance	120% of rated current for 1 minute furing every 5 minutes												
		Max.output frequency (Hz)	600.00Hz		400.00Hz										
		Carrier frequency (kHz)	2~10kHz(6kHz)		2~9kHz(4kHz)										
	Normal duty	Rated 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
		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
		Overload tolerance	120% of rated current for 1 minute furing every 5 minutes; 160% of rated current for 3 seconds during every 25 seconds												
		Max.output frequency (Hz)	600.00Hz		400.00Hz										
		Carrier frequency (kHz)	2~10kHz(6kHz)		2~9kHz(4kHz)										
Input rating		Input current (A) Light duty	91	110	150	180	220	260	310	370	460	530	616	683	770
		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												
		Efficiency (%)	97	97	97	97	97	97	97	97	97.5	97.5	97.5	97.5	97.5
		Weight	27± 1 Kg		38.5± 1.5Kg		64.8± 1.5Kg		86.5± 1.5Kg		134± 4Kg		228Kg		
		Cooling method	Fan cooling												
		Braking chopper	Optional												
		DC choke	Built-in, 3%												
		EMI Filter	Optional												

* means the rated output current is for the models of Version B.

NOTE

- The value of the carrier frequency is a factory setting. To increase the carrier frequency, the current needs to be decrease. See derating curve diagram of Pr06-55 for more information.
- When a load is a surge load, use a higher level model.
- For Frame A, B and C, Model VFDXXXCPXXX-21, the enclosure type is IP20/ UL OPEN TYPE.
- For FRAME D and above, if the last two characters of the model are 00 then the enclosure type is IP00/ IP20/UL OPEN TYPE; if the last two characters of the model are 21, the enclosure type is IP20/ NEMA1/ UL TYPE1.

General Specifications

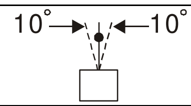
Control Characteristics	Control Method	1: V/F, 2: SVC
	Starting Torque	Reach up to 160% or above at 0.5Hz.
	V/F Curve	4 point adjustable V/F curve and square curve
	Speed Response Ability	5Hz (vector control can reach up to 40Hz)
	Torque Limit	Light duty: max. 130% torque current Normal duty: max. 160% torque current
	Torque Accuracy	±5%
	Max. output frequency (Hz)	230V: 600.00Hz (55kW and above: 400.00Hz) 460V: 600.00Hz (90kW and above: 400.00Hz)
	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, rated output current is 160% for 3 seconds Light duty: rated output current is 120% 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	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, Slip compensation, Torque compensation, JOG frequency, Frequency upper/lower limit settings, DC injection braking at start/stop, High slip braking, Energy saving control, MODOBUS communication (RS-485 RJ45, max. 115.2 kbps)
	Fan Control	Frame A and B series: On/off control Frame C and series above: PMW control
Protection Characteristics	Motor Protection	Electronic thermal relay protection
	Over-current Protection	Light duty: Over-protection for 200% rated current; current clamp: 130~135% Normal duty: Over-protection for 240%; current clamp: 17-~175%
	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, c UL us, GB/T12668-2, PCT (certification in progress)

NOTE

The max. output frequency will vary with the setting of carrier frequency, please refer to the description of Pr. 01-00.

9-3 Environment for Operation, Storage and Transportation

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

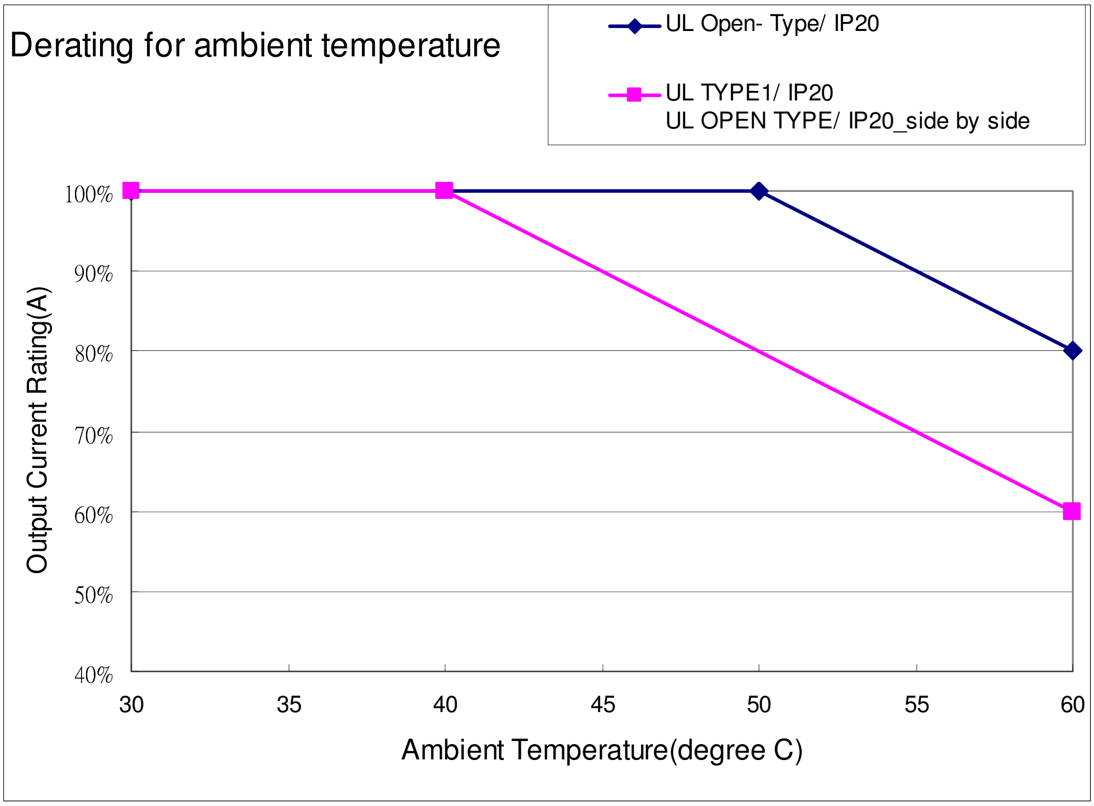
Environment	Installation location	IEC60364-1/IEC60664-1 Pollution degree 2, Indoor use only	
	Surrounding Temperature	Storage	-25 °C ~ +70 °C
		Transportation	-25 °C ~ +70 °C
		Non-condensation, non-frozen	
	Rated Humidity	Operation	Max. 95%
		Storage/ Transportation	Max. 95%
		No condense water	
	Air 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
		If the AC motor drive is to be used under harsh environment with high level of contamination (e.g. dew, water, dust), make sure it is installed in an environment qualified for IP54 such as in a cabinet.	
	Altitude	Operation	If AC motor drive is installed at altitude 0~1000m, follow normal operation restriction. If it is install at altitude 1000~2000m, decrease 2% of rated current or lower 0.5℃ 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° (under normal installation position)		

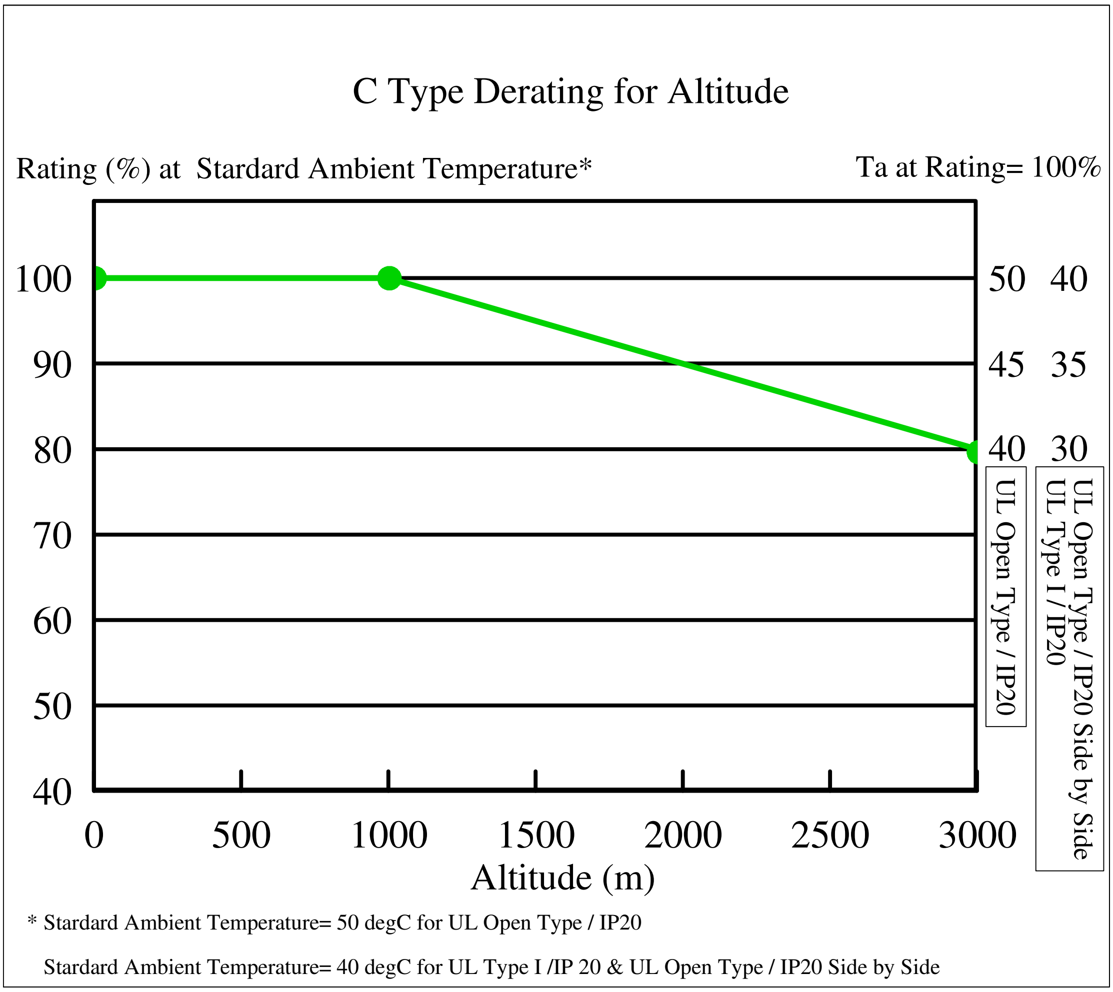
9-4 Specification for Operation Temperature and Protection Level

Model	Frame	Top cover	Conduit box	Protection level	Operation temperature
VFDxxxxCP23A-21 VFDxxxxCP43A-21 VFDxxxxCP4EA-21, VFDxxxxCP4EB-21 VFDxxxxCP43C-21	Frame A~C 230V: 0.75~30kW 460V: 0.75~37kW	Top cover removed	Standard concuit plate	IP20/UL Open Type	ND:-10~50℃ LD: -10~40℃
		Standard with top cover		IP20/ UL Type1/ NEMA1	ND:-10~40℃ LD: -10~40℃
	Frame D~H 230V: 37kW and above 460V: 45kW and above	N/A	With condult box	IP20/UL Type1/NEMA1	ND:-10~40℃ LD: -10~40℃
VFDxxxxCP23A-00 VFDxxxxCP43A-00 VFDxxxxCP43B-00 VFDxxxxCP43C-00,	Frame D~H 230V: 37kW and above 460V: 45kW and above	N/A	No conduit box	IP00 IP20/UL Open Type 	ND:-10~50℃ LD: -10~40℃

NOTE: ND=Normal Duty; LD=Light Duty

9-5 Derating of Ambient Temperature and Altitude





Protection Level	Operating Environment
UL Type I / IP20	When the AC motor drive is operating at the rated current and the ambient temperature has to be between -10℃ ~ +40℃. When the temperature is over 40℃, for every increase by 1℃, decrease 2% of the rated current. The maximum allowable temperature is 60℃.
UL Open Type / IP20	When the AC motor drive is operating at the rated current and the ambient temperature has to be between -10℃ ~ +50℃. When the temperature is over 50℃, for every increase by 1℃, decrease 2% of the rated current. The maximum allowable temperature is 60℃.
High Altitude	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 temperature for every 100m increase in altitude. Maximum altitude for Corner Grounded is 2000m. Contact Delta for more information, if you need to use this motor drive at an altitude of 2000m or higher.

Chapter 10 Digital Keypad

10-1 Descriptions of Digital Keypad

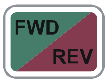
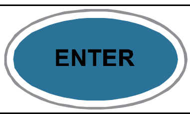
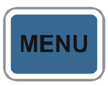
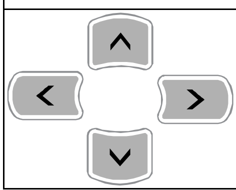
KPC-CC01 KPC-CE01(Option)

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

Installation Method

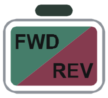
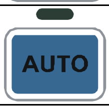
1. Embedded type and can be put flat on the surface of the control box. The front cover is water proof.
2. Buy a MKC-KPPK model to do wall mounting or embedded mounting. Its protection level is IP66.
3. The maximum RJ45 extension lead is 5 m (16ft)
4. This keypad can only be used on Delta's motor drive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

Descriptions of Keypad Functions

Key	Descriptions
	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 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.
	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 Key Press ENTER and go to the next level. If it is the last level then press ENTER to execute the command.
	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.
	Press menu to return to main menu. Menu content: KPC-CE01 does not support function 5 ~13. 1. Parameter setup 7. Quick start 13. PC Link 2. Copy Parameter 8. Display Setup 3. Keypad Locked 9. Time Setup 4. PLC Function 10. Language Setup 5. Copy PLC 11. Startup Menu 6. Fault Record 12. Main Page
	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.

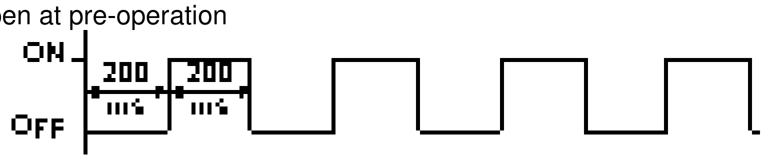
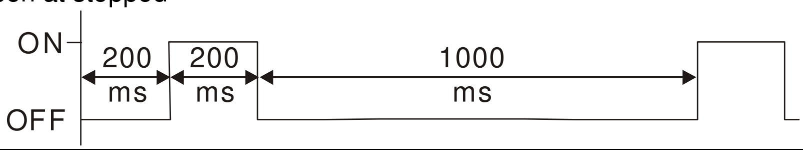
	Function Key 1. The functions keys have factory settings and can be defined by users. The factory settings of F1 and F4 work with the function list below. For example, F1 is JOG function, F4 is a speed setting key for adding/deleting user defined parameters. 2. Other functions must be defined by TPEditor first. TPEditor software V1.40 or later 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 10-15 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 1. Green light is on, the drive is running forward. 2. Red light is on, the drive is running backward. 3. Twinkling light: the drive is changing direction.
	(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).
CANopen ~"RUN"	RUN LED: (see table below)
CANopen ~"ERR"	ERR LED: (see table below)

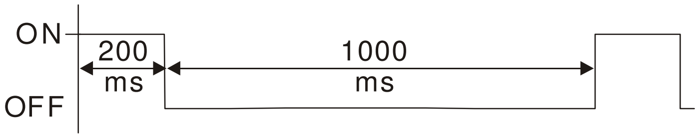
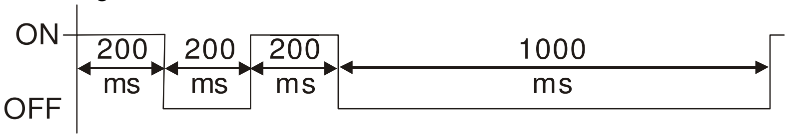
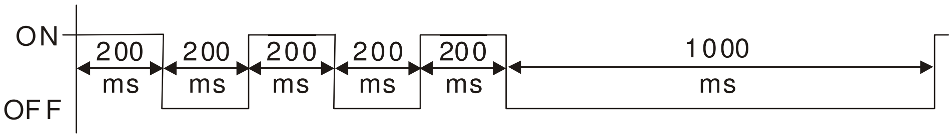
CANopen ~"RUN"

RUN LED:

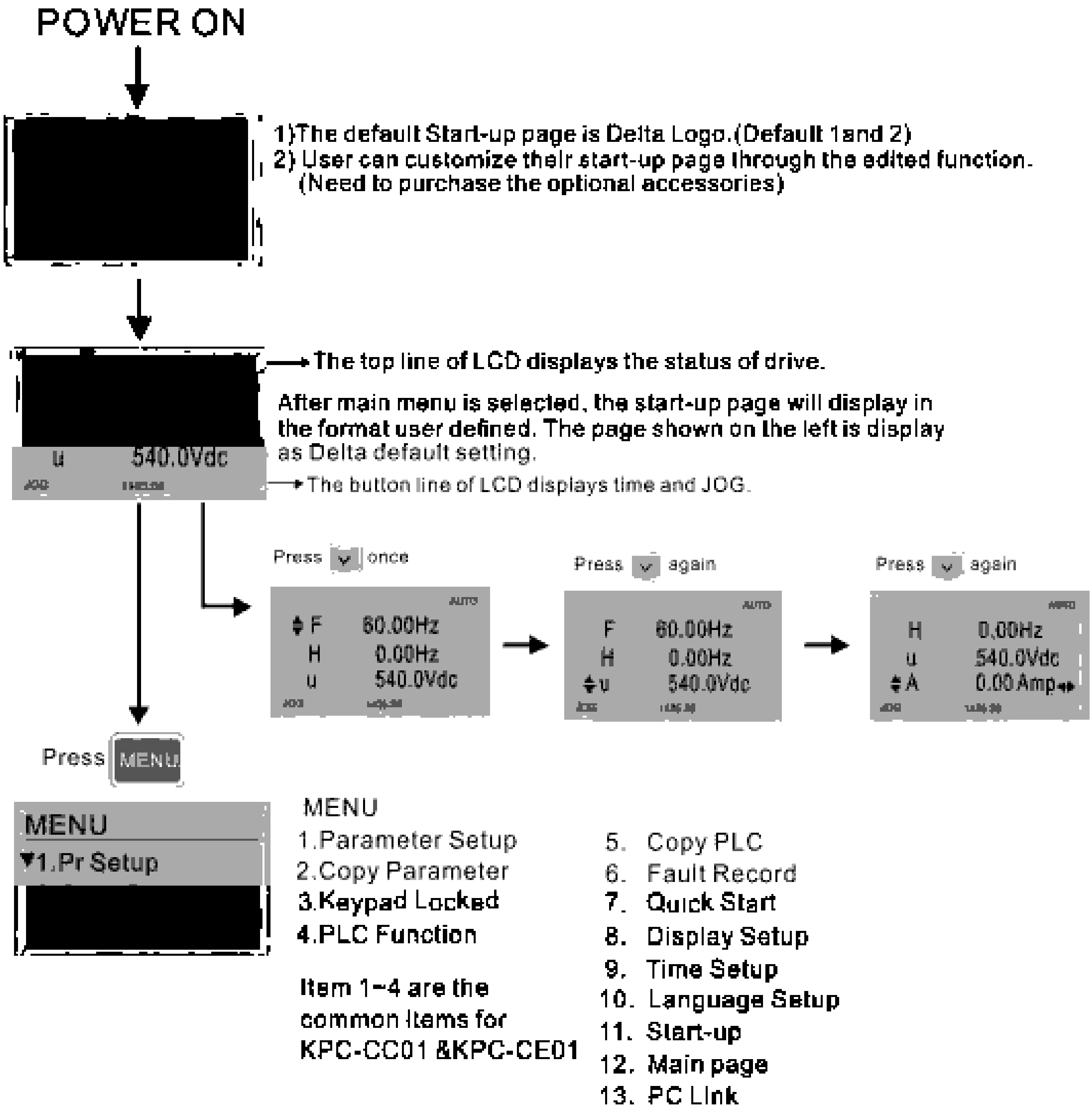
LED status	Condition/State
OFF	CANopen at initial LED steady off
Blinking	CANopen at pre-operation 
Single flash	CANopen at stopped 
ON	CANopen at operation status LED steady on

CANopen ~"ERR"

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

10-2 Function of Digital Keypad KPC-CC01



NOTE

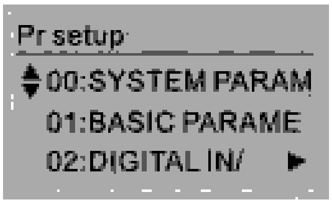
1. Startup page can only display pictures, no flash.
2. When Power ON, it will display startup page then the main page. The main page displays Delta's default setting F/H/A/U, the display order can be set by Pr.00.03 (Startup display). When the selected item is U page, use left key and right key to switch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

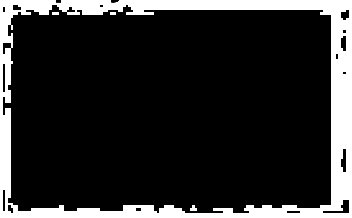
Press for more options.



▶ : show complete sentence

Press for complete information

Display item

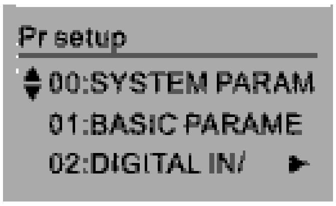


MENU
1.Parameter Setup
2.Copy Parameter
3.Keypad Locked
4.PLC Function

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

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

1. Parameter Setup

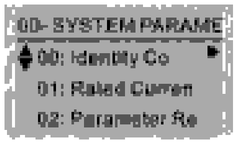


Press ENTER to select.

Press to select a parameter group.

Once a parameter group is selected, press to go into that group.

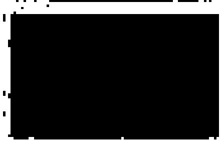
For example: Setup source of master frequency command.



Once in the Group 00 Motor Drive Parameter, Use Up/Down key to select parameter 20: Auto Frequency Command.

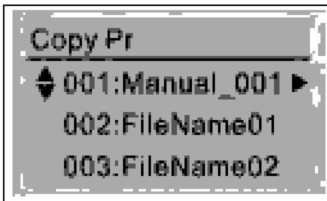
When this parameter is selected, press ENTER key to go to this parameter's setting menu.

Use Up/Down key to choose a setting.
For example: Choose "2 Analogue Input, then press the ENTER key.



After pressing the ENTER key, an END will be displayed which means that the parameter setting is done.

2. Copy Parameter

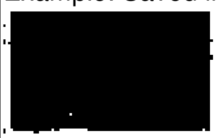


Press ENTER key to go to 001~004: content storage

4 duplicates are provided

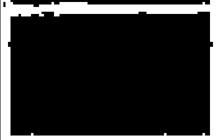
The steps are shown in the example below.

Example: Saved in the motor drive.

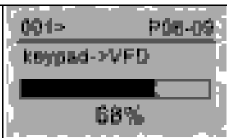


1 Go to Copy Parameter

2 Select the parameter group which needs to be copied and press ENTER key.



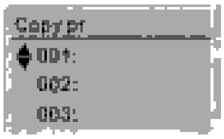
1 Select 1: Save in the motor drive.
2. Press ENTER key to go to "Save in the motor drive" screen.



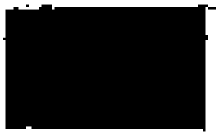
Begin to copy parameters until it is done.

Once copying parameters is done, keypad will automatically be back to this screen.

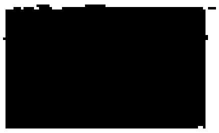
Example: Saved in the keypad.



1. Once copying parameters is done, keypad will automatically be back to this screen.
2. Select the parameter group which needs to be copied and press ENTER key.



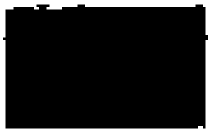
Press ENTER key to go to “Save in the motor drive” screen.



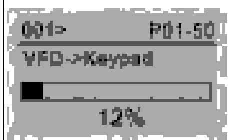
Use Up/Down key to select a symbol.
Use Left/Right key to move the cursor to select a file name.

String & Symbol Table:

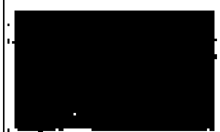
！” ＃＄％＆’ （）＊＋，－．／０１２３４５６７８９：；＜＝
＞？＠ＡＢＣＤＥＦＧＨＩＪＫＬＭＮＯＰＱＲＳＴＵＶＷＸＹＺ
［＼］︿＿ ‘ａｂｃｄｆｇｈｉｊｋｌｍｎｏｐｑｒｓｔｕｖｗｘ
ｙｚ｛｜｝～



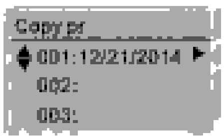
Once the file name is confirmed, press ENTER key.



To begin copying parameters until it is done.



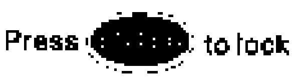
When copying parameters is completed, keypad will automatically be back to this screen.



Press Right key to see the date of copying parameters.

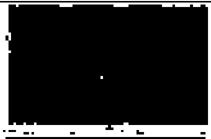
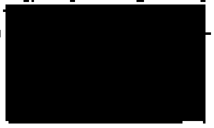
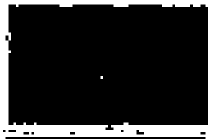
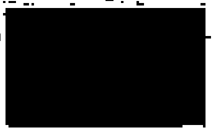
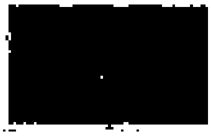
Press Right key to see the time of copying parameters.

3. Keypad locked

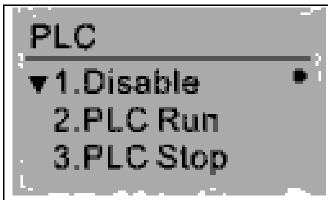
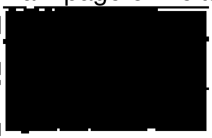
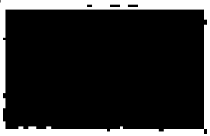
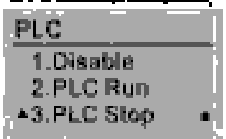
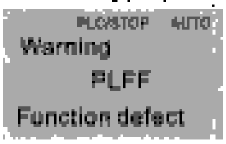


Keypad Locked

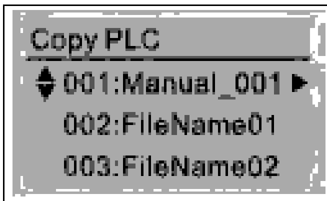
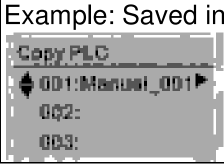
This function is used to lock the keypad. The main page would not display “keypad locked” when the keypad is locked, however it will display the message”please press ESC and then ENTER to unlock the keypad” when any key is pressed.

		When the keypad is locked, the main screen doesn't display any status to show that.
		Press any key on the keypad; a screen as shown in image on the left will be displayed.
		If ESC key is not pressed, the keypad will automatically be back to this screen.
		The keypad is still locked at this moment. By pressing any key, a screen as shown in the image on the left will still be displayed.
		Press ESC for 3 seconds to unlock the keypad and the keypad will be back to this screen. Then each key on the keypad is functional.
	Turn off the power and turn on the power again will not lock keypad.	

4. PLC Function

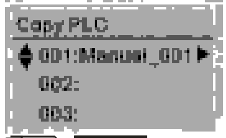
 Press Up/Down key to select a PLC's function. Then press ENTER.	When activate and stop PLC function, the PLC status will be displayed on main page of Delta default setting.	
		Optipn 2: Enable PLC function
		Factory setting on the main screen displays PLC/RUN status bar.
		Option 3: Disable PLC function
		Factory setting on the main screen displays PLC/STOP status bar
		If the PLC program is not available in the control board, PLFF warning will be displayed when choosing option 2 or 3. In this case, select option 1 : No Function to clear PLFF warning.
	The PLC function of KPC-CE01 can only displays: 1. PLC0 2. PLC1 3. PLC2	

5. Copy PLC

	4 duplicates are provided The steps are shown in the example below. Example: Saved in the motor drive.	
		1 Go to Copy PLC 2 Select a parameter group to copy then press ENTER

1 Select 1: Save in the motor drive.
2. Press ENTER key to go to "Save in the motor drive" screen.

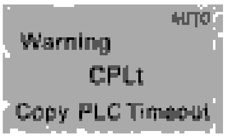
Begin to copy PLC until it is done.



Once copying PLC is done, keypad will automatically be back to this screen.

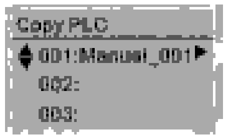
NOTE

If "Option 1: Save in the motor drive" is selected, verify if the PLC program is built-in to KPC-CC01 keypad. If PLC program is not available in the keypad while "Option 1: Save in the motor drive" is selected, an "ERR8 Warning: Type not matching" will be display on the screen.

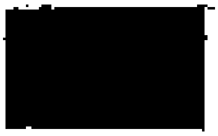


Unplug and plug back the keypad while copying the PLC program will have a CPLt warning.

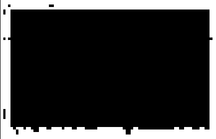
Example: Saved in the keypad.



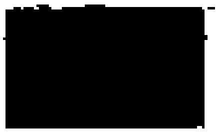
1. Once copying PLC is done, keypad will automatically be back to this screen.
2. Select the parameter group which needs to be copied and press ENTER key.



Press ENTER key to go to "Save in the motor drive" screen.

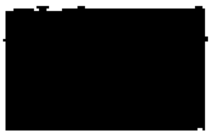


If WPLSoft editor is installed and password is set, enter the password to save the file onto digital display.



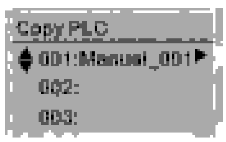
Use Up/Down key to select a symbol.
Use Left/Right key to move the cursor to select a file name.

String & Symbol Table:
！” ＃＄％＆’ （）＊＋，－．／０１２３４５６７８９：；＜＝＞？＠Ａ
ＢＣＤＥＦＧＨＩＪＫＬＭＮＯＰＱＲＳＴＵＶＷＸＹＺ［＼］︿＿ ‘ａｂ
ｃｄｆｇｈｉｊｋｌｍｎｏｐｑｒｓｔｕｖｗｘｙｚ｛｜｝～

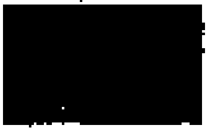
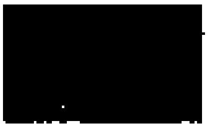


Once the file name is confirmed, press ENTER key.

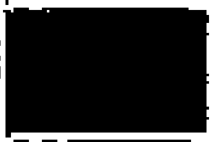
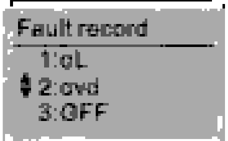
To begin copying parameters until it is done.



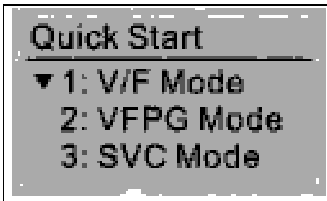
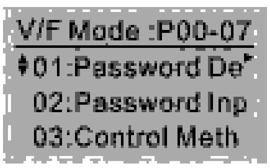
When copying parameters is completed, keypad will automatically be back to this screen.

	 Press Right key to see the date of copying parameters.  Press Right key to see the time of copying parameters.

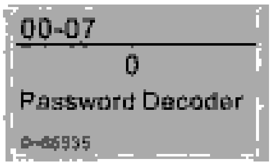
6. Fault record

 Press ENTER to select. KPC-CE01 does not support this function.	Able to store 6 error code (Keypad V1.02 and previous versions) Able to store 20 error code(Keypad V1.0e3 and later version) The most recent error record is shown as the first record. Select an error record to see its detail such as date, tme, frequency, current, voltage, DCBUs voltage)  Press Up/Down key to select an error record. After selecting an error code, press ENTER to see that error record's detail  Press Up/Down key to see an error record's detail such as date, time, frequency, current, voltage, DCBus voltage.  Press Up/Down key to select an error record. After selecting an error code, press ENTER to see that error record's detail  Press Up/Down key to see an error record's detail such as date, time, frequency, current, voltage, DCBus voltage. 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 Start

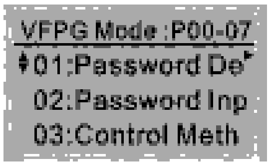
 Press ENTER to select. Quick Start: 1. V/F Mode	Description: 1. VF Mode  01:Password Decoder Items 1. Parameter Protection Password Input (P00-07) 2. Parameter Protection Password Setting (P00-08) 3. Control Mode (P00-10) 4. Control of Speed Mode (P00-11) 5. Load Selection (P00-16)

2. VFPG Mode
3. SVC Mode
4. FOCPG Mode
5. TQCPG Mode
6. My Mode

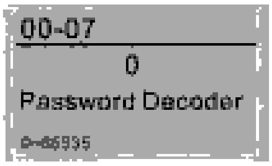


6. Source of the Master Frequency Command (AUTO) (P00-20)
7. Source of the Operation Command (AUTO) (P00-21)
8. Stop Method (P00-22)
9. Digital Keypad STOP function (P00-32)
10. Max. Operation Frequency (P01-00)
11. Base Frequency of Motor 1 (P01-01)
12. Max. Output Voltage Setting of Motor 1 (P01-02)
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)

2. VFPG Mode



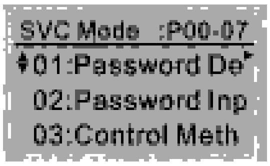
01: Password Decoder



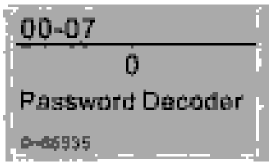
Items
1. Parameter Protection Password Input (P00-07)
2. Parameter Protection Password Setting (P00-08)
3. Control Mode (P00-10)
4. Control of Speed Mode (P00-11)
5. Load Selection (P00-16)
6. Source of the Master Frequency Command (AUTO) (P00-20)
7. Source of the Operation Command (AUTO) (P00-21)
8.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

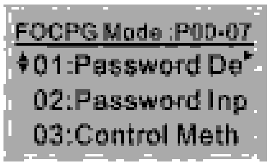


01: Password Decoder

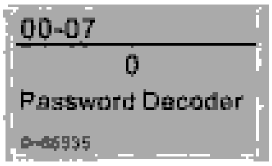


Items
1. Parameter Protection Password Input (P00-07)
2. Parameter Protection Password Setting (P00-08)
3. Control Mode (P00-10)
4. Control of Speed Mode (P00-11)
5. Load Selection (P00-16)
6. Carrier Frequency (P00-17)
7. Source of the Master Frequency Command (AUTO) (P00-20)
8. Source of the Operation 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

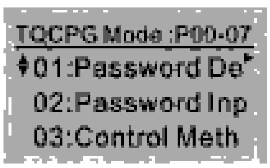


01: Password Decoder



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

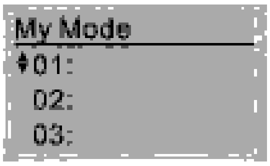


01: Password Decoder

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



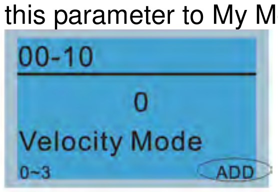
Click F4 in parameter setting page, the parameter will save to My Mode. To delete or correct the parameter, enter this parameter and click the “DEL” on the bottom right corner.

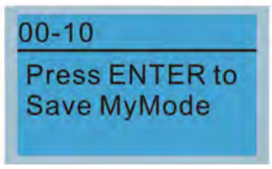
Items

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

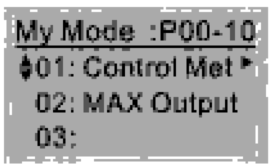
Setup process

1. Go to Parameter Setup function.
   Press ENTER to go to the parameter which you need to use. There is an ADD on the bottom right-hand corner of the screen. Press F4 on the key pad to add this parameter to My Mode

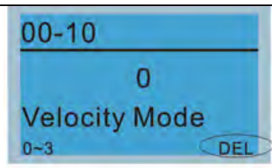


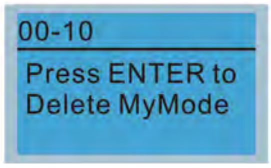


2. The parameter (Pr) will be displayed in My mode if it is properly saved.
   To correct or to delete this Pr. clicks DEL.

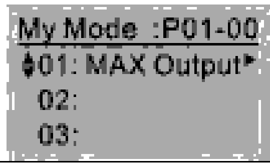


3. To delete a parameter, go to My Mode and select a parameter which you need to delete.
   Press ENTER to enter the parameter setting screen. There is a DEL on the bottom left-hand corner of the screen. Press F4 on the keypad to delete this parameter from My Mode.





4. After pressing ENTER to delete <01 Control Mode>, the <02 Maximum Operating Frequency > will automatically replace <01 Control Mode>.



8. Display setup

Press  to setting menu.

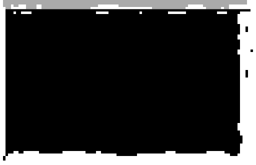
1. Contrast

Use Up/Down key to adjust the setting value.

After selecting a setting value. Press ENTER to see screen's display after contrast is adjusted to be +10.

When the setting value is 0 Min, the back light will be steady on.

Then press ENTER.



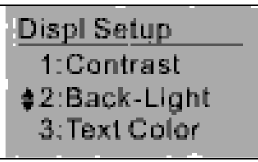
After select a setting value Press ENTER to see screen's display result after contrast is adjusted to be -10.

2. Back-light

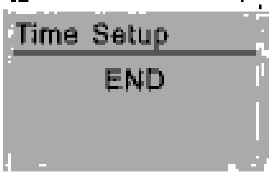
Press ENTER to go to Back Light Time Setting screnn.

Use Up/Down key to adjust the setting value.

When the setting value is 0 Min, the back light will be steady on.

		When the setting value is 10 Min, the backlight will be off in 10 minutes.

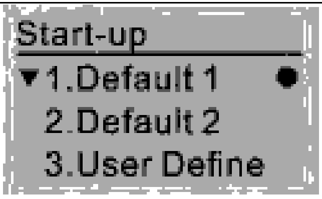
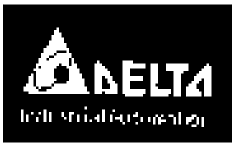
9. Time setting

 Use Left/Right key to select Year, Month, Day, Hour, Minute or Second to set up		Use Up/Down key to set up Year
		Use Up/Down key to set up Month
		Use Up/Down key to set up day
		Use Up/Down key to set up hour
		Use Up/Down key to set up Minute
		Use Up/Down key to set up Second
		After setting up, press ENTER to confirm the setup.
	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.	

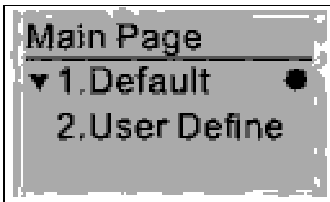
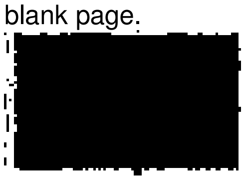
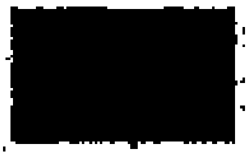
10. Language setup

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

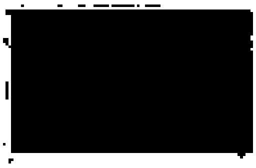
11. Startup-up

	1. Default 1 DELTA LOGO  2. Default 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> Go to Delta’s website to download TPEditor V1.40 or later versions. <u>http://www.delta.com.tw/product/em/download/download_main.asp?act=3&pid=3&cid=3&tpid=3</u>

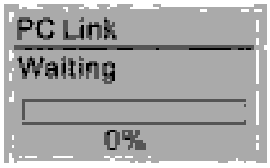
12. Main page

 Default picture and editable picture are available upon selection. Press ENTER to select.	1. Default page  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> Go to Delta’s website to download TPEditor V1.40 or later versions. <u>http://www.delta.com.tw/product/em/download/download_main.asp?act=3&pid=3&cid=3&tpid=3</u>

13. PC Link



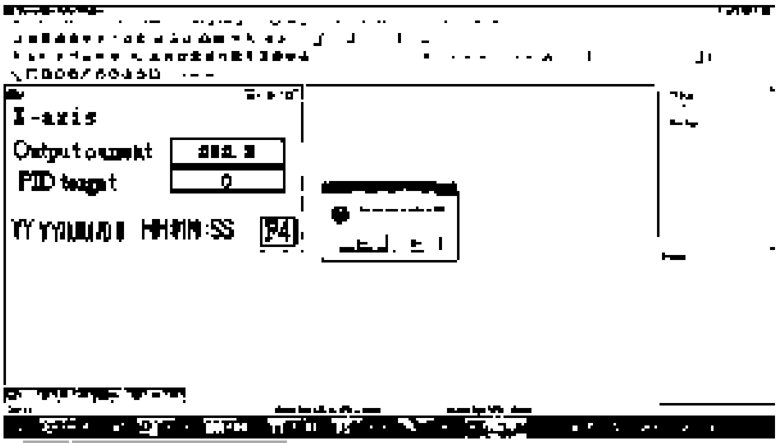
1. TPEditor: This function allows users to connect the keypad to a computer then to download and edit user defined pages.

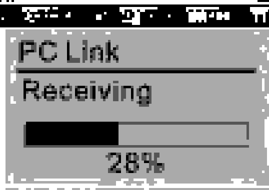


Click ENTER to go to <Waiting to connect to PC>

In TPEditor, choose <Communication>, then choose "Write to HMI"

Choose <YES> in the <Confirm to Write> dialogue box.





Start downloading pages to edit KPC-CC01.

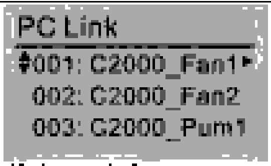
Download completed

2. VFDSoft: this function allows user to link to the VFDSoft Operating software then to upload data

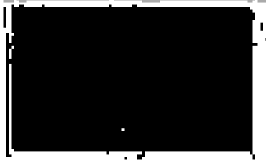
Copy parameter 1~4 in KPC-CC01

Connect KPC-CCO1 to a computer

Start downloading pages to edit to KPC-CC01

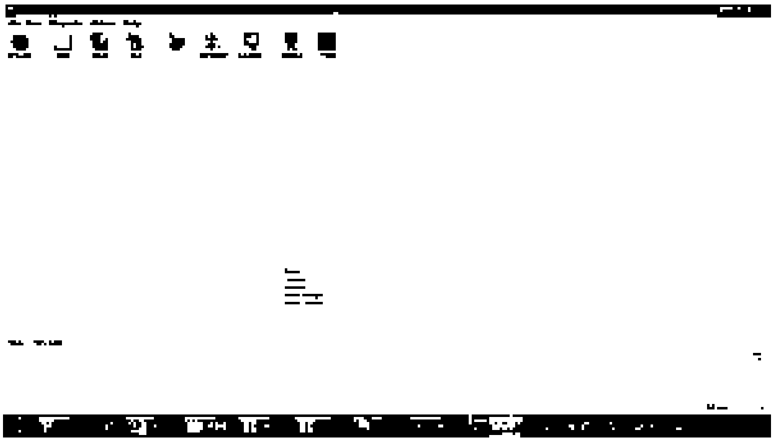


Use Up/Down key to select a parameter group to upload to VFDSoft.
Press ENTER

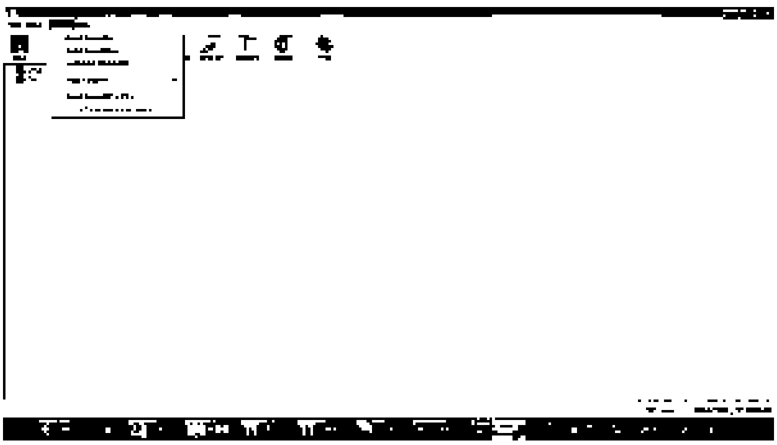


Waiting to connect to PC

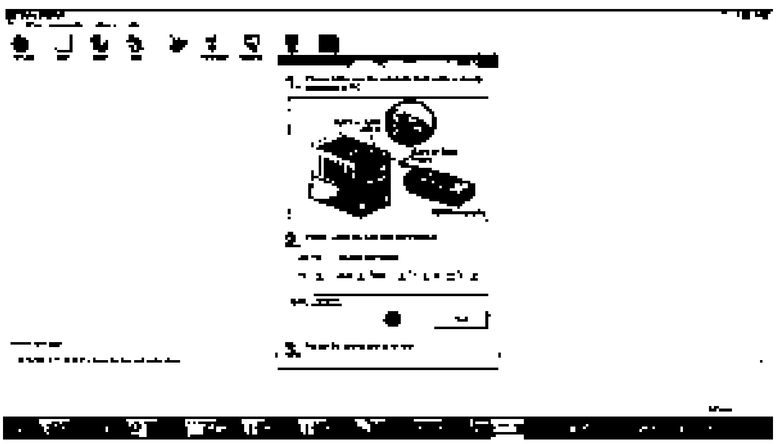
Open VFDSoft, choose <Parameter Manager function>

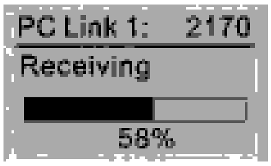
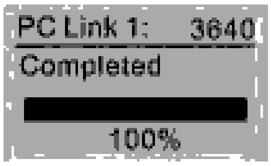


In Parameter Manager, choose <Load parameter table from KPC-CC01>



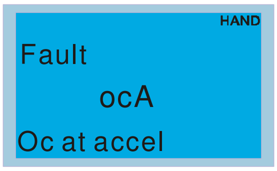
Choose the right communication port and click OK

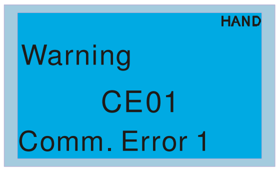


	 Start to upload parameters to VFDSoft  Uploading parameter is completed Before using the user defined starting screen and user defined main screen, the starting screen setup and the main screen setup have to be preset as user defined. If the user defined page are not downloaded to KPC-CC01, the starting screen and the main screen will be blank.

Other display

When fault occur, the menu will display:





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

Optional accessory: RJ45 Extension Lead for Digital Keypad

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

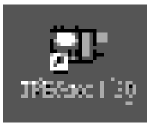
Note: When you need to buy communication cables, buy non-shielded , 24 AWG, 4 twisted pair, 100 ohms communication cables.

10-3 TPEditor Installation Instruction

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

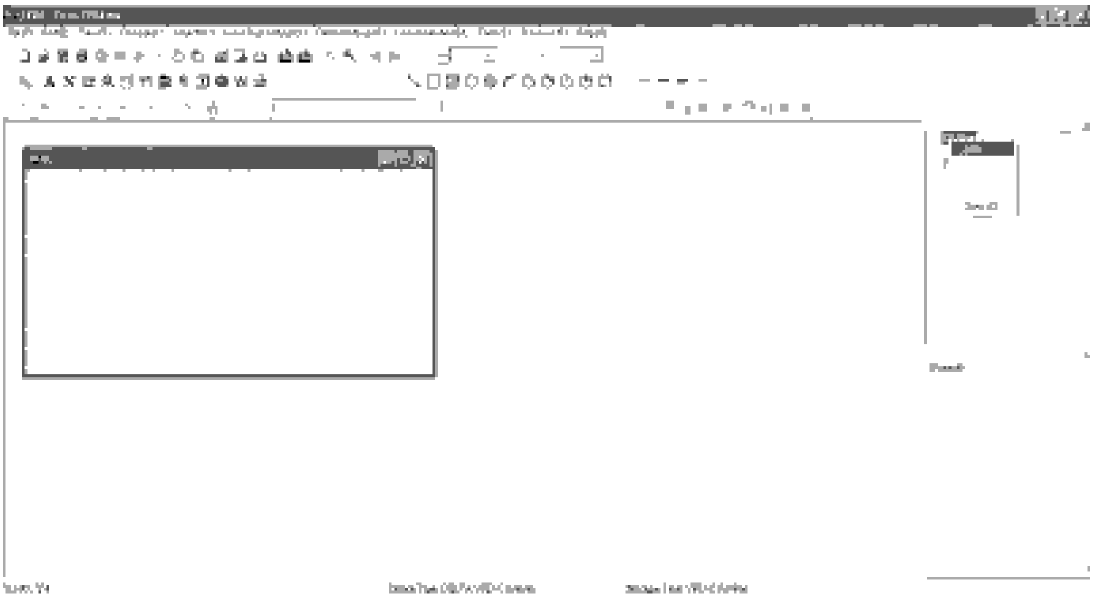
1) TPEditor: Setup & Basic Functions

1. Run TPEditor V1.40 or later versions.



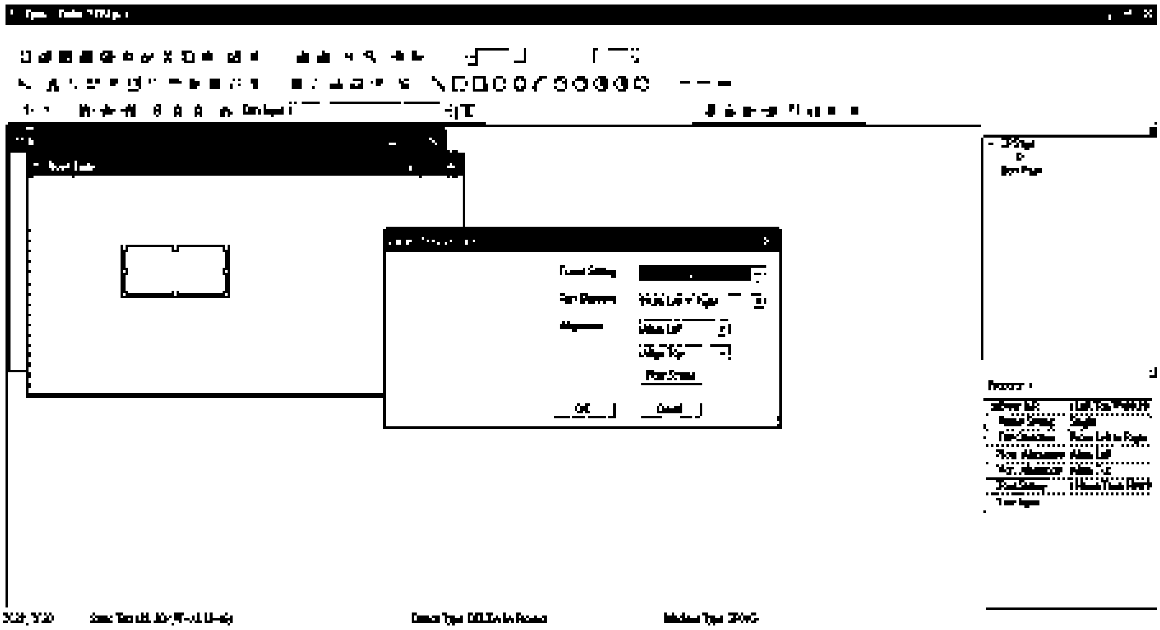
2. Go to File(F)→Click on New. The Window below will pop up. At the device type, click on the drop down menu and choose DELTA VFD-C Inverter. At the TP type, click on the drop down menu and choose VFD-C KeyPad. As for File Name, enter TPE0. Now click on OK.

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.

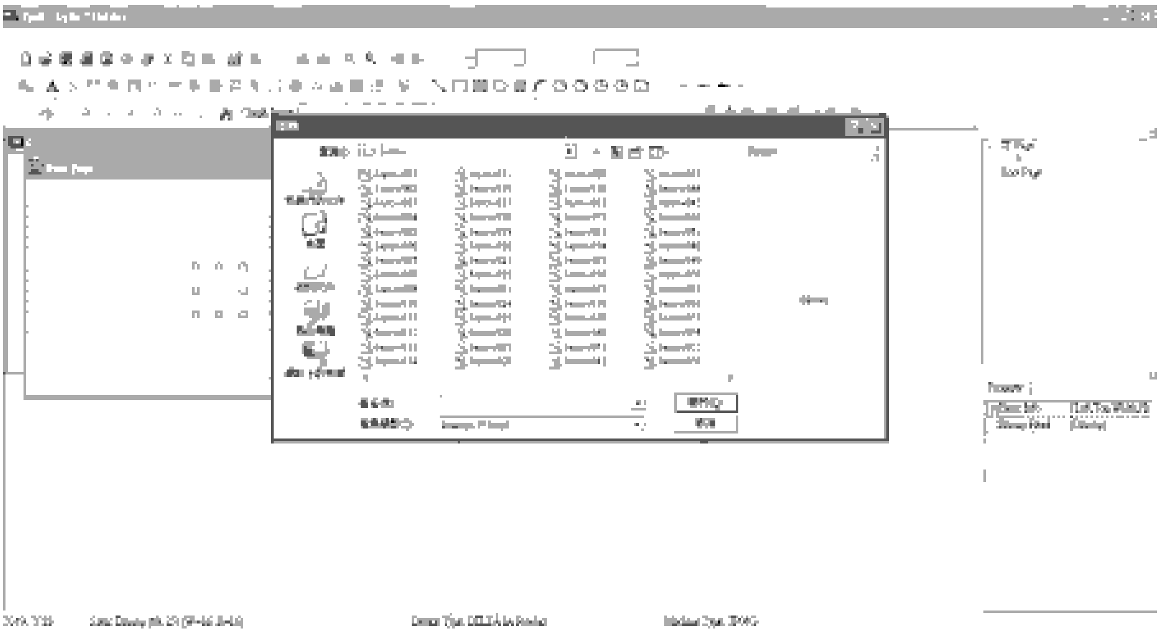


4. Edit Startup Page

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



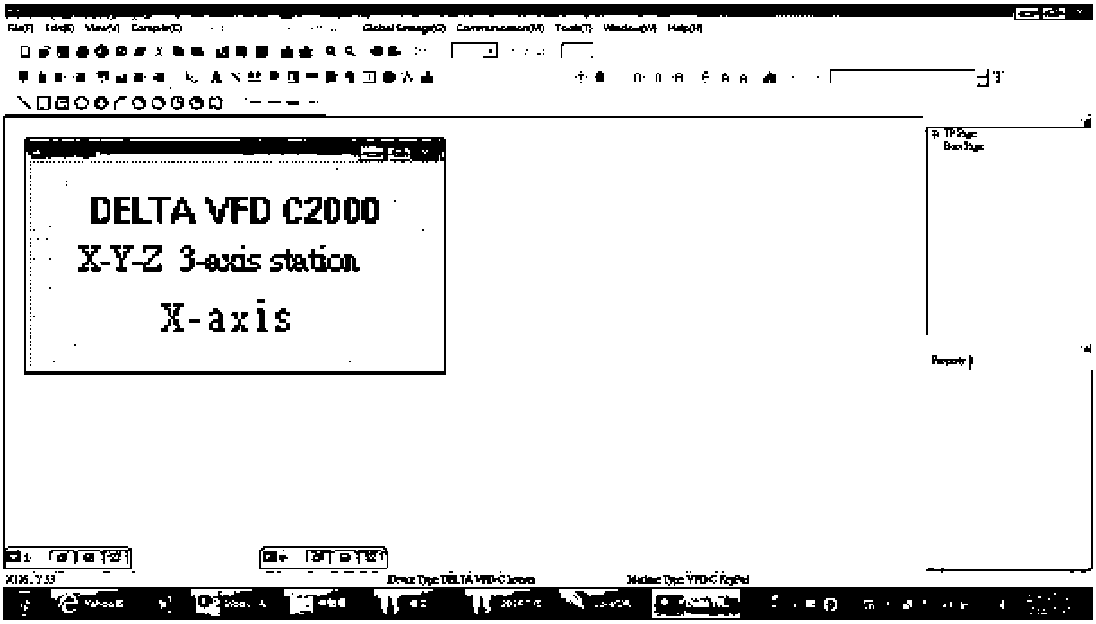
6. Static Bitmap →Open a blank page, then click once on this button and then double click on that blank page. The following window will pop up.



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.

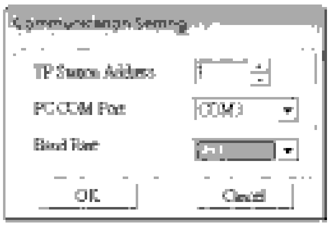
7. Geometric Bitmap  → As shown in the picture on the left side, there are 11 kinds of geometric bitmap to choose. Open a new blank page then click once on a geometric bitmap icon that you need. Then drag that icon and enlarge it to the size that you need on that blank page.

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

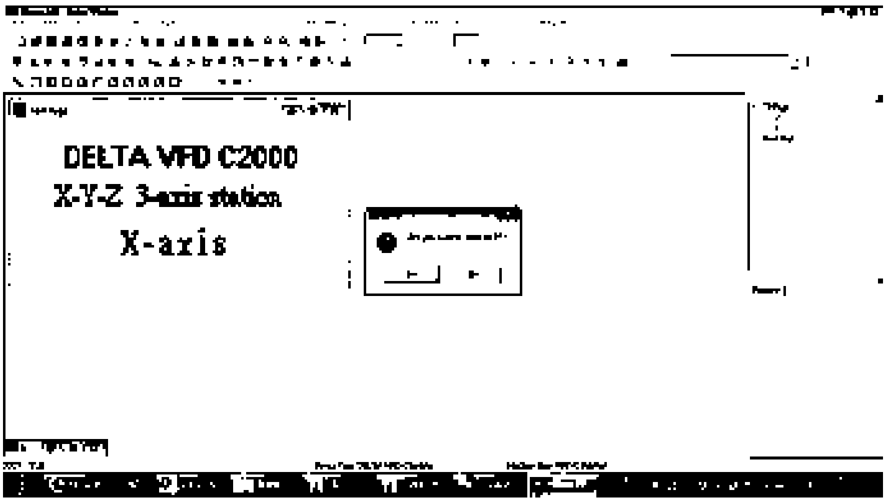


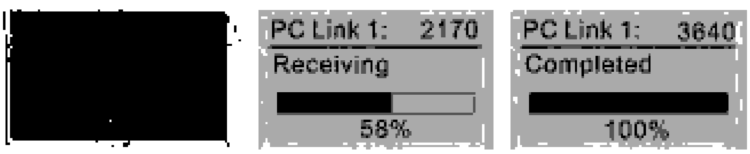
9. Downloading setting: Go to Tool > Communication. Set up communication port and speed of IFD6530.

10. Only three speed selections are available: 9600 bps, 19200 bps and 38400 bps.



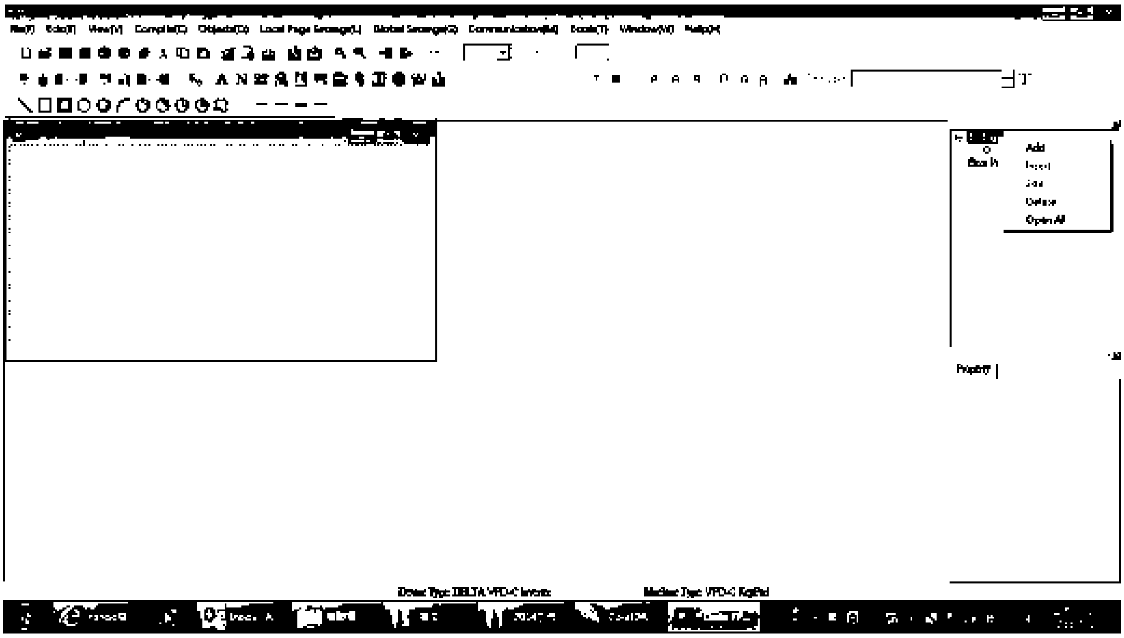
11. When a dialogue box displayed on the screen asking to confirm writing or not, press buttons on the keypad to go to MENU, select PC LINK and then press ENTER and wait for few seconds. Then select YES on the screen to start downloading.



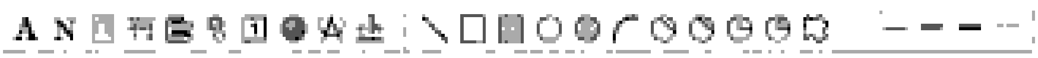


2) Edit Main Page & Example of Download

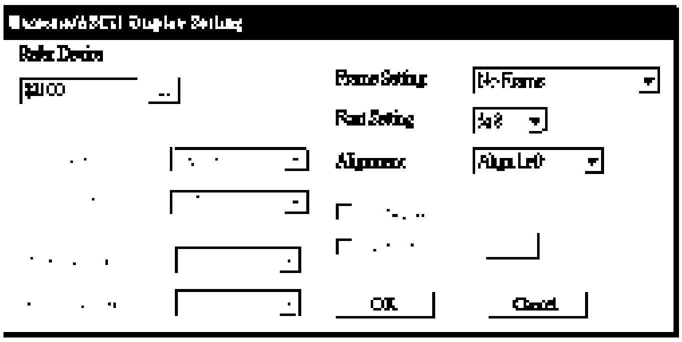
1. Go to editing page, select EditàAdd one page or press the button ADD on the right hand side of the HMI page to increase number of pages to edit. This keypad currently support up to 256 pages.



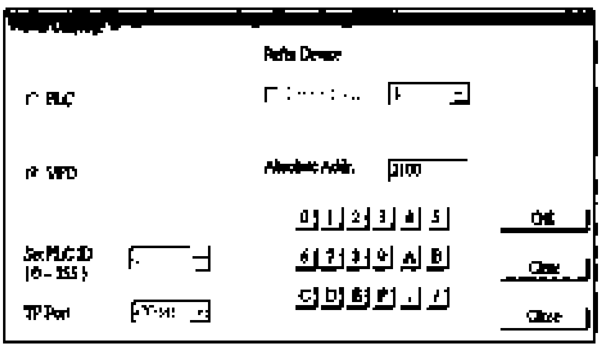
2. On the bottom right-hand corner of the HMI, click on a page number to edit or go to VIEW >HMI page to start editing main page. As shown in the image, the following objects are available. From left to right: Static Text, ASCII Display, Static Bitmap, Scale, Bar Graph, Button, Clock Display, Multi-state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



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

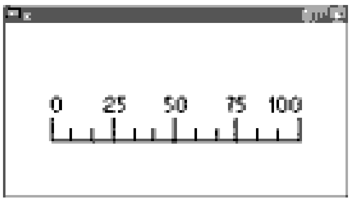


Related Device: Choose the VFD Communication Port that you need, if you want to read output frequency (H), set the VFD Communication Port to $2202. For other values, please refer to ACMD ModBus Comm Address List.

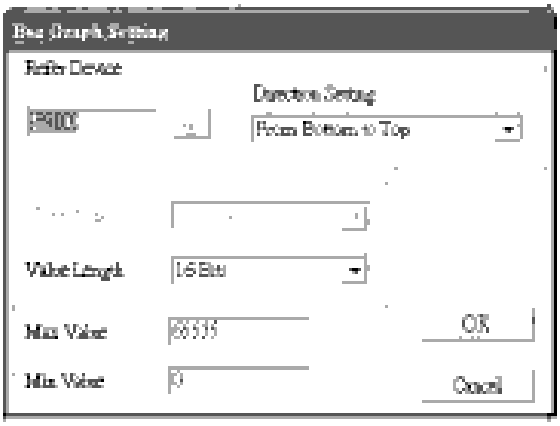


4. Scale Setting  : On the Tool Bar, click on this  for Scale Setting. You can also edit Scale Setting in the Property Window on the right hand side of your computer screen.

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



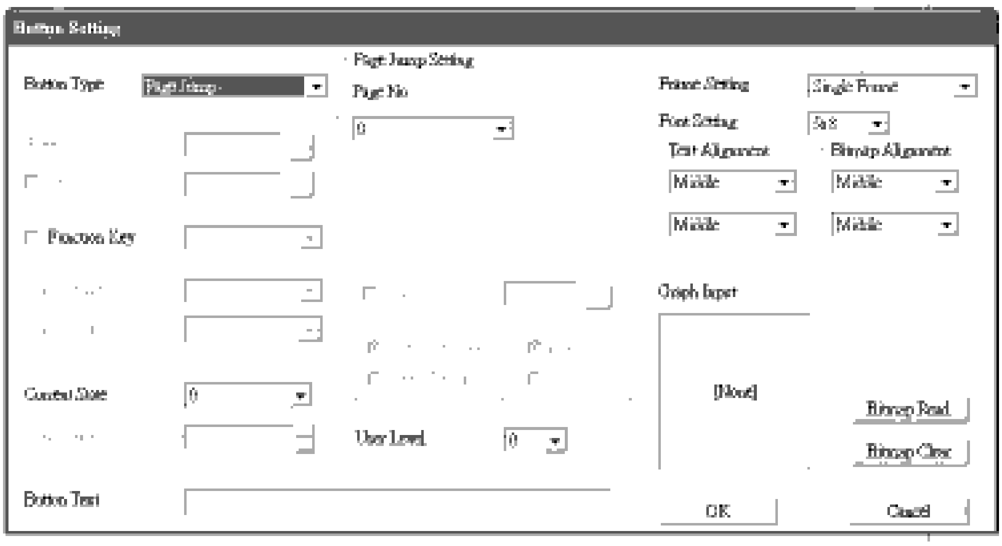
5. Bar Graph setting  :



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

6. Button  : 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.



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

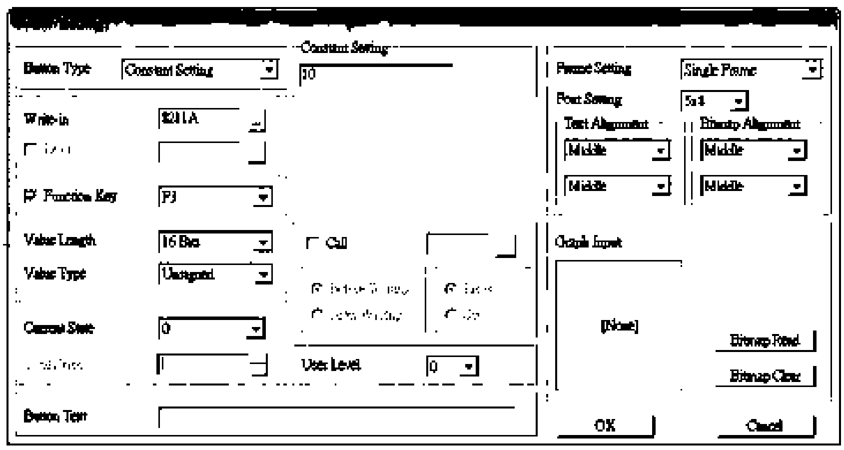
A [Page Jump] function setting

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

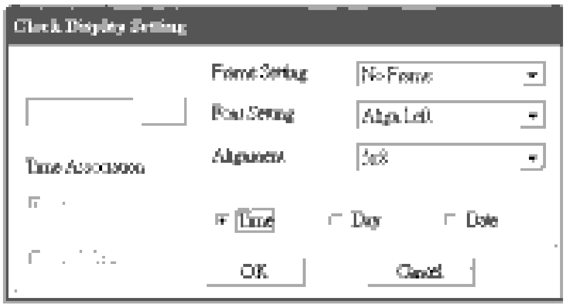
- Button Text: This function allows user to name buttons. For example, key in <Next Page> in the empty space, a button will have the wording <Next Page> displayed on it.

B [Constant setting] function

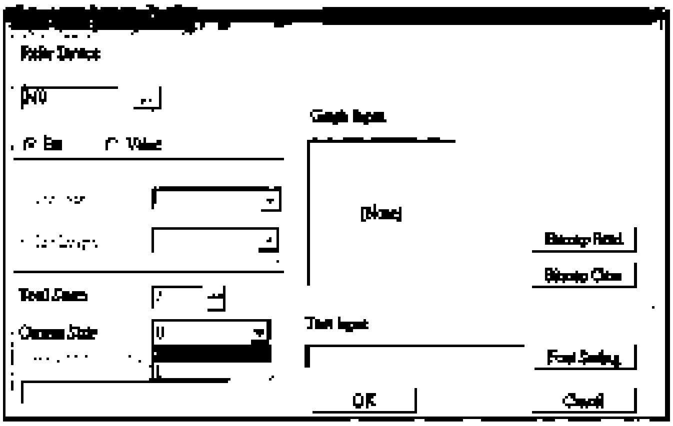
This function is to set up the memory address' value of the VFD or PLC. When pressing the <function button> set up in before, a value will be written to the memory address of the <Constant Setting>. This function can be used as initializing a variable.



7. Clock Display Setting : The setup window of the Clock Display is shown as the image below. Time, Day or Date can be displayed on the keypad.
   Open a new file and click once in that window, you will see the following
   In the clock display setting, you can choose to display Time, Day or Date on the Keypad. To adjust time, go to #9 on the Keypad's menu. You can also adjust Frame Setting, Font Setting and Alignment.



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



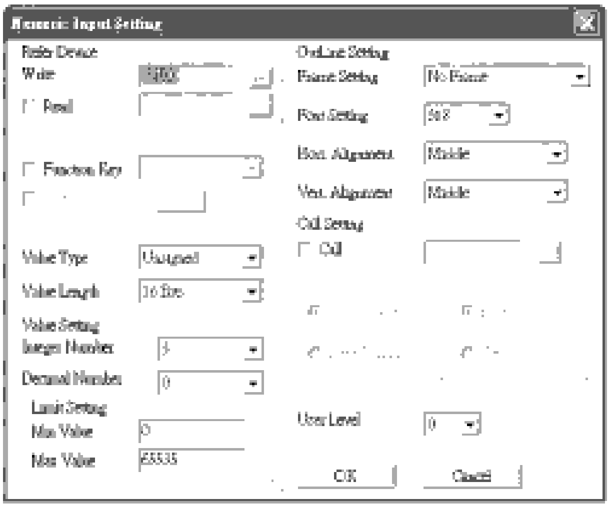
9. Unit Measurement : Click once on this Button:
   Open a new file and double click on that window, you will see the following

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.

10. Numeric Input Setting :

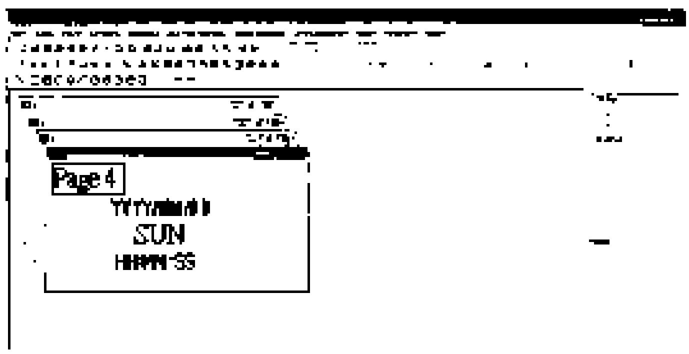
This menu allows you to provide parameters or communication ports and to input numbers.

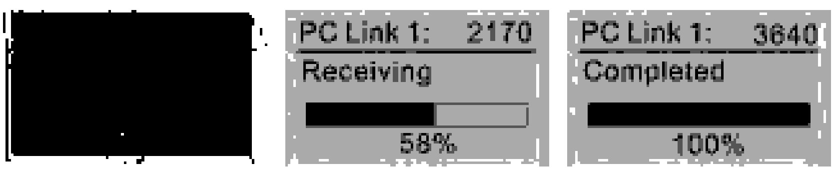
Click once on this button .
Open a new file and double click on that window, you will see the following:



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

11. Download TP Page : Press Up or Down key on the keypad until you reach #13 PC Link.
Then press Enter on the keypad and you will see the word “Waiting” on keypad’s screen. Now choose a page that you have created then go to Communication (M)→Write to TP(W) to start downloading the page to the keypad
When you see the word Completed on the keypad’s screen, that means the download is done.
Then you can press ESC on the keypad to go back to the menu of the keypad.





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

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

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

Warning Code

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

File Copy Setting Fault Description

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

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

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

Chapter 11 Summary of Parameters

This chapter provides summary of parameter settings for users 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 *Chapter 12 Description of Parameter Settings*.

00 Drive Parameters

Parameter	Function	Setting	Factory Setting
00-00	ID Code of the AC Motor Drive	4: 230V, 1HP (0.75kW) 5: 460 V, 1HP (0.75kW) 6: 230V, 2HP (1.5kW) 7: 460 V, 2HP (1.5kW) 8: 230V, 3HP (2.2kW) 9: 460 V, 3HP (2.2kW) 10: 230V, 5HP (3.7kW) 11: 460 V, 5HP (3.7kW) 12: 230V, 7.5HP (5.5kW) 13: 460 V, 7.5HP (5.5kW) 14: 230V, 10HP (7.5kW) 15: 460V, 10HP (7.5kW) 16: 230V, 15HP (11kW) 17: 460V, 15HP (11kW) 18: 230V, 20HP (15kW) 19: 460V, 20HP (15kW) 20: 230V, 25HP (18.5kW) 21: 460V, 25HP (18.5kW) 22: 230V, 30HP (22kW) 23: 460V, 30HP (22kW) 24: 230V, 40HP (30kW) 25: 460V, 40HP (30kW) 26: 230V, 50HP (37kW) 27: 460V, 50HP (37kW) 28: 230V, 60HP (45kW) 29: 460V, 60HP (45kW) 30: 230V, 75HP (55kW) 31: 460V, 75HP (55kW) 32: 230V, 100HP (75kW) 33: 460V, 100HP (75kW) 34: 230V, 125HP(90kW) 35: 460V, 125HP (90kW) 37: 460V, 150HP (110kW) 39: 460V, 175HP(132kW) 41: 460V, 215HP(160kW)	Read only

Parameter	Function	Setting	Factory Setting
		43: 460V, 250HP(185kW) 45: 460V, 300HP(220kW) 47: 460V, 375HP(280kW) 49: 460V, 425HP(315kW) 51: 460V, 475HP(355kW) 53: 460V, 536HP(400kW) 90: 230V, 4HP (3.0kW) 91: 460V, 4HP (3.0kW) 93: 460V, 5.5HP (4.0kW)	
00-01	Display AC Motor Drive Rated Current	Display by models	Read only
00-02	Parameter Reset	0: No function 1: Read only 2: Reserved 3: Reserved 4: Reserved 5: Reset KWH display to 0 6: Reset PLC (including CANopen Master Index) 7: Reset CANopen Index (Slave) 8: Reserved 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	Multi-function Display (User Defined)	0: Display output current (A) 1: Display counter value (c) 2: Display actual output frequency (H.) 3: Display DC-BUS voltage (u) 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: Reserved 9: Reserved 10: Display PID feedback in % (b) 11: Display AVI1 in % (1.) 12: Display ACI in % (2.) 13: Display AVI2 in % (3.) 14: Display the temperature of IGBT in °C (i.) 15: Display the temperature of heat sink in °C (c.) 16: The status of digital input (ON/OFF) (i) 17: The status of digital output (ON/OFF) (o)	3

	Parameter	Function	Setting	Factory Setting
			18: Multi-step speed (S) 19: The corresponding CPU pin status of digital input (d.) 20: The corresponding CPU pin status of digital output (O.) 21: Reserved 22: Reserved 23: Reserved 24: Reserved 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: Reserved 30: Display output of user defined (U) 31: H page x Pr.00-05 Display user Gain (K) 32: Reserved 33: Reserved 34: Operation speed of fan (%) (F.) 35: Reserved 36: Present operating carrier frequency of drive (Hz) (J.) 37: Reserved 38: Display drive's status (6.) 39: Reserved 40: Reserved 41: KWH display (Unit: KWH) (J) 42: PID Reference (Unit: %) (L.) 43: PID offset (Unit: %) (o.) 44: PID Output frequency, unit: Hz (b.) 45: Hardware ID (0)	
✍	00-05	Coefficient Gain in Actual Output Frequency	0.00~160.00	1.00
	00-06	Software version	Read only	#.##
✍	00-07	Parameter Protection Password Input	0~65535 0~4: The times of password attempts	0
✍	00-08	Parameter Protection Password Setting	0~65535 0: No password protection / password is entered correctly (Pr. 00-07) 1: Parameter is locked	0
	00-09 ~ 00-10	Reserved		

<table>
<tr><th>Parameter</th><th>Function</th><th colspan="3">Setting</th><th>Factory Setting</th></tr>
<tr><td>00-11</td><td>Velocity Control Mode</td><td colspan="3">0: VF (V/F control)
1: Reserved
2: SVC (Sensor-Less Vector Control)
3: Reserved
4: Reserved
5: Reserved
6: Reserved
7: Reserved</td><td>0</td></tr>
<tr><td>00-12
~
00-15</td><td colspan="5">Reserved</td></tr>
<tr><td>00-16</td><td>Loading mode selection</td><td colspan="3">0: Light duty
1: Normal duty</td><td>0</td></tr>
<tr><td rowspan="12">00-17</td><td rowspan="12">Carrier Frequency</td><td rowspan="4">2~15kHz</td><td rowspan="2">230V</td><td>LD: 1~20 HP</td><td rowspan="4">8</td></tr>
<tr><td>ND: 0.5~15 HP</td></tr>
<tr><td rowspan="2">460V</td><td>LD: 1~25 HP</td></tr>
<tr><td>ND: 0.5~20 HP</td></tr>
<tr><td rowspan="4">2~10kHz</td><td rowspan="2">230V</td><td>LD: 25~60 HP</td><td rowspan="4">6</td></tr>
<tr><td>ND: 20~50 HP</td></tr>
<tr><td rowspan="2">460V</td><td>LD: 30~100 HP</td></tr>
<tr><td>ND: 25~75 HP</td></tr>
<tr><td rowspan="4">2~9kHz</td><td rowspan="2">230V</td><td>LD: 75~125 HP</td><td rowspan="4">4</td></tr>
<tr><td>ND: 60~100 HP</td></tr>
<tr><td rowspan="2">460V</td><td>LD: 125~536 HP</td></tr>
<tr><td>ND: 100~475 HP</td></tr>
<tr><td>00-18</td><td colspan="5">Reserved</td></tr>
<tr><td>00-19</td><td>PLC command mask (SOOC, SOOF, SOTC, SOPC)</td><td colspan="3">bit 0: Control command is forcely controlled by PLC.
bit 1: Frequency command is forcely controlled by PLC.
bit 2: Reserved
bit 3: Reserved</td><td>0</td></tr>
<tr><td>00-20</td><td>Source of the MASTER Frequency Command (AUTO)</td><td colspan="3">0: Digital keypad
1: RS485 serial communication
2: External analog input (Pr. 03-00)
3: External UP/DOWN terminal
4: Reserved
5: Reserved
6: CANopen communication card
7: Reserved
8: Communication card (no CANopen card)</td><td>0</td></tr>
</table>

Parameter	Function	Setting	Factory Setting
00-21	Source of the Operation Command (AUTO)	0: Digital keypad 1: External analog input, keypad “STOP” is disabled. 2: RS485 serial communication, keypad “STOP” is disabled. 3: External UP/DOWN terminal 4: Reserved 5: Communication card (no CANopen card)	0
00-22	Stop method	0: Ramp to stop 1: Coast to stop	0
00-23	Motor Operating Direction Control	0: Enable forward/reverse 1: Reverse disable 2: Forward disable	0
00-24	Memory of Communication Frequency Command	Read only	Read only
00-25	User Defined Property	bit 0~3: User defined on decimal places 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 004xH: m/s 005xH: kW 006xH: HP 007xH: ppm 008xH: 1/m 009xH: kg/s 00AxH: kg/m 00BxH: kg/h 00CxH: lb/s 00DxH: lb/m 00ExH: lb/h 00FxH: ft/s 010xH: ft/m 011xH: M 012xH: ft 013xH: degC 014xH: degF 015xH: mbar 016xH: bar 017xH: Pa 018xH: kPa 019xH: mWG	0

Parameter	Function	Setting	Factory Setting
		01AxH: inWG 01BxH: ftWG 01CxH: Psi 01DxH: Atm 01ExH: L/s 01FxH: L/m 020xH: L/h 021xH: m3/s 022xH: m3/h 023xH: GPM 024xH: CFM	
00-26	Max. User Defined Value	Pr. 00-25 bit 0~3=0001B: No function: 0.0 Setting: 0.1~6553.5 Pr. 00-25 bit 0~3=0010B: No function: 0.00 Setting: 0.01~655.35 Pr. 00-25 bit 0~3=0011B: No function: 0.000 Setting: 0.001~65.535	0
00-27	User Defined Value	Read only	Read only
✎ 00-28	Switching from Auto mode to Hand mode	bit 0: Sleep function control bit 0: Cancel sleep function 1: Sleep function follows the setting of Auto mode. bit 1: Display of unit control bit 0: Change the unit to be Hz 1: Display of unit follows the setting of Auto mode. bit 2: PID control bit 0: Cancel PID control 1: PID control follows the setting of Auto mode. bit 3: Source of frequency control bit 0: The source of frequency is set by parameters. If the multi-step speed setting is activated then multi-step speed has the priority. 1: The source of frequency is set by Pr. 00-30, no matter the multi-step speed setting is activated or not.	0
00-29	Local / Remote Selection	0: Standard HOA function. 1: When switching between Local/Remote, if the drive is running, the drive will stop. If the drive is already stopped, it still remains stopped.	0

Parameter	Function	Setting	Factory Setting
		2: The drive still follows the setting at Remote while switching to Local. For example, if the setting at Remote is "running", the drive keeps on "running" even after the drive is switched from Remote to Local. Unless a "stop" command is given, then the drive will be stopped under LOCAL mode. 3: The drive still follows the setting at Local while switching to Remote. For example, if the setting at L is "stopping', the drive keeps "stopping" even after the drive is at Remote mode.Unless a "running" command is given, then the drive will start to run under Remote mode. 4: The drive remembers the both settings at Local and Remote. When switch to Remote, the drive follows right away the setting at Remote. When switch to Local, the drive follows instantly the setting at Local.	
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: Reserved 5: Reserved 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 is disabled. 2: RS-485 serial communication. Keypad STOP disabled. 3: CANopen communication card 4: Reserved 5: Communication card (no CANopen card)	0
00-32	Digital Keypad STOP Function	0: STOP key is disabled 1: STOP key is enabled	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

Parameter	Function	Setting	Factory Setting
00-50	Software Version (date)	Read only	Read only
00-51 ~ 00-61	Reserved		

01 Basic Parameters

	Parameter	Explanation	Settings	Factory Setting
	01-00	Max. Operating Frequency (Hz)	50.00~600.00Hz 45KW (60HP) and above: 0.00~400.00Hz	60.00/ 50.00
	01-01	Motor1: Max Output Frequency (Hz)	0.00~600.00Hz	60.00/ 50.00
	01-02	Motor1: Max Output Voltage (V)	230V models: 0.0V~255.0V 460V models: 0.0V~510.0V	220.0 400.0
	01-03	Mid-point Frequency 1 of Motor 1	0.00~600.00Hz	1.50/ 3.00
⚡	01-04	Mid-point Voltage 1 of Motor 1	230V: 0.0V~240.0V 460V: 0.0V~480.0V	10.0/ 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	0.00
⚡	01-12	Accel. Time 1	Pr. 01-45=0: 0.00~600.00 sec. Pr. 01-45=1: 0.00~6000.0 sec.	10.00/ 10.0
⚡	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		
⚡	01-22	JOG Frequency	0.00~600.00Hz	6.00
⚡	01-23	Frequency of 1st Acceleration/Deceleration & Frequency of 4th Acceleration/Deceleration	0.00~600.00Hz	0.00
⚡	01-24	S-curve for Acceleration Departure Time 1	Pr.01-45=0: 0.00~25.00 sec. Pr.01-45=1: 0.0~250.0 sec.	0.20/ 0.2
⚡	01-25	S-curve for Acceleration Arrival Time 2		

Parameter	Explanation	Settings	Factory Setting
01-26	S-curve for Deceleration Departure Time 1	Pr.01-45=0: 0.00~25.00 sec. Pr.01-45=1: 0.0~250.0 sec.	0.20/ 0.2
01-27	S-curve for Deceleration Arrival Time 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: Output at Minimum Frequency (according to Pr. 01-07, 01-41)	0
01-35	Motor 2: Max Output Frequency (Hz)	0.00~600.00Hz	60.00/ 50.00
01-36	Motor 2: Max Output Voltage (V)	230V models: 0.0V~255.0V 460V models: 0.0V~510.0V	200.0 400.0
01-37	Mid-point Frequency 1 of Motor 2	0.00~600.00Hz	1.50/ 3.00
01-38	Mid-point Voltage 1 of Motor 2	230V models: 0.0V~240.0V 460V models: 0.0V~480.0V	10.0/ 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 models: 0.0V~240.0V 460V models: 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 models: 0.0V~240.0V 460V models: 0.0V~480.0V	0.0/ 0.0
01-43	V/f Curve Selection	0: V/F curve determined by group 01 1: V/F curve to the 1.5 power 2: V/F curve to the 2 power 3: 60Hz, voltage is saturated when it's 50Hz 4: 72Hz, voltage is saturated when it's 60Hz 5: 50Hz, decrease gradually with third power 6: 50Hz, decrease gradually with square 7: 60Hz, decrease gradually with third power 8: 60Hz, decrease gradually with square	0

Parameter	Explanation	Settings	Factory Setting
		9: 50Hz, medium starting torque 10: 50Hz, large staring torque 11: 60Hz, medium startin torque 12: 60Hz, large starting torque 13: 90Hz, voltage is saturated when it's 60Hz 14: 120Hz, voltage is saturated when it's 60Hz 15: 180Hz, voltage is saturated when it's 60Hz	
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. (Limited by Pr. 01-12 to 01-21)	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/ 1.0
01-47	Reserved		
01-48	Reserved		
01-49	Deceleration Method	0: Normal decel. 1: Over fluxing decel. 2: Traction energy control	0

02 Digital Input/Output Parameters

Parameter	Explanation	Settings	Factory Setting
02-00	2-wire/3-wire Operation Control	0: 2-wire mode 1, power on for operation control 1: 2-wire mode 2, power on for operation control 2: 3-wire, power on for operation control	0
02-01	Multi-function Input Command 1 (MI1)	0: No function 1: Multi-step speed command 1 2: Multi-step speed command 2 3: Multi-step speed command 3 4: Multi-step speed command 4 5: Reset 6: JOG command (By KPC-CC01 or external control) 7: Acceleration/deceleration speed inhibit 8: The 1^{st}, 2^{nd} acceleration/deceleration time selection 9: The 3^{rd}, 4^{th} 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 optimal accel./ decel. time 14: Switch between motor 1 and motor 2 15: Operation speed command from AVI1 16: Operation speed command from ACI 17: Operation speed command from AVI2 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: Reserved 27: Reserved 28: Emergency stop (EF1) 29: Signal confirmation for Y-connection 30: Signal confirmation for Δ-connection 31: Reserved	1
02-02	Multi-function Input Command 2 (MI2)		2
02-03	Multi-function Input Command 3 (MI3)		3
02-04	Multi-function Input Command 4 (MI4)		4
02-05	Multi-function Input Command 5 (MI5)		0
02-06	Multi-function Input Command 6 (MI6)		0
02-07	Multi-function Input Command 7 (MI7)		0

Parameter	Explanation	Settings	Factory Setting
02-08	Multi-function Input Command 8 (MI8)	32: Reserved 33: Reserved 34: Reserved 35: Reserved 36: Reserved 37: Reserved 38: Disable EEPROM write function 39: Reserved 40: Force coast to stop 41: HAND switch 42: AUTO switch 43: Reserved 44: Reserved 45: Reserved 46: Reserved 47: Reserved 48: Reserved 49: Drive enable 50: Reserved 51: Selection for PLC mode bit 0 52: Selection for PLC mode bit 1 53: Trigger CANopen quick stop 54: UVW Magnetic Contactor On/Off 55: Brake Released Signal 56: LOC/REM Selection 57: Reserved 58: Enable fire mode (with RUN Command) 59: Enable fire mode (without RUN Command) 60: All motors disabled 61: Motor #1 disabled 62: Motor #2 disabled 63: Motor #3 disabled 64: Motor #4 disabled 65: Motor #5 disabled 66: Motor #6 disabled 67: Motor #7 disabled 68: Motor #8 disabled	0
02-26	Input terminal of I/O extension card (MI10)		0
02-27	Input terminal of I/O extension card (MI11)		0
02-28	Input terminal of I/O extension card (MI12)		0
02-29	Input terminal of I/O extension card (MI13)		0
02-30	Input terminal of I/O extension card (MI14)		0
02-31	Input terminal of I/O extension card (MI15)		0
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	0.001~1.000 Hz/ms	0.001
02-11	Multi-function Input Response Time	0.000~30.000 sec.	0.005
02-12	Dgital Input Operation Setting	0000h ~ FFFFh (0: N.O.; 1: N.C.)	0000h

Parameter	Explanation	Settings	Factory Setting
02-13	RLY1: Multi Output Terminal	0: No function 1: Operation Indication 2: Operation speed attained 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, does not return to 0 (Pr. 02-20) 18: Preliminary count value attained, returns to 0 (Pr. 02-19) 19: External Base Block input (B.B.) 20: Warning output 21: Over voltage warning 22: Over-current stall prevention warning 23: Over-voltage stall prevention warning 24: Operation mode indication 25: Forward command 26: Reverse command 27: Output when current ≧ Pr. 02-33 28: Output when current <Pr. 02-33 29: Output when frequency ≧ Pr. 02-34 30: Output when frequency < Pr.02-34 31: Y-connection for the motor coil 32: ∆-connection for the motor coil 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: Reserved 40: Speed attained (including Stop) 41: Reserved	11
02-14	RLY2: Multi Output Terminal		1
02-15	RLY3: Multi Output Terminal		66
02-36	Expansion Card Output Terminal (MO10)		0
02-37	Expansion Card Output Terminal (MO11)		0
02-38	Expansion Card Output Terminal (MO12)		0
02-39	Output terminal of the I/O extension card (MO13)		0
02-40	Output terminal of the I/O extension card (MO14)		0
02-41	Output terminal of the I/O extension card (MO15)		0

<table>
<tr><th>Parameter</th><th>Explanation</th><th>Settings</th><th>Factory Setting</th></tr>
<tr><td>02-42</td><td>Output terminal of the I/O extension card (MO16)</td><td rowspan="5">42: Reserved
43: Reserved
44: Low current output
45: UVW magnetic contactor enabled
46: Reserved
47: Brake output closed
48: Reserved
49: Reserved
50: Output for CANopen control
51: Output for RS485
52: Output for communication card
53: Fire mode indication
54: Bypass fire mode indication
55: Motor #1 output
56: Motor #2 output
57: Motor #3 output
58: Motor#4 output
59: Motor#5 output
60: Motor #6 output
61: Motor#7 output
62: Motor#8 output
63: Reserved
64: Reserved
65: Reserved
66: SO Logic A output (Pr.02-15)
67: Reserved
68: SO Logic B output (Pr.02-15)</td><td>0</td></tr>
<tr><td>02-43</td><td>Output terminal of the I/O extension card (MO17)</td><td>0</td></tr>
<tr><td>02-44</td><td>Output terminal of the I/O extension card (MO18)</td><td>0</td></tr>
<tr><td>02-45</td><td>Output terminal of the I/O extension card (MO19)</td><td>0</td></tr>
<tr><td>02-46</td><td>Output terminal of the I/O extension card (MO20)</td><td>0</td></tr>
<tr><td>02-16
~
02-17</td><td colspan="3">Reserved</td></tr>
<tr><td>02-18</td><td>Multi output direction</td><td>0000h ~ FFFFh (0: N.O.; 1: N.C.)</td><td>0000h</td></tr>
<tr><td>02-19</td><td>Terminal counting value attained</td><td>0~65500</td><td>0</td></tr>
<tr><td>02-20</td><td>Preliminary counting value attained (not return to 0)</td><td>0~65500</td><td>0</td></tr>
<tr><td>02-21</td><td colspan="3">Reserved</td></tr>
<tr><td>02-22</td><td>Desired Frequency Attained 1</td><td>0.00~600.00Hz</td><td>60.00/
50.00</td></tr>
<tr><td>02-23</td><td>The Width of the Desired Frequency Attained 1</td><td>0.00~600.00Hz</td><td>2.00</td></tr>
<tr><td>02-24</td><td>Desired Frequency Attained 2</td><td>0.00~600.00Hz</td><td>60.00/
50.00</td></tr>
<tr><td>02-25</td><td>The Width of the Desired Frequency Attained 2</td><td>0.00~600.00Hz</td><td>2.00</td></tr>
<tr><td>02-32</td><td>Brake Delay Time</td><td>0.000~65.000 sec.</td><td>0.000</td></tr>
</table>

Parameter	Explanation	Settings	Factory Setting
02-33	Output Current Level Setting for Multi-function External Terminals	0~100%	0
02-34	Output frequency setting for multi-function output terminal	0.00~600.00Hz	0.00
02-35	External Operation Control Selection after Reset and Activate	0: Disabled 1: Drive runs if run command exists after reset or power on.	0
02-47 ~ 02-49	Reserved		
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 Input terminal occupied by PLC	Monitor the status of PLC input terminals	Read only
02-53	Display External Output Terminal occupied by PLC	Monitor the status of PLC output terminals	Read only
02-54	Display the Frequency Command Memory of External Terminal	Read only	Read only
02-55 ~ 02-56	Reserved		

03 Analog Input / Output Parameters

Parameter	Explanation	Settings	Factory Setting
03-00	Analog Input 1 (AVI1)	0: No function 1: Frequency command (torque limit under torque control mode) 2: Reserved 3: Reserved 4: PID target value 5: PID feedback signal 6: PTC thermistor input value 7: Reserved 8: Reserved 9: Reserved 10: Reserved 11: PT100 thermistor input value 12: Reserved 13: PID offset 14: Reserved 15: Reserved 16: Reserved 17: Reserved	1
03-01	Analog Input 2 (ACI)		0
03-02	Analog Input 3 (AVI2)		0
03-03	AVI1 Analog Input Bias	-100.0~100.0%	0
03-04	ACI Analog Input Bias	-100.0~100.0%	0
03-05	AVI2 Analog Input Bias	-100.0~100.0%	0
03-06	Reserved		
03-07	AVI1 Positive/ Negative Bias Mode	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	ACI Positive/ Negative Bias Mode		0
03-09	AVI2 Positive/ Negative Bias Mode		0
03-10	Analog Frequency Command for Reverse Run	0: Negative frequency input is disabled. Forward and reverse motions are controlled by digital keypad or by external terminal. 1: Negative frequency input is enabled. Forward motion when positive frequency, reverse motion when negative frequency. Forward and reverse motions are not controlled by digital keypad or by external terminal.	0
03-11	Analog Input Gain 1 (AVI 1)	-500.0 ~ 500.0 %	100.0
03-12	Analog Input Gain 2 (ACI)	-500.0 ~ 500.0 %	100.0
03-13	Analog Input Gain 1 (AVI 2)	-500.0 ~ 500.0 %	100.0

<table>
<tr><th>Parameter</th><th>Explanation</th><th>Settings</th><th>Factory Setting</th></tr>
<tr><td>03-14</td><td>Analog Input Gain 2 (AVI 2)</td><td>-500.0 ~ 500.0 %</td><td>100.0</td></tr>
<tr><td>03-15</td><td>Analog Input Filter Time (AVI1)</td><td>0.00~20.00 sec.</td><td>0.01</td></tr>
<tr><td>03-16</td><td>Analog Input Filter Time (ACI)</td><td>0.00~20.00 sec.</td><td>0.01</td></tr>
<tr><td>03-17</td><td>Analog Input Filter Time (AVI2)</td><td>0.00~20.00 sec.</td><td>0.01</td></tr>
<tr><td>03-18</td><td>Addition Function of the Analog Input</td><td>0: Disable addition function
(AVI1, ACI, AVI2)
1: Enable addition function</td><td>0</td></tr>
<tr><td>03-19</td><td>Loss of the ACI Signal</td><td>0: Disable
1: Continue operation at the last frequency
2: Decelerate to 0 Hz
3: Stop immediately and display ACE</td><td>0</td></tr>
<tr><td>03-20</td><td>Multi-function Output 1 (AFM1)</td><td rowspan="2">0: Output frequency (Hz)
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: Reserved
9：AVI1 %
10：ACI %
11：AVI2 %
12: Reserved
13: Reserved
14: Reserved
15: Reserved
16: Reserved
17: Reserved
18: Reserved
19: Reserved
20: CANopen analog output
21: RS485 analog output
22: Communication card analog output
23: Constant voltage output</td><td>0</td></tr>
<tr><td>03-23</td><td>Multi-function Output 2（AFM2）</td><td>0</td></tr>
<tr><td>03-21</td><td>Gain for Analog Output 1 (AFM1)</td><td>0~500.0%</td><td>100.0</td></tr>
<tr><td>03-22</td><td>Analog Output 1 Value in REV Direction (AFM1)</td><td>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</td><td>0</td></tr>
<tr><td>03-24</td><td>Gain for Analog Output 2 (AFM2)</td><td>0~500.0%</td><td>100.0</td></tr>
</table>

Parameter	Explanation	Settings	Factory Setting
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	AFM2 Output Offset	-100.00~100.00%	0.00
03-28	AVI1 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 Analog Output Terminal	0000h~FFFFh Monitor the status of PLC output terminals	Read only
03-31	AFM2 0-20mA Output Selection	0: 0-20mA 1: 4-20mA	0
03-32	AFM1 DC Output Setting Level	0.00~100.00%	0.00
03-33	AFM2 DC Output Setting Level	0.00~100.00%	0.00
03-34	AFM1 0~20mA Output Selection	0: 0~20mA 1: 4~20mA	0
03-35	AFM1 Output Filter time	0.00 ~ 20.00 sec.	0.01
03-36	AFM2 Output Filter time	0.00 ~ 20.00 sec.	0.01
03-37 ~ 03-43	Reserved		
03-44	MO by Source of AI Level	0: AVI 1 1: ACI 2: AVI2	0
03-45	AI Upper Level of MO	-100% ~ +100%	50%
03-46	AI Lower Level of MO		10%
03-47 ~ 03-49	Reserved		
03-50	Analog Input Curve Slection	0: Regular curve 1: 3 point curve of AVI1 2: 3 point curve of ACI 3: 3 point curve of AVI1 & ACI 4: 3 point curve of AVI2 5: 3 point curve of AVI1 & AVI2 6: 3 point curve of ACI & AVI2 7: 3 point curve of AVI1 & ACI & AVI2	7
03-51	AVI1 Low Point	03-28=0: 0.00~10.00 (V) 03-28≠0: 0.00~20.00 (mA)	0.00
03-52	AVI1 Low Point Percentage	0.00~100.00%	0.00

Parameter	Explanation	Settings	Factory Setting
03-53	AVI1 Mid Point	03-28=0: 0.00~10.00 (V) 03-28≠0: 0.00~20.00 (mA)	5.00
03-54	AVI1 Mid Point Percentage	0.00~100.00%	50
03-55	AVI1 High Point	03-28=0: 0.00~10.00 (V) 03-28≠0: 0.00~20.00 (mA)	10.00
03-56	AVI1 High Point Percentage	0.00~100.00%	100.00
03-57	ACI Low Point	03-28=0: 0.00~10.00 (V) 03-28≠0: 0.00~20.00 (mA)	4.00
03-58	ACI Low Point Percentage	0.00~100.00%	0.00
03-59	ACI Mid Point	03-28=0: 0.00~10.00 (V) 03-28≠0: 0.00~20.00 (mA)	12.00
03-60	ACI Mid Point Percentage	0.00~100.00%	50.00
03-61	ACI High Point	03-28=0: 0.00~10.00 (V) 03-28≠0: 0.00~20.00 (mA)	20.00
03-62	ACI High Point Percentage	0.00~100.00%	100.00
03-63	AVI2 Low Point Voltage	0.00~10.00V	0.00
03-64	AVI2 Low Point Percentage	0.00~100.00%	0.00
03-65	AVI2 Mid Point Voltage	0.00~10.00V	5.00
03-66	AVI2 Mid Point Percentage	0.00~100.00%	50.00
03-67	AVI2 High Point Voltage	0.00~10.00V	10.00
03-68	AVI2 High Point Percentage	0.00~100.00%	100.00

04 Multi-step Speed Parameters

Parameter	Explanation	Settings	Factory Setting
04-00	1st Step Speed Frequency	0.00~600.00Hz	0.0
04-01	2nd Step Speed Frequency	0.00~600.00Hz	0.0
04-02	3rd Step Speed Frequency	0.00~600.00Hz	0.0
04-03	4th Step Speed Frequency	0.00~600.00Hz	0.0
04-04	5th Step Speed Frequency	0.00~600.00Hz	0.0
04-05	6th Step Speed Frequency	0.00~600.00Hz	0.0
04-06	7th Step Speed Frequency	0.00~600.00Hz	0.0
04-07	8th Step Speed Frequency	0.00~600.00Hz	0.0
04-08	9th Step Speed Frequency	0.00~600.00Hz	0.0
04-09	10th Step Speed Frequency	0.00~600.00Hz	0.0
04-10	11th Step Speed Frequency	0.00~600.00Hz	0.0
04-11	12th Step Speed Frequency	0.00~600.00Hz	0.0
04-12	13th Step Speed Frequency	0.00~600.00Hz	0.0
04-13	14th Step Speed Frequency	0.00~600.00Hz	0.0
04-14	15th Step Speed Frequency	0.00~600.00Hz	0.0
04-15 ~ 04-49	Reserved		
04-50	PLC Buffer 0	0~65535	0
04-51	PLC Buffer 1	0~65535	0
04-52	PLC Buffer 2	0~65535	0
04-53	PLC Buffer 3	0~65535	0
04-54	PLC Buffer 4	0~65535	0
04-55	PLC Buffer 5	0~65535	0
04-56	PLC Buffer 6	0~65535	0
04-57	PLC Buffer 7	0~65535	0
04-58	PLC Buffer 8	0~65535	0
04-59	PLC Buffer 9	0~65535	0
04-60	PLC Buffer 10	0~65535	0
04-61	PLC Buffer 11	0~65535	0
04-62	PLC Buffer 12	0~65535	0
04-63	PLC Buffer 13	0~65535	0
04-64	PLC Buffer 14	0~65535	0
04-65	PLC Buffer 15	0~65535	0
04-66	PLC Buffer 16	0~65535	0
04-67	PLC Buffer 17	0~65535	0
04-68	PLC Buffer 18	0~65535	0
04-69	PLC Buffer 19	0~65535	0

05 Motor Parameters

(IM: Induction Motor; PM: Permanent Magnet Motor)

Parameter	Explanation	Settings	Factory Setting
05-00	Motor Auto Tuning	0: No function 1: Measure IM in dynamic status (motor spinning) (Rs, Rr, Lm, Lx, no-load current) 2: Measure IM in static status (motor not spinning)	0
05-01	Full-Load current of IM 1 (A)	10~120% of the drive's rated current	###.##
05-02	Rated Power of IM 1 (kW)	0~655.35kW	###.##
05-03	Rated Rotational Speed of IM 1 (rpm)	0~65535 1710 (60Hz 4 poles); 1410 (50Hz 4 poles)	1710
05-04	Pole Number of IM 1	2~20	4
05-05	No Load Current of IM1 (A)	0~ Pr. 05-01 of factory setting	###.##
05-06	Stator Resistance (Rs) of IM1	0~65535 mΩ	0.000
05-07	Rotor Resistance (Rr) of IM1	0~65535 mΩ	0.000
05-08	Magnetizing Inductance (Lm) of IM 1	0~65535 mH	0.0
05-09	Stator Inductance (Lx) of IM 1	0~65535 mH	0.0
05-10 ~ 05-12	Reserved		
05-13	Rated Current of Induction Motor 2 (Amps)	0~65535	###.##
05-14	Rated Power of Induction Motor 2 (kW)	0~655.35kW	###.##
05-15	Rated Rotational Speed of Induction Motor 2 (rpm)	0~65535 1710 (60Hz 4poles); 1410 (50Hz 4 poles)	1710
05-16	Pole Number of IM 2	2~20	4
05-17	No-load Current of IM 2 (A)	0~Pr. 05-01 factory setting	###.##
05-18	Stator Resistance (Rs) of IM 2	0.000~65.535 Ω	0.000
05-19	Rotor Resistance (Rr) of IM 2	0.000~65.535 Ω	0.000
05-20	Magnetizing Inductance (Lm) of IM 2	0.0~6553.5 mH	0.0
05-21	Stator Inductance (Lx) of IM 2	0.0~6553.5 mH	0.0
05-22	Induction Motor 1/ Motor 2 Selection	1: Motor 1 2: Motor 2	1

Parameter	Explanation	Settings	Factory Setting
✔ 05-23	Frequency for Y-connection/ Δ-connection Switch of IM	0.00~600.00Hz	60.00
05-24	Y-connection/ Δ-connection Switch of IM	0：Disable 1：Enable	0
✔ 05-25	Delay Time for Y-connection/ Δ-connection Switch of IM	0.000~60.000 sec.	0.200
05-26	Accumulative Watt Per Second of Motor in Low Word (W-sec)	Read only	0.0
05-27	Accumulative Watt Per Second of Motor in High Word (W-sec)	Read only	0.0
05-28	Accumulative Watt-hour of Motor (W-Hour)	Read only	0.0
05-29	Accumulative Watt-hour of Motor in Low Word (kW-Hour)	Read only	0.0
05-30	Accumulative Watt-hour of Motor in High Word (kW-Hour)	Read only	0.0
05-31	Accumulated Motor Operation Time (minutes)	00~1439	0
05-32	Accumulative Motor Operation Time (day)	00~65535	0

06 Protection Parameters

Parameter	Explanation	Settings	Factory setting
06-00	Low Voltage Level	230V: 150.0~220.0Vdc Frame E and above: 190.0~220.0Vdc 460V: 300.0~440.0Vdc Frame E and above: 380.0~440.0Vdc	180.0/ 360.0 Frame E and above: 200.0/ 400.0
06-01	Over-voltage Stall Prevention	230V: 350.0~450.0Vdc 460V: 700.0~900.0Vdc	380.0/ 760.0
06-02	Selection for Over-voltage Stall Prevention	0: Traditional over-voltage stall prevention 1: Smart over-voltage prevention	0
06-03	Over-current Stall Prevention during Acceleration	Normal duty: 0~160% (100%: drive's rated current) Light duty: 0~130% (100%: drive's rated current)	Normal duty: 120 Light duty: 120
06-04	Over-current Stall Prevention during Operation	Normal duty: 0~160% (100%: drive's rated current) Light duty: 0~130% (100%: drive's rated current)	Normal duty: 120 Light duty: 120
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	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)	10~200% (100%: drive's rated current)	120
06-08	Over-torque Detection Time (OT1)	0.1~60.0 sec.	0.1

Parameter	Explanation	Settings	Factory setting
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 operate after detection. 4: Over-torque detection during operation, stop operation after detection.	0
06-10	Over-torque Detection Level (OT2)	10~200% (100%: drive's rated current)	120
06-11	Over-torque Detection Time (OT2)	0.1~60.0 sec.	0.1
06-12	Maximum Torque Limit	0~200% (100%: drive's rated current)	150
06-13	Electronic Thermal Relay Selection (Motor 1)	0: Special motor (with external forced cooling) 1: Self-cooled motor (so motor with fan on the shaft) 2: Electronic thermal relay disabled	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℃	105.0
06-16	Stall Prevention Limit Level	0~100% (Pr. 06-03, Pr. 06-04)	50
06-17	Current Error Record	0: No fault record 1: Over-current during accel. (ocA) 2: Over-current during decel. (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 accel. (ovA) 8: Over-voltage during decel. (ovd) 9: Over-voltage during constant speed (ovn) 10: Over-voltage at stop (ovS) 11: Low-voltage during accel. (LvA) 12: Low-voltage during decel. (Lvd) 13: Low-voltage during constant speed (Lvn) 14: Stop mid-low voltage (LvS) 15: Phase loss protection (PHL) 16: IGBT over-heat (oH1) 17: Capacitance over-heat (oH2) (over 40HP) 18: tH1o (TH1 open: IGBT over-heat protection error)	0
06-18	Second Most Recent Error Record		0
06-19	Third Most Recent Error Record		0

<table>
<tr><th>Parameter</th><th>Explanation</th><th>Settings</th><th>Factory setting</th></tr>
<tr><td>06-20</td><td>Fourth Most Recent Error Record</td><td rowspan="3">19: tH2o (TH2 open: capacitance over-heat protection error)
20: Reserved
21: Drive over-load (oL) (When current is 150% of the rated current, the drive will be overloaded.)
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: Under current 1 (uc)
29: Reserved
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: Reserved
43: Reserved
44: Reserved
45: Reserved
46: Reserved
47: Reserved
48: ACI reference input loss (ACE)
49: External fault input (EF)
50: Emergency stop (EF1)
51: External base block (BB)
52: Password error (Pcode)
53: Software code error
54: Communication error (cE1)
55: Communication error (cE2)
56: Communication error (cE3)
57: Communication error (cE4)
58: Communication error (cE10)
59: PU time-out (cP10)
60: Brake transistor error (bf)
61: Y-connection / △-connection switch error (ydc)</td><td>0</td></tr>
<tr><td>06-21</td><td>Fifth Most Recent Error Record</td><td>0</td></tr>
<tr><td>06-22</td><td>Sixth Most Recent Error Record</td><td>0</td></tr>
</table>

Parameter	Explanation	Settings	Factory setting
		62: Decel. energy bakup error (dEb) 63: Slip error (oSL) 64: Electromagnet switch error (ryF) 65: Reserved 66: Reserved 67: Reserved 68: Reserved 69: Reserved 70: Reserved 71: Reserved 72: Channel 1 (STO1~SCM1) internal hardware error 73: External safety gate S1 74: FIRE mode output 75: Reserved 76: STO (Safety Torque Off) 77: Channel 2 (STO2~SCM2) internal hardware error 78: Channel 1 and Channel 2 internal hardware error 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: Reserved 86: Reserved 87: Reserved 88: Reserved 89: Reserved 90: Inner PLC function is forced to stop (FStp) 91: Reserved 92: Reserved 93: Reserved 94: Reserved 95: Reserved 96: Reserved 97: Reserved 98: Reserved 99: CPU command error (TRAP) 100: Reserved 101: CANopen software disconnect 1 (CGdE) 102: CANopen software disconnect 2 (CGdE) 103: CANopen synchronous error (CSYE)	

Parameter	Explanation	Settings	Factory setting
		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) 108: Reserved 109: Reserved 110: Reserved 111: InrCOM time out (ictE)	
06-23	Fault Output Option 1	The meaning of the value corresponds to bit: bit 0: Current bit 1: Voltage bit 2: Over load bit 3: System bit 4: Feedback bit 5: External error bit 6: Communication (refer to bit table for fault code)	0
06-24	Fault Output Option 2		0
06-25	Fault Output Option 3		0
06-26	Fault Output Option 4		0
06-27	Electronic Thermal Relay Selection 2 (Motor 2)	0: Special motor (with external forced cooling) 1: Self-cooled motor (so motor with fan on the shaft) 2: Electronic thermal relay disabled	2
06-28	Electronic Thermal Operating Time of Motor 2 (seconds)	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 Commanad when Malfunction	0.00~655.35Hz	Read only
06-32	Output Frequency when Malfunction	0.00~655.35Hz	Read only
06-33	Output Voltage when Malfunction	0.0~6553.5V	Read only
06-34	DC Voltage at Malfunction	0.0~6553.5V	Read only
06-35	Output Current at Malfunction	0.00~655.35A	Read only
06-36	IGBT Temperature at Malfunction	-3276.7~3276.7℃	Read only
06-37	Capacitance Temperature at Malfunction	-3276.7~3276.7℃	Read only
06-38	Motor Speed in rpm at Malfunction	-32767~32767 rpm	Read only
06-39	Reserved		

	Parameter	Explanation	Settings	Factory setting
	06-40	Status of Multi-function Input Terminal when Malfunction	0000h~FFFFh	Read only
	06-41	Status of Multi-function Output Terminal when Malfunction	0000h~FFFFh	Read only
	06-42	Drive Status when Malfunction	0000h~FFFFh	Read only
	06-43	Reserved		
⚡	06-44	STO Alarm Latch	0: STO alarm latch 1: STO alarm no latch	0
⚡	06-45	Action for Detected Output Phase Loss (OPhL)	0: Warn and keep operation 1: Warn and ramp to stop 2: Warn and coast to stop 3: No warning	3
⚡	06-46	Detecting Time of Output Phase Loss	0~65.535 sec.	0.500
⚡	06-47	Current Level of Detected Output Phase Loss	0~655.35%	1.00
⚡	06-48	Time for Detecting Output Phase Loss before Run	0~65.535 sec.	0.000
	06-49	Reserved		
⚡	06-50	Time of Detected Input Phase Loss	0.00~600.00 sec.	0.20
	06-51	Reserved		
⚡	06-52	Ripple of the Detected Input Phase Loss' s Ripple	230V models: 0.0~150 Vdc 460V models: 0.0~320 Vdc	30.0/ 60.0
⚡	06-53	Action for 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 surrent and limit carrier wave by loaded current and temperature 1: Constant carrier frequency and limit loaded current by setting carrier wave 2: Constant rated current (same as setting 0), but current limit is closed	0
⚡	06-56	PT100 Detection Level 1	0.000~10.000 V	5.000
⚡	06-57	PT100 Detection Level 2	0.000~10.000 V	7.000
⚡	06-58	PT100 Level 1 Frequency Protect	0.00~600.00 Hz	0.00
⚡	06-59	Delay Time of PT100 Level 1 Frequency Protection	0~6000 sec.	60
⚡	06-60	Software Detection GFF Current Level (% rated current of the drive)	0.0~6553.5%	60.0

Parameter	Explanation	Settings	Factory setting
06-61	Software Detection of GFF Low Pass Filter Gain	0~655.35 sec.	0.10
06-62	Disable Level of dEb	230V models: 0~220.0 Vdc 460V models: 0~440.0 Vdc	150.0/ 300.0
06-63	Fault Record 1 (Day)	0~65535	Read only
06-64	Fault Record 1 (Min.)	0~1439	Read only
06-65	Fault Record 2 (Day)	0~65535	Read only
06-66	Fault Record 2 (Min.)	0~1439	Read only
06-67	Fault Record 3 (Day)	0~65535	Read only
06-68	Fault Record 3 (Min.)	0~1439	Read only
06-69	Fault Record 4 (Day)	0~65535	Read only
06-70	Fault Record 4 (Min.)	0~1439	Read only
06-71	Low Current Setting Level	0.0~100.0%	0.0
06-72	Low Current Detection Time	0.00~360.00 sec.	0.00
06-73	Options when Low Current Occurs	0: No function 1: Warn and coast to stop 2: Warn and ramp to stop by 2nd deceleration time 3: Warn and operation continues	0
06-74 ~ 06-79	Reserved		
06-80	Fire Mode	0: No function 1: Forward operation 2: Reverse operation	0
06-81	Operating Frequency when Running Fire Mode (Hz)	0.00~600.00 Hz	60.00
06-82	Bypass Fire Mode Enabled	0: Disable bypass 1: Enable bypass	0
06-83	Delayed Time when Bypass Fire Mode	0.0~6550.0 sec.	0.0
06-84	Auto Reset Counter of Fire Mode	0~10	0
06-85	Length of Time to Reset Auto-counter (sec.)	0.0~6000.0 sec.	60.0

07 Special Parameters

Parameter	Explanation	Settings	Factory Setting
07-00	Built-in Software Brake Level	230V series: 350.0~450.0 Vdc 460V series: 700.0~900.0 Vdc	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 seconds	0.0
07-04	Startup Frequency for DC Brake	0.00~600.00Hz	0.00
07-05	Voltage Increasing Percentage	0~200%	100
07-06	Restart after Momentary Power Down	0: Stop operation 1: Speed search starting from last speed before the moment of power down. 2: Speed search starting from 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%	100
07-10	Treatment to Restart After Fault	0: Stop operation 1: Speed search starts with current speed 2: Speed search starts with minimum output frequency	0
07-11	# of Auto Reset after Errors Occurred	0~10	0
07-12	Speed Search while Start-up	0: Disable 1: Speed search starting from maximum output frequency 2: Speed search starting from start-up motor frequency 3: Speed search starting from minimum output frequency	0
07-13	Deceleration Time at Momentary Power Down (dEb function: Deceleration Energy Backup)	0: Disable 1: 1st decel. time 2: 2nd decel. time 3: 3rd decel. time 4: 4th decel. time 5: System decel. time 6: Auto decel. time	0
07-14	DEB Return Time	0.0~25.0 sec.	0.0
07-15	Dwell Time at Accel.	0.00~600.00 sec.	0.00
07-16	Dwell Frequency at Accel.	0.00~600.00 Hz	0.00
07-17	Dwell Time at Decel.	0.00~600.00 sec.	0.00
07-18	Dwell Frequency at Decel.	0.00~600.00 Hz	0.00

Parameter	Explanation	Settings	Factory Setting
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 the preliminary heat sink's temperature reached around 60℃ (140℉). 4: Fan always OFF	0
07-20	Emergency Stop (EF) & Force to Stop Selection	0: Coast stop 1: By deceleration Time 1 2: By deceleration Time 2 3: By deceleration Time 3 4: By deceleration Time 4 5: System Deceleration 6: Automatic Deceleration	0
07-21	Auto Energy-sAVI1ng Operation	0: Disable 1: Enable	0
07-22	Energy-sAVI1ng 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 (To be "1" under SVC control mode)	0
07-27	Slip Compensation Gain (V/F and SVC control mode)	0.00~10.0	0.00
07-28	Reserved		
07-29	Slip Deviation Level	0.0~100.0% 0: Not-detectable	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 (Number of auto reset after error occurred)	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 AVI1 (Pr. 03-00) 2: Reserved 3: Reserved 4: Positive PID feedback from external terminal AVI1 (Pr. 03-00) 5: Reserved 6: Reserved 7: Reserved 8: Reserved	0
08-01	Proportional Gain (P)	0.0~100.0%	1.0
08-02	Integral Time (I)	0.00~100.00 sec. 0.00: No intergration	1.00
08-03	Derivative Time (D)	0.00~1.00 sec.	0.00
08-04	Upper Limit of Integral Control	0.0~100.0%	100.0
08-05	PID Output Frequency Limit	0.0~110.0%	100.0
08-06	PID Feedback Value	-200.00 ~ 200.00%	0.00
08-07	PID Delay Time	0.0~35.0 sec.	0.0
08-08	Feedback Signal Detection Time	0.0~3600.0 sec.	0.0
08-09	Options on Feedback Error	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 Reference Point	0.00~600.00Hz or 0~200.00%	0.00
08-11	Wake-up Reference Point	0.00~600.00Hz or 0~200.00%	0.00
08-12	Sleep Time	0.0~600.00 sec.	0.0
08-13	PID Deviation Level	1.0~50.0%	10.0
08-14	PID Deviation Time	0.1~300.0 sec.	5.0
08-15	Filter Time for PID Feedback	0.1~300.0 sec.	5.0
08-16	PID Compensation Selection	0: Parameter setting 1: Analog input	0
08-17	PID Compensation	-100.0~+100.0%	0
08-18	Setting of Sleep mode function	0: Follow PID output command 1: Follow PID feedback signal	0
08-19	Integral Limit during Wakeup	0.0~200.0%	50.0
08-20	PID Mode Selection	0: Serial connection 1: Parallel connection	0
08-21	Enable PID to Change Operation Direction	0: Operation direction cannot be changed 1: Operation direction can be changed	0
08-22	Wakeup Delay Time	0 ~ 600.00 sec.	0.00

09 Communication Parameters

Parameter	Explanation	Settings	Factory Setting
09-00	COM1 Communication Address	1~254	1
09-01	COM1 Transmission Speed	4.8~115.2 Kbps	9.6
09-02	COM1 Transmission Fault Treatment	0: Warn and continue operation 1: Warn and ramp to stop 2: Warn and coast to stop 3: No warning and continue operation	3
09-03	COM1 Time-out Detection	0.0~100.0 sec.	0.0
09-04	COM1 Communication Protocol	1: 7, N, 2 (ASCII) 2: 7, E, 1 (ASCII) 3: 7, O, 1 (ASCII) 4: 7, E, 2 (ASCII) 5: 7, O, 2 (ASCII) 6: 8, N, 1 (ASCII) 7: 8, N, 2 (ASCII) 8: 8, E, 1 (ASCII) 9: 8, O, 1 (ASCII) 10: 8, E, 2 (ASCII) 11: 8, O, 2 (ASCII) 12: 8, N, 1 (RTU) 13: 8, N, 2 (RTU) 14: 8, E, 1 (RTU) 15: 8, O, 1 (RTU) 16: 8, E, 2 (RTU) 17: 8, O, 2 (RTU)	1
09-05 ~ 09-08	Reserved		
09-09	Response Delay Time	0.0~200.0ms	2.0
09-10	Main Communication Frequency (Hz)	0.00~600.00Hz	60.00
09-11	Block Transfer 1	0~65535	010Ch
09-12	Block Transfer 2	0~65535	010Dh
09-13	Block Transfer 3	0~65535	010Ah
09-14	Block Transfer 4	0~65535	010Bh
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

Parameter	Explanation	Settings	Factory Setting
09-25	Block Transfer 15	0~65535	0
09-26	Block Transfer 16	0~65535	0
09-27 ~ 09-29	Reserved		
09-30	Communication Decoding Method	0: Decoding Method 1 1: Decoding Method 2	1
09-31	Internal Communication Protocol	0: Modbus 485 1: BACnet	0
09-32	Reserved		
09-33	PLC Command Force to 0	0~65535	0
09-34	Reserved		
09-35	PLC Address	1~254	2
09-36	CANopen Slave Address	1~127	0
09-37	CANopen Speed	0: 1M bps 1: 500K bps 2: 250K bps 3: 125K bps 4: 100K bps (Delta Only) 5: 50K bps	0
09-38	Reserved		
09-39	CANopen Warning Record	bit 0: CANopen Guarding Time out bit 1: CANopen Heartbeat Time out bit 2: CANopen SYNC Time out bit 3: CANopen SDO Time out bit 4: CANopen SDO buffer overflow bit 5: Can Bus Off bit 6: Error protocol of CANopen bit 7: Reserved bit 8: The setting values of CANopen indexs are fail bit 9: The setting value of CANopen address is fail bit10: The checksum value of CANopen indexs is fail	0
09-40	CANopen Decoding Method	0: Delta defined decoding method 1: CANopen DS402 Standard	1
09-41	CANopen Communication Status	0: Node reset state 1: Com reset state 2: Boot up state 3: Pre-operation state 4: Operation state 5: Stop state	0

Parameter	Explanation	Settings	Factory Setting
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 5: Reserved 6: Reserved 7: Quick stop active state 8: Reserved 9: Reserved 10: Reserved 11: Reserved 12: Reserved 13: Error reaction active state 14: Error State	0
09-43	Reserved		
09-44	Reserved		
09-45	CANopen Master function	0: Disable 1: Enable	0
09-46	CANopen Master Address	0~127	100
09-47 ~ 09-49	Reserved		
09-50	BACnet Dnet	0~127	10
09-51	BACnet Baud Rate	9.66~76.8 kbps	38.4
09-52	BACnet Device ID L	0~65535	10
09-53	BACnet Device ID H	0~63	0
09-54	Reserved		
09-55	BACnet Max Address	0~127	127
09-56	BACnet Password	0~65535	0
09-57 ~ 09-59	Reserved		
09-60	Identification of Communication Card	0: No communication card 1: DeviceNet Slave 2: Profibus-DP Slave 3: CANopen Slave 4: Modbus-TCP Slave 5: EtherNet/IP Slave 6~8: Reserved	0
09-61	Firmware Version of Communication Card	Read only	##
09-62	Product Code	Read only	##
09-63	Error Code	Read only	##

Parameter	Explanation	Settings	Factory Setting
09-64 ~ 09-69	Reserved		
09-70	Address of Communication Card	DeviceNet: 0-63 Profibus-DP: 1-125	1
09-71	Communication Card 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 settings of communication card speed	0: Disable This mode, baud rate can only be 0,1,2,3 in standard DeviceNet speed 1: Enable 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

Parameter	Explanation	Settings	Factory Setting
09-84	Gateway Address 1 of the Communication Card	0~255	0
09-85	Gateway Address 2 of the Communication Card	0~255	0
09-86	Gateway Address 3 of the Communication Card	0~255	0
09-87	Gateway Address 4 of the Communication Card	0~255	0
09-88	Password for Communication Card (Low word)	0~99	0
09-89	Password for Communication Card (High word)	0~99	0
09-90	Reset Communication Card	0: No function 1: Reset to return to the factory setting	0
09-91	Additional Setting for Communication Card	bit 0: Enable IP filter : bit 1: Enable internet parameters (1bit) Once the setup of internet parameter is done, the bit 1 will be enabled. But after the parmeters of the communication card are updated, this bit 1 will be disabled. bit 2: Enable login password (1bit) When login password is correctly entered, the bit 2 will be enabled. But after the parameters of the communication card are updated, this bit 2 will be disabled.	0
09-92	Status of Communication Card	bit 0: Enable password. When the communication card is locked by a password, this bit 0 will be enabled. When the password is clear, this bit 0 will be disabled.	0

10 PID Control Parameters

Group 10 PID Control Parameters are reserved.

11 Advanced Parameters

Group 11 Advanced parameters are reserved.

12 PUMP Parameters

Parameter	Explanation	Settings	Factory Setting
12-00	Circulative Control	0: No operation 1: Fixed Time Circulation (by time) 2: Fixed quantity circulation (by PID) 3: Fixed quantity control 4: Fixed Time Circulation+ Fixed quantity circulation 5: Fixed Time Circulation+ Fixed quantity control	0
12-01	Number of motors to be connected	From only 1 and up to 8 motors	1
12-02	Operating time of each motor (minutes)	0 to 65500 min	0
12-03	Delay Time due to the Acceleration (or the Increment) at Motor Switching	0.0 to 3600.0 sec	10
12-04	Delay Time due to the Deceleration (or the Decrement) at Motor Switching (seconds)	0.0 to 3600.0 sec	10
12-05	Delay time while fixed quantity circulation at Motor Switching (seconds)	0.0 to 3600.0 sec	100
12-06	Frequency when switching motors at fixed quantity circulation (Hz)	0.00 to 600.00 Hz	6000
12-07	Action to do when Fixed Quantity Circulation breaks down.	0: Turn off all output 1: Motors powered by mains electricity continues to operate.	0
12-08	Frequency when stopping auxiliary motor (Hz)	0.00 to 600.00 Hz	0

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Chapter 12 Description of Parameter Setting

00 Drive Parameters

✓ The parameter can be set during operation.

00 - 00 ID 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 ID code in Pr.00-00.

📖 The factory setting is the rated current for light duty. Set Pr.00-16 to 1 to display the rated current for normal 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	30
HP	1.0	2.0	3.0	5.0	7.5	10	15	20	25	30	40
ID Code of the AC Motor Drive	4	6	8	10	12	14	16	18	20	22	24
Rated Current of Light Duty (A)	5	7.5	10	15	21	31	46	61	75	90	105
Rated Current of Normal Duty (A)	4.6	5	8	11	17	25	33	49	65	75	90

Frame	D		E		
kW	37	45	55	75	90
HP	50	60	75	100	125
ID Code of the AC Motor Drive	26	28	30	32	34
Rated Current of Light Duty (A)	146	180	215	276	322
Rated Current of Normal Duty (A)	120	146	180	215	255

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	37
HP	1	2	3	5	5.5	7.5	10	15	20	25	30	40	50
ID Code of the AC Motor Drive	5	7	9	11	93	13	15	17	19	21	23	25	27
Rated Current of Light Duty (A)	3	4.2	5.5	8.5	10.5	13	18	24	32	38	45	60	73
Rated Current of Normal Duty (A)	2.8	3.0	4.0	6.0	9.0-	10.5	12	18	24	32	38	45	60

Frame	D0		D		E		F		G		H		
kW	45	55	75	90	110	132	160	185	220	280	315	355	400
HP	60	75	100	125	150	175	215	250	300	375	425	475	536
ID Code of the AC Motor Drive	29	31	33	35	37	39	41	43	45	47	49	51	53
Rated Current of Light Duty (A)	91	110	150	180	220	260	310	370	460	530	616	683	770
Rated Current of 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
5: Reset KWH display to 0.
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 is60Hz)

- When it is set to 1, all parameters are read only except Pr.00-02~00-08 and it can be used with password setting for password protection. It needs to set Pr.00-02 to 0 before changing other parameter settings.
- When it is set to 9 or 10: all parameters are reset to factory settings. If password is set in Pr.00-08, input the password set in Pr.00-07 to reset to factory settings.
- When it is set to 5, KWH display value can be reset to 0 even when the drive is operating. Pr. 05-26, 05-27, 05-28, 05-29, 05-30 reset to 0.
- When it is set to 6: clear internal PLC program (includes the related settings of PLC internal CANopen master)
- When it is set to 7: reset the related settings of CANopen slave.
- When it is set to 6、7、9、10, please re-power the motor drive after setting.

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 Multi-function Display (user defined)

Factory setting: 3

Settings 0: Display output current (A) (Unit: Amps)
1: Display counter value (c) (Unit: CNT)
2: Display actual output frequency (H.) (Unit: Hz)
3: Display DC-BUS voltage (v) (Unit: Vdc)
4: Display output voltage (E) (Unit: Vac)
5: Display output power angle (n) (Unit: deg)
6: Display output power in kW (P) (Unit: Kw)

7: Display actual motor speed rpm (r = 00: positive speed; -00 negative speed) (Unit: rpm)

8: Reserve

9: Reserve

10: Display PID feedback (b) (Unit: %)

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

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

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

14: Display the temperature of IGBT (i.) (Unit: ℃)

15: Display the temperature of capacitance (c.) (Unit: ℃)

16: The status of digital input (ON/OFF) refer to Pr.02-12 (i) (Refer to Note3)

17: Display digital output status ON/OFF (Pr.02-18) (o) (refer to NOTE 4)

18: Display the multi-step speed that is executing (S)

19: The corresponding CPU pin status of digital input (d) (refer to NOTE 3)

20: The corresponding CPU pin status of digital output (0.) (refer to NOTE 4)

21: Reserve

22: Reserve

23: Reserve

24: Reserve

25: Overload counting (0.00~100.00%) (o.) (Refer to Note 6) (Unit: %)

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

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

28: Display PLC register D1043 data (C) display in hexadecimal

29: Reserve

30: Display output of user defined (U)

31: H page x 00-05 Display user Gain(K)

32: Reserve

33: Reserve

34: Operation speed of fan (F.) (Unit: %)

35: Reserve

36: Present operating carrier frequency of drive (Hz) (J.)

37: Reserve

38: Display drive status (6.) (Refer to Note 7)

39: Reserve

40: Reserve

41: KWH display (J) (Unit: KWH)

42: PID reference (h.) (Unit: %)

43: PID offset (o.) (Unit: %)
44: PID output frequency (b.) (Unit: Hz)
45: Hardware ID

Note 1

It can display negative values when setting analog input bias (Pr.03-03~03-10).
Example: assume that AVI1 input voltage is 0V, Pr.03-03 is 10.0% and Pr.03-07 is 4 (Serve bias as the center).

Note 2

Example: If REV, MI1 and MI6 are ON, the following table shows the status of the terminals.
0 means OFF, 1 means 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.02-11 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.

Note 3

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 OFF. The display status will be shown as follows.
0 means OFF, 1 means ON

Terminal	MO20-MO18				MO17-MO14				MO13-MO10				Reserved	Reserved	RY3	RY2	RY1
Status	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

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.

00 - 05 Coefficient Gain in Actual Output Frequency

Factory Setting: 1.00

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 Input Parameter Protection Password

Factory Setting: 0

Settings 0~65535

Display 0~4 (# of times of password attempts)

- This parameter allows user to enter their password (which is pre-set in Pr.00-08) to unlock the parameter protection and to make changes to the parameter.
- After you set up this parameter, make sure that you note its value for any future use.
- The purpose of hAVI1ng Pr.00-07 and Pr.00-08 is to prevent the personal misoperation.
- If you forget 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.
- When setting up a password all parameters read are 0, except parameter 00-08.

00 - 08 Set up a Parameter Protection Password

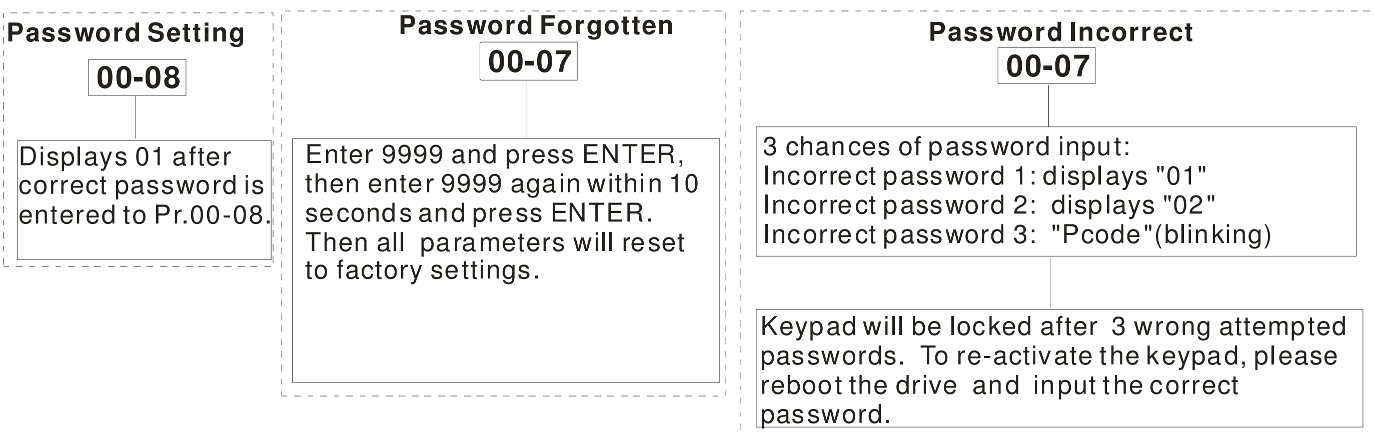
Factory Setting: 0

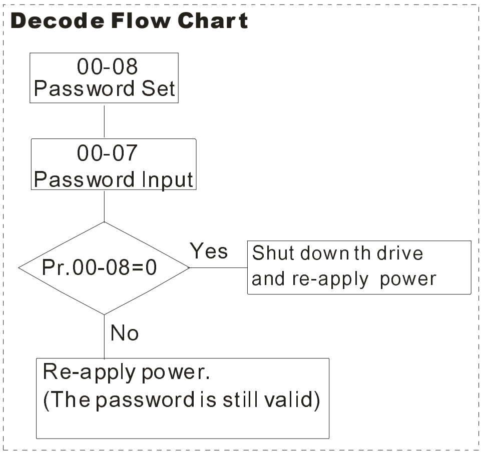
Settings 0~65535

Display 0: No password protection / password is entered correctly (Pr00-07)

1: Password has been set

- To set a password to protect your parameter settings. In the first time, password can be set directly. After setting, the value of 00-08 will become 1, which means password protection is activated. When the password is set, if any parameter setting needs to be changed, be sure to enter correct password in 00-07, and then the password will be inactivated temporarily with 00-08 changing to 0. At this time, parameters setting can be changed. After setting, re-power the motor drive, and password will be activated again.
- To cancel the password protection, after entering correct password in 00-07, 00-08 also needs to be set as 0 again to inactive password protection permanently. If not, password protection will be active after motor drive re-power.
- The keypad copy function will work normally only when the password protection is inactivated temporarily or permanently, and password set in 00-08 will not be copied to keypad. So when copying parameters from keypad to motor drive, the password need to be set manually again in the motor drive to active password protection.





00 - 09 ~ 00 - 10	Reserved

00 - 11	Velocity Control Mode

Factory Setting: 0

Settings 0：V/F（V/F control）

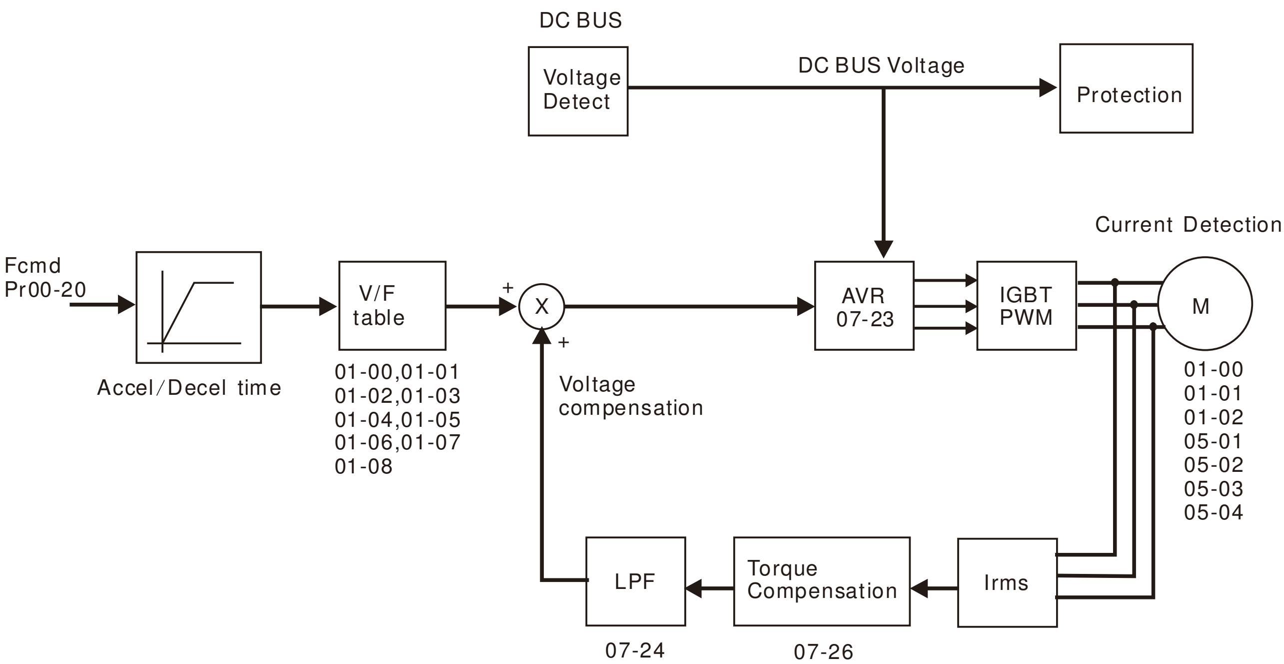
2：SVC（Sensorless Vector Control）

📖 This parameter determines the control method of the AC motor drive: ◦

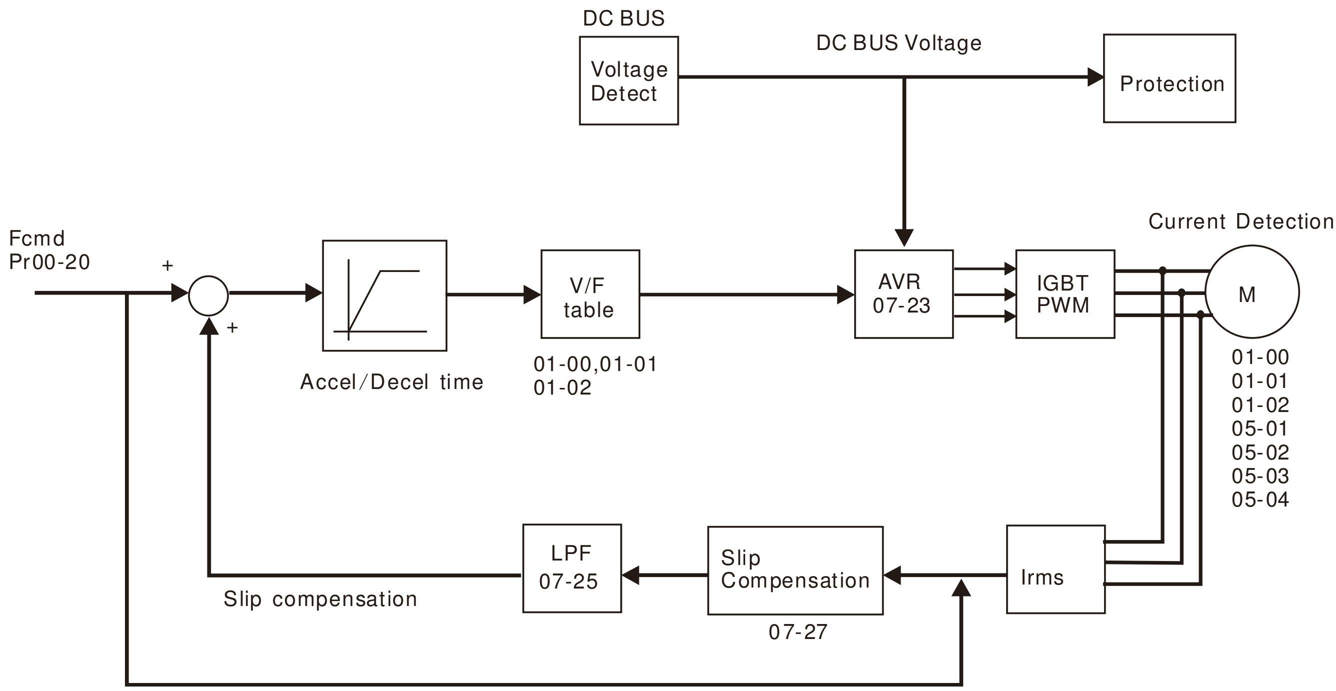
0: V/F control: user can design proportion of V/f as required and can control multiple motors simultaneously.

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

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



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



00 - 12 ~ 00 - 15	Reserved

00 - 16 Loading mode selection

Factory Setting: 0

Settings 0: Light duty

1: Normal duty

📖 Light duty 230V series & 460V series: When the output current is 120% of the rated output current, the endurance time is 60 seconds. Refer to Pr.00-17 for the setting of carrier frequency. Refer to chapter specifications or Pr.00-01 for the rated current.

📖 Normal duty 230 V series & 460V series: When the output current is 120% of the rated output current, the endurance time is 60 seconds. When the output current is 160% of the rated output current, the endurance time is 3 seconds. . Refer to Pr.00-17 for the setting of carrier frequency. Refer to chapter specifications or Pr.00-01 for the rated current.

📖 Pr.00-01 changes as the setting of Pr.00-16 changes. The default setting and maximum setting range of Pr.06-03, 06-04 will change as the setting of Pr.00-16 changes

00 - 17 Carrier Frequency

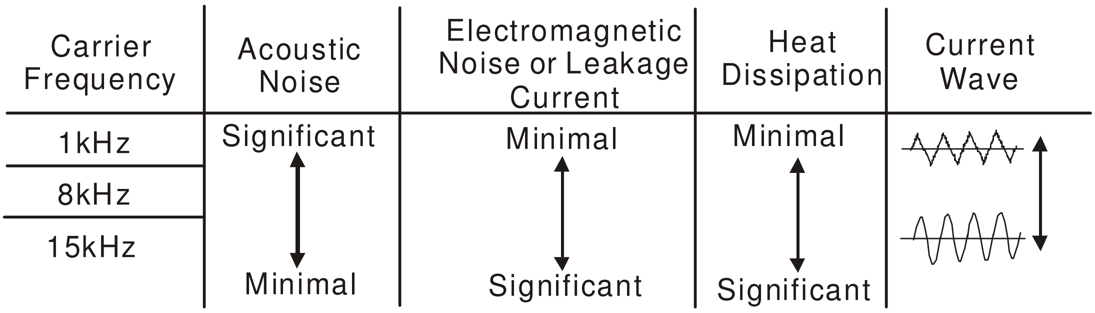
Factory Setting: As shown in table below

Settings 2～15kHz

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

230V series			
Models	1-20HP [0.75-15kW]	25-60HP [18.5-45kW]	75-125HP [55-90kW]
Settings	2~15kHz	2~10kHz	2~9kHz
Light Duty Factory Setting	8kHz	6kHz	4kHz
Normal Duty Factory Setting	8 kHz	6 kHz	4 kHz

460V series			
Models	1-25HP [0.75-18.5kW]	30-100HP [22-75kW]	125-536HP [90-400kW]
Settings	2~15kHz	2~10kHz	2~9kHz
Light Duty Factory Setting	8kHz	6kHz	4kHz
Normal Duty Factory Setting	8 kHz	6 kHz	4 kHz



- 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: Reserved

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
6: CANopen communication card
8: Communication card (no CANopen card)

- To set the source of the master frequency in AUTO mode.
- Pr.00-20 and 00-21 are for the settings of frequency source and operation source in AUTO mode. Pr.00-30 and 00-31 are for the settings of frequency source and operation source in HAND mode. The AUTO/HAND mode can be switched by the keypad KPC-CC01 or multi-function input terminal (MI).
- The factory setting of frequency source or operation source is for AUTO mode. It will return to AUTO mode whenever power on again after power off. If there is multi-function input terminal used to switch AUTO/HAND mode. The highest priority is the multi-function input terminal. When the external terminal is OFF, the drive won't receive any operation signal and can't execute JOG.

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
5: Communication card (not includes CANopen card)

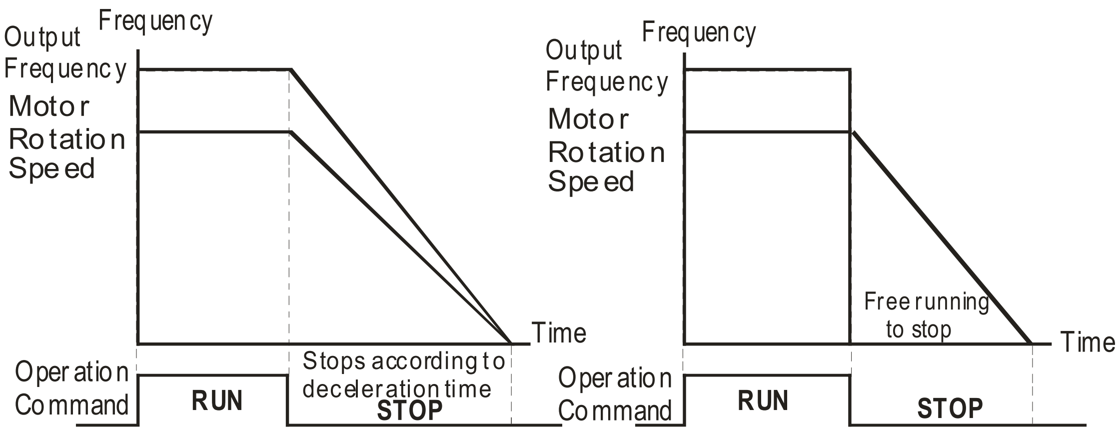
- To set the source of the operation command in AUTO mode.
- When the operation command is controlled by the keypad KPC-CC01, keys RUN, STOP and JOG (F1) are valid.

00 - 22 Stop Mode

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

1. **Ramp to stop:** the AC motor drive decelerates from the setting of deceleration time to 0 or minimum output frequency (Pr. 01-07) and then stop.
2. **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.
   - ☑ 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.
   - ☑ 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

⌁ 00 - 23 Motor Operating Direction Control

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 Communication 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 Property

Factory Setting: 0

Settings
Bit 0~3: user defined decimal place
0000B: no decimal place
0001B: one decimal place
0010B: two decimal place
0011B: three decimal place

Bit 4~15: user defined unit
000xH: Hz
001xH: rpm
002xH: %
003xH: kg
004xH: m/s
005xH: kW
006xH: HP
007xH: ppm
008xH: 1/m
009xH: kg/s
00AxH: kg/m
00BxH: kg/h
00CxH: lb/s
00DxH: lb/m
00ExH: lb/h
00FxH: ft/s
010xH: ft/m
011xH: m
012xH: ft
013xH: degC
014xH: degF
015xH: mbar
016xH: bar
017xH: Pa
018xH: kPa
019xH: mWG
01AxH: inWG
01BxH: ftWG
01CxH: psi
01DxH: atm
01ExH: L/s
01FxH: L/m

020xH: L/h
021xH:m3/s
022xH: m3/h
023xH: GPM
024xH:CFM

_

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

00 - 26 Max. User Defined Value

Factory Setting: 0

Settings 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)

- User defined 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.

✓ 00 - 28 Switching from Auto mode to Hand mode

Factory Setting: 0

Settings 0 ~ 65535

Bit0 : Sleep Function Control Bit
0: Cancel sleep function
1: Sleep function and Auto mode are the same

Bit1 : Unit of the Control Bit
0: Unit of the Control Bit
1: Same unit as the Auto mode

Bit2 : PID Control Bit
0: Cancel PID control
1: PID control and Auto mode are the same.

Bit3: Frequence Source Control Bit
0: Frequency command set by parameter, if multi-step speed is activate, then multi-step speed has the priority
1: Frequency command set by parameter 00-30

00 - 29 Local/Remote Selection

Factory Setting: 0

Settings 0: Standard HOA function
1: Switching Local/Remote, the drive stops
2: Switching Local/Remote, the drive runs as the REMOTE setting for frequency and operation status
3: Switching Local/Remote, the drive runs as the LOCAL setting for frequency and operation status
4: Switching Local/Remote, the drive runs as LOCAL setting when switch to Local and runs as REMOTE setting when switch to Remote for frequency and operation status.

- The factory setting of Pr.00-29 is 0 (standard Hand-Off-Auto function). The AUTO frequency and source of operation can be set by Pr.00-20 and Pr.00-21, and the HAND frequency and source of operation can be set by Pr.00-30 and Pr.00-31. AUTO/HAND mode can be selected or switched by using digital keypad (KPC-CC01) or setting multi-function input terminal MI= 41, 42.
- When external terminal MI is set to 41 and 42 (AUTO/HAND mode), the settings Pr.00-29=1,2,3,4 will be disabled. The external terminal has the highest priority among all command, Pr.00-29 will always function as Pr.00-29=0, standard HOA mode.
- When Pr.00-29 is not set to 0, Local/Remote function is enabled, the top right corner of digital keypad (KPC-CC01) will display "LOC" or "REM" (the display is available when KPC-CC01 is installed with firmware version higher than version 1.021). The LOCAL frequency and source of operation can be set by Pr.00-20 and Pr.00-21, and the REMOTE frequency and source of operation can be set by Pr.00-30 and Pr.00-31. Local/Remote function can be selected or switched by using digital keypad (KPC-CC01) or setting external terminal MI=56. The AUTO key of the digital keypad now controls for the REMOTE function and HAND key now controls for the LOCAL function.
- When MI is set to 56 for LOC/REM selection, if Pr.00-29 is set to 0, then the external terminal is disabled.
- When MI is set to 56 for LOC/REM selection, if Pr.00-29 is not set to 0, the external terminal has the highest priority of command and the ATUO/HAND keys will be disabled.

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
6: CANopen communication card
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
5: Communication card (not including CANopen card)

- 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 Enable Digital Keypad STOP Function

Factory Setting: 0

Settings 0: STOP key disable
1: STOP key enable

- This parameter works when the source of operation command is not digital keypad (Pr00-21≠0). When Pr00-21=0, the stop key will not follow the setting of this parameter.

00 - 33 ~ 00 - 47 Reserved

✓ 00 - 48 Display Filter Time (Current)

Factory Setting: 0.100

Settings 0.001~65.535

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

✓ 00 - 49 Display Filter Time on the Keypad

Factory Setting: 0.100

Settings 0.001~65.535

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

00 - 50 Software Version (date)

Factory Setting: Read Only

Settings 0~65535

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

00 - 51 ~ 00 - 61 Reserved

01 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.
- For models 230V, 55kW (75HP) and above, the setting range is 0.00~400.00Hz.
  For models 460V, 90kW (120HP) and above, the setting range is 0.00~400.00Hz.

Carrier frequency at least required value	The max. output frequency IM VF IM VFPG IM SVC
2k	200 Hz
3k	300 Hz
4k	400 Hz
5k	500 Hz
6k	600
--- For models 230V, 55kW and above, the max. output frequency is 400Hz (carrier frequencyshould at least be 4k) --- For models 460V, 90kW and above, the max. output frequency is 400Hz (carrier frequencyshould at least be 4k)	

01 - 01 Motor1: Max Output Frequency(Hz) (Base Frequency/Motor Rated Frequency)
01 - 35 Motor 2: Max Output Frequency (Hz) (Base Frequency/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.

01 - 02 Motor1: Max Output Voltage (V)
01 - 36 Motor 2: Max Output Voltage (V) (Base Voltage/Motor Rated Voltage)

Factory Setting: 200.00/400.00

Factory Setting: 3.0

Settings 230V series 0.0~255.0V

460V series 0.0~510.0V

Settings 0.00~600.00Hz

📖 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: 1.50/3.00
Motor drive with 215HP and above: 1.50

Settings 0.00~600.00Hz

⚡ 01 - 04 Mid-point Voltage 1 of Motor 1

Factory Setting: 10.0/22.0
Motor drive with 215HP and above: 10.0

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

01 - 37 Mid-point Output Frequency 1 of Motor 2

Factory Setting: 3.00
Motor drive with 215HP and above: 1.50

Settings 0.00~600.00Hz

⚡ 01 - 38 Mid-point Output Voltage 1 of Motor 2

Factory Setting: 11.0/22.0
Motor drive with 215HP and above: 10.0

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
Motor drive with 215HP and above: 2.0

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

01 - 39 Motor 2: Middle Output Frequency 2

Factory Setting: 0.50

Settings 0.00~600.00Hz

✎ 01 - 40 Motor 2: Middle Output Voltage 2

Factory Setting: 2.0/4.0
Motor drive with 215HP and above: 2.0

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

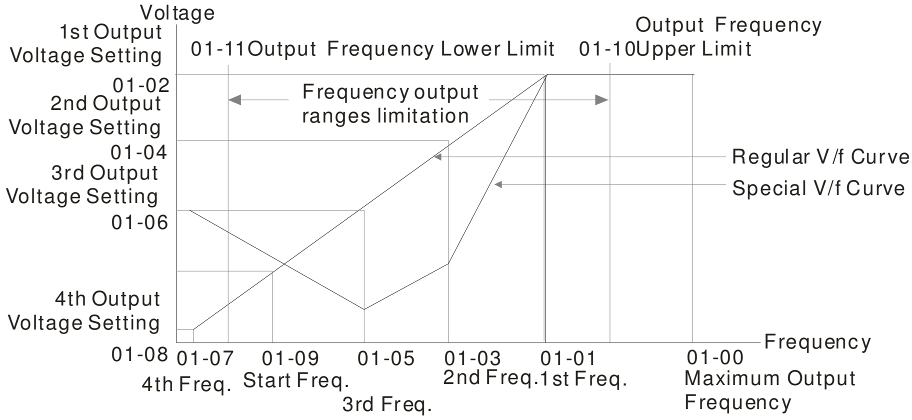
Settings 0.00~600.00Hz

✎ 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.

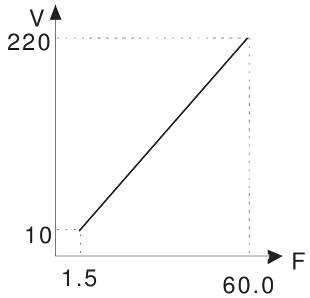


V/f Curve

Common settings of V/f curve:

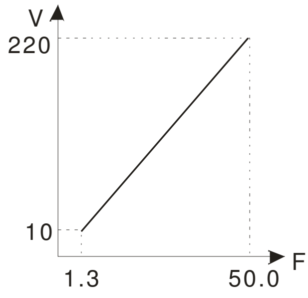
(1) General purpose

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

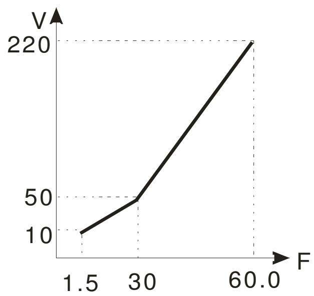
Motor spec. 50Hz



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

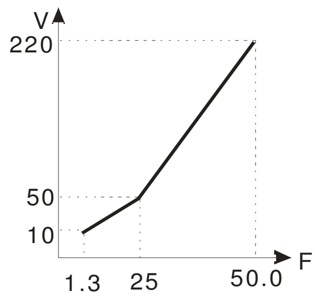
(2) Fan and hydraulic machinery

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

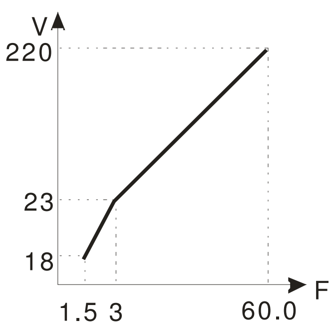
Motor spec. 50Hz



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

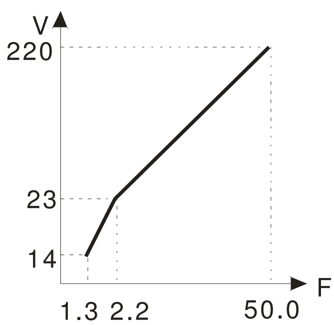
(3) High starting torque

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

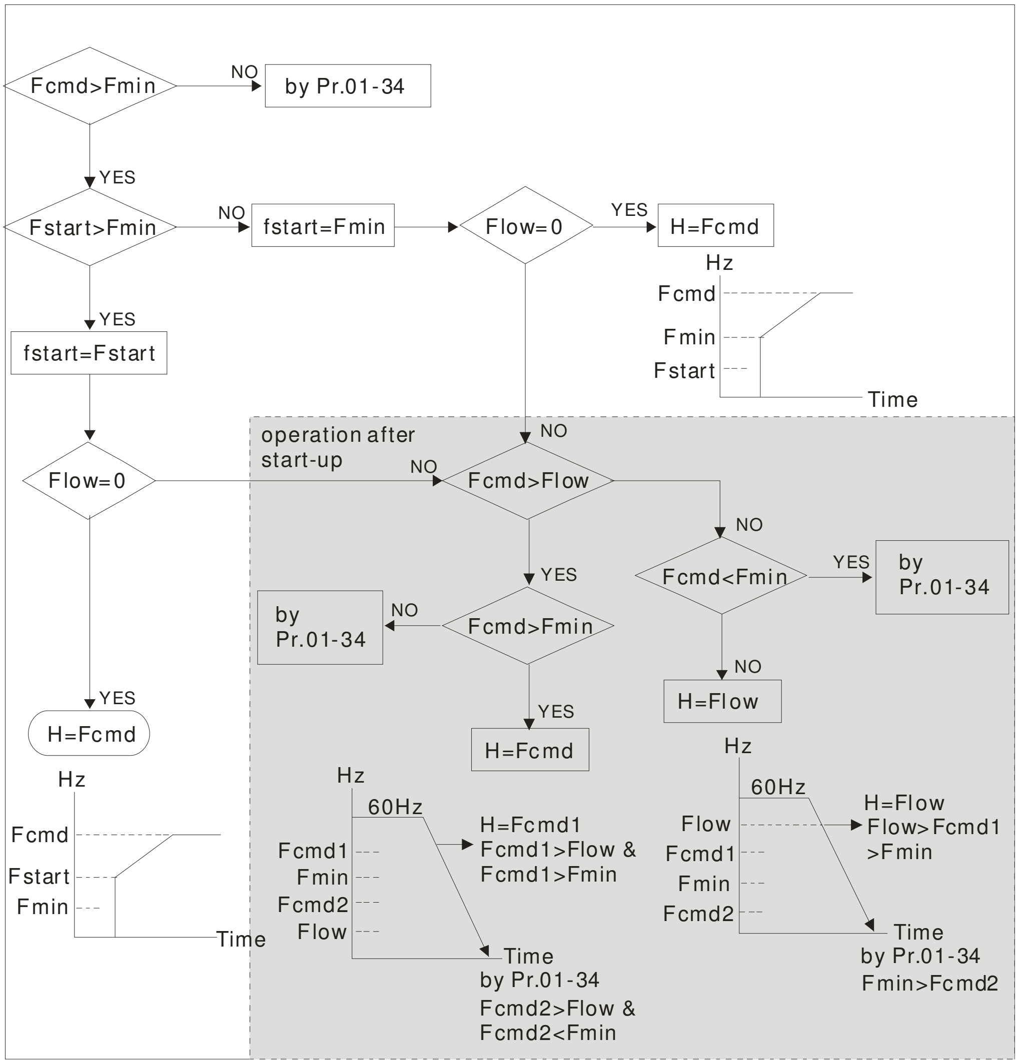
01 - 09 Start-Up Frequency

Factory Setting: 0.50

Settings 0.0~600.00Hz

📖 When start frequency is higher than the min. out put 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 0.00~600.00Hz

01 - 11 Output Frequency Lower Limit

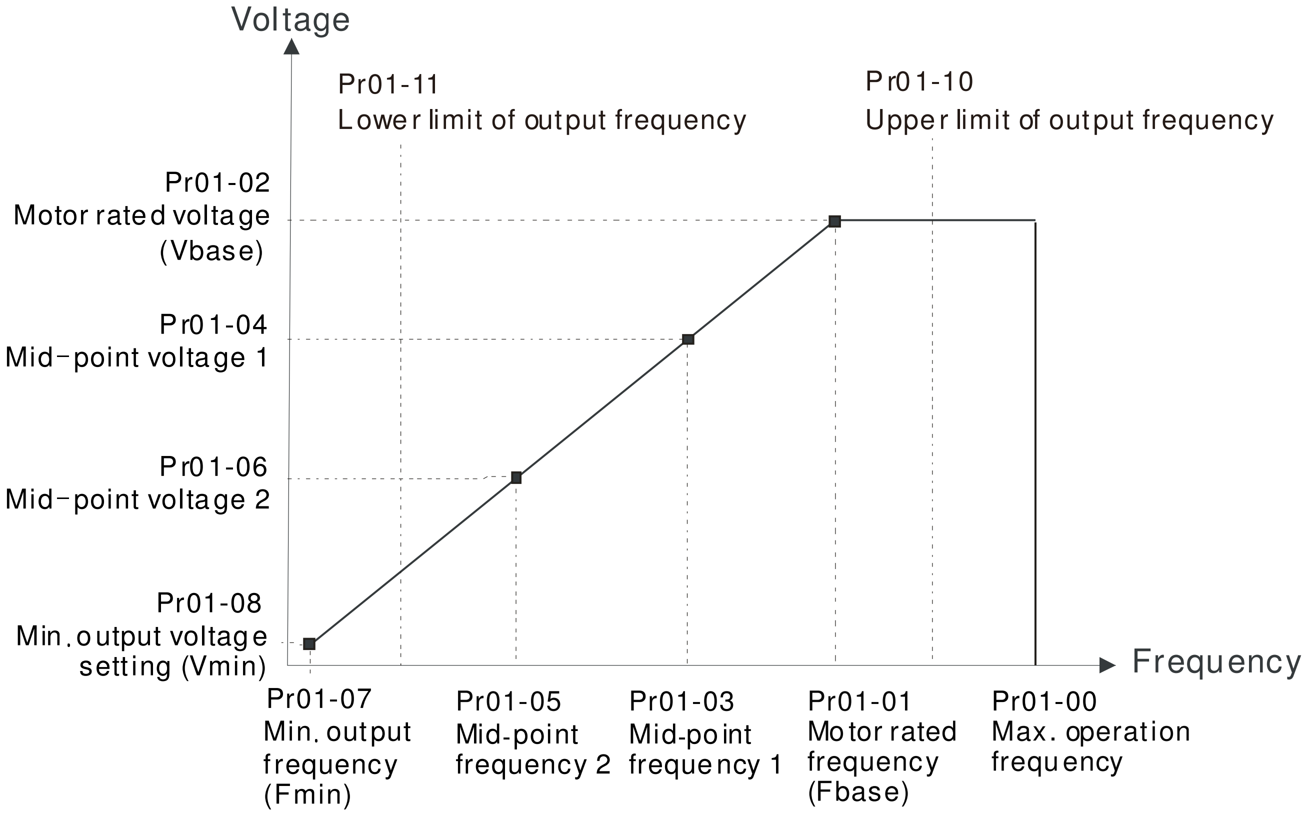
Factory Setting: 0.00

Settings 0.00~600.00Hz

📖 The upper/lower output frequency setting is used to limit the actual output frequency. If the frequency setting is higher than the upper limit (01-10), it will run with the upper limit frequency. If output frequency lower than output frequency lower limit (01-11) and frequency setting is higher than min. frequency (01-07), it will run with lower limit frequency. The upper limit frequency should be set to be higher than the lower limit frequency. Pr.01-10 setting must be ≥ Pr.01-11 setting.

📖 Upper output frequency will limit the max. Output frequency of drive. If frequency setting is higher than Pr.01-10, the output frequency will be limited by Pr.01-10 setting.

- When the drive starts the function of slip compensation (Pr.07-27) or PID feedback control, drive output frequency may exceed frequency command but still be limited by this setting.
- Related parameters: Pr.01-00 Max. Operation Frequency and Pr.01-11 Output Frequency Lower Limit



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

✎ 01 - 12 Accel. Time 1
✎ 01 - 13 Decel. Time 1
✎ 01 - 14 Aceel. Time 2
✎ 01 - 15 Decel. Time 2
✎ 01 - 16 Accel. Time 3
✎ 01 - 17 Decel. Time 3

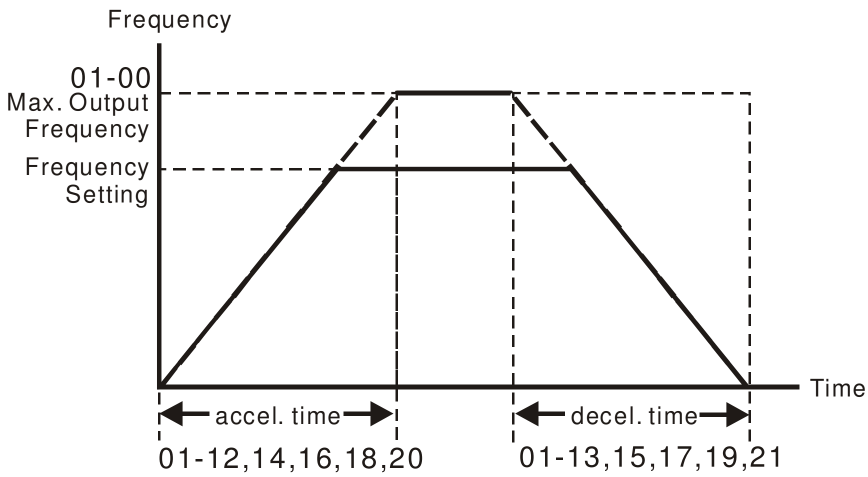
01 - 18 Accel. Time 4
01 - 19 Decel. Time 4
01 - 20 JOG Acceleration Time
01 - 21 JOG Deceleration Time

Factory Setting: 10.00/10.0

Settings Parameters 01-45=0：0.00~600.00 seconds

Parameters 01-45=1：0.0~6000.0 seconds

- The Acceleration Time is to determine the length of time required for the AC motor drive to ramp from 0.0 Hz to Maximum Output Frequency (Pr.01-00). The Deceleration Time is to determine the length of time required for an AC motor drive to decrease from Maximum Output Frequency (Pr.01-00) to 0.00Hz.
- The Acceleration/Deceleration Time is invalid when setting 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 action time set up above.
- 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 (JOG)

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, and decelerates from Pr.01-22 to 0Hz.

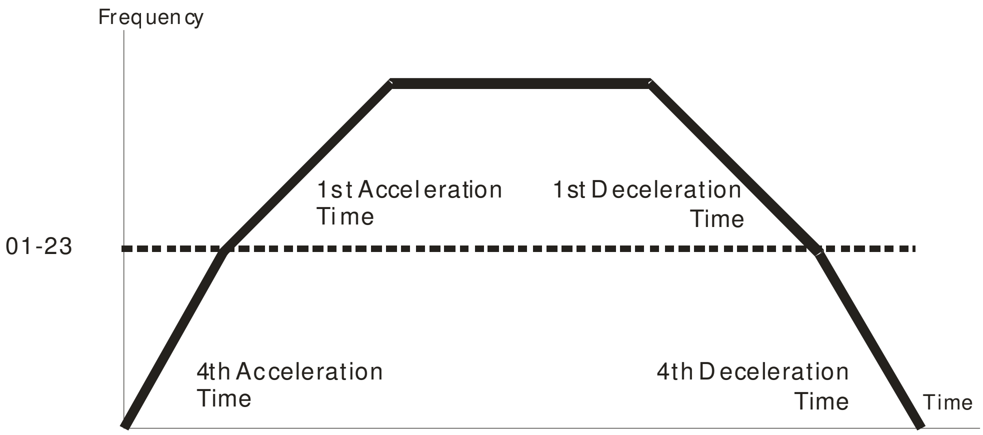
- The JOG command can't be executed when the AC motor drive is running. In the same way, when the JOG command is executing, other operation commands are invalid except forward/reverse commands and STOP key on the digital keypad.
- The optional keypad KPC-CE01 doesn't support JOG function.

01 - 23 Frequency of 1st Acceleration / Deceleration & Frequency of 4th Acceleration / Deceleration.

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.



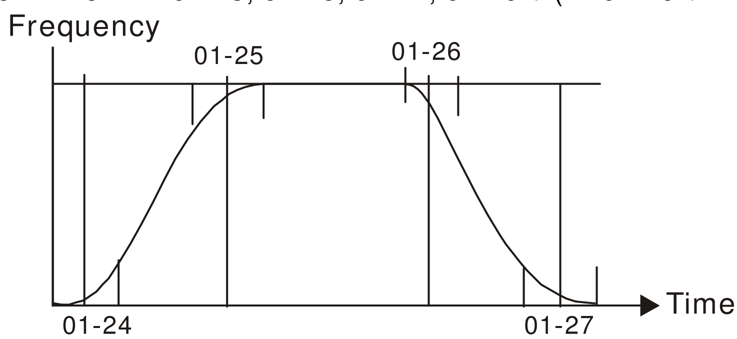
1st/4th Acceleration/Deceleration Frequency Switching

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 Parameter 01-45=0：0.00~25.00 seconds
Parameter 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

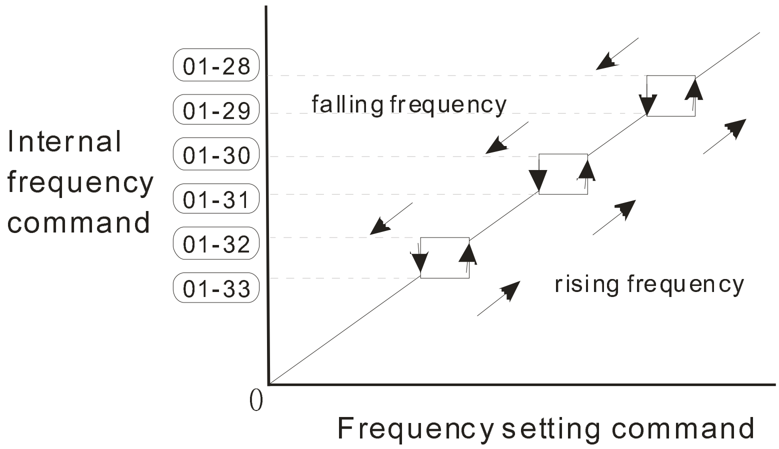


01 - 28 Upper limit of Frequency 1 setting not allowed
01 - 29 Lower limit of Frequency 1 setting not allowed
01 - 30 Upper limit of Frequency 2 setting not allowed
01 - 31 Lower limit of Frequency 2 setting not allowed
01 - 32 Upper limit of Frequency 3 setting not allowed
01 - 33 Lower limit of Frequency 3 setting not allowed

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.
- 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 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.
- The setting of frequency command (F) can be set within the range of skip frequencies. At 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

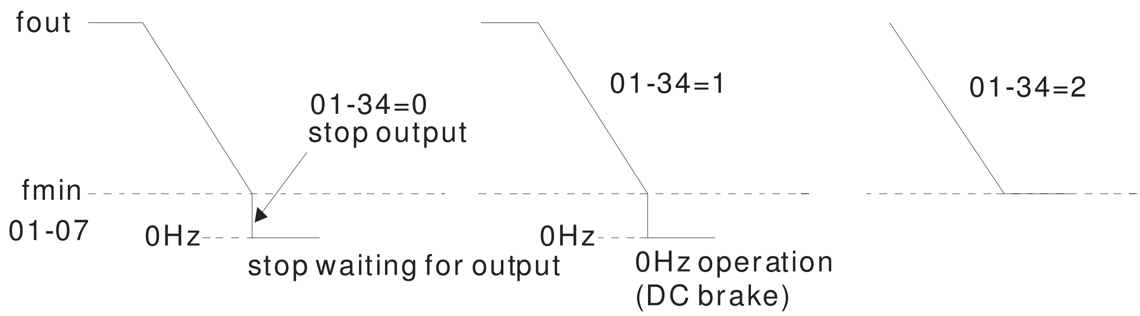
1: Zero-speed operation

2: Output at Minimum Frequency (according to 01-07, 01-41)

- 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 it is set to 1, it will execute DC brake by Vmin(Pr.01-08 and Pr.01-42) in V/F and SVC modes.
- 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 and SVC modes.

📖 When it is set to 2 and if the setting of Pr01-11(output frequency lower limit) is bigger than Fmin, then the motor drive will run in accordance with the setting of Pr01-11 in VF and SVC mode.

📖 In V/F and SVC modes



01 - 43 V/F Curve Selection

Factory Setting: 0

Settings 0: V/F curve determined by group 01

1: V/F curve to the 1.5 power

2: V/F curve to the 2 power

3: 60Hz, voltage is saturated when it's 50Hz

4: 72Hz, voltage is saturated when it's 60Hz

5: 50Hz, decrease gradually with third power

6: 50Hz, decrease gradually with square

7: 60Hz, decrease gradually with third power

8: 60Hz, decrease gradually with square

9: 50Hz, medium starting torque

10: 50Hz, large staring torque

11: 60Hz, medium startin torque

12: 60Hz, large starting torque

13: 90Hz, voltage is saturated when it's 60Hz

14: 120Hz, voltage is saturated when it's 60Hz

15: 180Hz, voltage is saturated when it's 60Hz

📖 V/F curve can be selected from 15 kinds of default settings or set manually.

📖 After setting 01-43 depending on the application, the set value can be fine tuned in 01-00~01-08 to fit the application more precisely.

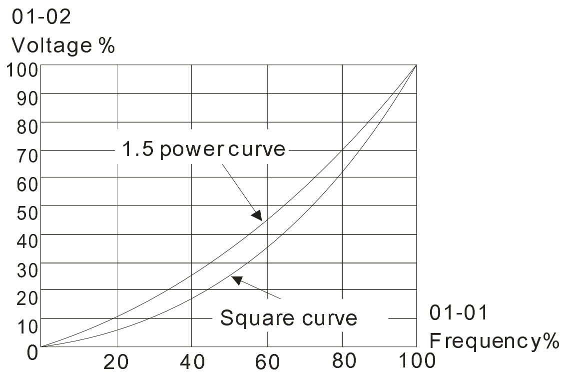
NOTE

1. If the V/F curve is not selected properly, it may result motor to generate insufficient torque or may lead to high current output due to overfluxing.
2. When the drive is reset by 00-02, 01-43 is reset as well.

Setting	SPEC.	Feature	Purpose
0	Normal V/F curve	Constant torque	For normal application. This required torque for load is the same no matter the rotor speed of motor.
1	V/F curve to the 1.5 power	Variable torque	To set higher level of V/F curve, the torque in low speed is relatively low, which is not recommended for high acceleration/deceleration application.
2	V/F curve to the 2 power		

Setting	SPEC.	Feature	Purpose
3	60Hz (voltage saturation in 50Hz)	Constant torque	For normal application. This required torque for load is the same no matter the rotor speed of motor
4	72Hz (voltage saturation in 60Hz)		
5	3th decreasing (50Hz)	Decreasing torque	For fans, pumps, the required torque derating relative to the load.
6	2nd decreasing (50Hz)		
7	3th decreasing (60Hz)		
8	2nd decreasing (60Hz)		
9	Mid. starting torque (50Hz)	High starting torque	Select high starting torque when: ● Wiring between the drive and motor exceeds 150 m ● A large amount of starting torque is required (like lift) ● An AC reactor is installed in the output side of the drive
10	High starting torque (50Hz)		
11	Mid. starting torque (60Hz)		
12	High starting torque (60Hz)		
13	90Hz (voltage saturation in 60Hz)	Constant output operation	The curve for operation above 60Hz. To operate above 60Hz, the output voltage is fixed.
14	120Hz (voltage saturation in 60Hz)		
15	180Hz (voltage saturation in 60Hz)		

- When setting to 0, refer to Pr.01-01~01-08 for motor 1 V/f curve. For motor 2, refer to Pr.01-35~01-42.
- When setting to 1 or 2, the 2nd and the 3rd voltage frequency setting are invalid.
- If a motor load is a variable torque load (the torque is in direct proportion to the speed, such as the load of a fan or a pump), it will 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 the higher power V/F curve, low frequency torque will be even lower so it is not suitable for fast acceleration/deceleration. It is recommended NOT to apply this parameter for any fast acceleration/deceleration.



〆 01 - 44 Optimal Acceleration/Deceleration Setting

Factory Setting: 0

Settings 0: Linear accel. /decel.

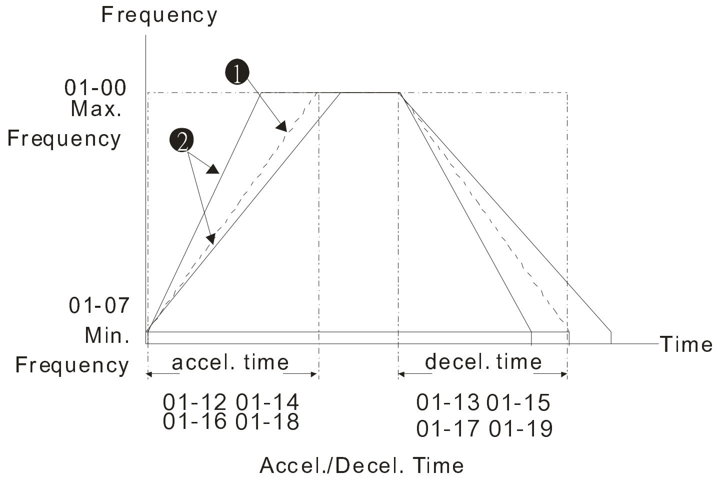
1: Auto accel., Linear decel.

2: Linear accel., Auto decel.

3: Auto accel. / decel.

4: Linear, stall prevention by auto accel./decel. (limit by

- This parameter helps to decrease efficiently the mechanical vibration when a motor starts/stops a load. It auto-detects the torque size of a load, then it will accelerate to reach the frequency of your setting within the shortest time and the smoothest start-up current. It can also auto-detect the re-generated voltage of a load, and then it will decelerate to stop the motor within the shortest time and in a smoothest way.
- Setting 0 Linear accel./decel.: it will accelerate/decelerate according to the setting of Pr.01-12~01-19.
- Setting1 to Auto accel./decel.: it can reduce the mechanical vibration and prevent the complicated auto-tuning processes. It won't stall during acceleration so a brake resistor is not required. In addition, it can improve the operation efficiency and save energy.
- Setting 3 Auto accel./decel. (auto calculation of the accel./decel. time by actual load): this setting helps to decrease efficiently the mechanical vibration when the drive starts/stops a load. It auto-detects the torque size of a load, then it will accelerate to reach the frequency of your setting within the shortest time and the smoothest start-up current. It can also auto-detect the re-generated voltage of a load, and then it will decelerate to stop the drive within the shortest time and in a smoothest way.
- Setting 4 Stall prevention by auto accel./decel. (limited by 01-12 to 01-21): if the acceleration/deceleration is in a reasonable range, it will accelerate/decelerate in accordance with the setting of Pr.01-12~01-19. If the accel./decel. time is too short, the actual accel./decel. time will be greater than the setting of accel./decel. time.



1 When Pr.01-44 is set to 0.

2 When Pr.01-44 is set to 3.

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

Factory Setting: 0

Settings 0: Unit 0.01 second

1: Unit 0.1 second

01 - 46 CANopen Quick Stop Time

Factory Setting: 1.00

Settings Parameter 01-45=0: 0.00~600.00 seconds

Parameter 01-45=1: 0.0~6000.0 seconds

- It is to set up the length of time required when a drive decelerates from its max. operation frequency (Pr.01-00) to 0.00Hz in CANopen control mode. .

01 - 47 Reserved

01 - 48 Reserved

01 - 49 Deceleration Method

Factory Setting: 0

Settings 0: Normal deceleration
1: Over Fluxing deceleration
2: Traction Energy Control

- 🕮 When Pr01-49=0, the deceleration or stop will according to original deceleration method.
- 🕮 When Pr01-49=1: drive will control the deceleration time according to the Pr06-01 setting value and DC BUS voltage.
  DC BUS >95% of Pr06-01 Over-voltage Stall Prevention setting value →enable Over fluxing deceleration method.
  If the Pr06-01=0→Drive will enable Over fluxing deceleration method according to the operating voltage and DC BUS regenerative voltage This method will refer to the deceleration time setting and the actual deceleration time will longer than the deceleration time setting.
- 🕮 Actual deceleration time will longer than the deceleration time setting because the Over-voltage Stall Prevention function.
- 🕮 When Pr01-49=1, please used with the parameter Pr06-02=1 to get a better over voltage suppression effect during deceleration.
- 🕮 Pr01-49=2: this function is based on the drives' ability to auto-adjust output frequency and voltage in order to get faster DC BUS energy consumption and the actual deceleration time will be as much as possible consistent with the deceleration parameter set up time. When real deceleration time does not conform to the expected deceleration time and cause an over-voltage errors, recommended that to use this setting.. .

02 Digital Input/Output Parameters

〆 The parameter can be set during operation.

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

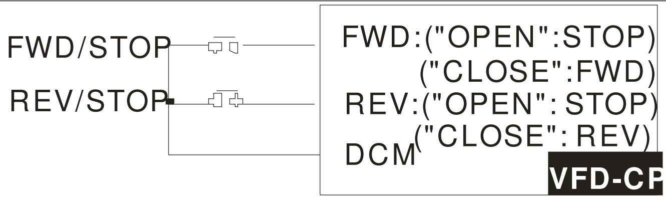
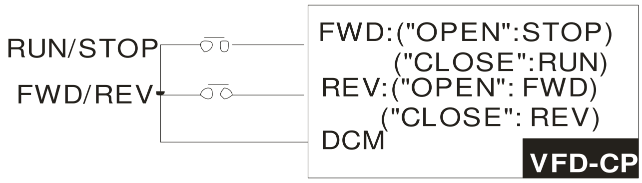
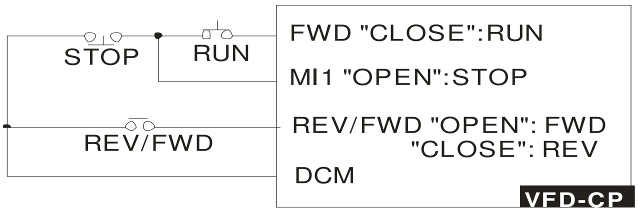
Factory Setting: 0

Settings 0: 2 wire mode 1

1: 2 wire mode 2

2: 3 wire mode

📖 This parameter is to set the operation control method. There are three different control modes.

02-00	**Control Circuits of the External Terminal**
When the setting is 0 Two-wire mode 1 FWD/STOP REV/STOP	
When setting is 1 Two-wire mode 2 RUN/STOP REV/FWD	
3: Three-wire operation control	

02 - 01 Multi-function Input Command 1 (MI1) (MI1) when Pr02-00 is set at "3": Three-wire operation control, the terminal M1 becomes the STOP contact

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

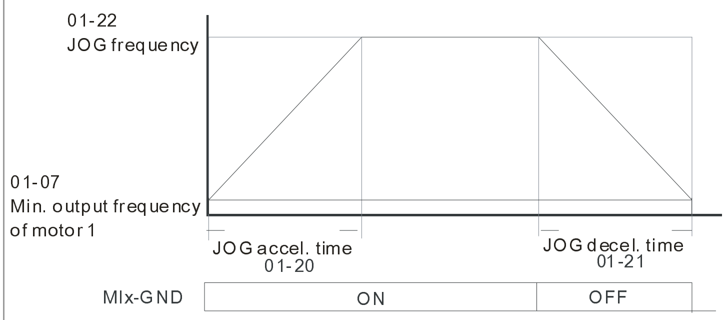
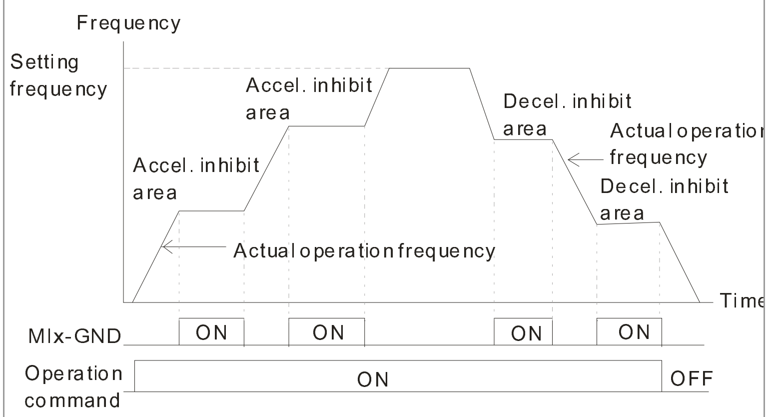
0: No function
1: multi-step speed command 1
2: multi-step speed command 2
3: multi-step speed command 3
4: multi-step speed command 4
5: Reset
6: JOG command（By KPC-CC01 or external control）
7: acceleration/deceleration speed not allow
8: the 1st, 2nd acceleration/deceleration time selection
9: the 3rd, 4th acceleration/deceleration time selection
10: EF Input (Pr.07-20)
11：B.B input from external (Base Block)
12: Output stop
14: switch between motor 1 and motor 2
15: operation speed command from AVI1
16: operation speed command from ACI
17: operation speed command from AVI2
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
28: Emergency stop (EF1)
29: Signal confirmation for Y-connection
30: Signal confirmation for Δ-connection
38：Disable write EEPROM function
40: Enforced coast to stop
41：HAND switch
42：AUTO switch
43~48: Reserved
49: Drive enabled
50: Slave dEb run
51: Selection for PLC mode bit 0
52: Selection for PLC mode bit 1
53: Triggered CANOpen quick stop
54: UVW Magnetic Contactor On/OFF
55: Confirmation signal of the released brake
56: LOC/REM Selection
57: Reserved
58: Enable fire mode (with RUN Command)
59: Enable fire mode (without RUN Command)

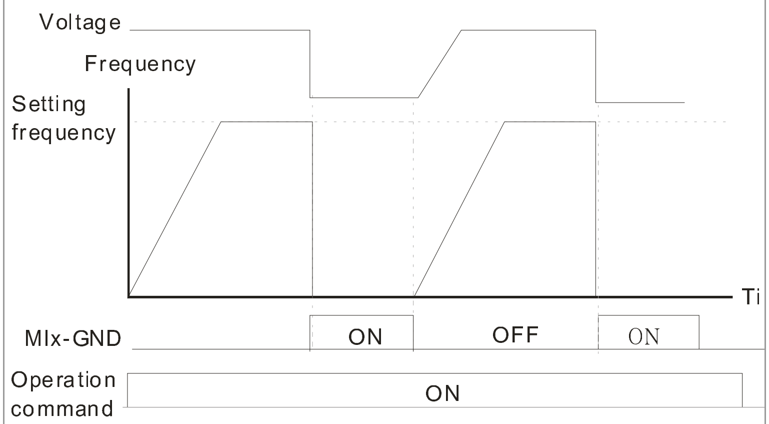
60: Disable all the motors
61: Disable Motor#1
62: Disable Motor#2
63: Disable Motor#3
64: Disable Motor#4
65: Disable Motor #5
66: Disable Motor#6
67: Disable Motor#7
68: Disable Motor#8

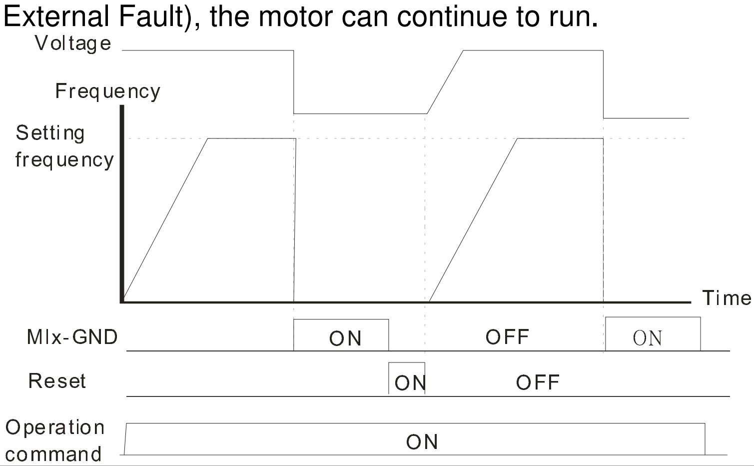
- This parameter selects the functions for each multi-function terminal.
- Parameter 02-26 to 02-31 will be physical input terminals after expansion cards are installed. If there is no expansion cards installed, these parameters remain virtual terminals. For example, after installing the multiple function expansion card “EMC-D42A”, Parameter 02-26 to 02-29 are defined as corresponding parameters for terminals MI10 to MI13. But Parameters 02-30 to 02-31 are still virtual terminals.
- When terminals are defined as virtual, you need a digital keypad such as KPC-CC01 or a communication mode to modify status of bit 8~15 (0 means ON, 1 means OFF) at Parameter 02-12.
- If the setting of the Parameter 02-00 is "2: 3 wire mode," then the terminal MI 1 becomes a STOP contact .So the function which was set at this terminal is automatically disabled.

Table of Functions
(for Normally Open (N.O.) Contacts , ON means contact is CLOSED; OFF means contact is OPEN)

Settings	Functions	Descriptions
0	No Function	
1	Multi-step **speed** command **1**	15-speed can be conducted through the digital status of the 4 terminals. It will be 16-speed if the master speed is included. (Refer to parameter of Group04)
2	Multi-step **speed** command 2	
3	Multi-step **speed** command 3	
4	Multi-step **speed** command 4	
5	Reset	After the error of the drive is eliminated, use this terminal to reset the drive.
6	JOG Command	Before executing this function, wait for the drive stop completely. While the drive is running, the operating direction can be modified and STOP key on the keypad is still 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.

<table>
<tr><th>Settings</th><th>Functions</th><th>Descriptions</th></tr>
<tr><td></td><td></td><td>
</td></tr>
<tr><td>7</td><td>Acceleration / Deceleration Speed Inhibit</td><td>When this function is enabled, the acceleration and deceleration are stopped right away. After this function is disabled, the AC motor drive re-starts to accel./decel. from the inhibiting point.

</td></tr>
<tr><td>8</td><td>The 1st, 2nd acceleration or deceleration time selection</td><td rowspan="2">The acceleration/deceleration time of the drive can be selected from this function or the digital status of the terminals; there are 4 acceleration/deceleration speeds in total for selection.
<table>
<tr><th>MIx=9</th><th>MIx=8</th><th>Accel./Decel.</th></tr>
<tr><td>OFF</td><td>OFF</td><td>1st Accel./Decel.</td></tr>
<tr><td>OFF</td><td>ON</td><td>2nd Accel/Decel.</td></tr>
<tr><td>ON</td><td>OFF</td><td>3rd Accel/Decel.</td></tr>
<tr><td>ON</td><td>ON</td><td>4th Accel./Decel.</td></tr>
</table></td></tr>
<tr><td>9</td><td>The 3rd, 4th acceleration or deceleration time selection</td></tr>
<tr><td>10</td><td>EF Input (EF: External Fault)</td><td>External fault input terminal. It decelerates by Pr.07-20 setting (If there is any External Fault, it will be saved in an error log)</td></tr>
<tr><td>11</td><td>External B.B. Input (Base Block)</td><td>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.</td></tr>
</table>

Settings	Functions	Descriptions
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. 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 mode 01, 02, 03 or 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 parameters of motor 2. When it is OFF: use parameters of motor 1.
15	Operation speed command form AVI1	When the contact is ON, the source of the frequency has to be from AVI1. SetPr03-00 = 1. (If the operation speed commands are set to AVI1, ACI and AVI2 at the same time. The priority is AVI1＞ACI＞AVI2)
16	ACI Operation speed command form ACI	When the contact is ON, the source of the frequency has to be from ACI. Set Pr03-01=1. (If the operation speed commands are set to AVI1, ACI and AVI2 at the same time. The priority is AVI1＞ACI＞AVI2)
17	Operation speed command form AVI2	When this function is enabled, the source of the frequency has to be from AVI2. Set Pr03-02 =1. (If the operation speed commands are set to AVI1, ACI and AVI2 at the same time. The priority is AVI1＞ACI＞AVI2)
18	Emergency Stop (07-20)	When the contact is ON, the drive will ramp to stop by setting of Pr.07-20.
19	Digital Up command	Before using this function, choose a source of frequency(Pr00-20 or Pr00-30) to do external up/down input. When the contact is ON, the frequency of the drive will be increased or decreased by one unit (Parameter 02-00). If this function is constantly ON, the frequency will be increased or decreased by setting of Pr.02-09 or Pr.02-10.
20	Digital Down Command	

Settings	Functions	Descriptions
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.
28	Emergency stop (EF1)	When the contact is ON, the drive will execute emergency stop and display EF1 on the keypad. The motor stays in the free run until the error is cleared. (terminal's status is back to normal). Only after pressing RESET" (EF: External Fault), the motor can continue to run. 
29	Signal confirmation for Y-connection	When the control mode is V/F and the contact is ON, the drive will operate by following the 1st V/F.
30	Signal confirmation for △ connection	When the control mode is V/F and contact is ON, the drive will operate by following the 2nd V/F.
38	Disable EEPROM write function	When this contact is ON, write to EEPROM is disabled. However, the modified value will be back to the old value after restarting the motor drive.
40	Enforced coast to stop	When this contact is ON during an operation, the drive will free run to stop.

<table>
<tr><th>Settings</th><th>Functions</th><th>Descriptions</th></tr>
<tr><td>41</td><td>HAND switch</td><td rowspan="2">☑ When multi-function input terminal is switched OFF, it executes a STOP command. That means when switching to OFF during the operation, the drive will also stop.
☑ When switching by the keypad KPC-CC01 during an operation, the drive will be switched to the status after stop.
☑ When a command is entered via a keypad such as KPC-CC01, the drive will stop for few seconds then switch to the status in accordance with that command.
☑ Digital keypad displays the drive’s status such as HAND/OFF/AUTO<table><tr><th></th><th>Bit 1</th><th>Bit 0</th></tr><tr><td>OFF</td><td>0</td><td>0</td></tr><tr><td>AUTO</td><td>0</td><td>1</td></tr><tr><td>HAND</td><td>1</td><td>0</td></tr><tr><td>OFF</td><td>1</td><td>1</td></tr></table></td></tr>
<tr><td>42</td><td>AUTO switch</td></tr>
<tr><td>43
~
48</td><td colspan="2">Reserved</td></tr>
<tr><td>49</td><td>Drive enabled</td><td>When drive = Enabled, RUN command is valid.
When drive = Disabled, RUN command is invalid.
When drive is in an Operation, motor coast to stop.</td></tr>
<tr><td>50</td><td colspan="2">Slave dEb run</td></tr>
<tr><td>51</td><td>Selection for PLC mode bit0</td><td rowspan="2"><table><tr><th>PLC status</th><th>Bit 1</th><th>Bit 0</th></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>Triggered 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</td><td>UVW magnetic contactor ON/OFF</td><td>To receive confirmation signals while there is UVW magnetic contactor during output.</td></tr>
<tr><td>55</td><td>Confirmation signal of released brake</td><td>This parameter needs to be used with P02-56. The main purpose is to make sure if mechanical brake works or not after triggering brake release command.
If the action is right, mechanical brake will give signal to MI terminal.
Please check time sequence chart for reference.</td></tr>
</table>

<table>
<tr><th>Settings</th><th>Functions</th><th>Descriptions</th></tr>
<tr><td>56</td><td>LOC/REMOTE switch</td><td>Use Pr.00-29 to select for LOCAL/REMOTE mode (refer to Pr.00-29).
When Pr.00-29 is not set to 0, on the digital keypad KPC-CC01 it will display LOC/REM status. (It will display on the KPC-CC01 if the firmware version is above version 1.021).
<table><tr><th></th><th>Bit 0</th></tr><tr><td>REM</td><td>0</td></tr><tr><td>LOC</td><td>1</td></tr></table></td></tr>
<tr><td>57</td><td colspan="2">Reserved</td></tr>
<tr><td>58</td><td>Enable fire mode with RUN Command</td><td>Enable this function under fire mode to force the drive to run (while there is RUN COMMAND).</td></tr>
<tr><td>59</td><td>Enable fire mode without RUN Command</td><td>Enable this function under fire mode to force the drive to run (while there isn't RUN COMMAND).</td></tr>
<tr><td>60</td><td>Disable all the motors</td><td>When the multi-motor circulative control is enable, all motors will park freely, when the function terminal set to be ON.</td></tr>
<tr><td>61</td><td>Disable Motor#1</td><td rowspan="8">These functions work with multi-motor circulative control, motor #1 to # 8 can be set to park freely. If any of Auxiliary Motor#1 to Motor#8 is out of order or under maintenance, enable this terminal to bypass that motor.</td></tr>
<tr><td>62</td><td>Disable Motor#2</td></tr>
<tr><td>63</td><td>Disable Motor#3</td></tr>
<tr><td>64</td><td>Disable Motor#4</td></tr>
<tr><td>65</td><td>Disable Motor#5</td></tr>
<tr><td>66</td><td>Disable Motor#6</td></tr>
<tr><td>67</td><td>Disable Motor#7</td></tr>
<tr><td>68</td><td>Disable Motor#8</td></tr>
</table>

02 - 09 UP/DOWN Key Mode

Factory Setting: 0

Settings 0：UP/DOWN by the accel./decal. Time

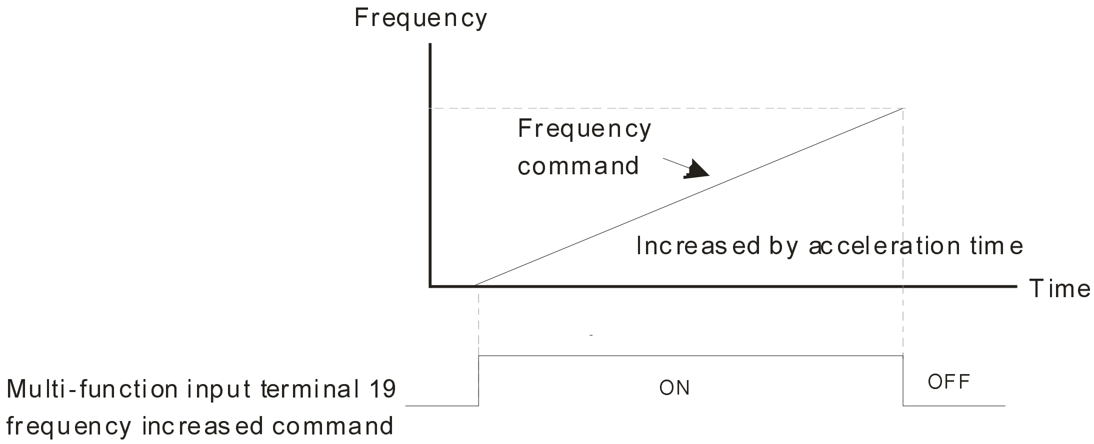
1：UP/DOWN constant speed（by parameter 02-10）

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

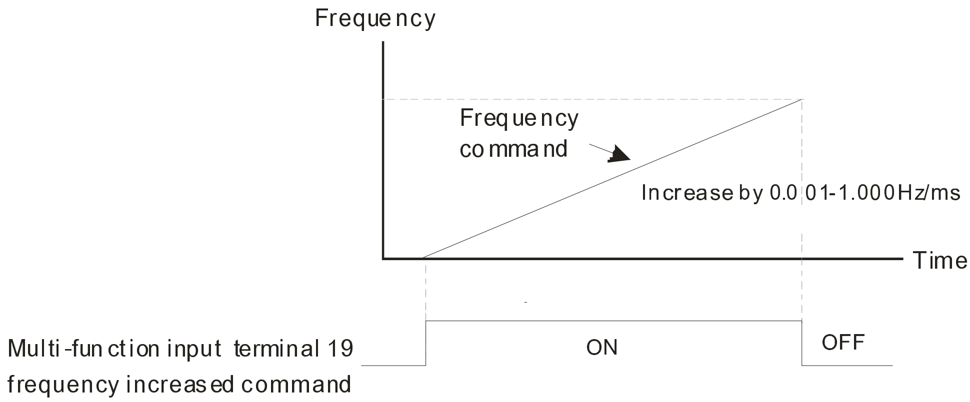
Factory Setting: 0.001

Settings 0.001~1.000Hz/ms

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



- Pr.02-09 set to 1: use multi-function input terminal ON/OFF to increase/decrease the frequency command(F) according to the setting of Pr.02.10(0.001~1.000Hz/ms).



02 - 11 Digital Input Response Time

Factory Setting: 0.005

Settings 0.000~30.000 seconds

- This parameter is to set the response time of digital input terminals FWD, REV and MI1~MI8.
- It is 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 Setting

Factory Setting: 0000h

Settings 0000h~FFFFh (0:OFF ; 1:ON.)

- The setting of this parameter is in hexadecimal.
- This parameter is 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
MI15	MI14	MI13	MI12	MI11	MI10	MI8	MI7	MI6	MI5	MI4	MI3	MI2	MI1	REV	FWD

- The parameters below set the functions of each multi-function terminal.
- Pr.02-36~Pr.02-41 can only be set after installing optional card.
- 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)

02 - 13 Relay1: Multi Output Terminal

Factory Setting: 11

02 - 14 Relay2: Multi Output Terminal

Factory Setting: 1

02 - 15 Relay3: Multi Output Terminal

Factory Setting: 66

02 - 16 Reserved

02 - 17 Reserved

02 - 36 Expansion Card Output Terminal (MO10) or (RA10)

02 - 37 Expansion Card Output Terminal (MO11) or (RA11)

02 - 38 Expansion Card Output Terminal (MO12) or (RA12)

02 - 39 Output terminal of the I/O extension card (MO13) or (RA13)

02 - 40 Output terminal of the I/O extension card (MO14) or (RA14)

02 - 41 Output terminal of the I/O extension card (MO15) or (RA15)

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)

MO16, MO17, MO18, MO19, MO20 are virtual terminals. Their functions are controlled by the bit 11~ bit15 of Pr02-18.

Factory Setting: 0

Settings:

0: No function

1: Operation Indication

2: Operation speed attained

3: Desired Frequency Attained 1 (Parameter 02-22)

4: Desired Frequency Attained 2 (Parameter 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, does not return to 0 (Pr.02-20)

18: Preliminary count value attained, returns to 0 (Pr.02-19)

19: External base block input

20: Warning output

21: Over voltage warning

22: Over-current stall prevention warning

23: Over-voltage stall prevention warning

24: Operation mode indication

25: Forward command

26: Reverse command

27: Output when current >= Pr.02-33

28: Output when current <Pr.02-33

29: Output when frequency >= Pr.02-34 (>= 02-34)

30: Output when frequency < Pr.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)

40: Speed attained (including Stop)

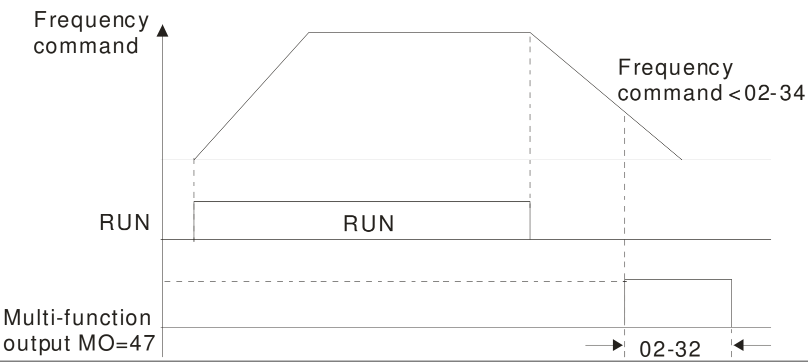
44: Low current output

45: UVW Magnetic Contactor enabled
47: Brake output closed
50: Output for CANopen control
51: Output for RS485
52: Output for communication card
53: Fire mode indication
54: Bypass fire mode indication
55: Motor #1 Output
56: Motor #2 Output
57: Motor #3 Output
58: Motor#4 Output
59: Motor#5 Output
60: Motor #6 Output
61: Motor#7 Output
62: Motor#8 Output
66: SO contact A (N.O.)
67: Analog input signal level achieved
68: SO contact B (N.C.)

- This parameter selects the functions for each multi-function terminal.
- Pr.02-36~Pr.02-41 can only be set after installing optional card.
- 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	This terminal has 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.

Settings	Functions	Descriptions
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 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.

Settings	Functions	Descriptions
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.
40	Speed Attained (including zero speed)	Active when the output frequency reaches frequency setting or stop
44	Low Current Output	This function needs to be used with Pr.06-71 ~ Pr.06-73
45	UVW Magnetic Contactor enabled	When the function "54: UVW Magnetic Contactor On/OFF" of Pr02-31 is enabled, this contact will work.
47	Brake Released 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. 
50	Output for CANopen control	For CANopen communication output
51	Output for RS-485	For RS-485 output
52	Out put for communication card	For CMC-MOD01, CMC-EIP01, CMC-PN01, CMC-DN01communication control to do output
53	Fire mode indication	When #58 or #59 is enabled, this function will work.
54	By pass fire mode indication	When by pass function is enabled in the fire mode, this contact will work.
55	Motor #1 output	When setting multi-motor circulative function, the multi-function output terminal will automatically set up Pr02-13~Pr02-15 and Pr02-36~Pr02-40 in accordance with Pr12-01's setting.
56	Motor #2 output	
57	Motor #3 output	
58	Motor #4 output	
59	Motor #5 output	
60	Motor #6 output	
61	Motor #7 output	
62	Motor #8 output	

<table>
<tr><th>Settings</th><th>Functions</th><th>Descriptions</th></tr>
<tr><td>66</td><td>SO contact A (N.O.)</td><td rowspan="2">
<table>
<tr><td rowspan="2">Status of drive</td><td colspan="2">Status of safety output</td></tr>
<tr><td>N.O. (MO=66)</td><td>N.C. (MO=68)</td></tr>
<tr><td>Normal</td><td>Broken circuit (Open)</td><td>Short circuit (Close)</td></tr>
<tr><td>STO</td><td>Short circuit (Close)</td><td>Broken circuit (Open)</td></tr>
<tr><td>STL1~STL3</td><td>Short circuit (Close)</td><td>Broken circuit (Open)</td></tr>
</table>
</td></tr>
<tr><td>68</td><td>SO contact B (N.C.)</td></tr>
<tr><td>67</td><td>Analog input signal level achieved</td><td>Multi-function output terminals operate when analog input signal level is between high level and low level.
03-44: Select the analog signal channel, AVI, ACI, and AUI which is going to be compared.
03-45: The high level of analog input, factory setting is 50%.
03-46: The low level of analog input, factory setting is 10%.
If analog input > 03-45, then multi-function output terminal operates.
If analog input < 03-46, then multi-function output terminal stops outputting.</td></tr>
</table>

02 - 18 Multi-output Direction

Factory Setting: 0

Settings 0000h~FFFh (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. For example: If Pr02-13=1, Relay 1 is open when the drive runs and is closed when the drive is stopped

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	Reserved	Reserved	RY3	RY2	RY1

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

Factory Setting: 0

Settings 0~65500

- 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.

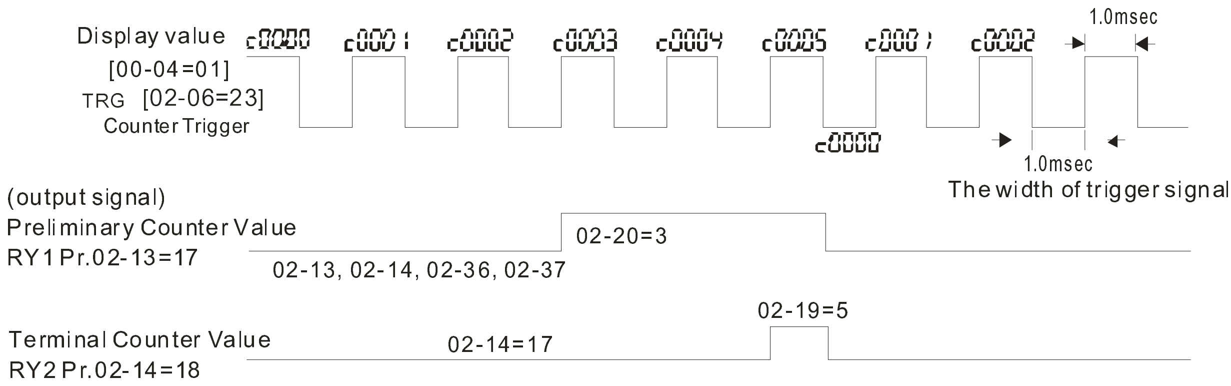
02 - 20 Preliminary count value attained (not return to 0)

Factory Setting: 0

Settings 0~65500

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

See the sequence diagram below:



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 - 24 Desired Frequency Attained 2

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

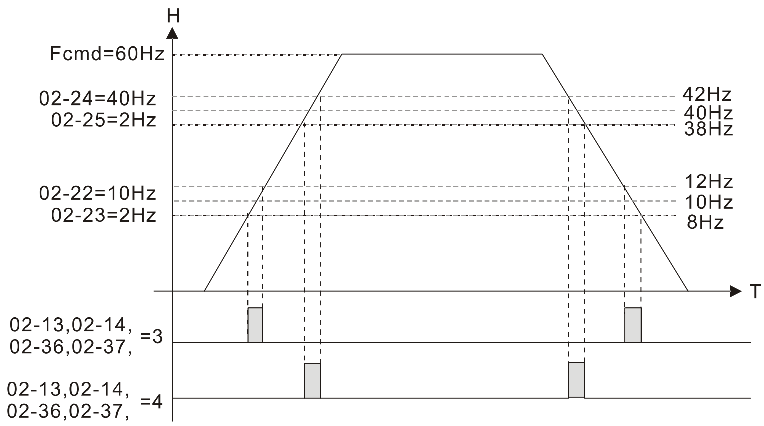
Settings 0.00~600.00Hz

02 - 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.

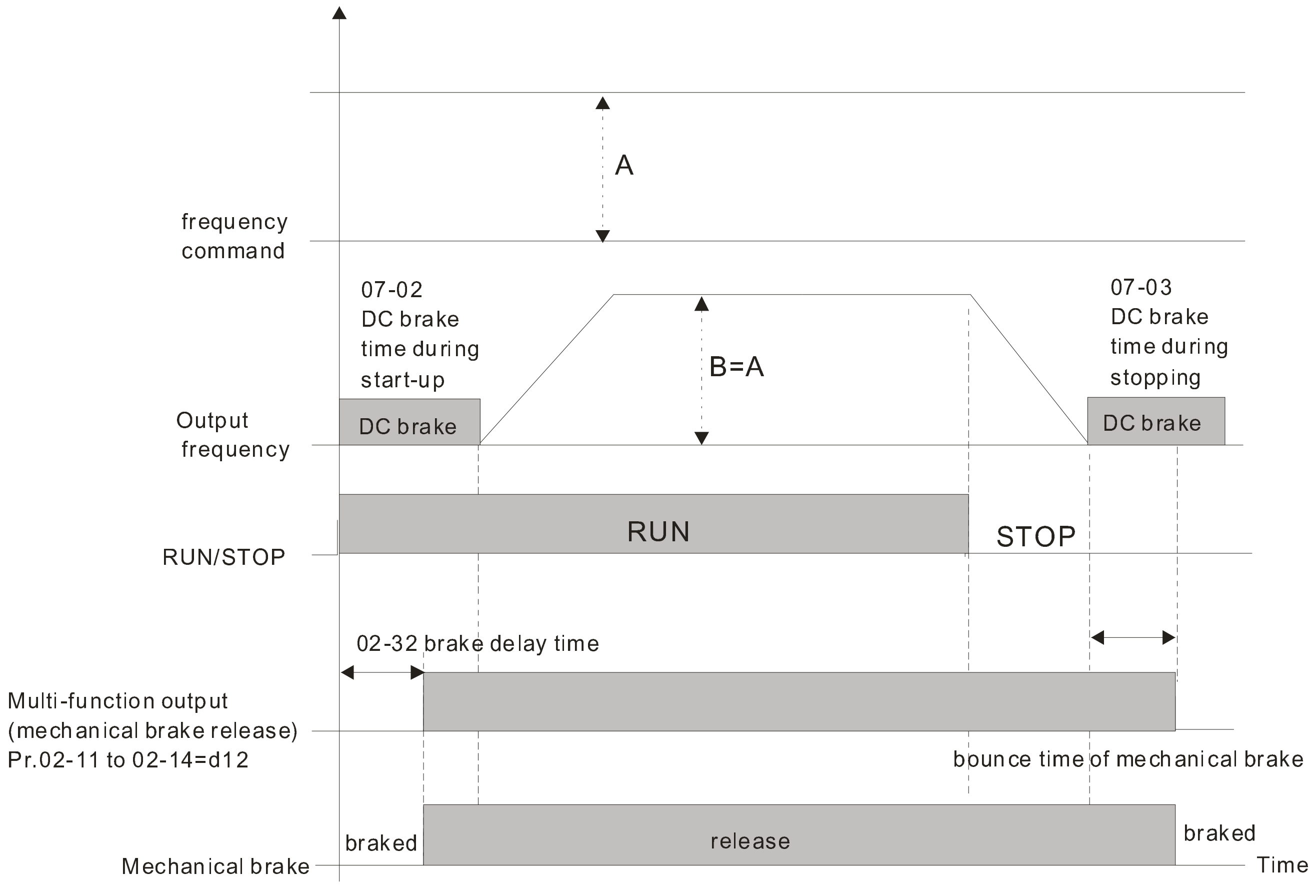


02 - 32 Brake Delay Time

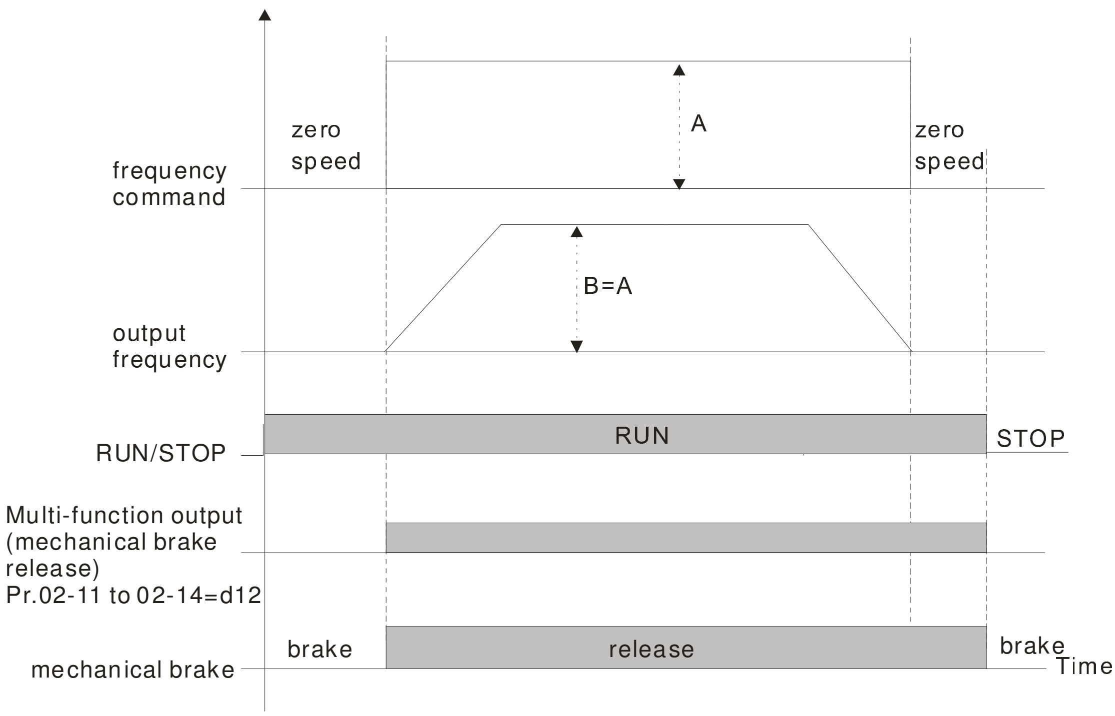
Factory Setting: 0.000

Settings 0.000~65.000 seconds

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



If this parameter is applied 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 larger 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 smaller 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.

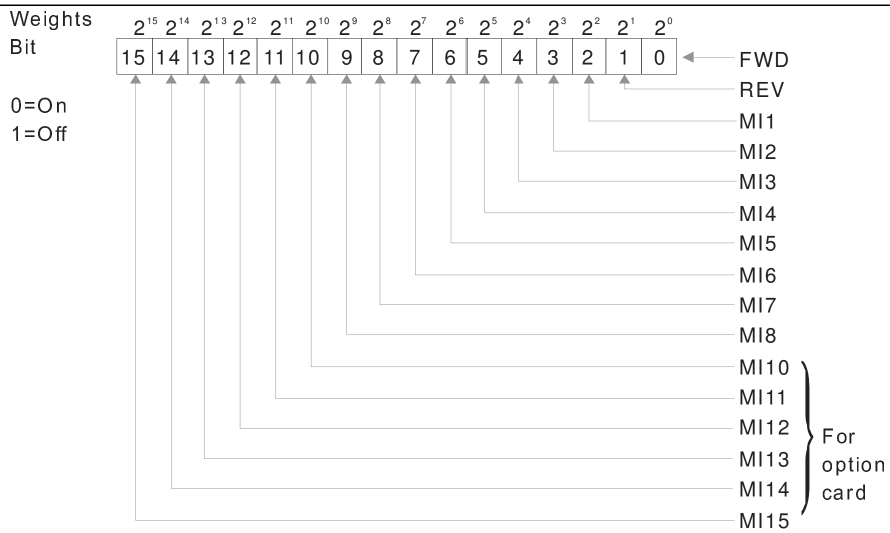
- Setting 1:

  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 ~ 02 - 49 Reserved

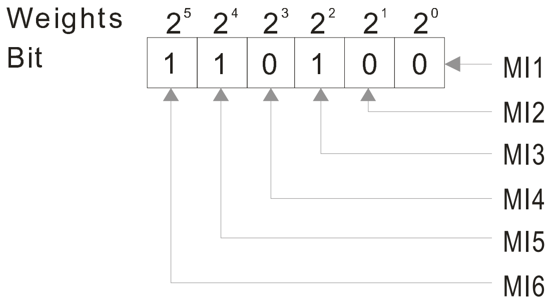
02 - 50 Display the Status of Multi-function Input Terminal

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

$= bit5x2^5+bit4x2^4+bit2x2^2$

$= 1x2^5+1x2^4+1x2^2$

$=32+16+4 =52$

NOTE

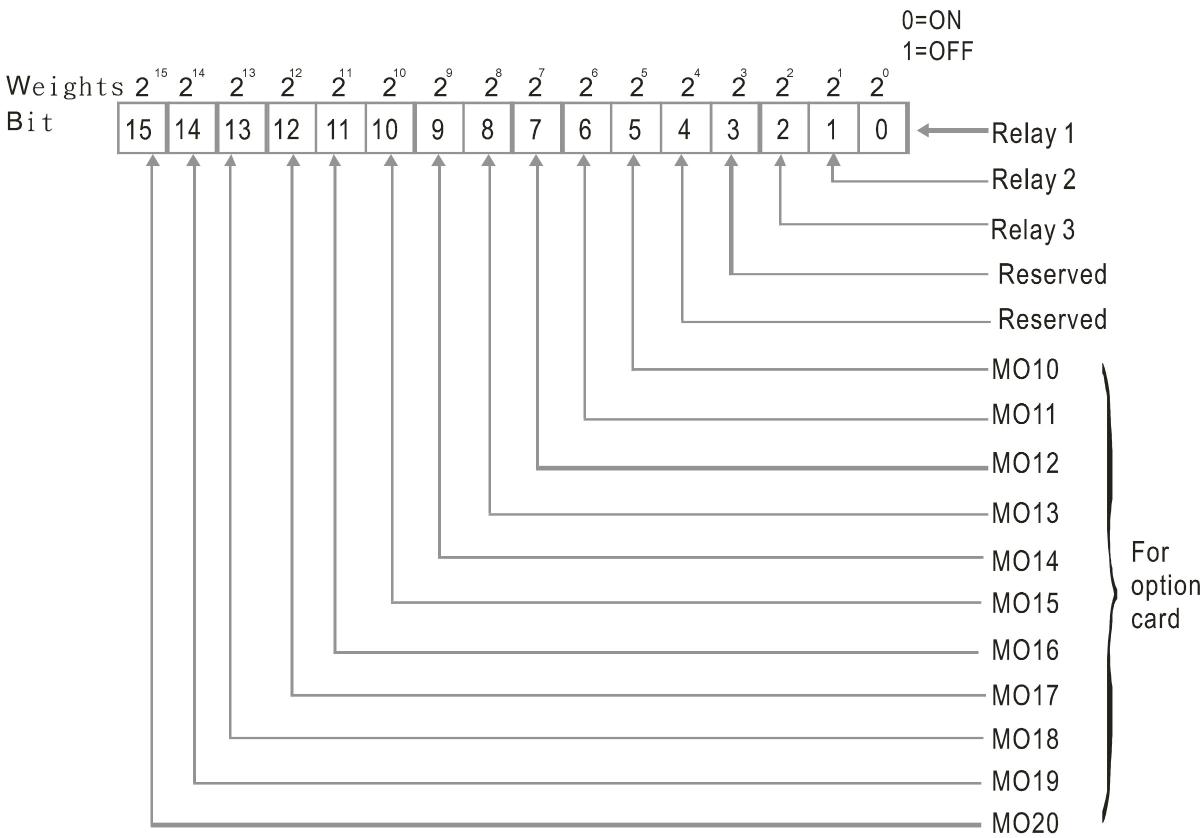
$2^5=32$ $2^4=16$ $2^3=8$ $2^2=4$
$2^1=2$ $2^0=1$

02 - 51 Status of Multi-function Output Terminal

Factory Setting: Read Only

For Example:

If Pr.02-51 displays 00023h (Hex), i.e. the value is 35, and 100011 (binary). It means RY1, RY2 and MO3 are ON.



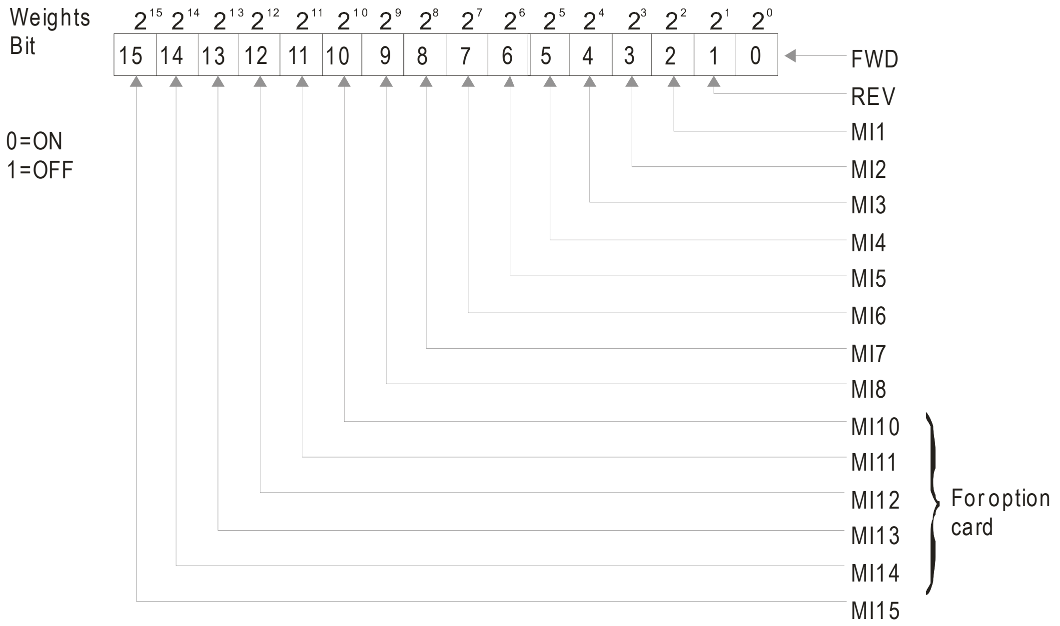
NOTE

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

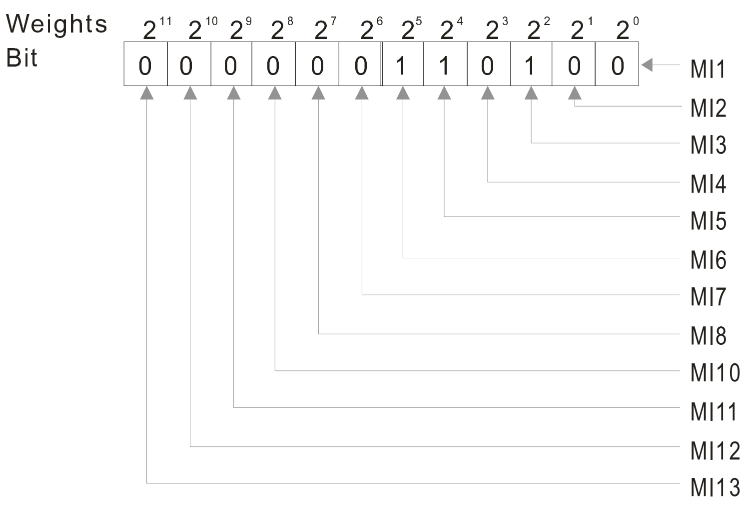
02 - 52 Display External Output terminal occupied by PLC

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

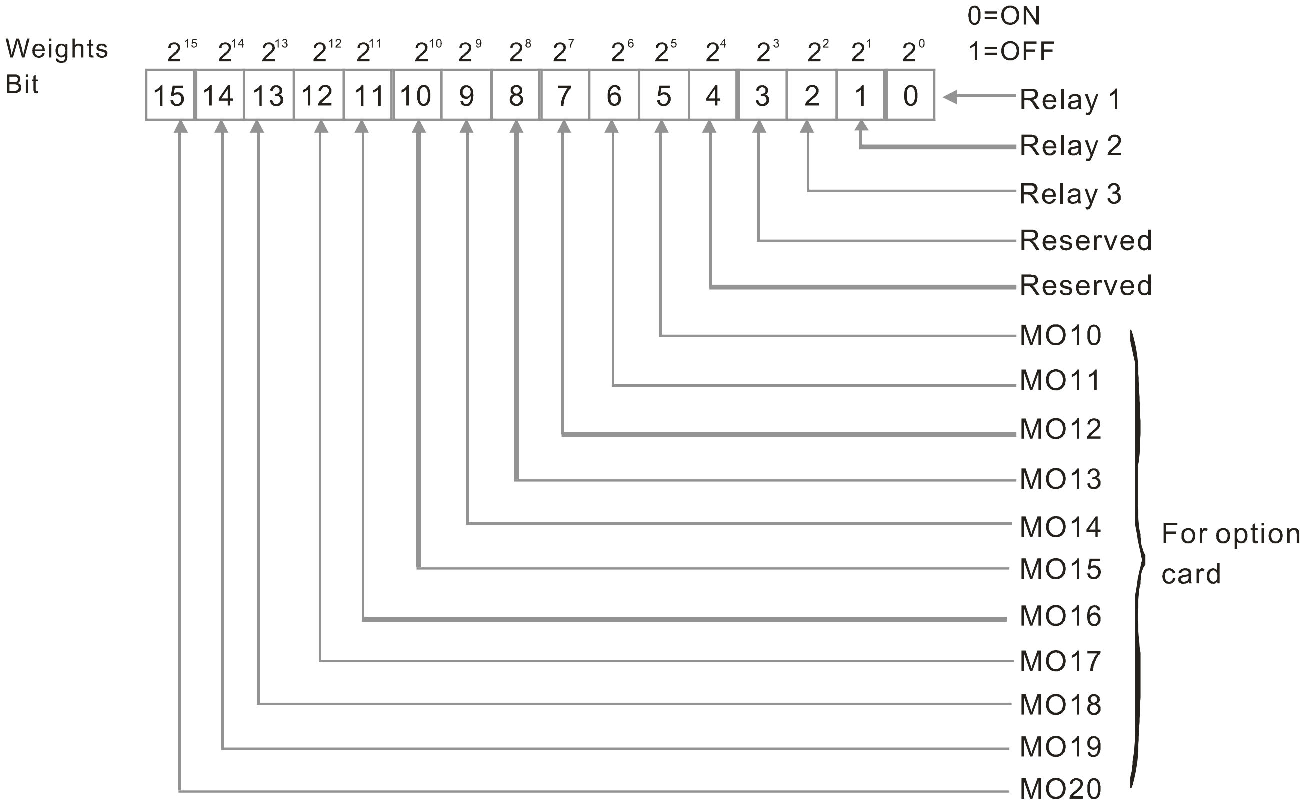
Displays
$= bit5x2^{5}+bit4x2^{4}+bit2x2^{2}$
$= 1x2^{5}+1x2^{4}+1x2^{2}$
$=32+16+4 =52$

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 Output Terminal occupied by PLC

Factory Setting: Read Only

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



NOTE

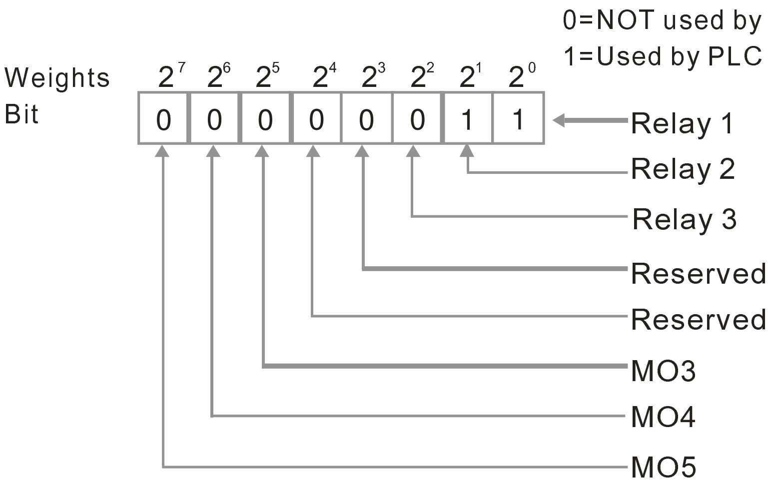
$2^7=128$ $2^6=64$

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

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

For example:

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



Display value

$3=2+1$

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

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

02 - 54 Display the Frequency Command Memory of 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.

02 – 55 ~ 02 - 56 Reserved

03 Analog Input/Output Parameters

✎ The parameter can be set during operation

✎ **03 - 00** Analog Input 1 (AVI1)

Factory Setting: 1

✎ **03 - 01** Analog Input 2(ACI)

Factory Setting: 1

✎ **03 - 02** Analog Input 3 (AVI2)

Factory Setting: 1

Settings
0：No function
1：Frequency command
4：PID target value (Refer to Group 8)
5：PID feedback signal (Refer to Group 8)
6：PTC thermistor input value
11：PT100 thermistor input value
12：Reserved
13：PID compensation value
14~17：Reserved

- When use analog input as PID reference value, Pr00-20 must set 2(analog input).
  Setting method 1: Pr03-00~03-02 set 1 as PID reference input
  Setting method 2: Pr03-00~03-02 set 4 as PID reference input
  If the setting value 1 and set value 4 existed at the same time, AVI input has highest priority to become PID reference input.
- When use analog input as PID compensation value, Pr08-16 must set 1(Source of PID compensation is analog input). The compensation value can be observed via Pr08-17.
- When it is frequency command or TQC speed limit, the corresponding value for 0~±10V/4~20mA is 0 – max. output frequency(Pr.01-00)
- 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 (AVI1)

Factory Setting: 0

Settings -100.0~100.0%

- It is to set the corresponding AVI1 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 current of the external analog input 0.

03 - 05 AVI2 Analog Input Bias

Factory Setting: 0

Settings -100.0~100.0%

- It is used to set the corresponding AVI2 voltage of the external analog input 0.
- The relation between external input voltage/current and setting frequency: 0~10V (4-20mA) corresponds to 0~Pr01-00 (max. operation frequency).

03 - 06 Reserved

03 - 07 Positive/negative Bias Mode (AVI1)
03 - 08 Positive/negative Bias Mode (ACI)
03 - 09 Positive/negative Bias Mode (AVI2)

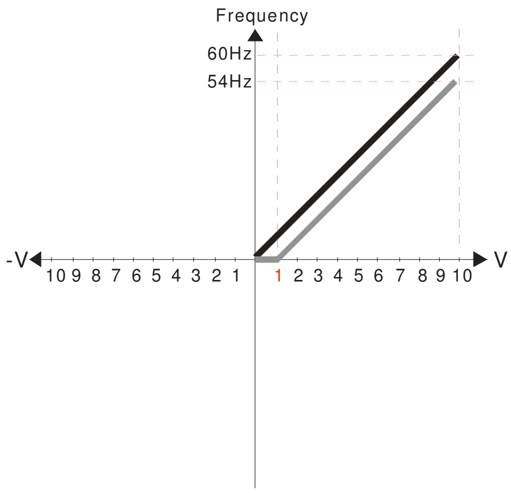
Factory Setting: 0

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.

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

Diagram 01

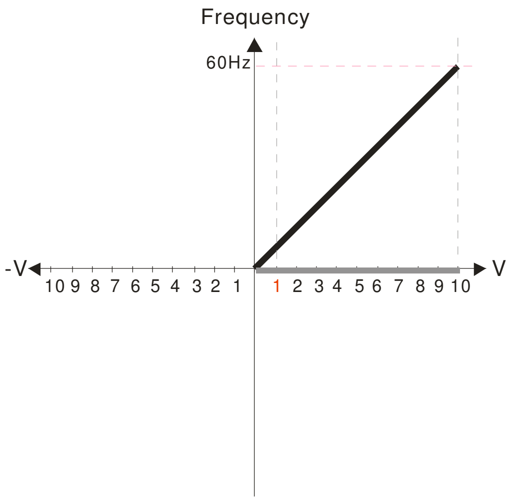


Pr.03-03=10%
Pr.03-07~03-09 (Positive/Negative Bias Mode)
0: No bias
1: Lower than or equal to bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Serve bias as the center

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

Pr.03-11 Analog Input Gain 1 (AVI1)= 100%

Diagram 02



Pr.03-03=10%

Pr.03-07~03-09 (Positive/Negative Bias Mode)

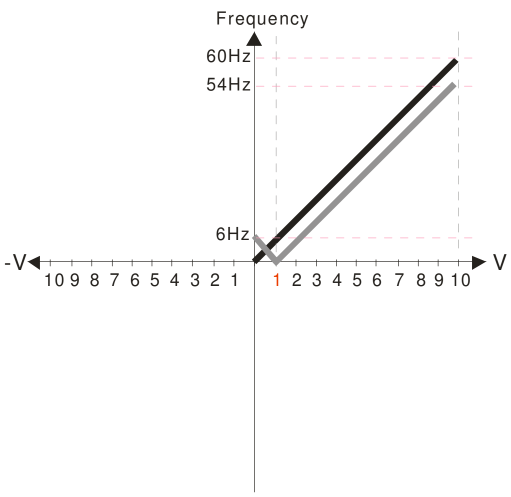
0: No bias
1: Lower than or equal to bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Serve bias as the center

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

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

Pr.03-11 Analog Input Gain1 (AVI1)=100%

Diagram 03



Pr.03-03=10%

Pr.03-07~03-09 (Positive/Negative Bias Mode)

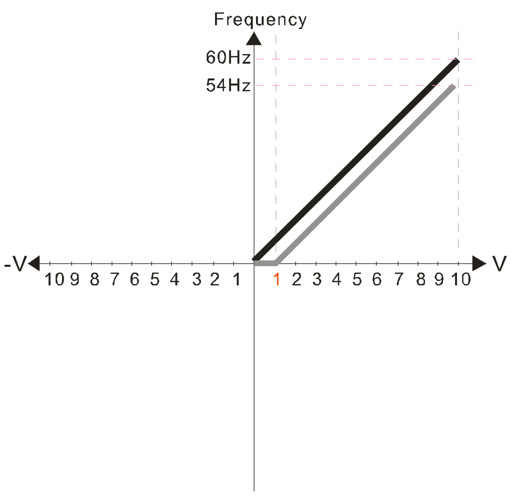
0: No bias
1: Lower than or equal to bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Serve bias as the center

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

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

Pr.03-11 Analog Input Gain 1(AVI1) = 100%

Diagram 04



Pr.03-03=10%

Pr.03-07~03-09 (Positive/Negative Bias Mode)

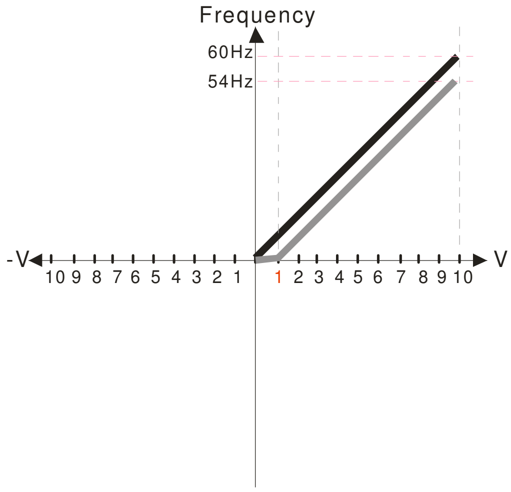
0: No bias
1: Lower than or equal to bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Serve bias as the center

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

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

Pr.03-11 Analog Input Gain1 (AVI 1) = 100%

Diagram 05



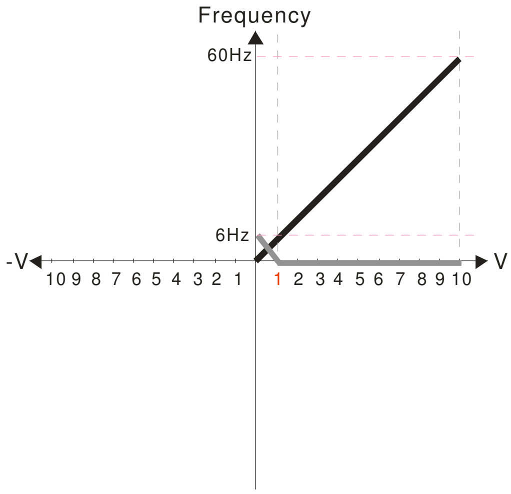
Pr.03-03=10%

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

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

Pr.03-11 Analog Input Gain 1 (AVI 1)= 100%

Diagram 06



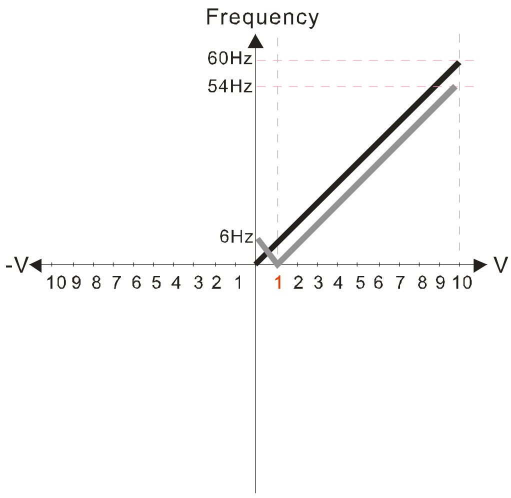
Pr.03-03=10%

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

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

Pr.03-11 Analog Input Gain 1 (AVI1)= 100%

Diagram 07



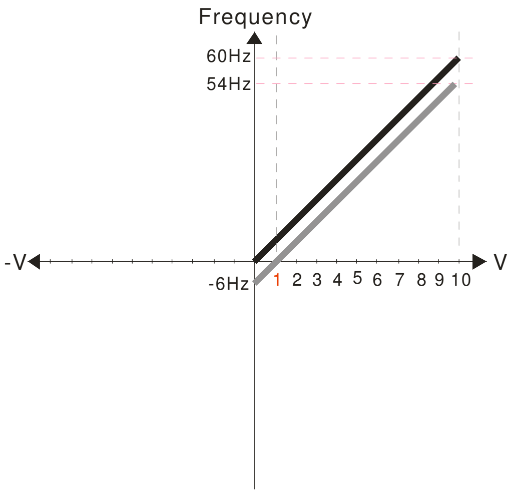
Pr.03-03=10%

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

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

Pr.03-11 Analog Input Gain 1 (AVI 1) = 100%

Diagram 08



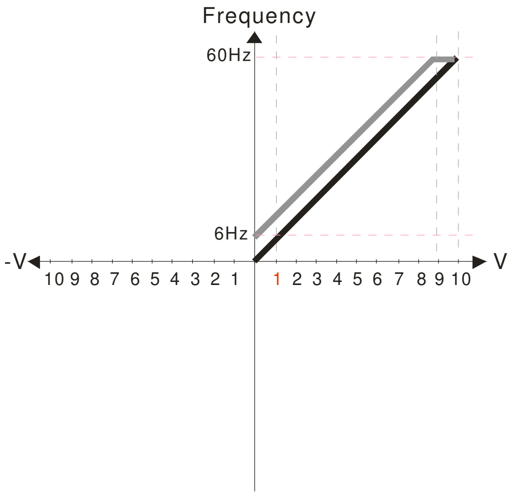
Pr.03-03=10%

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

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

Pr.03-11 Analog Input Gain 1(AVI 1) = 100%

Diagram 09



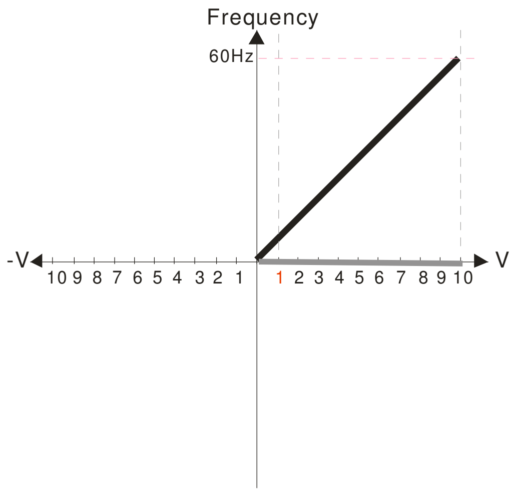
Pr.03-03=-10%

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

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

Pr.03-11 Analog Input Gain 1 (AVI 1)= 100%

Diagram 10



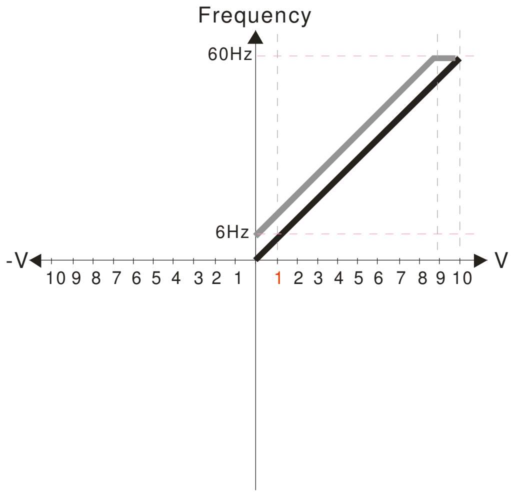
Pr.03-03=-10%

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

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

Pr.03-11 Analog Input Gain 1 (AVI 1)= 100%

Diagram 11



Pr.03-03=-10%

Pr.03-07~03-09 (Positive/Negative Bias Mode)

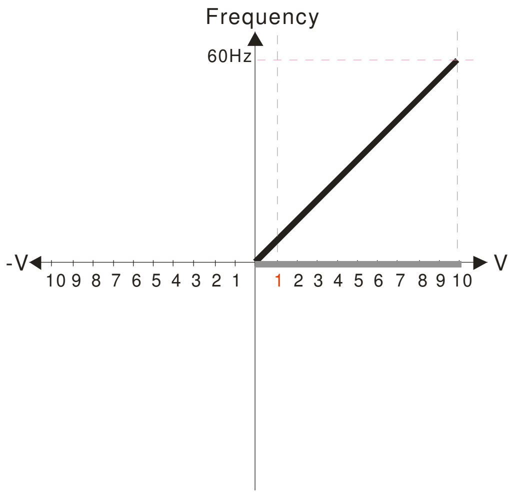
0: No bias
1: Lower than or equal to bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Serve bias as the center

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

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

Pr.03-11 Analog Input Gain 1 (AVI 1) = 100%

Diagram 12



Pr.03-03=-10%

Pr.03-07~03-09 (Positive/Negative Bias Mode)

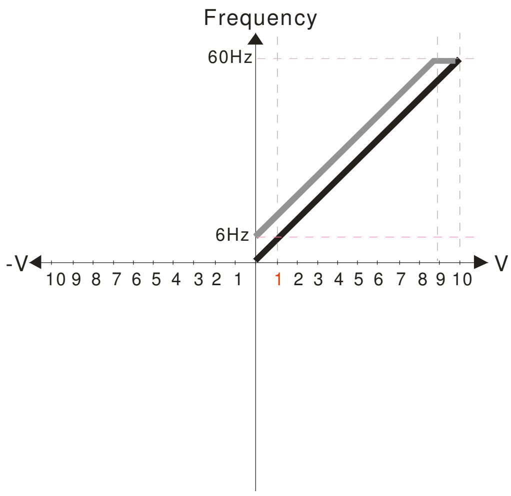
0: No bias
1: Lower than or equal to bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Serve bias as the center

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

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

Pr.03-11 Analog Input Gain 1 (AV 1 I)= 100%

Diagram 13



Pr.03-03=-10%

Pr.03-07~03-09 (Positive/Negative Bias Mode)

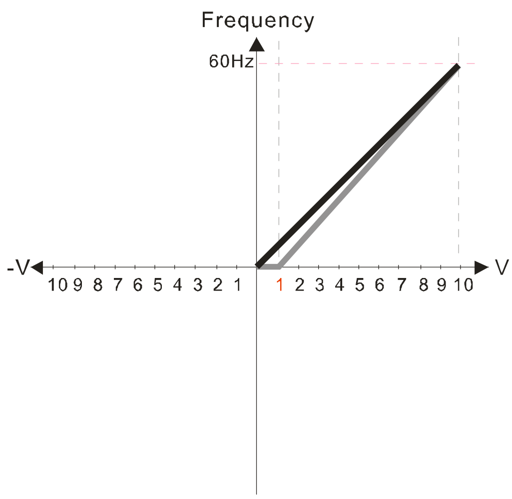
0: No bias
1: Lower than or equal to bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Serve bias as the center

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

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

Pr.03-11 Analog Input Gain 1(AVI 1) = 100%

Diagram 14



Pr.03-03=-10%

Pr.03-07~03-09 (Positive/Negative Bias Mode)

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

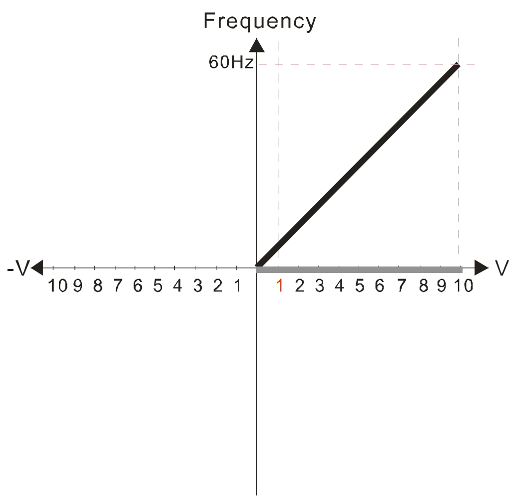
Pr.03-10 (Analog Frequency Command for Reverse Run)

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

Pr.03-11 Analog Input Gain 1 (AVI 1)= 111.1%

10/9=111.1%

Diagram 15



Pr.03-03=10%

Pr.03-07~03-09 (Positive/Negative Bias Mode)

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

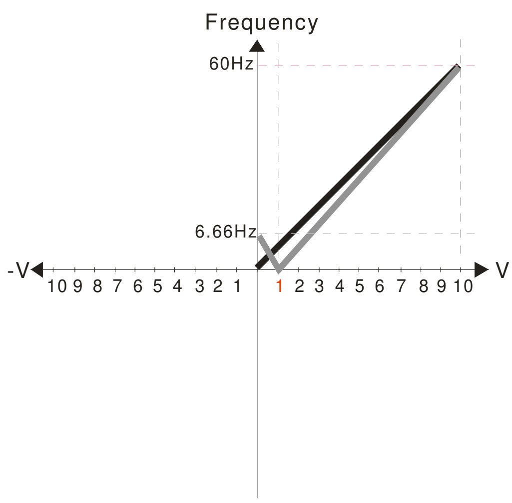
Pr.03-10 (Analog Frequency Command for Reverse Run)

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

Pr.03-11Analog Input Gain 1 (AVI 1)=111.1%

10/9 =111.1%

Diagram 16



Pr.03-03=10%

Pr.03-07~03-09 (Positive/Negative Bias Mode)

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

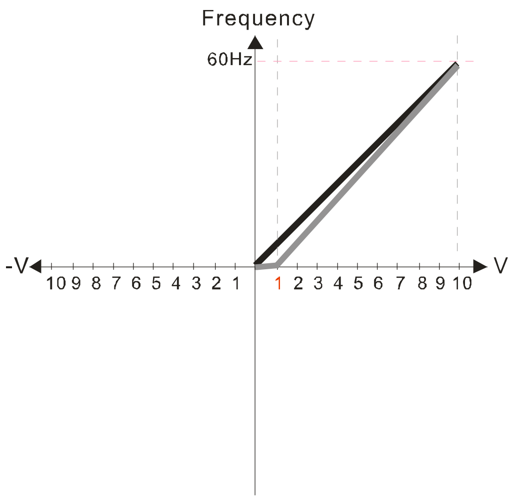
Pr.03-10 (Analog Frequency Command for Reverse Run)

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

Pr.03-11 Analog Input Gain 1 (AVI 1) = 111.1%

10/9 =111.1%

Diagram 17



Pr.03-03=10%

Pr.03-07~03-09 (Positive/Negative Bias Mode)

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

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

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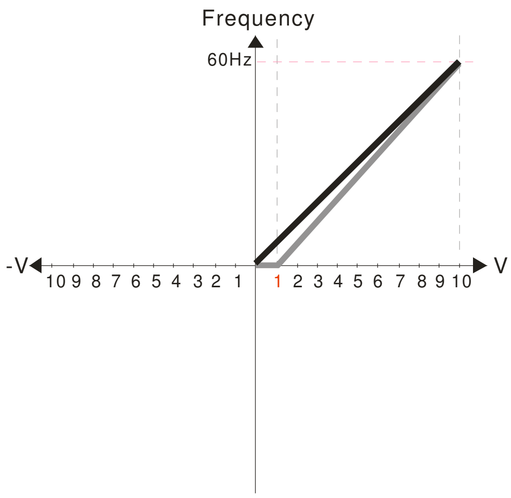
1: Negative frequency is valid. Positive frequency = forward run; negative frequency = reverse run. Direction can not be switched by digital keypad or external terminal control.

Pr.03-11 Analog Input Gain 1 (AVI 1) = 111.1%
10/9 =111. 1%

Diagram 18



Pr.03-03=10%

Pr.03-07~03-09 (Positive/Negative Bias Mode)

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

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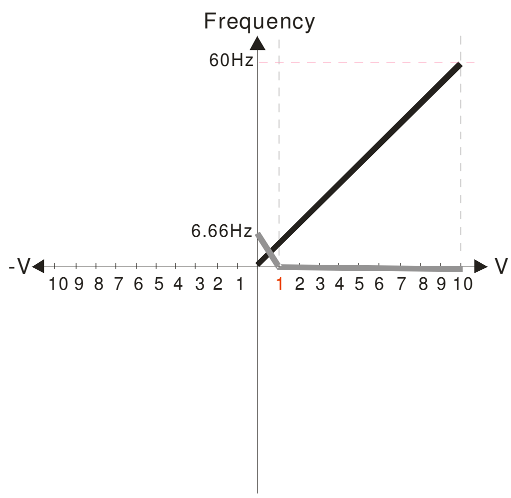
1: Negative frequency is valid. Positive frequency = forward run; negative frequency = reverse run. Direction can not be switched by digital keypad or external terminal control.

Pr03-11 Analog Input Gain 1(AVI 1) = 111.1%
10/9 =111. 1%

Diagram 19



Pr.03-03=10%

Pr.03-07~03-09 (Positive/Negative Bias Mode)

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

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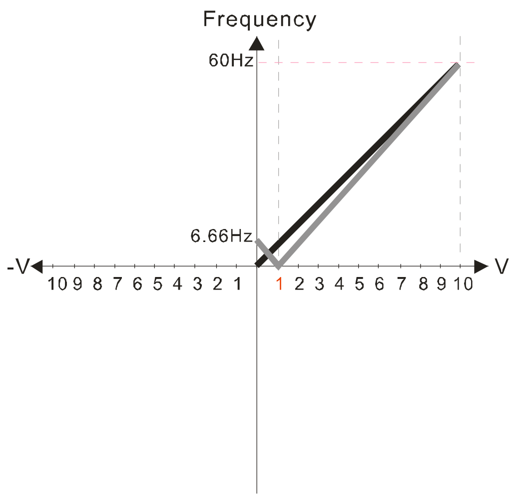
1: Negative frequency is valid. Positive frequency = forward run; negative frequency = reverse run. Direction can not be switched by digital keypad or external terminal control.

Pr03-11 Analog Input Gain1 (AVI 1) = 111.1%
10/9 =111.1 %

Diagram 20



Pr.03-03=10%

Pr.03-07~03-09 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal to bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
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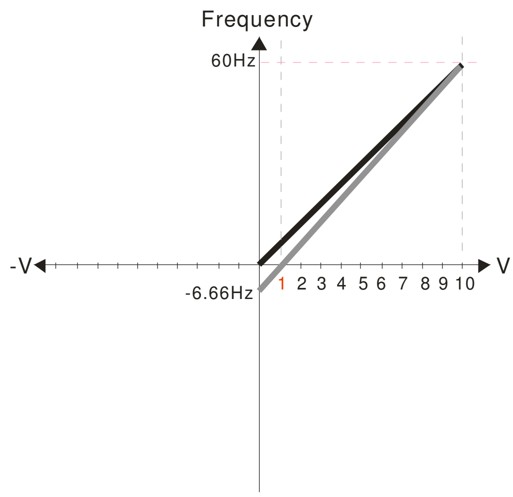
Pr03-11 Analog Input Gain 1 (AVI 1) = 111.1%

10/9 =111. 1%

Diagram 21



Pr.03-03=10%

Pr.03-07~03-09 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal to bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
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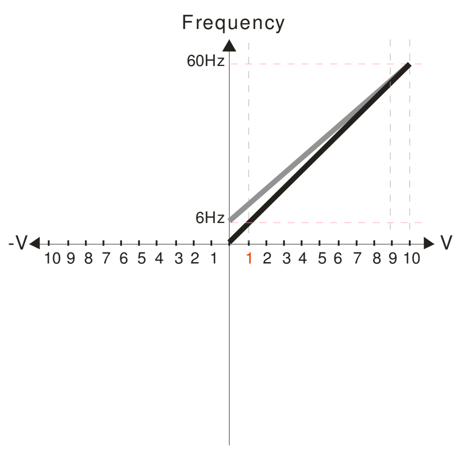
Pr03-11 Analog Input Gain 1 (AVI 1) = 111.1%

10/ 9 = 111.1%

Diagram 22



Pr.03-07~03-09 (Positive/Negative Bias Mode)

0: No bias
1: Lower than or equal to bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
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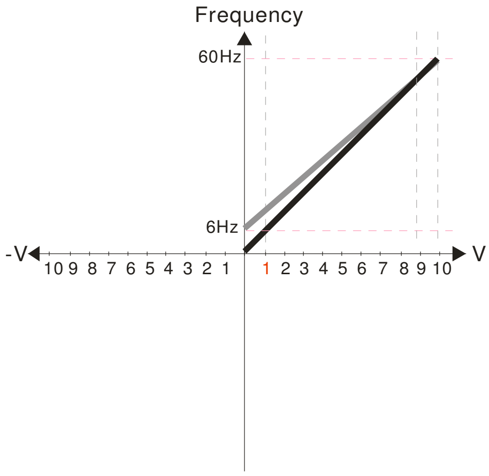
0: Negative frequency is not valid. Forward and reverse run is controlled by digital keypad or external terminal.
1: Neagtive frequency is valid. Positive frequency = forward run; negative frequency = reverse run. Direction can not be switched by digital keypad or external teriminal control.

Calculate the bias: $\frac{60\text{-}6Hz}{10V} = \frac{6\text{-}0Hz}{XV}$ $XV = \frac{10}{9} = 1.11V$

$\therefore Pr.03\text{-}03 = \frac{1.11}{10} \times 100\%$

Calculate the gain: $Pr.03\text{-}11 = \frac{10V}{11.1V} \times 100\% = 90.0\%$

Diagram 23



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

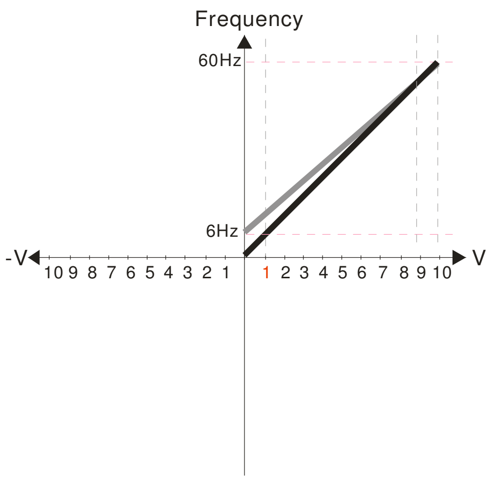
Pr.03-10 (Analog Frequency Command for Reverse Run)
- 0: Negative frequency is not valid. Forward and reverse run is controlled by digital keypad or external terminal.
- 1: Negative frequency is valid. Positive frequency = forward run; negative frequency = reverse run. Direction can not be switched by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

Calculate the bias: $\frac{60-6\text{Hz}}{10\text{V}} = \frac{6-0\text{Hz}}{X\text{V}}$ $X\text{V} = \frac{10}{9} = 1.11\text{V}$

$\therefore$ Pr. 03-03= $\frac{1.11}{10}$ x100%

Calculate the gain: Pr. 03-11= $\frac{10\text{V}}{11.1\text{V}}$ x100% = 90.0%

Diagram 24



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

Pr.03-10 (Analog Frequency Command for Reverse Run)
- 0: Negative frequency is not valid. Forward and reverse run is controlled by digital keypad or external terminal.
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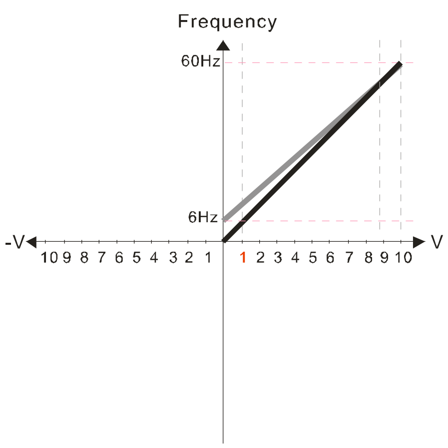
Calculate the gain: Pr. 03-11= $\frac{10\text{V}}{11.1\text{V}}$ x 100% =90.0%

Diagram 25



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

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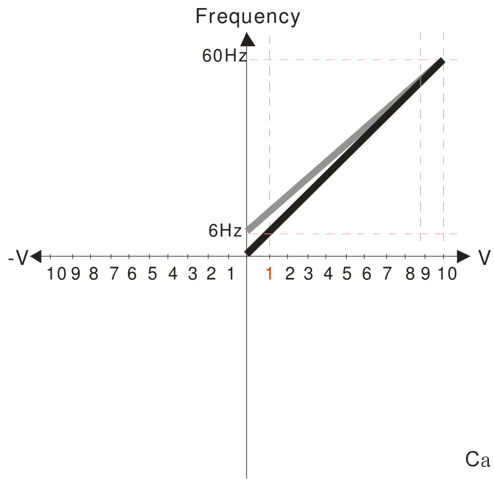
$\therefore$ Pr. 03-03= $\frac{1.11}{10}$ x100%

Calculate the gain: Pr. 03-11= $\frac{10\text{V}}{11.1\text{V}}$x100% =90.0%

Diagram 26



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

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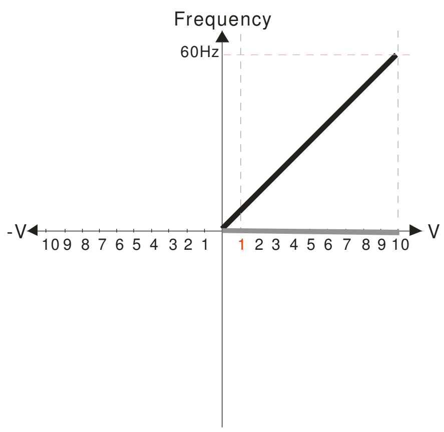
Calculate the gain: $Pr.03\text{-}11 = \frac{10V}{11.1V} \times 100\% = 90.0\%$

Diagram 27



Pr.03-07~03-09 (Positive/Negative Bias Mode)
- 0: No bias
- 1: Lower than or equal to bias
- 2: Greater than or equal to bias
- 3: The absolute value of the bias voltage while serving as the center
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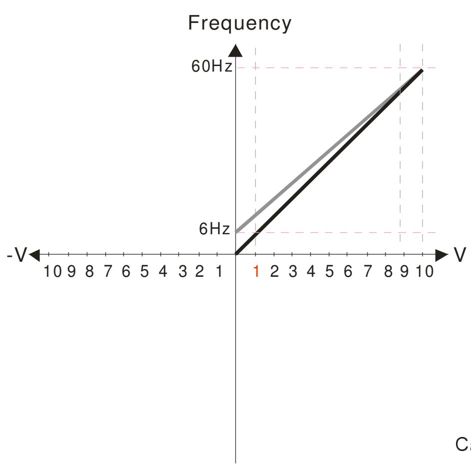
Calculate the gain: $Pr.03\text{-}11 = \frac{10V}{11.1V} \times 100\% = 90.0\%$

Diagram 28



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

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

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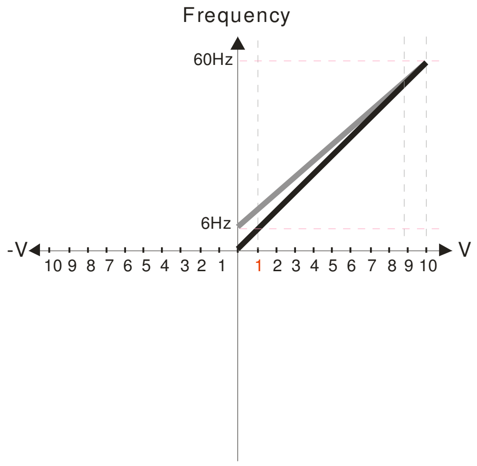
Calculate the gain: $Pr.03\text{-}11 = \frac{10V}{11.1V} \times 100\%\ 90.0\%$

Diagram 29



Pr.03-07~03-09 (Positive/Negative Bias Mode)

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

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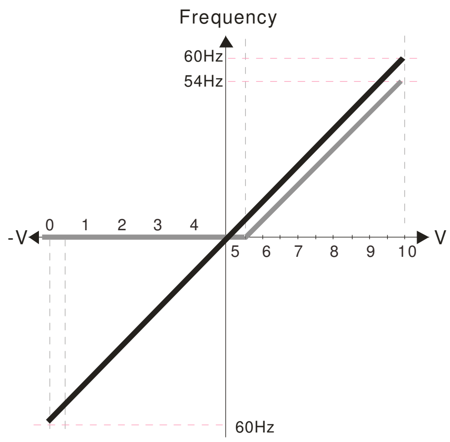
$\therefore$ Pr.03-03 $= \frac{1.11}{10} \times 100\%$

Calculate the gain: Pr.03-11 $= \frac{10\text{V}}{11.1\text{V}} \times 100\% = 90.0\%$

Diagram 30



Pr.00-21=0 (Dgital keypad control and d run in FWD direction)

Pr.03-05 Analog Positive Voltage Input Bias (AVI2) =10%

Pr.03-07~03-09 (Positive/Negative Bias Mode)

0 Nobias
1: Lower than or equal to bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Serve bias as the center

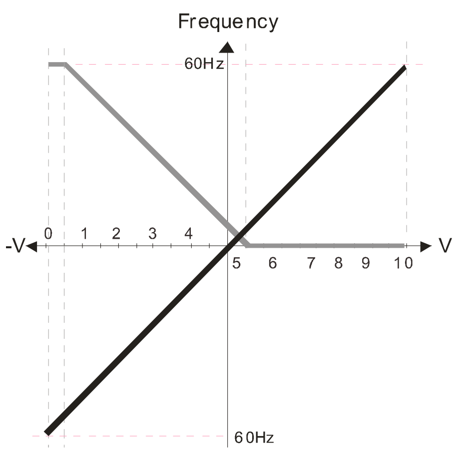
Pr.03-10 (Analog Frequency Command for Reverse Run)

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

Pr.03-13 Analog Input Gain 3 (AVI2)= 100%

Pr.03-14 Analog Input Gain 4 (AVI2)= 100%

Diagram 31



Pr.00-21=0 (Dgital keypad control and d run in FWD direction)

Pr.03-05 Analog Positive Voltage Input Bias (AVI2) = 10%

Pr.03-07~03-09 (Positive/Negative Bias Mode)

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3: The absolute value of the bias voltage while serving as the center
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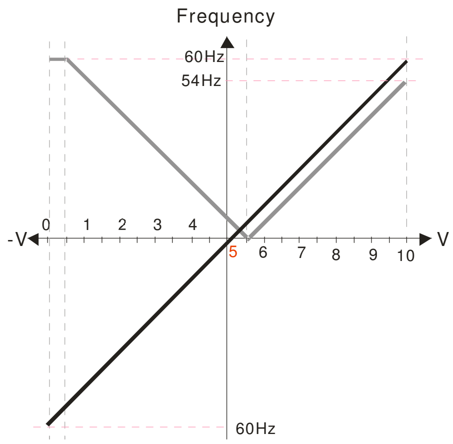
1: Negative frequency is valid. Positive frequency = forward run; negative frequency = reverse run. Direction can not be switched by digital keypad or external terminal control.

Pr.03-13 Analog Input Gain 3 (AVI2) = 100%

Pr.03-14 Analog Input Gain 4 (AVI2) = 100%

Diagram 32



Pr.00-21=0 (Digital keypad control and d run in FWD direction)
Pr.03-05 Analog Positive Voltage Input Bias (AVI2) = 10%
Pr.03-07~03-09 (Positive/Negative Bias Mode)
0: No bias
1: Lower thna or equal to bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Serve bias as the center

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0: Negative frequency is not valid. Forward and reverse run is controlled by digital keypad or external terminal.
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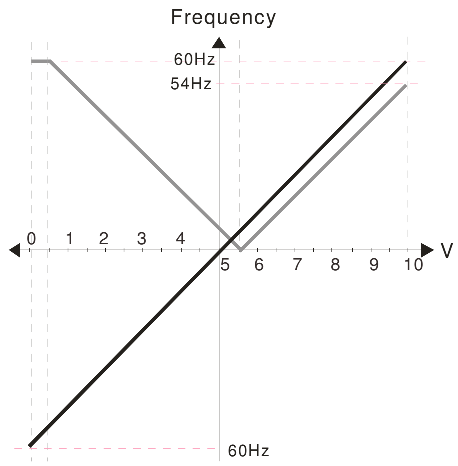
Pr.03-13 Analog Input Gain 3 (AVI2)= 100%
Pr.03-14 Analog Input Gain 4 (AVI2)= 100%

Diagram 33



Pr.00-21=0 (Digital keypad control and d run in FWD direction)
Pr.03-05 Analog Positive Voltage Input Bias (AVI2) = 10%
Pr.03-07~03-09 (Positive/Negative Bias Mode)
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1: Lower than or equal to bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Serve bias as the center

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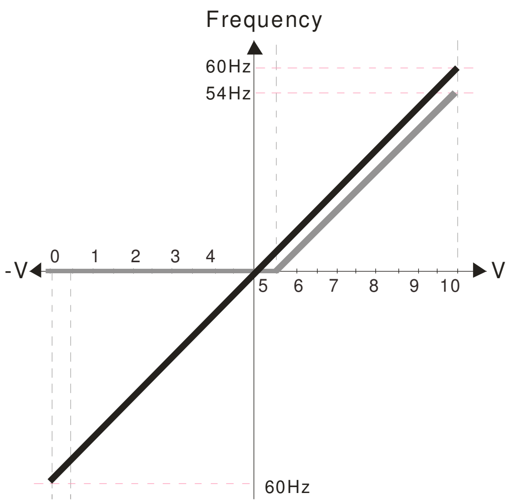
Pr.03-13 Analog Input Gain3 (AVI2)= 100%
Pr.03-14 Analog Input Gain 4 (AVI2)= 100%

Diagram 34



Pr.00-21=0 (Digital keypad control and run in FWD direction)
Pr.03-05 Analog Positive Voltage Input Bias (AVI2) = 10%
Pr.03-07~03-09 (Positive/Negative Bias Mode)
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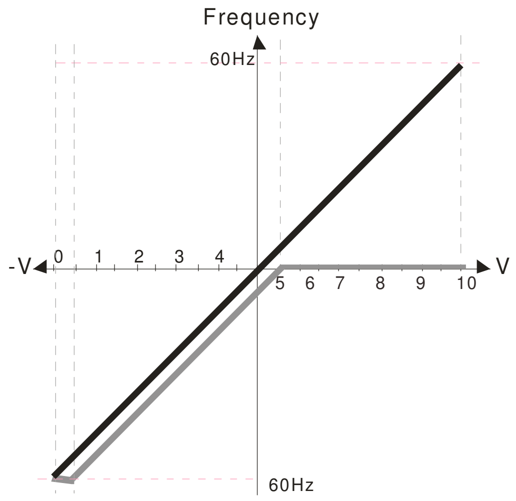
Pr.03-13 Analog Input Gain 3 (AVI2)= 100%
Pr.03-14 Analog Input Gain 4 (AVI2)= 100%

Diagram 35



Pr.00-21=0 (Digital keypad control and run in FWD direction)
Pr.03-05 Analog Positive Voltage Input Bias (AVI2) = 10%
Pr.03-07~03-09 (Positive/Negative Bias Mode)

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2: Greater than or equal to bias
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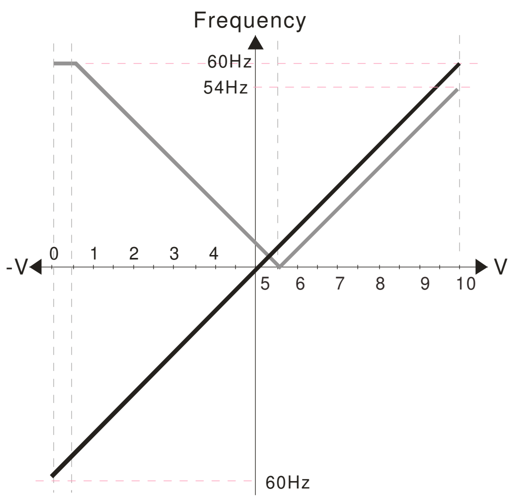
Pr.03-13 Analog Input Gain 3 (AVI2)= 100%
Pr.03-14 Analog Input Gain 4 (AVI2)= 100%

Diagram 36



Pr.00-21=0 (Digital keypad control and run in FWD direction)
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Pr.03-07~03-09 (Positive/Negative Bias Mode)

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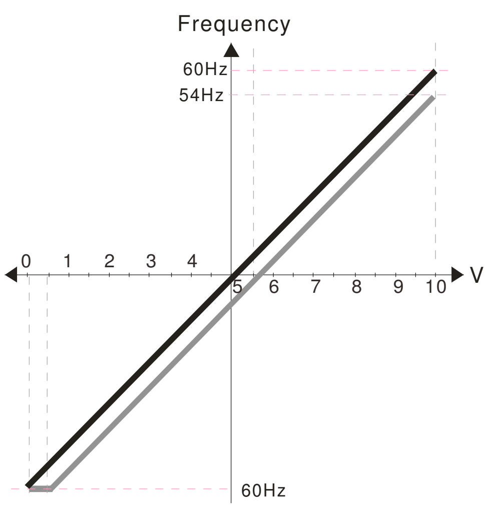
Pr.03-13 Analog Input Gain 3 (AVI2)= 100%
Pr.03-14 Analog Input Gain 4 (AVI2)= 100%

Diagram 37



Pr.00-21=0 (Digital keypad control and run in FWD direction)
Pr.03-05 Analog Positive Voltage Input Bias (AVI2) = 10%
Pr.03-07~03-09 (Positive/Negative Bias Mode)

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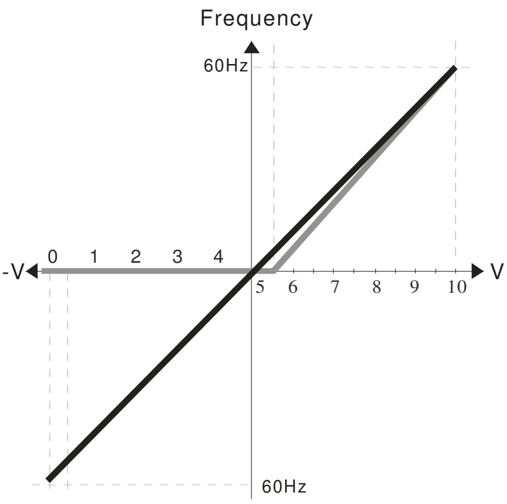
Pr.03-13 Analog Input Gain 3 (AVI2)= 100%
Pr.03-14 Analog Input Gain 4 (AVI2)= 100%

Diagram 38



Pr.00-21=0 (Digital keypad control and run in FWD direction)
Pr.03-05 Analog Positive Voltage Input Bias (AVI2) = 10%
Pr.03-07~03-09 (Positive/Negative Bias Mode)

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1: Lower than or equal to bias
2: Greater than or equal to bias
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4: Serve bias as the center

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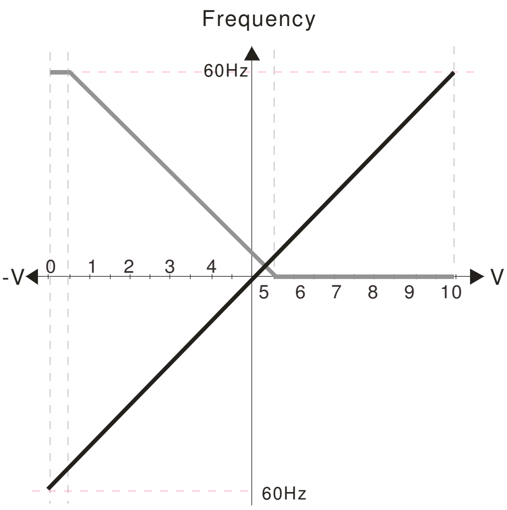
Pr.03-13 Analog Input Gain 3 (AVI2)= 111.1%
Pr.03-14 Analog Input Gain 4 (AVI2) = 111.1%

Diagram 39



Pr.00-21=0 (Digital keypad control and run in FWD direction)
Pr.03-05 Analog Positive Voltage Input Bias (AVI2) = 10%
Pr.03-07~03-09 (Positive/Negative Bias Mode)

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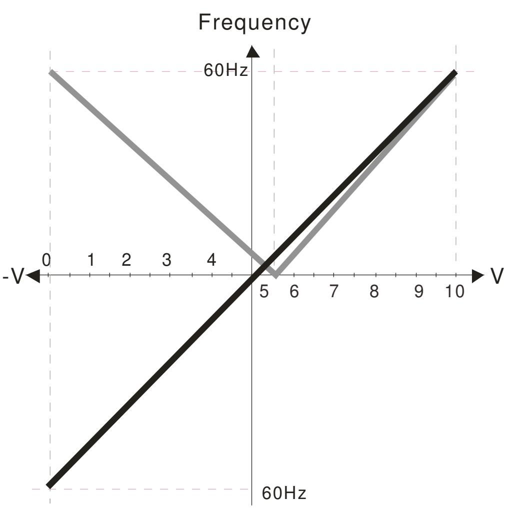
1: Lower than or equal to bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Serve bias as the center

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

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

Pr.03-13 Analog Input Gain 3 (AVI2)= 100%
Pr.03-14 Analog Input Gain 4 (AVI2) = 90.9%

Diagram 40



Pr.00-21=0 (Digital keypad control and run in FWD direction)
Pr.03-05 Analog Positive Voltage Input Bias (AVI2) = 10%
Pr.03-07~03-09 (Positive/Negative Bias Mode)

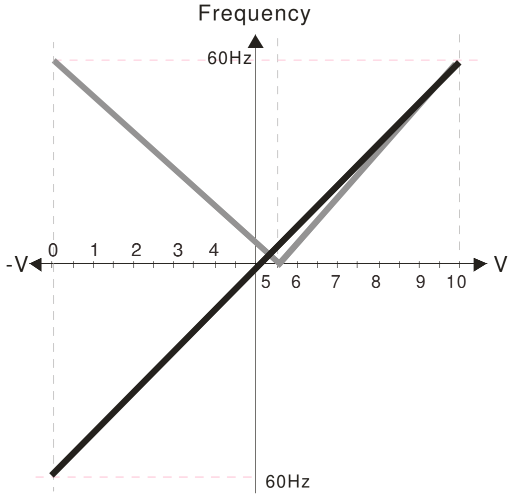
0: No bias
1: Lower than or equal to bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Serve bias as the center

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

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

Pr.03-13 Analog Input Gain 3 (AVI2)= 111.1%
Pr.03-14 Analog Input Gain 4 (AVI2) = 90.9%

Diagram 41

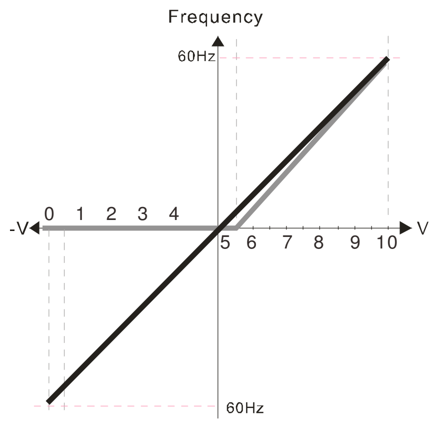


Pr.00-21=0 (Digital keypad control and run in FWD direction)
Pr.03-05 Analog Positive Voltage Input Bias (AVI2) = 10%
Pr.03-07~03-09 (Positive/Negative Bias Mode)
0: No bias
1: Lower than or equal to bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Serve bias as the center

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

Pr.03-13 Analog Input Gain 3 (AVI2)= 111.1%
Pr.03-14 Analog Input Gain 4 (AVI2) = 90.9%

Diagram 42

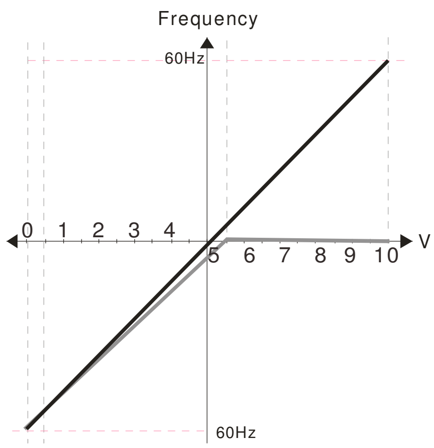


Pr.00-21=0 (Digital keypad control and run in FWD direction)
Pr.03-05 Analog Positive Voltage Input Bias (AVI2) = 10%
Pr.03-07~03-09 (Positive/Negative Bias Mode)
0: No bias
1: Lower than or equal to bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Serve bias as the center

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

Pr.03-13 Analog Input Gain 3 (AVI2)= 111.1%
(10/9) *100% = 111.1%
Pr.03-14 Analog Input Gain 4 (AVI2) = 90.9%
(10/11) *100% = 90.9%

Diagram 43

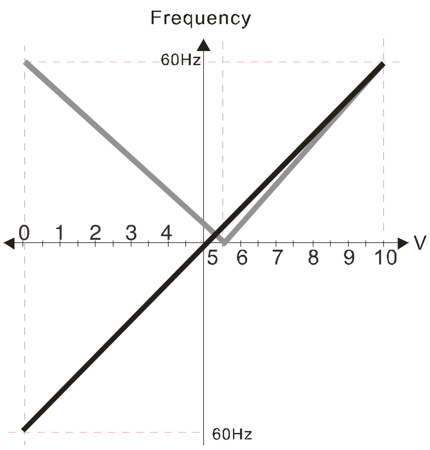


Pr.00-21=0 (Digital keypad control and run in FWD direction)
Pr.03-05 Analog Positive Voltage Input Bias (AVI2) = 10%
Pr.03-07~03-09 (Positive/Negative Bias Mode)
0: No bias
1: Lower than or equal to bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Serve bias as the center

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

Pr.03-13 Analog Input Gain 3 (AVI2)= 111.1%
(10/9) *100% = 111.1%
Pr.03-14 Analog Input Gain 4 (AVI2) = 90.9%
(10/11) *100% = 90.9%

Diagram 44

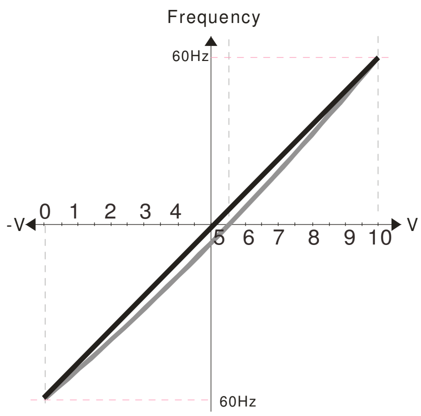


Pr.00-21=0 (Digital keypad control and run in FWD direction)
Pr.03-05 Analog Positive Voltage Input Bias (AVI2) = 10%
Pr.03-07~03-09 (Positive/Negative Bias Mode)
0: No bias
1: Lower than or equal to bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Serve bias as the center

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

Pr.03-13 Analog Input Gain3 (AVI2)= 111.1%
(10/9) *100% = 111.1%
Pr.03-14 Analog Input Gain 4 (AVI2) = 90.9%
(10/11) *100% = 90.9%

Diagram 45



Pr.00-21=0 (Digital keypad control and run in FWD direction)
Pr.03-05 Analog Positive Voltage Input Bias (AVI2) = 10%
Pr.03-07~03-09 (Positive/Negative Bias Mode)
0: No bias
1: Lower than or equal to bias
2: Greater than or equal to bias
3: The absolute value of the bias voltage while serving as the center
4: Serve bias as the center

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

Pr.03-13 Analog Input Gain 3 (AVI2)= 111.1%
(10/9) *100% = 111.1%
Pr.03-14 Analog Input Gain 4 (AVI2) = 90.9%
(10/11) *100% = 90.9%

✓ 03 - 10 Analog Frequency Command for Reverse Run

Factory Setting: 0

Settings 0: Negative frequency input is disabled. Forward and reverse motions are controlled by digital keypad or by external terminal.

1: Negative frequency input is enabled. Forward motion when positive frequency, reverse motion when negative frequency. Forward and reverse motions are not controlled by digital keypad or by external terminal.

📖 Parameter 03-10 is used to enable reverse run command when a negative frequency (negative bias and gain) is input to AVI or ACI analog signal input (except AUI).

📖 Condition for negative frequency (reverse)

1. Pr03-10=1
2. Bias mode=Serve bias as center
3. Corresponded analog input gain < 0(negative), make input frequency be negative.

📖 In using addition function of analog input (Pr03-18=1), when analog signal is negative after adding, this parameter can be set for allowing reverse or not. The result after adding will be restricted by "Condition for negative frequency (reverse)"

✓ 03 - 11	Analog Input Gain 1 (AVI1)
✓ 03 - 12	Analog Input Gain 2 (ACI)
✓ 03 - 13	Analog Input Gain 1 (AVI2)
✓ 03 - 14	Analog Input Gain 2 (AVI2)

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 (AVI1)
✓ 03 - 16	Analog Input Filter Time (ACI)
✓ 03 - 17	Analog Input Filter Time (AVI2)

Factory Setting: 0.01

Settings 0.00~20.00 seconds

📖 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（AVI1、ACI、AVI2）

1：Enable

📖 When Pr03-18 is set to 1:

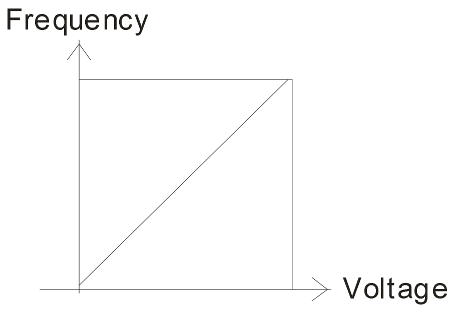
EX1: Pr03-00=Pr03-01=1 Frequency command= AVI+ACI

EX2: Pr03-00=Pr03-01=Pr03-02=1 Frequency command = AVI+ACI+AVI2

EX3: Pr03-00=Pr03-02=1 Frequency command = AVI+AVI2

EX4: Pr03-01=Pr03-02=1 Frequency command = ACI+AVI2

📖 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.



$$\text{Fcommand}=[(\text{ay}\ \ \text{bias})*\text{gain}]*\frac{\text{Fmax(01-00)}}{\text{10V or 16mA or 20mA}}$$

Fcommand: the corresponding frequency for 10V or 20mA
ay : 0-10V, 4-20mA, 0-20mA
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 4~20mA signal is loss, when AVIc(Pr.03-28=2) or ACIc (03-29=0).
- When Pr.03-28 is not set to 2, it means the voltage input to AVI terminal is 0-10V or 0-20mA. At this moment, Pr.03-19 will be invalid.
- When Pr.03-29 is set to 1, it means the voltage input to ACI terminal is for 0-10V. At this moment, Pr.03-19 will be invalid.
- When setting is 1 or 2, it will display warning code “AnL” on the keypad. It will be blinking until the loss of the ACI signal is recovered.
- When the motor drive stops, the condition of warning does not exist, then the warning will disappear.

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%
9	AVI1 %	（0~10V/ 0~20mA/ 4~mA =0~100%）
10	ACI %	（4~20mA/ 0~10V/ 0~20mA =0~100%）
11	AVI2%	（-10~10V=0~100%）
20	CANopen analog output	
21	RS485 analog output	

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 controlled by Pr.03-32 and Pr03-33.Example: Set Pr03-32 to 0~100.00% which corresponds to 0~10V of AFM1. Set Pr03-33 to 0~100.00% which corresponds to 0~10V of AFM2.

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

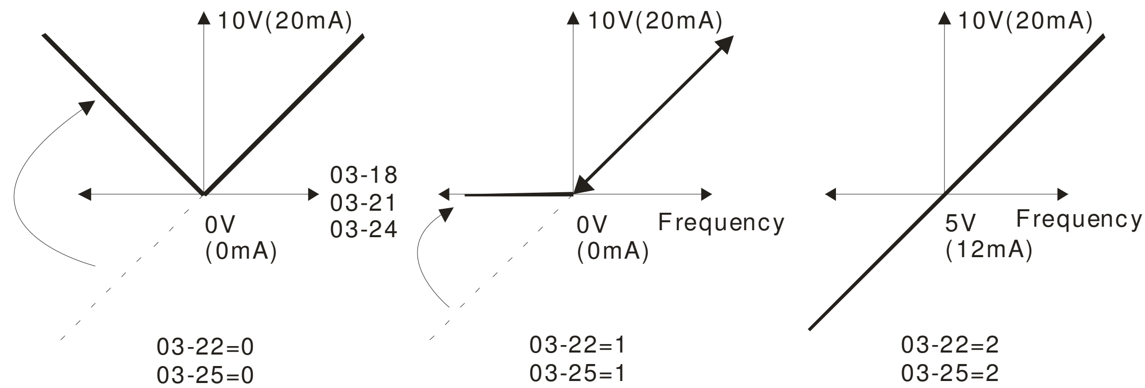
03 - 25 Analog Output 2 Value in REV Direction (AFM2)

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 AFM2 Output Offset

Factory Setting: 0.00

Settings -100,00 ~ 100.00 %

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

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

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

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

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

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

03 - 28 AVI1 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.

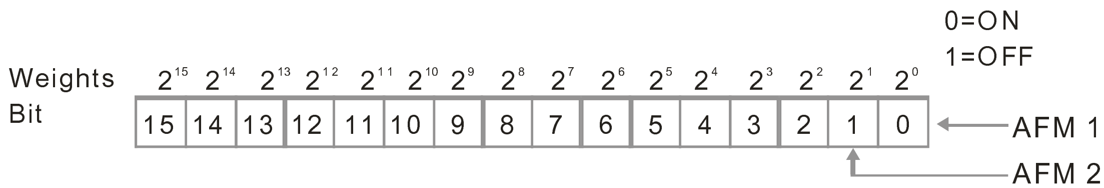
03 - 30 Status of PLC Output Terminal

Factory Setting: 000h

Settings 0000h~FFFFh

Monitor the status of PLC analog output terminals

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



NOTE

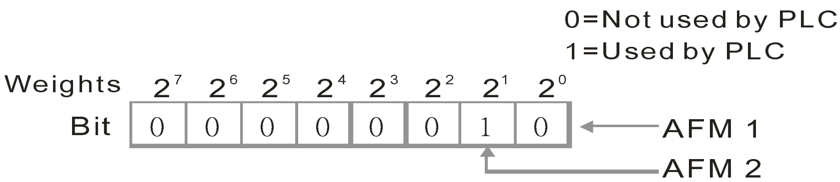
$2^7=128$ $2^6=64$

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

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

📖 For Example:

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



Display value

$2=1\mathrm{x}2^1+0\mathrm{x}2^0$

$=\mathrm{bit}\ 1\mathrm{x}2^1+\mathrm{bit}\ 0\mathrm{x}2^0$

✔ 03 - 31 AFM2 0-20mA Output Selection
✔ 03 - 34 AFM1 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%

📖 Pr03-32 and Pr03-33 work with the setting "#23 Constant voltage output" of "Pr03-20 & Pr03-23" to set up the constant voltage at AFM. For example: At Pr03-22, set 0~100.00% to correspond to the 0~10V of AFM1. At Pr03-33, set 0~100.00% to correspond to the 0~10V of AFM2.

✔ 03 - 35 AFM1 Filter Output Time
✔ 03 - 36 AFM2 Filter Output Time

Factory Setting: 0.01

Settings 0~20s

03 - 37 ~ 03 - 43 Reserved

✔ 03 - 44 MO by AI level

Factory Setting: 0

Settings 0: AVI1

1: ACI

2: AVI2

✔ 03 - 45 AI Upper level

Factory Setting: 50%

Settings -100%~100%

✔ 03 - 46 AI Lower level

Factory Setting: 10%

Settings -100%~100%

📖 This function is require to work with Multi-function Output item “67” Analog signal level achieved. The MO active when AI input level is higher than Pr03-45 AI Upper level. The MO shutoff when the AI input is lower that Pr03-46 AI Lower level.

📖 AI Upper level must bigger than AI Lower level.

03 - 47 ~ 03 - 49	Reserved

03 - 50	Analog Calculation Selection

Factory Setting: 0.00

Settings 0: Regular Curve
1: 3 point curve of AVI1
2: 3 point curve of ACI
3: 3 point curve of AVI 1& ACI
4: 3 point curve of AVI2
5: 3 point curve of AVI1 & AVI2
6: 3 point curve of ACI & AVI2
7: 3 point curve of AVI 1& ACI & AVI2

- Set Pr03-50 = 0, all analog input signal are calculated by using bias and gain.
- Set Pr03-50 =1, AVI1 is calculated by using frequency and voltage/current in corresponding format (Pr03-51 ~ Pr03-56), other analog input signals are calculated by using bias and gain.
- Set Pr03-50 =2, ACI is calculated by using frequency and voltage/current in corresponding format (Pr03-57 ~ Pr03-62), other analog input signals are calculated by using bias and gain.
- Set Pr03-50 =3, AVI1 and ACI are calculated by using frequency and voltage/current in corresponding format (Pr03-51 ~ Pr03-62), other analog input signals are calculated by using bias and gain.
- Set Pr03-50 =4, AVI2 is calculated by using frequency and voltage in corresponding format (Pr03-63 ~ Pr03-68), other analog input signals are calculated by using bias and gain.
- Set Pr03-50=5, AVI and AVI2 are calculated by using frequency and voltage/current in corresponding format (Pr03-51~ Pr03-5, Pr03-63~Pr03-68), other analog input signal are calculated by using bias and gain.
- Set Pr03-50=6, ACI and AVI2 are calculated by using frequency and voltage/current in corresponding format (Pr03-57 ~ Pr03-68), other analog input signals are calculated by using bias and gain.
- Set Pr03-50=7, all the analog input signals are calculated by using frequency and voltage/current in corresponding format (Pr03-51 ~ Pr03-68

03 - 51	AVI1 Low Point

Factory Setting: 0

Settings 03-28=0, 0.00~10.00V
03-28≠0, 0.00~20.00mA

03 - 52 AVI1 Low Point Percentage

Factory Setting : 0.00%

Setting 0.00 ~ 100.00%

03 - 53 AVI1 Mid Point

Factory Setting : 5.00

Setting 0.00 ~ 10.00 / 0.00 ~ 20.00

03 - 54 AVI1 Mid Point Percentage

Factory Setting : 50%

Setting 0 ~ 100%

03 - 55 AVI1 High Point

Factory Setting : 10.00

Setting 0.00 ~ 10.00 / 0.00 ~ 20.00

03 - 56 AVI1 High Point Percentage

Factory Setting : 50%

Setting 0 ~ 100%

- When Pr.03-28 = 0, AVI1setting is 0-10V and the unit is in voltage (V).
- When Pr.03-28 ≠ 0, AVI1 setting is 0-20mA or 4-20mA and the unit is in current (mA).
- When setting analog input AVI1 to frequency command, it 100% corresponds to Fmax (Pr.01-00 Max. operation frequency).
- The 3 parameters (Pr03-51, Pr03-53 and Pr03-53) must meet the following argument: P03-51 < P03-53 < P03-55. The 3 proportional points (Pr03-52, Pr03-54 and Pr03-56) doesn't have any limit. Between two points is a linear calculation. The ACI and AVI2 are same as AVI1.
- The output % will become 0% when the AVI1 input value is lower than low point setting.

For example:

P03-51 = 1V; P03-52 = 10%. The output will become 0% when AVI1 input is lower than 1V. If the AVI1 input is swing between 1V and 1.1V, drive's output frequency will beats between 0% and 10%

03 - 57 ACI Low Point

Factory Setting : 4.00

Setting 0.00 ~ 10.00 / 0.00 ~ 20.00

03 - 58 ACI Low Point Percentage

Factory Setting : 0%

Setting 0 ~ 100%

03 - 59 ACI Mid Point

Factory Setting : 12.00

Setting 0.00 ~ 10.00 / 0.00 ~ 20.00

03 - 60 ACI Mid Point Percentage

Factory Setting : 50%

Setting 0 ~ 100%

03 - 61 ACI High Point

Factory Setting : 20.00

Setting 0.00 ~ 10.00 / 0.00 ~ 20.00

03 - 62 ACI High Point Percentage

Factory Setting : 100

Setting 0 ~ 100%

- When Pr.03-29=1, ACI setting is 0-10V and the unit is in voltage (V).
- When Pr.03-29≠1, ACI setting is 0-20mA or 4-20mA and the unit is in current (mA).
- When setting analog input ACI to frequency command, it 100% corresponds to Fmax (Pr.01-00 Max. operation frequency).
- The 3 parameters (Pr03-57, Pr03-59 and Pr03-61) must meet the following argument: P03-57 < P03-59 < P03-61. The 3 proportional points (Pr03-58, Pr03-60 and Pr03-62) doesn't have any limit. Between two points is a linear calculation.
- The output % will become 0% when the ACI input value is lower than low point setting. For example:

P03-57 = 2mA; P03-58 = 10%. The output will become 0% when AVI input is lower than 2mA. If the ACI input is swing between 2mA and 2.1mA, drive's output frequency will beats between 0% and 10%.

03 - 63 AVI2 Low Point Voltage

Factory Setting : 0V

Setting 0.00 ~ 10.00V

03 - 64 AVI2 Low Point Percentage

Factory Setting : 0%

Setting 0 ~ 100%

⚡03 - 65 AVI2 Mid Point Voltage

Factory Setting : 5.00V

Setting 0.00 ~ 10.00V

⚡03 - 66 AVI2 Mid Point Percentage

Factory Setting : 50%

Setting 0 .00~ 100%

⚡03 - 67 AVI2 High Point Voltage

Factory Setting :10.00V

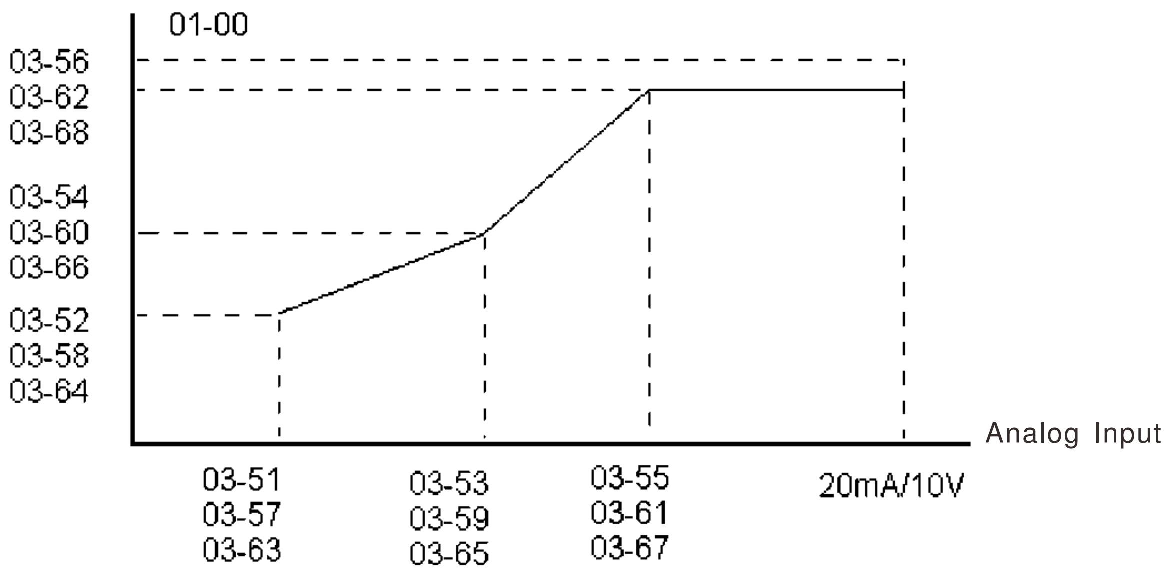
Setting 0.00 ~ 10.00V

⚡03 - 68 AVI2 High Point Percentage

Factory Setting :100%

Setting 0 .00~ 100%

- When AVI1 Selection (Pr03-28) is AVI, the setting range of Pr03-51, Pr03-52, Pr03-55 have to be 0.00~10.00 or 0.00~20.00.
- When ACI Selection (Pr03-29) is AVI, the setting range of Pr03-57, Pr03-59 and Pr03-61 have to be 0.00~10.00 or 0.00~20.00.
- The analog input values can be set at Pr03-51 ~ Pr03-68 and the maximum operating frequency can be set at Pr01-00. The corresponding functions of open-loop control are shown as image below.



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

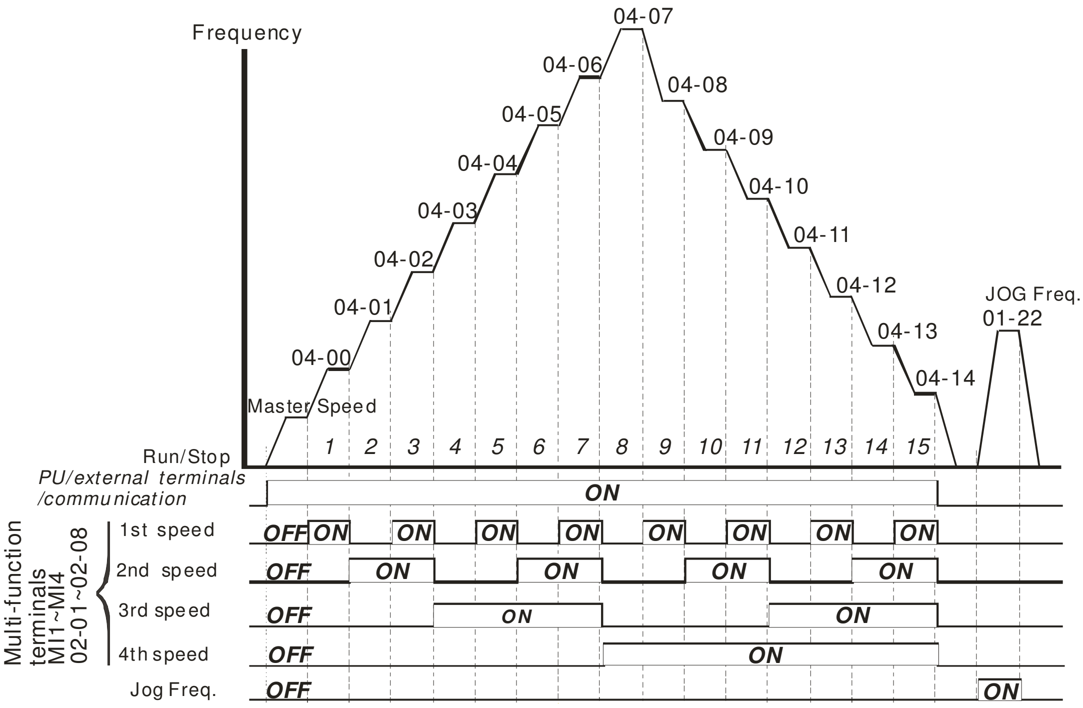
Settings 0.00~600.00Hz

- 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 - 15 ~ 04 - 49	Reserved

✓	04 - 50	PLC Buffer 0
✓	04 - 51	PLC Buffer 1
✓	04 - 52	PLC Buffer 2
✓	04 - 53	PLC Buffer 3
✓	04 - 54	PLC Buffer 4
✓	04 - 55	PLC Buffer 5
✓	04 - 56	PLC Buffer 6
✓	04 - 57	PLC Buffer 7
✓	04 - 58	PLC Buffer 8
✓	04 - 59	PLC Buffer 9
✓	04 - 60	PLC Buffer 10
✓	04 - 61	PLC Buffer 11
✓	04 - 62	PLC Buffer 12

✓ 04 - 63	PLC Buffer 13
✓ 04 - 64	PLC Buffer 14
✓ 04 - 65	PLC Buffer 15
✓ 04 - 66	PLC Buffer 16
✓ 04 - 67	PLC Buffer 17
✓ 04 - 68	PLC Buffer 18
✓ 04 - 69	PLC Buffer 19

Factory Setting: 0

Settings	0~65535

- The PLC buffer can be combined with PLC or HMI programming for variety application.

05 Motor Parameters

✓ 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)

Induction Motor

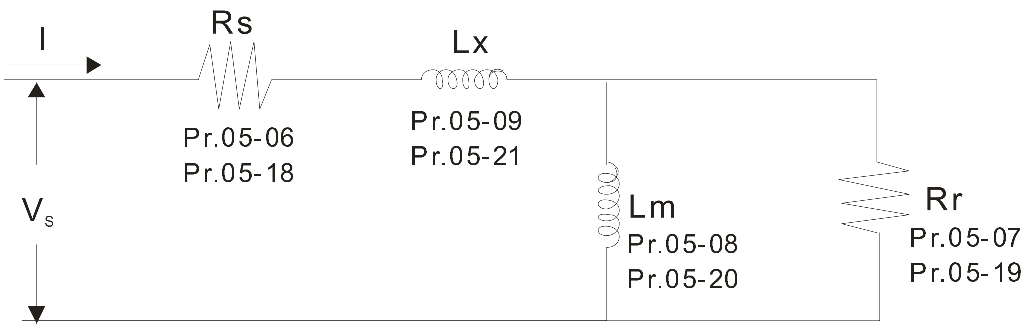
- Start auto tuning by press the【Run】key and the measured value will be written into motor 1 (Pr.05-05 ~05-09, Rs, Rr, Lm, Lx, no-load current) and motor 2 (Pr.05-17 to Pr.05-21) automatically.

- 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.

	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

3. 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.
4. 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.
5. 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

☑ 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 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).

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

Unit: Ampere
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 2.5~30A.(25*10%=2.5A and 25*120%=30A)

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

Factory Setting: 0

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.
- Before set up Pr05-04, this parameter must be set.

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).
- Set up Pr.05-04 after setting up Pr. 01-01 and Pr.05-03 to make sure motor operate normally.
- For example: the Pr05-04 factory setting range is "2~4". If use a 6 poles motor, to set up Pr01-01 and Pr05-03 according the motor nameplate, then the Pr05-04 setting range will become 2~6 automatically

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

Unit: Ampere
Factory Setting:
###.##

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

- The factory setting is 40% motor rated current.
- For model with 110kW and above, default setting is 20% motor rated current .

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

Factory Setting: 0.000

Settings 0.000~65.535Ω

05 - 07 Rotor Resistance (Rr) of Mo1

Factory Setting：0

Settings 0.000~65.535Ω

05 - 08 Magnetizing Inductance (Lm) of Induction Motor 1

Factory Setting：0.0

Settings 0.0~6553.5mH

05 - 09 Stator Inductance (Lx) of Induction Motor 1

Factory Setting：0.0

Settings 0.0~6553.5mH

05 - 10 ~ 05 - 12 Reserved

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

Unit: Ampere

Factory Setting: #.##

Settings 10~120%

📖 This value should be set according to the rated current 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 2.5~30A.(25*10%=2.5A 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

1710(60Hz 4 poles)；
1410(50Hz 4 poles)

Settings 0~65535

📖 It is used to set the rated speed of the motor according to 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).
- Set up Pr.05-04 after setting up Pr. 01-35 and Pr.05-05 to make sure motor operate normally

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

Unit: Ampere

Factory Setting: #.##

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

- The factory setting is 40% motor rated current.
- For model with 110kW and above, default setting is 20% motor rated current.

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

Factory Setting：0.000

Settings 0.000~65.535mΩ

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

Factory Setting：0.0

Settings 0.0~65535mH

05 - 22 Induction Motor 1/ 2 Selection

Factory Setting: 1

Settings 1: Motor 1

2: Motor 2

- To set the motor that driven by the AC motor drive.

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

Factory Setting: 60.00

Settings 0.00~600.00Hz

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

Factory Setting: 0

Settings 0: Disable

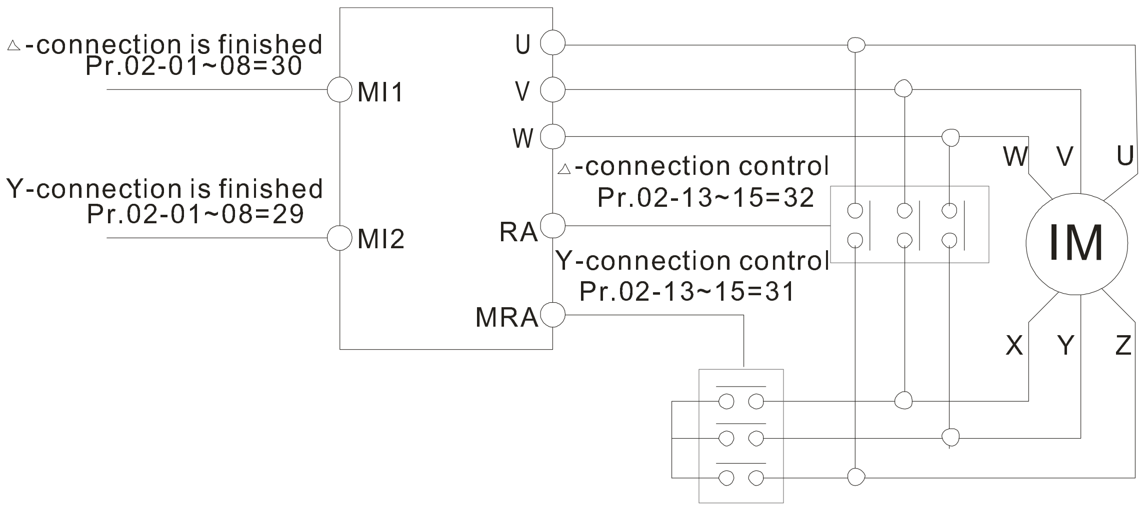
1: Enable

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

Factory Setting: 0.200

Settings 0~60.000 seconds

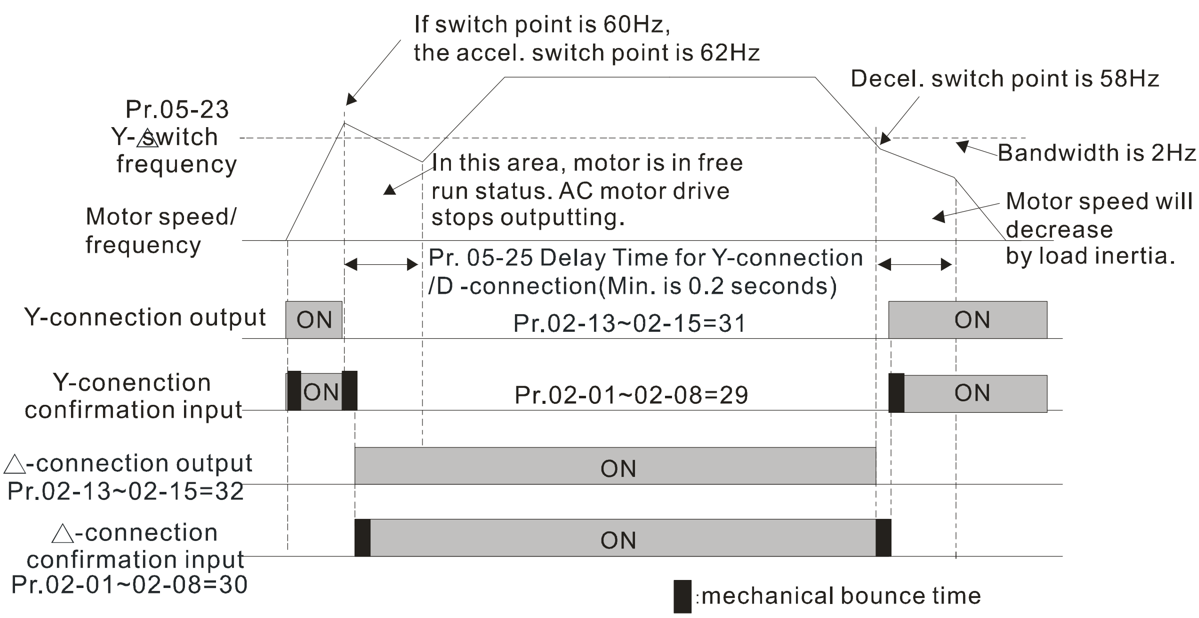
- Pr 05-23 and Pr.05-25 are applied in the wide range motors and the motor coil will execute the switch of Y-connection/Δ-connection as required. (The wide range motors has relation with the motor design. In general, it has higher torque at low speed and Y-connection and it has higher speed at high speed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

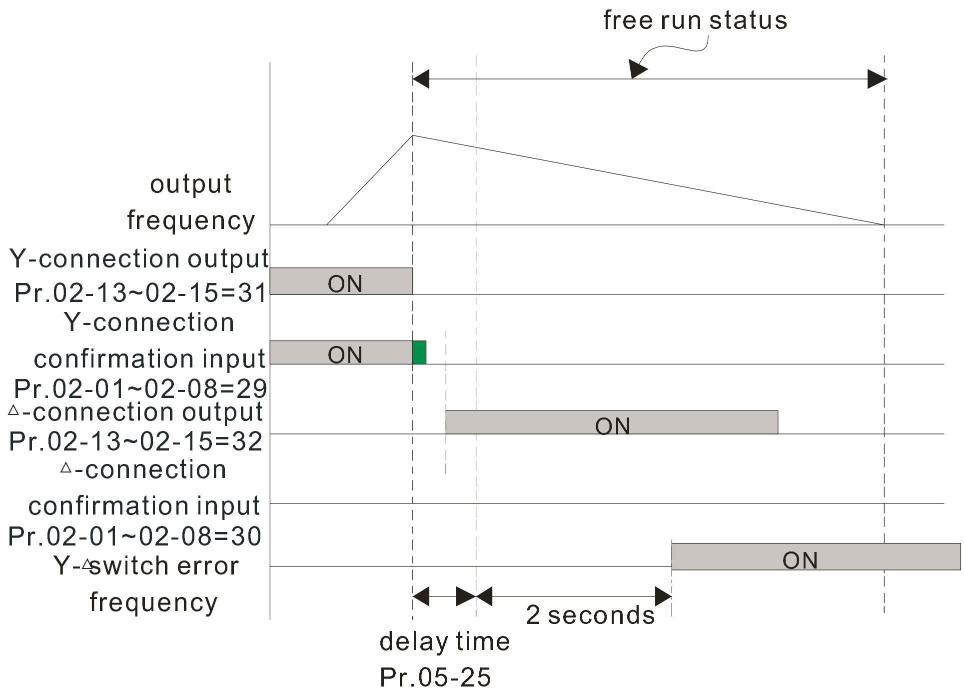


Y- Δconnection switch: can be used for wide range motor

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

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





05 - 26 Accumulative Watt Per Second of Motor in Low Word (W-sec)

Factory Setting: 0.0

Settings Read only

05 - 27 Accumulative Watt Per Second of Motor in High Word (W-sec)

Factory Setting: 0.0

Settings Read only

05 - 28 Accumulative Watt-hour of Motor (W-Hour)

Factory Setting: 0.0

Settings Read only

05 - 29 Accumulative Watt-hour of Motor in Low Word (KW-Hour)

Factory Setting: 0.0

Settings Read only

05 - 30 Accumulative Watt-hour of Motor in High Word (KW-Hour)

Factory Setting: 0.0

Settings Read only

📖 Pr.05-26~05-29 records the amount of power consumed by motors. The accumulation begins when the drive is activated and record is saved when the drive stops or turns OFF. The amount of consumed watts will continue to accumulate when the drive activate again. To clear the accumulation, set Pr.00-02 to 5 then the accumulation record will return to 0.

05 - 31 Accumulative Motor Operation Time (Min)

Factory Setting: 00

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.

06 Protection Parameters

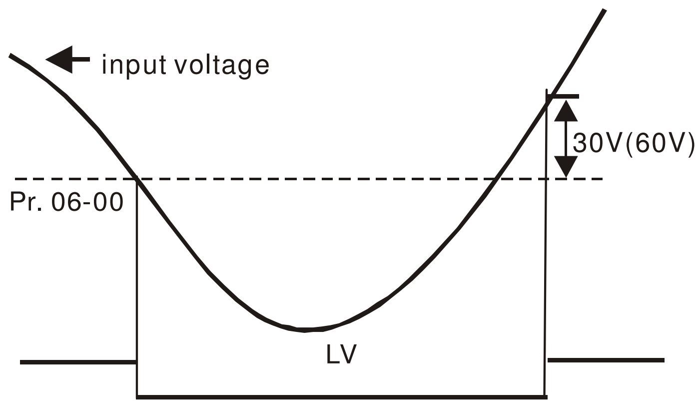
⌁ The parameter can be set during operation

⌁ 06 - 00 Low Voltage Level

Factory Setting: 180.0/360.0
Frame E and above: 200.0/400.0

Settings 230V models: 150.0~220.0V
Frame E and above: 190.0~220.0V
460V models: 300.0~440.0V
Frame E and above: 380.0~440.0V

- This parameter is used to set the Low Voltage level. When the DC BUS voltage is lower than Pr06-00, drive will stop output and free to stop.
- If the drive is triggered LV fault during the operation, drive will stop output and free to stop. There are three LV faults, LvA (LV during acceleration), LvD (LV during deceleration), and LvN (LV in constant speed) which will be triggered in different stage of drive operation. These faults need to be reset manually to restart the drive, while setting restart after momentary power off function (Pr07-06, Pr07-07), the drive will restart automatically.
- If LV is triggered when the drive is in stop status, the fault is named LvS (LV during stop), which will not be recorded, and the drive will restart automatically when input voltage is 30Vdc (230V series) or 60Vdc (460V series) higher than LV level.



⌁ 06 - 01 Over-voltage Stall Prevention

Factory Setting: 380.0/760.0

Settings 230V models: 350.0~450.0V
460V models: 700.0~900.0V
0：Disable this function

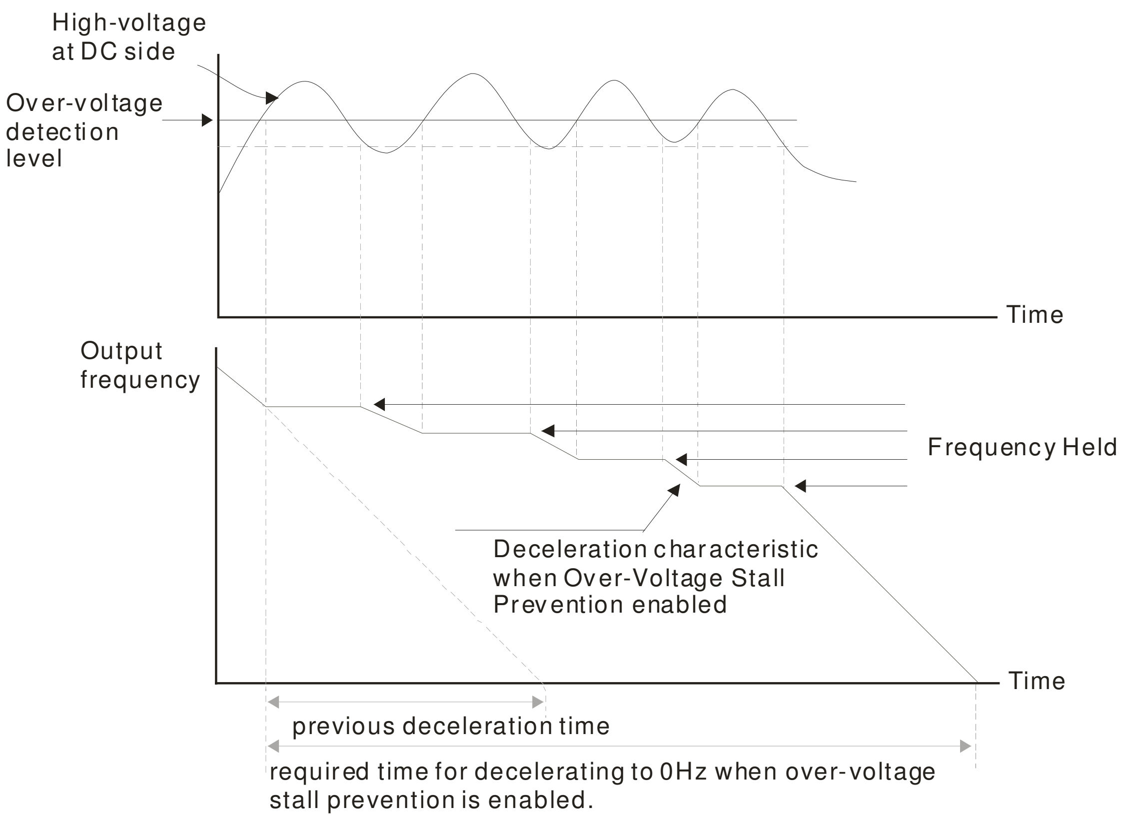
1. When Pr.06-01 is set to 0.0, the over-voltage stall prevention function is disabled. When braking units or resistors are connected to the drive, this setting is suggested.
2. When the setting is not 0.0, the over-voltage stall prevention is activated. This setting should refer to power supply system and loading. If the setting is too low, then over-voltage stall prevention will be easily activate, which may increase deceleration time.
3. Related parameters: Pr01-13, Pr01-15, Pr01-17, Pr01-19 Decel. Time 1~4, Pr02-13~Pr02-14 Multiple-function output (Relay 1 and 2), Pr02-16~Pr02-17 Multiple-function output (MO1,2), and Pr06-02 selection for over-voltage stall prevention.

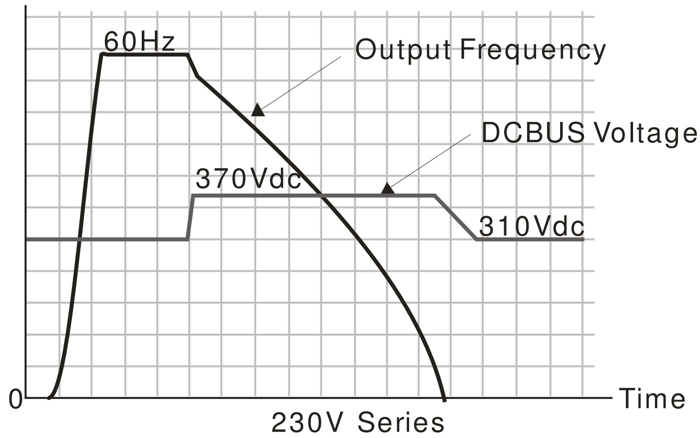
⌁ 06 - 02 Over-voltage Stall Prevention

Settings 0: Traditional over-voltage stall prevention　　Factory Setting: 0

1: Smart over-voltage prevention

- This function is used for the occasion that the load inertia is unsure. When it stops in the normal load, the over-voltage won't occur during deceleration and fulfill the setting of deceleration time. Sometimes, it may not stop due to over-voltage during decelerating to stop when increasing the load regenerative inertia. At this moment, the AC drive will auto add the deceleration time until drive stop.
- Pr 06-02 is set to 0: During deceleration, the DC bus voltage may exceed its maximum allowable value due to motor regeneration in some situation, such as loading inertia is too high or Decel. Time is set too short. When traditional over-voltage stall prevention is enabled, the drive will not decelerate further and keep the output frequency constant until the voltage drops below the setting value again.
- When Pr 06-02 is set to 1, the drive will maintain DCbus voltage when decelerating and prevent OV.



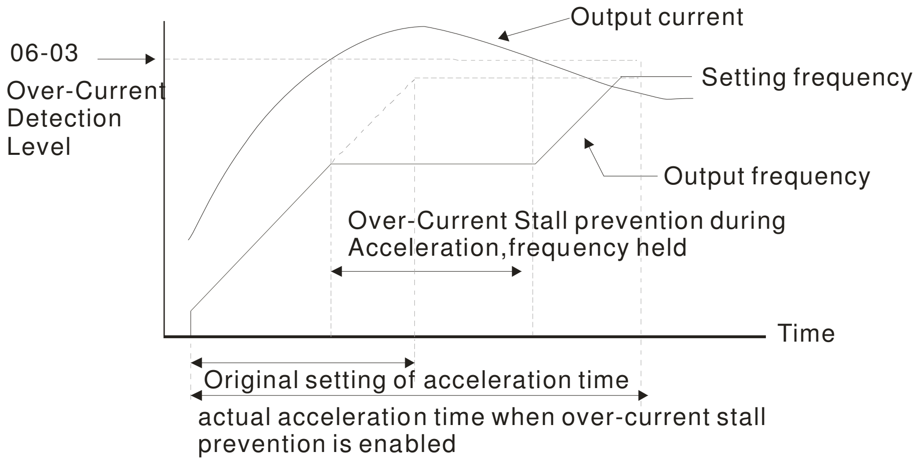


- When the over-voltage stall prevention is enabled, drive deceleration time will be larger than the setting.
- When there is any problem as using deceleration time, refer to the following items to solve it.
  1. Add the suitable deceleration time.
  2. Add brake resistor (refer to Chapter 7-1 for details) to dissipate the electrical energy that regenerated from the motor as heat type.
- Related parameters: Pr01-13, Pr01-15, Pr01-17, Pr01-19 Decel. Time 1~4, Pr02-13~Pr02-14 Multiple-function output (Relay 1 and 2), Pr02-16~Pr02-17 Multiple-function output (MO1,2), and Pr06-01 over-voltage stall prevention.

06 - 03 Over-current Stall Prevention during Acceleration

Settings	Normal duty：0~160%（100% drive's rated current）	Factory Setting: 120
	Light duty：0~130%（100% drive's rated current）	Factory Setting: 120

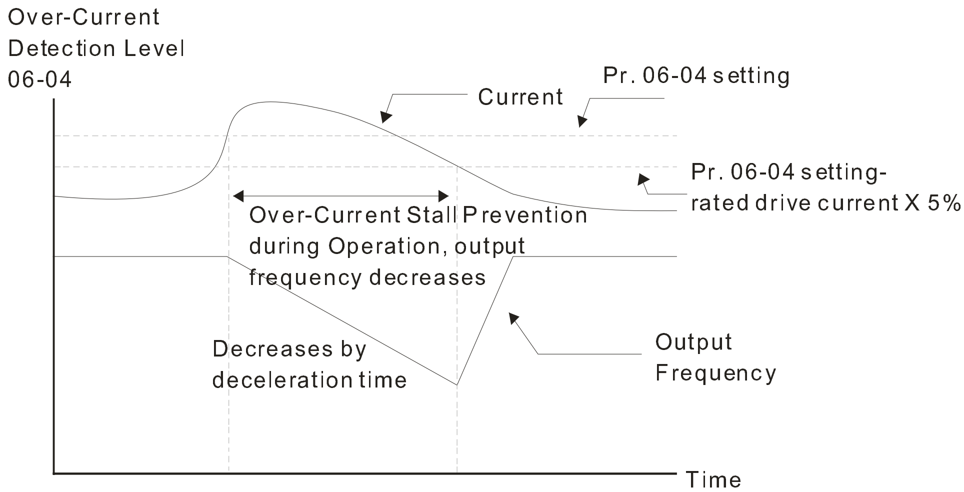
- If the motor load is too large or drive acceleration time is too short, the AC drive output current may increase abruptly during acceleration and it may cause motor damage or trigger protection functions (OL or OC). This parameter is used to prevent this situation
- During acceleration, the AC drive output current may increase abruptly and exceed the value specified by Pr.06-03 due to rapid acceleration or excessive load on the motor. When this function is enabled, the AC drive will stop accelerating and keep the output frequency constant until the current drops below the maximum value.
- When the over-current stall prevention is enabled, drive acceleration time will be larger than the setting
- When the Over-Current Stall Prevention occurs due to too small motor capacity or in the factory setting, please decrease Pr.06-03 setting.
- When there is any problem by using acceleration time, refer to the following items to solve it
  1. Add the suitable acceleration time.
  2. Set Pr01-44 Optimal Acceleration/Deceleration Setting, to 1, 3 or 4
  3. Related parameters: **Pr01-12** Accel. Time 1, **Pr01-14** Accel. Time 2, Pr01-16 Time 3, **Pr01-18** Accel. Time 4, **Pr01-44** Optimal Acceleration/Deceleration Setting, **Pr02-13** Relay1: Multi Output Terminal, **Pr02-14** Relay2: Multi Output Terminal, **Pr02-15** Relay3: Multi Output Terminal
- 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 at Constant Speed

Settings	Normal duty：0 ~160% (100% drive's rated current)	Factory Setting: 120%
	Light duty：0 ~130% (100% drive's rated current)	Factory Setting: 120%

- 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 200% (100%: drive's rated current)

06 - 08 Over-torque Detection Level (OT1)

Factory Setting: 0.1

Settings 0.1~60.0 seconds

06 - 10 Over-torque Detection Level (OT2)

Factory Setting: 120

Settings 10~200%（100% drive's rated current）

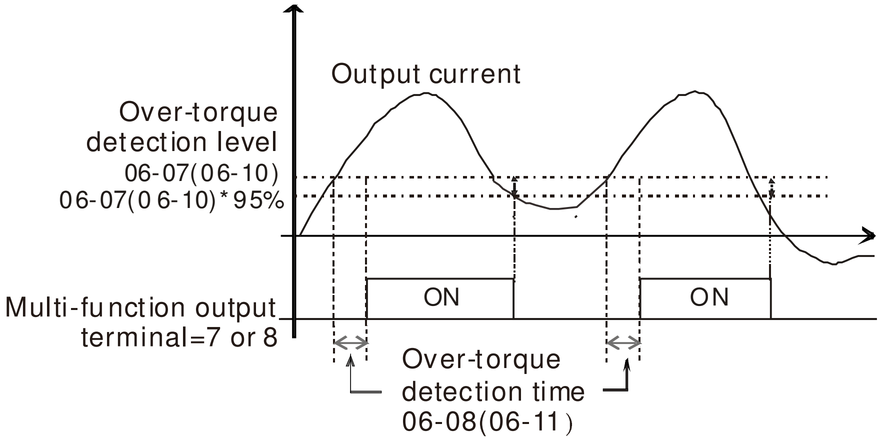
06 - 11 Over-torque Detection Time (OT2)

Factory Setting: 0.1

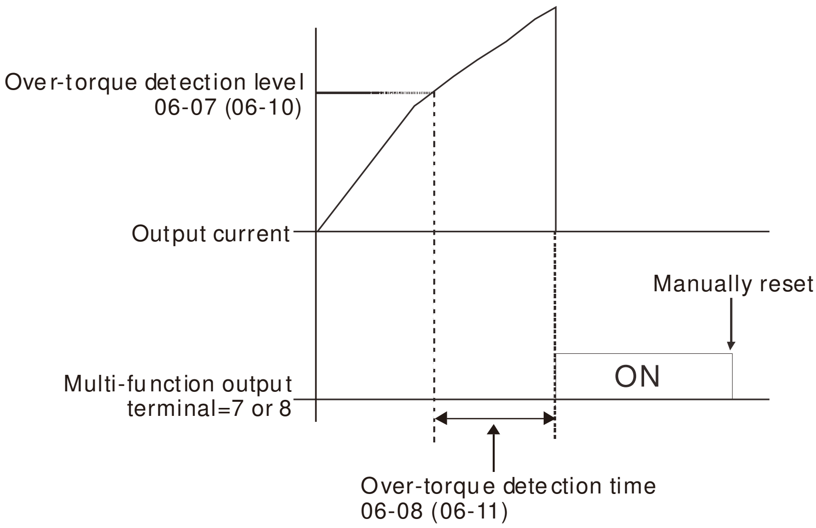
Settings 0.1~60.0 秒

- When the output current exceeds the over-torque detection level (Pr06-07 or Pr06-10) and also exceeds Pr06-08 or Pr06-11, the over torque detection will follow the setting of Pr06-06 and Pr06-09.

📖 When Pr06-06 or Pr06-09 is set to 1 or 3, the motor drive will have the ot1/ot2 warning after Over Torque Detection, while the motor drive will keep running. The warning will be off only until the output current is smaller than the 5% of the over-torque detection level (Pr06-07 and Pr06-10).



📖 When Pr06-06 or Pr06-09 is set to 2 or 4, the motor drive will have the ot1/ot2 fault after Over Torque Detection. Then the motor drive stop running until it is manually reset.



06 - 12 Maximum Current Limit

Factory Setting: 150

Settings 0~200%（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: Special motor (with external forced cooling)

1: Self-cooled motor (so motor with fan on the shaft)

2: Disable

📖 It is used to prevent self-cooled motor overheats under low speed. User can use electronic thermal relay to limit driver's output power.

📖 Setting as 0 is suitable for special motor (motor fan using independent power supply). For this kind of motor, the cooling capacity is not related to motor speed obviously. So the action of electronic thermal relay will remain stable in low speed, which can ensure the motor's load capability in low speed.

📖 Setting as 1 is suitable for standard motor (motor fan is fixed on the rotor shaft). For this kind of motor, the cooling capacity is low in low speed, and the action of electronic thermal relay will reduce the action time, which ensure the life of motor.

📖 When the power ON/OFF is often switched, even setting as 0 or 1 can bot protect the motor well. It is because when the power is switched off, the electronic thermal relay protection will be reset. If there are several motors connected to one motor drive, please install electronic thermal relay in each motor respectively.

06 - 14 Electronic Thermal Characteristic for Motor 1

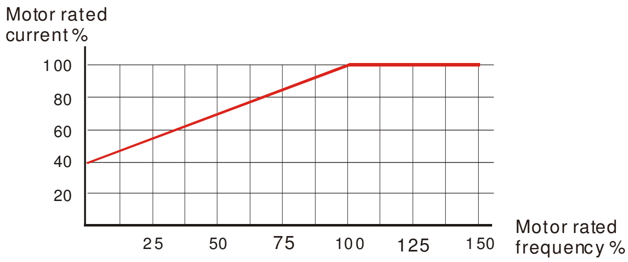
06 - 28 Electronic Thermal Characteristic for Motor 2

Factory Setting: 60.0

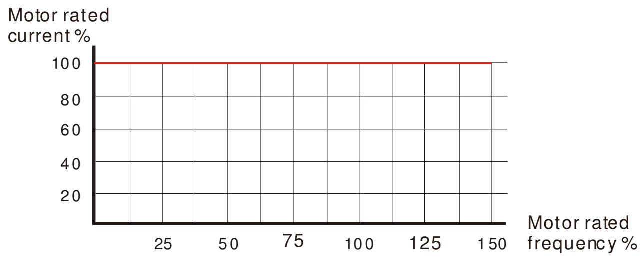
Settings 30.0~600.0 seconds

📖 The parameter is set by the 150% of motor rated current and the setting of Pr.06-14 and Pr.06-28 to prevent the motor damaged from overheating. When it reaches the setting, it will display "EoL1/EoL2" and the motor will be in free running.

📖 This parameter is to set the action time of electronic thermal relay. It works based on the I2t characteristic curve of electronic thermal relay, output frequency and current of motor drive, and operation time to prevent motor from over-heat.



Motor cooling curve with shaft-fixed fan



Motor cooling curve with independent fan

📖 The action of electronic thermal relay depends on the setting of Pr06-13/Pr06-27.

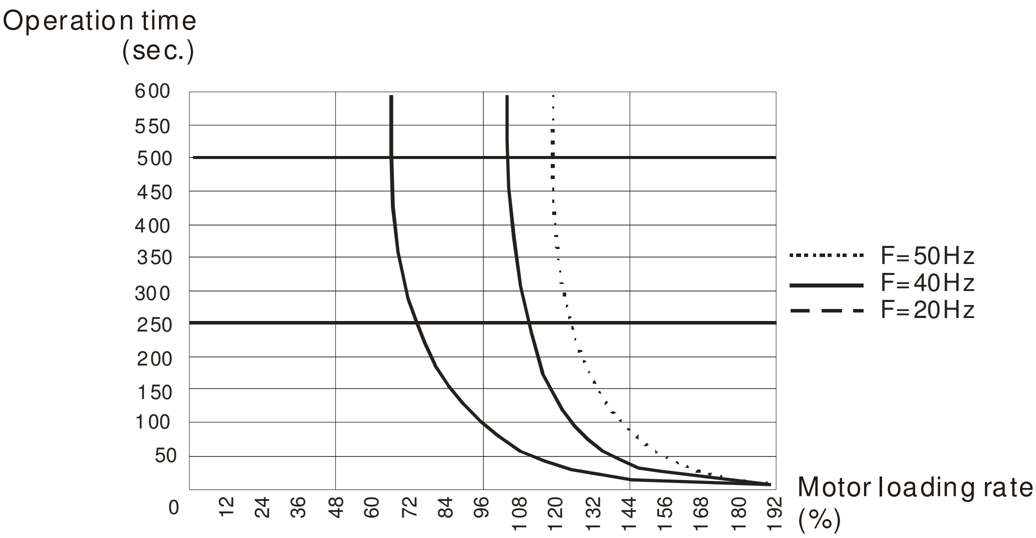
1. 06-13 or 06-27 is set 0 (using special motor)：

   When output current of motor drive is higher than 150% of motor rated current (refer to motor cooling curve with independent fan), motor drive will start to count the time. When the accumulated time exceeds Pr06-14 or 06-28, electronic thermal relay will act.

2. 06-13 or 06-27 is set 1 (using standard motor)：

   When output current of motor drive is higher than 150% of motor rated current (refer to motor cooling curve with shaft-fixed fan), motor drive will start to count the time. When the accumulated time exceeds Pr06-14 or 06-28, electronic thermal relay will act.

   The real electronic thermal relay action time will adjust with drive output current (shown as motor loading rate). When the current is high, the action time is short; when the current is small, the action time is long. Please refer to following chart:



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

Factory Setting:105.0

Settings 0.0~110.0℃

- When this parameter is set as 110.0℃，the drive will trigger error and stop instead of warning once the temperature reaches 110.0℃
- For Frame C and above, when IGBT temperature reached (06-15 setting minus 15℃), heatsink fan will accerlate to th highest speed. When IGBT temperature is lower than (06-15 setting minus 35℃), and Cap temperature is lower than (OH2 warning level minus 10℃), heatsink fan will retrieve to its setting speed.
- If the setting of this parameter is lower than 35℃, the adjustment level will be still 35℃.

06 - 16 Stall Prevention Limit Level

Factory Setting: 50

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

- When operation frequency is larger than Pr.01-01; e.g. Pr06-03=150%, Pr. 06-04=100% and Pr. 06-16=80%:
  Calculate the Stall Prevention Level during acceleration: Pr.06-03 * Pr.06-16=150x80%=120%
  Calculate the Stall Prevention Level at constant speed: Pr.06-04 * Pr.06-16=100x80%=80%.

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: Under current 1 (uC)

29: Reserved
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: Reserved
43: Reserved
44: Reserved
45: Reserved
46: Reserved
47: Reserved
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:Software code error
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)
65~71 : Reserved
72 : STO Loss 1
73: External safety gate S1
74: Output in Fire Mode
75: Reserved

76: STO

77: STO Loss 2

78: STO Loss 3

79: Uocc U phase over current (Detection begins as RUN is pressed, software protection)

80: Vocc V phase over current (Detection begins as RUN is pressed, software protection)

81: Wocc W phase over current (Detection begins as RUN is pressed, software protection)

82: OPHL U phase output phase loss

83: OPHL Vphase output phase loss

84: OPHL Wphase output phase loss

85~89：Reserved

90: Inner PLC function is forced to stop

91~98: Reserved

99: CPU trap error

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: InrCOM Internal communication overtime error

- 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：Reserved							
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)				●			

Fault Code	Bit0	Bit1	Bit2	Bit3	Bit4	Bit5	Bit6
	current	Volt.	OL	SYS	FBK	EXI	CE
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：Reserved					●		
43：Reserved					●		
44：Reserved					●		
45：Reserved					●		
46：Reserved					●		
47：Reserved					●		
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：Software code error				●			
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)						●	
65~71：Reserved						●	
72：STO Loss 1						●	
73：External safety gate S1				●			
74: Fire mode output						●	
75：Reserved							
76：STO						●	
77：STO Loss 2						●	
78：STO Loss 3						●	
79: U phase over current (Uocc)	●						

Fault Code	Bit0 current	Bit1 Volt.	Bit2 OL	Bit3 SYS	Bit4 FBK	Bit5 EXI	Bit6 CE
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	●						
85~89：Reserved							
90：Inner PLC function is forced to stop				●			
91~98：Reserved							
99：CPU Trap error				●			
100：Reserved							
101: CGdE CANopen software disconnect1							●
102: CHbE CANopen software disconnect2							●
103: CSYE CANopen synchronous error							●
104: CbFE CANopen hardware disconnect							●
105: CIdE CANopen index setting error							●
106: CAdE CANopen slave station number setting error							●
107: CFrE CANopen index setting exceed limit							●
108~110: Reserved							
111: InrCOM Internal communication overtime error							●

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

- This is the operating mode of a drive after Pr.06-29 is set to define PTC detection.

06 - 30 PTC Level

Factory Setting: 50.0

Settings 0.0~100.0%

- It needs to set AVI1/ACI/AVI2 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 output frequency. 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 -3276.7~3276.7℃

📖 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 -3276.7~3276.7℃

📖 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 -32767~32767 rpm

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

06 - 39 Reserved

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 STO Alarm Latch

Factory Setting: Read Only

Settings 0: STO alarm Latch
1: STO alarm no Latch

- Pr06-44=0 STO Alarm Latch: after the reason of STO Alarm is cleared, a Reset command is need to clear STO Alarm.
- Pr06-44=1 STO Alarm no Latch: after the reason of STO Alarm is cleared, the STO Alarm will be cleared automatically.
- All of STL1~STL3 error are “Alarm latch” mode (in STL1~STL3 mode, the Pr06-44 function is no effective).

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

- The OPHL protect will be active when the setting is not 3.

06 - 46 Detecting Time of Output Phase Loss

Factory Setting: 0.500

Settings 0.000~65.535 seconds

06 - 47 Current detection level of output phase loss

Factory Setting: 1.00

Settings 0.00 ~ 655.35%

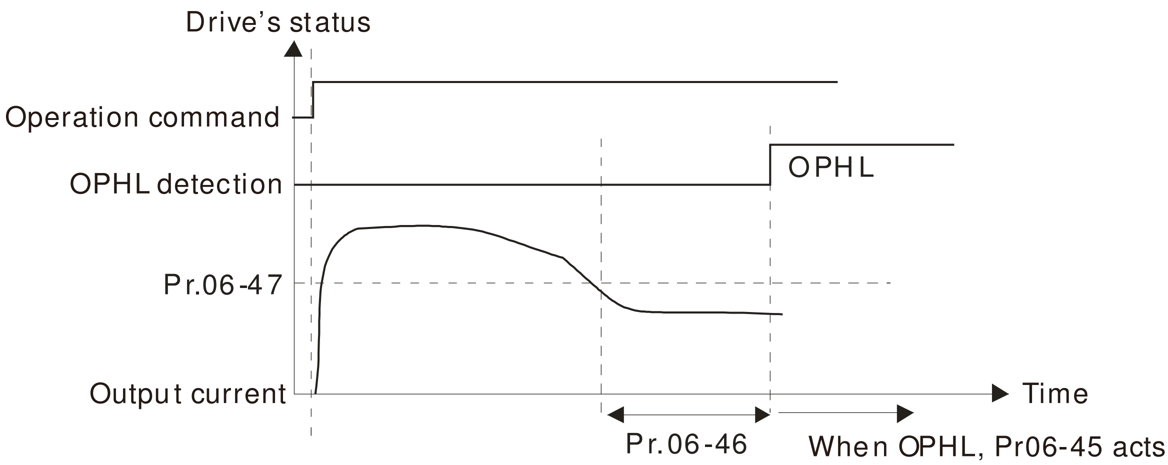
06 - 48 Output phase loss detection function executing time before run

Factory Setting: 0.000

Settings 0.000~65.535 seconds

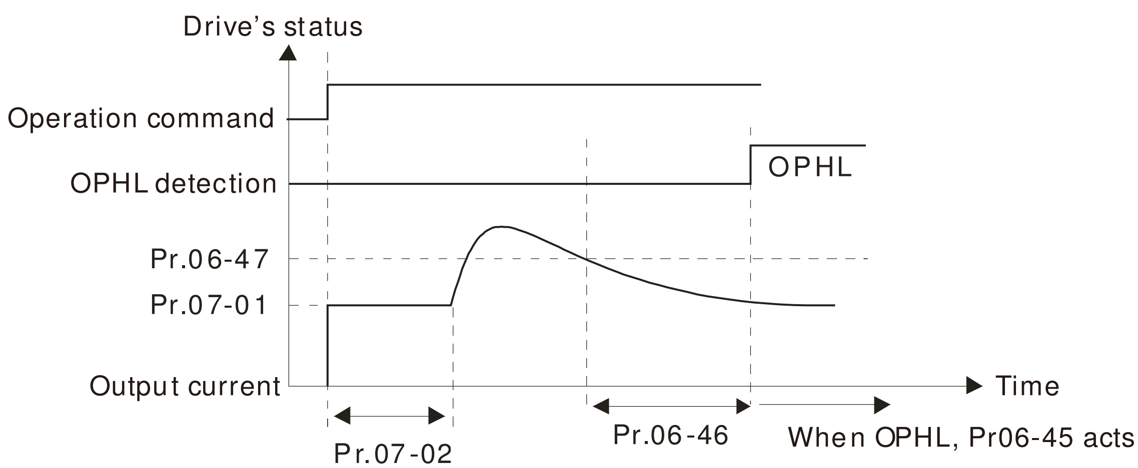
- When Pr06-48 is 0, OPHL detection function will be disabled
- Status 1 : Motor drive is in operation

  Any phase is less than Pr06-47 setting level, and exceeds Pr06-46 setting time, motor drive will perform Pr06-45 setting.



- Status 2 : Motor drive is in stop; Pr06-48=0 ; Pr07-02≠0

  After motor drive starts, DC brake will be applied in accord to Pr07-01 and Pr07-02. During this period, OPHL detection will not be conducted. After DC brake, motor drive starts to run, and conducts the OPHL protection as mentioned in status 1.

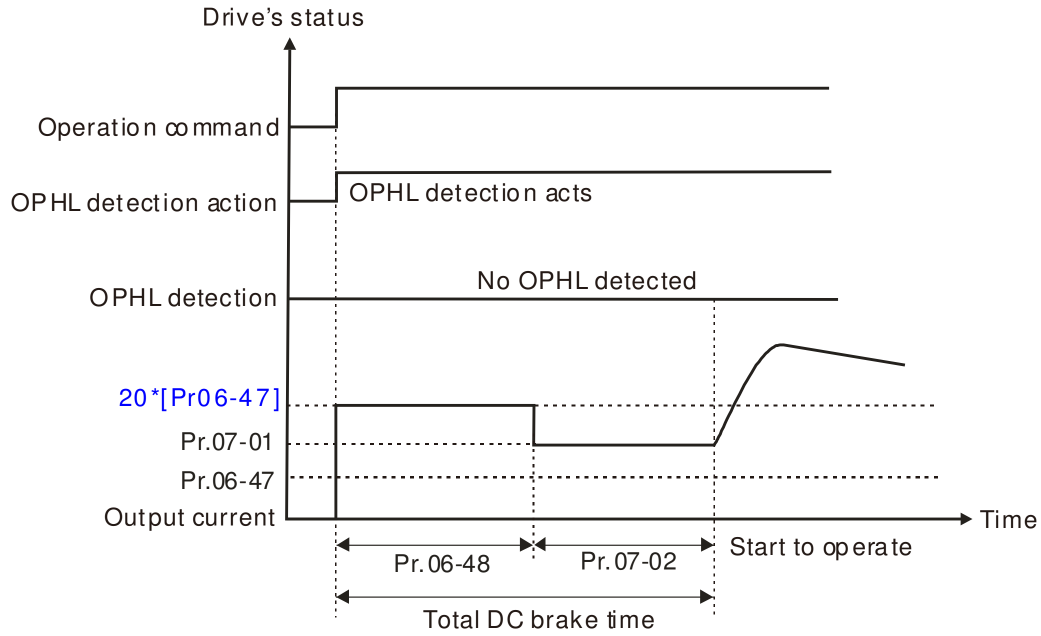


📖 Status 3: Motor drive is in stop; Pr06-48≠0 ; Pr07-02≠0

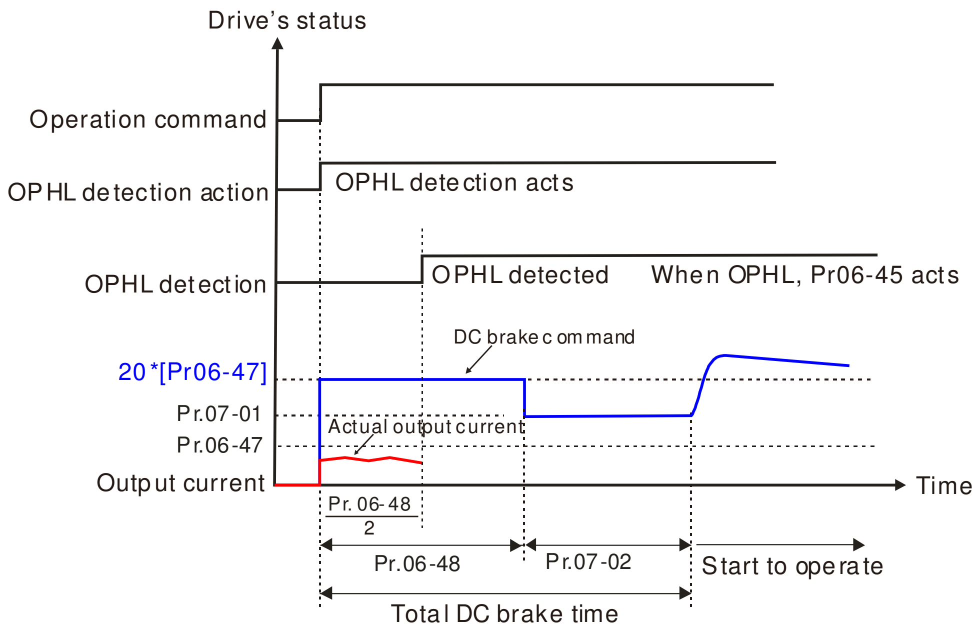
When motor drive starts, it will perform Pr06-48 and then Pr07-02 (DC brake). DC brake current level in this status includes two parts, one is 20 times of Pr06-47 setting value in Pr06-48 setting time, and Pr07-02 setting value in Pr07-01 setting time. Total DC brake time is T=Pr06-48+Pr07-02.

In this period, if OPHL happens, motor drive starts to count until Pr06-48/2, motor drive will perform Pr06-45 setting.

Status 3-1: Pr06-48≠0, Pr07-02≠0 (No OPHL detected before operation)



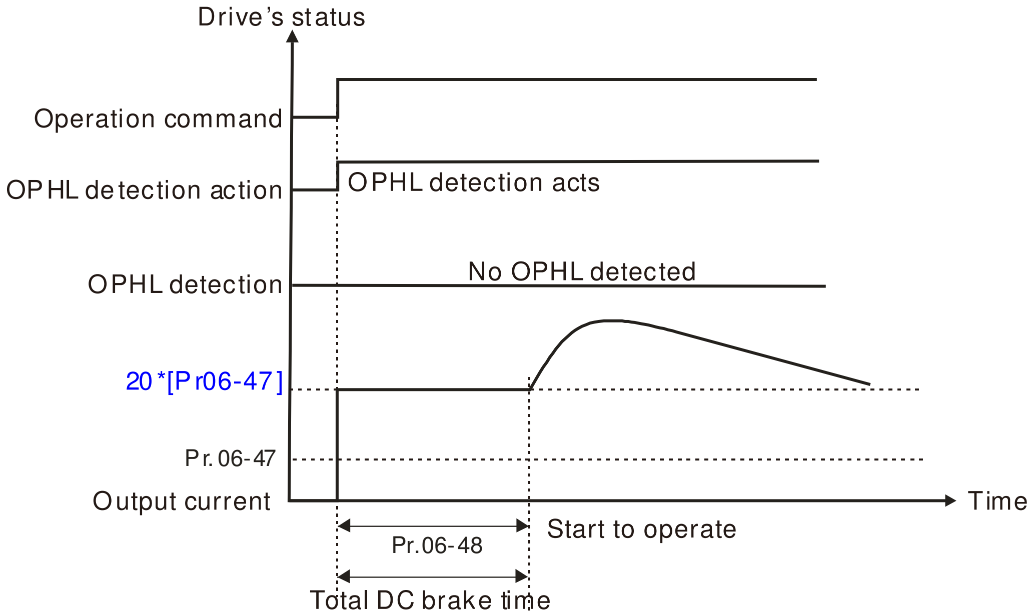
Status 3-2: Pr06-48≠0, Pr07-02≠0 (OPHL detected before operation)



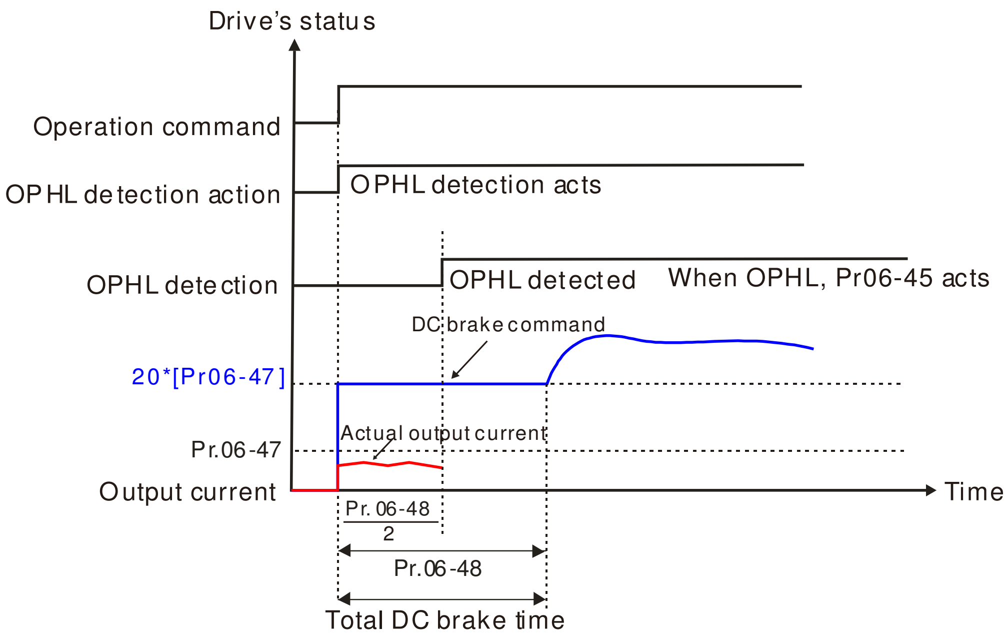
📖 Status 4: Motor drive is in stop; Pr06-48≠0 ; Pr07-02=0

When motor drive starts, it will perform Pr06-48 as DC brake. The DC brake current level is 20 times of Pr06-47 setting value. In this period, if OPHL happens, motor drive starts to count until Pr06-48/2, motor drive will perform Pr06-45 setting.

Status 4-1: Pr06-48≠0, Pr07-02=0 (No OPHL detected before operation)



Status 4-2: Pr06-48≠0, Pr07-02=0 (OPHL detected before operation)



06 - 49 Reserved

06 - 50 Detection Time of Input Phase Loss

Factory Setting: 0.20

Settings 0.00~600.00 seconds

This parameter is to set time to detect input phase loss. The factory setting is 0.20 second which means to check every 0.20 second.

06 - 51 Reserved

06 - 52 Ripple of Input Phase Loss

Factory Setting: 30.0 / 60.0

Settings 230V models: 0.0~160.0 Vdc
460V models 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.

DCBUS ripple will be checked every 06-50 time, and if DCBUS ripple is less than 166HZ and the amplitude is bigger than 06-52 setting, and continuously 20 times, the ORP counting will be there, and after counting, ORP there. The counting time is different based on the different current status, you can refer to the table below.

（I）%	Actual seconds
50	432
75	225
120	60

06 - 54 Reserved

06 - 55 Derating Protection

Factory Setting: 0

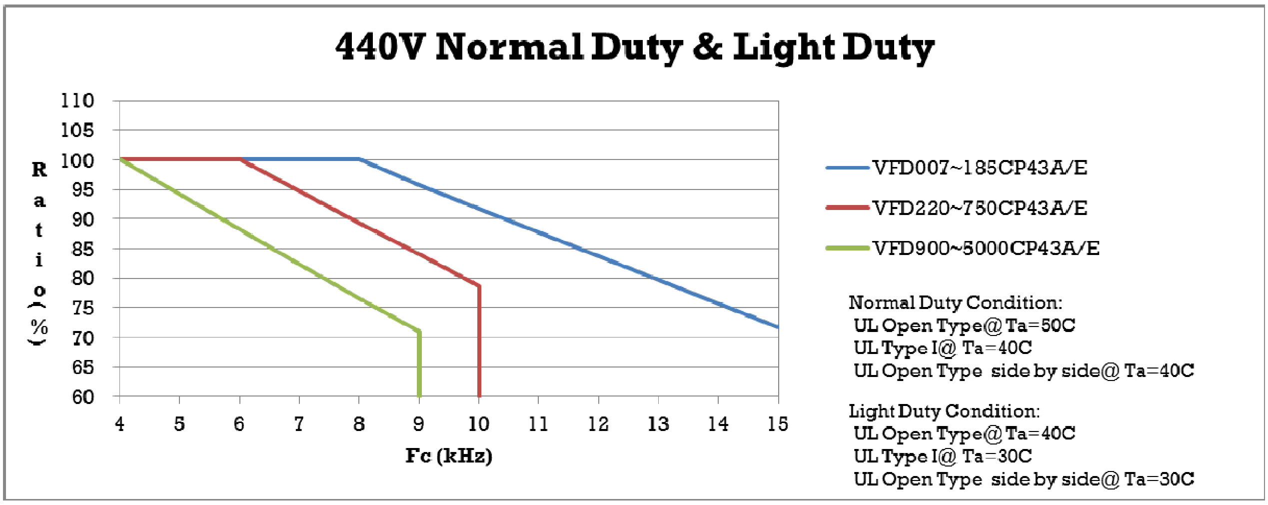
Settings 0: constant rated current and limit carrier wave by load current and temperature
1: constant carrier frequency and limit load current by setting carrier wave
2: constant rated current(same as setting 0), but close current limit

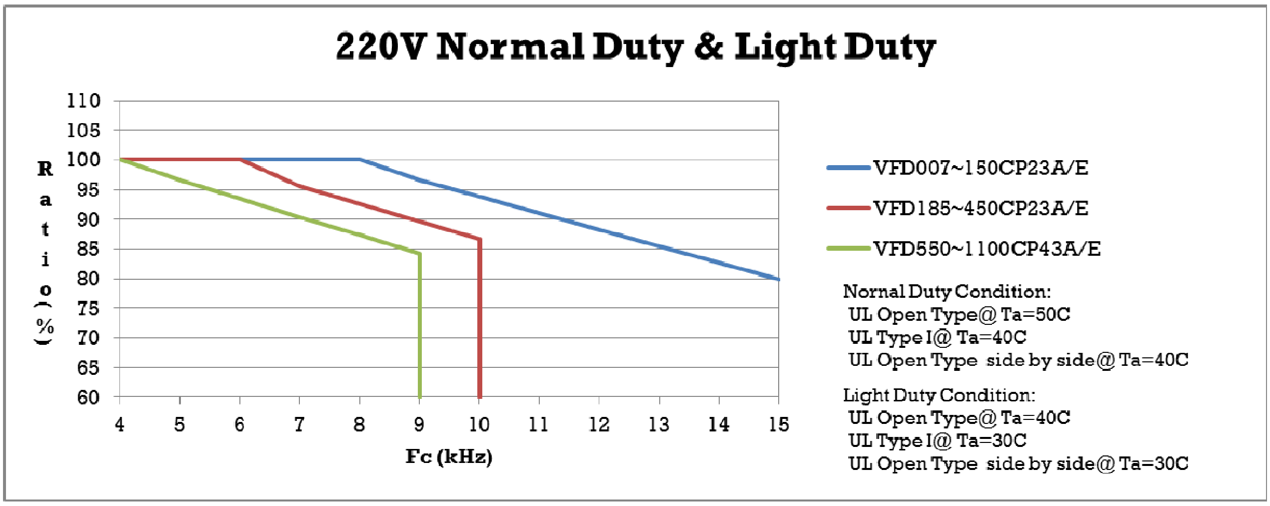
Setting 0: When the rated current is constant, carrier frequency (Fc) outputted by PWM will auto decrease according to surrounding temperature, overload output current and time. If overload situation is not frequent and only cares the carrier frequency operated with the rated current for a long time 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 **VFD007CP43A-21** 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.

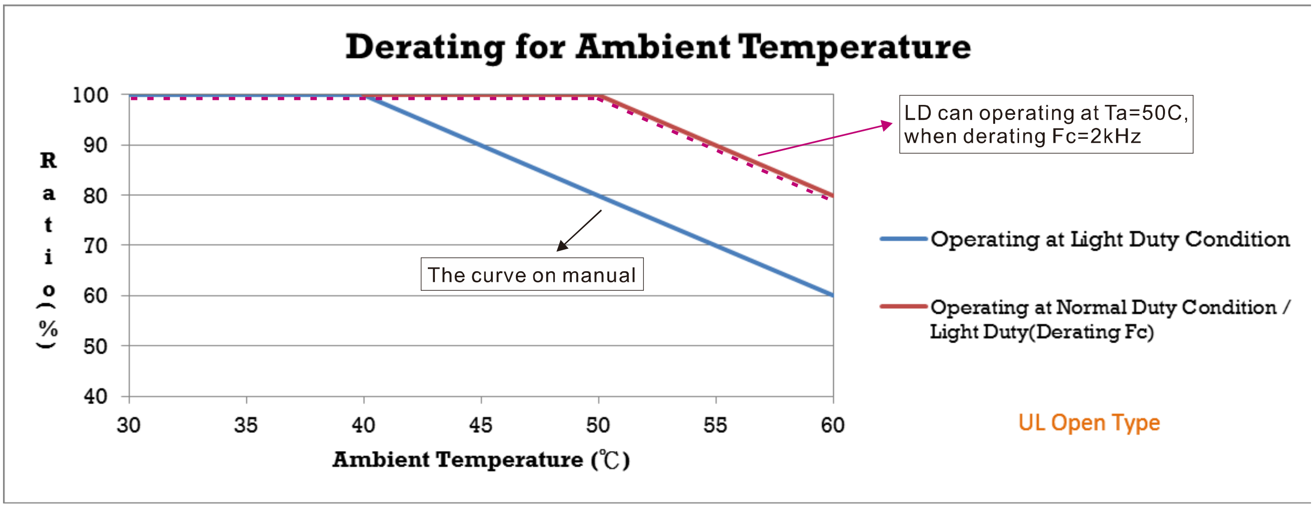
- **Setting 1**: It is used for the fixed carrier frequency and prevents the carrier wave changes and motor noise caused by the surrounding temperature and frequent overload.
  Refer to the following for the derating level of rated current. Take **VFD007CP43A-21** in normal duty as example, when the 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*130% of output current in the light duty. The advantage is that it can provide higher output current when the setting is higher than the factory setting of carrier frequency. The disadvantage is that it decreases carrier wave easily when overload.
- It should be used with Pr. 00-16 and Pr.00-17 for setting.
- Ambient temperature will also affect the derating, please refer to ambient temperature derating curve.

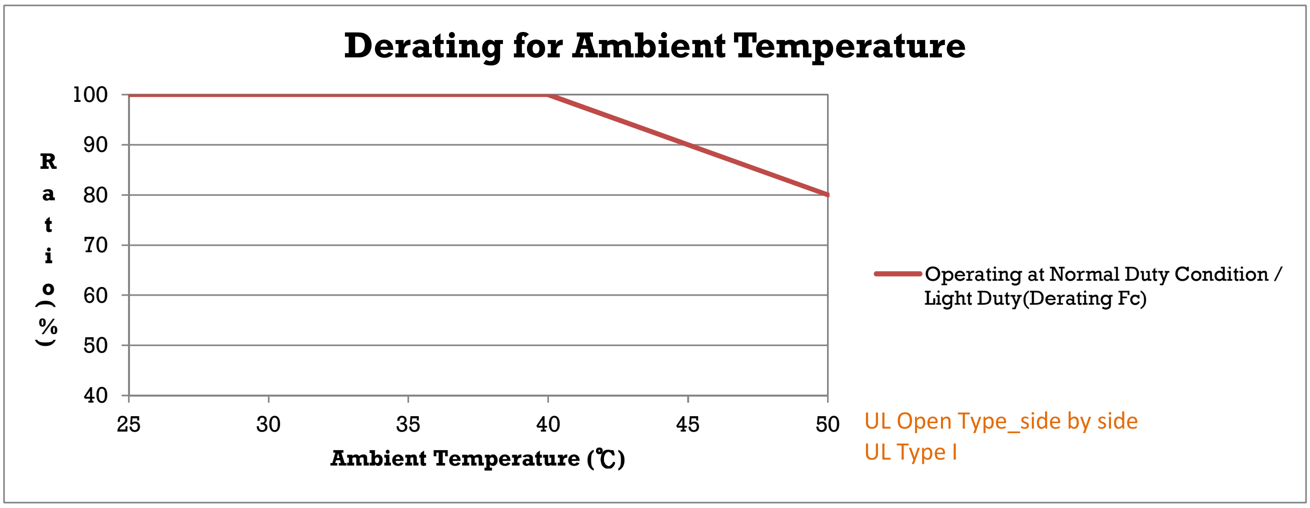
Derating curve





Ambient Temperature derating Curve





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 PT100 Handling Delay Time

Factory Setting: 60

Settings 0 ~ 6000 sec

📖 PT100 operation

(1) Use AVI1, AUI or AVI2(set to 0-10V) for analog voltage input and select PT100 mode.

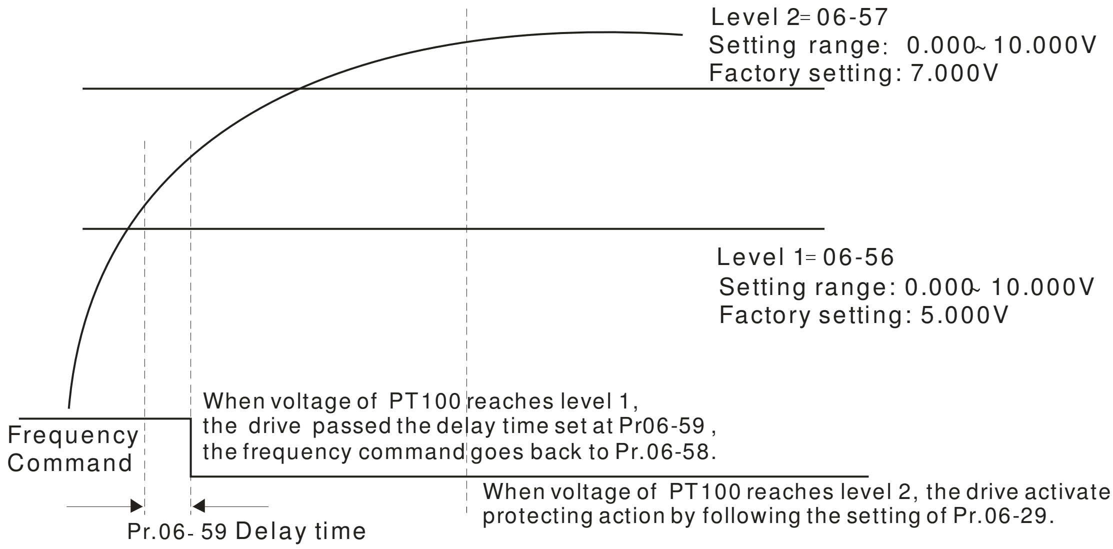
(2) Choose one of the analog voltage input type: (a)AVI (Pr.03-00=11), (b) AUI (Pr.03-02=11), or (c) ACI (Pr.03-01=11 and Pr.03-29=1).

(3) When using ACI as analog voltage input, set Pr.03-01=11 and Pr.03-29=1. Then switch SW2 to 0-10V on the I/O control terminal block.

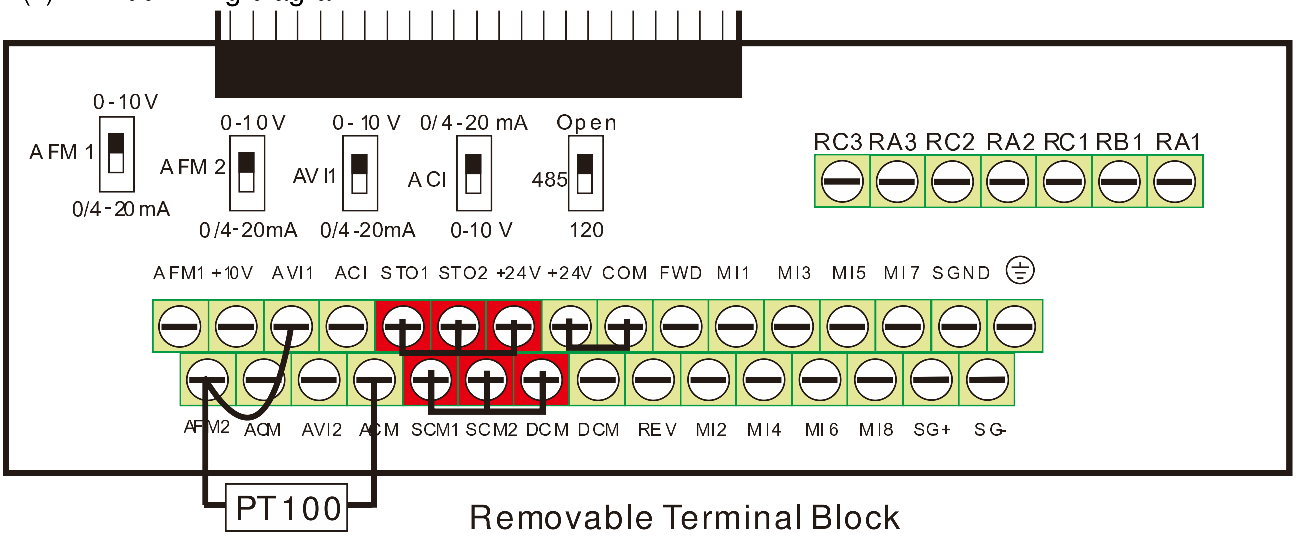
(4) Set Pr.03-23=23 and AFM2 to constant current output. Switch AFM2 (SW2) to 0-20mA on the I/O control terminal block and set constant current output to 9mA by setting Pr.03-33=45. The AFM2 constant output current is 20mA * 45% = 9mA.

(5) Pr.03-33 is for adjusting the constant voltage or constant current of AFM2, the setting range is 0~100.00%.

(6) There are two types of action level for PT100. The diagram of PT protecting action is shown as below:



(7) PT100 wiring diagram:



Removable Terminal Block

Figure 1

📖 When Pr.06-58=0.00Hz, PT100 function is disabled.

Example:
A PT100 is installed to the drive. If motor temperature reaches 135℃ (275℉) or higher, the drive will decrease motor frequency to the setting of Pr.06-58. Motor will operate at this frequency (Pr.06-58) till the motor temperature decreases to 135℃(275℉) or lower. If motor temperature exceeds 150℃(302℉), the motor will decelerate to stop and outputs an 'OH3' warning.

Set up process:

1. Switch AFM2 (SW2) to 0-20mA on the I/O control terminal block. (Refer to Figure 1, PT100 wiring diagram)
2. Wiring (Refer to Figure 1, PT100 wiring diagram):

   Connect external terminal AFM2 to (+)
   Connect external terminal ACM to (-)
   Connect external terminals AFM2 and AVI to short-circuit
3. Set Pr.03-00=11 or Pr.03-23=23 or Pr.03-33=45%(9mA)
4. Refer to RTD temperature and resistance comparison table
   Temperature=135℃, resistance=151.71Ω; Input current: 9mA, Voltage: approximately: 1.37Vdc
   Temperature=150℃, resistance=157.33Ω; Input current:9mA, Voltage: approximately: 1.42Vdc
5. Set Pr.06=56=1.37 and Pr.06-58=10Hz. When RTD temperature increases to 135℃ or higher, the drive will decelerate to the selected frequency. When Pr.06-58=0, the drive will not run.
6. Set Pr.06-57=1.42 and Pr.06-29=1 (warning and decelerate to stop). When RTD temperature increases to 150℃ or higher, the drive will decelerate to stop and outputs an 'OH3' warning.

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 0.0~655.35 seconds

📖 When the motor drive detects the unbalanced three-phase out current is higher than the setting of Pr06-60, GFF protection will be activated. Then the motor drive will stop outputting.

06 - 62 Disable Level of dEb

Factory Setting: 150.0/300.0

Settings 230V models: 0.0~200.0 Vdc
460V models 0.0~400.0 Vdc

📖 The dEb will be enabled, when the voltage of DCBus is higher than the setting at Pr06-62.

06 - 63	Fault Record 1 (day)
06 - 65	Fault Record 2 (day)
06 - 67	Fault Record 3 (day)
06 - 69	Fault Record 4 (day)

Factory Setting :Read only

Settings 0~65535 Day

06 - 64	Fault Record 1 (min)
06 - 66	Fault Record 2 (min)
06 - 68	Fault Record 3 (min)
06 - 70	Fault Record 4 (min)

Factory Setting :Read only

Settings 0~1439 minute

📖 When there is any malfunctions in motor drive operation, Pr06-17~22 will record 6 malfunctions recently, and Pr06-63~70 can record the operation time for 4 malfunctions in sequence. It can help to check if there is any wrong with the drive according to the recorded internal time.

For example: The first error: ocA occurs in 1000 minutes after motor drive start operation. The second error: ocd happens after another 1000 minutes. The 3rd error: ocA happens after another 1000 minutes. Then, the 5th error is ocd, happening 1000 minutes following 4th error. Last, 6th error ocn happens 1000 minutes after 5th error.

Then Pr06-17~Pr06-22 and Pr06-63~Pr06-70 will be:

	1st fault	2nd fault	3rd fault	4th fault	5th fault	6th fault
06-17	ocA	ocd	ocn	ocA	ocd	ocn
06-18	0	ocA	ocd	ocn	ocA	ocd
06-19	0	0	ocA	ocd	ocn	ocA
06-20	0	0	0	ocA	ocd	ocn
06-21	0	0	0	0	ocA	ocd
06-22	0	0	0	0	0	ocA
06-63	1000	560	120	1120	680	240
06-64	0	1	2	2	3	4
06-65	0	1000	560	120	1120	680
06-66	0	0	1	2	2	3
06-67	0	0	1000	560	120	1120
06-68	0	0	0	1	2	2
06-69	0	0	0	1000	560	120
06-70	0	0	0	0	1	2

※ From time record, it can be known that the last fault (Pr06-17) happened after the drive run for 4days and 240 minutes.

06 - 71 Low Current Setting Level

Factory Setting: 0.0

Settings 0.0 ~ 100.0 %

06 - 72 Low Current Detecting Time

Factory Setting: 0.00

Settings 0.00 ~ 360.00 seconds

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

- The drive will operate as the setting of Pr.06-73 when output current is lower than the setting of Pr.06-71 and when low current continues for a period longer than the setting of Pr.06-72. This parameter can also be used with external multi-function output terminal 44 (MO44) for low current output.
- The low current detection function will not be executed when drive is at sleep or standby status

06 - 74 ~ 06 - 79 Reserved

06 - 80 Fire Mode

Factory Setting: 0.00

Settings 0: No Function
1: Forward Operation
2: Reverse Operation

- This parameter needs to work with multi-input function terminal #58 or #59 and multi-output function terminal #53 and #54.
  Setting is 0: Fire mode is disabled
  Setting is 1: When there is a fire, motors will operate clockwisely (U, V.W).
  Setting is 2: When there is a fire, motors will operate counter-clockwisely.

06 - 81 Operating Frequency when running Fire Mode

Factory Setting: 6000

Settings 0.00 ~ 600.00 hz

- This parameter is to set up the drive's frequency when the fire mode is enabled.

06 - 82 Enable Bypass on Fire Mode

Factory Setting: 0.

Settings 0: Disable Bypass
1: Enable Bypass

06 - 83 Bypass Delay Time on Fire Mode

Factory Setting: 0.0

Settings 0.00 ~ 6550.0 seconds

06 - 84 Number of Times of Unusual Reset at Fire Mode

Factory Setting: 0

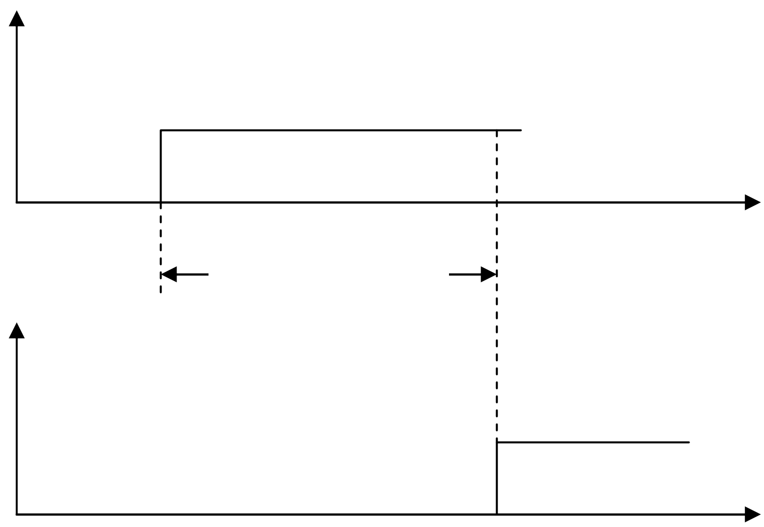
Settings 0 ~ 10

06 - 85 Length of Time of Unusual Reset

Settings 0.00 ~ 6000.0sec Factory Setting: 60.0

📖 The settings of Pr06-82 to Pr06-85 decide if switch motors to operating under mains electricity.

Diagram of Bypass function’s Sequence



Conditions required to enable the bypass function

When Pr06-82 is set to 1 and under one of two conditions below.

(1) When operating at fire mode , there is error(as shown in the table below) and the fire alarm rings according to the time setting of Pr06-83, then the bypass function will be enabled. MFO bypass indication will be ON.

(2) When operating at fire mode, there is an error on auto-reset and the number of time to auto-reset remains zero or the fire alarm rings according to the time setting of Pr06-83, then the bypass function will be enabled. MFO bypass indication will be ON. If the auto rest is successful before the bypass function is enabled, then the bypass delay counter will return to zero to wait for next trigger.

Table 1: Error detection under Normal mode, Fire mode and Bypass function at Fire mode. (V means detectable)

Code	Error name	Normal mode	Fire Mode	Enable bypass function
1	Over current during Acceleration (ocA)	V(RS)	V(able to auto-reset)	V
2	Over current during deceleration (ocd)	V(RS)	V(able to auto-reset)	V
3	Over current during normal speed (ocn)	V(RS)	V(able to auto-reset)	V
4	Ground Fault (GFF)	V	V(able to auto-reset)	V
5	IGBT short circuit (occ)	V(RS)	V(able to auto-reset)	V
6	Over current during Stop (ocS)	V(RS)	V(able to auto-reset)	V
7	Over voltage during Acceleration (ovA)	V(RS)	V(able to auto-reset)	V
8	Over voltage during deceleration (ovd)	V(RS)	V(able to auto-reset)	V
9	Over voltage during normal speed (ovn)	V(RS)	V(able to auto-reset)	V
10	Over voltage during Stop (ovS)	V(RS)	V(able to auto-reset)	V
11	Low voltage during Acceleration (LvA)	V	Not-detectable	Not-detectable
12	Low voltage during deceleration (Lvd)	V	Not-detectable	Not-detectable
13	Low voltage during normal speed (Lvn)	V	Not-detectable	Not-detectable
14	Low voltage during Stop (LvS)	V	Not-detectable	Not-detectable
15	Input phase loss (OrP)	V	V(able to auto-reset)	V
16	Over heat 1 (oH1)	V	V(able to auto-reset)	V
17	Over heat 2 (oH2)	V	V(able to auto-reset)	V
18	Thermister 1 open (tH1o)	V	V(able to auto-reset)	V
19	Thermister 2 open (tH2o)	V	V(able to auto-reset)	V
21	Over Load (oL) (150% 1Min, Inverter)	V	Not-detectable	Not-detectable
22	Motor 1 over load (EoL1)	V	Not-detectable	Not-detectable
23	Motor 2 over load (EoL2)	V	Not-detectable	Not-detectable
24	Over heat 3 (oH3) (PTC)	V	V(able to auto-reset)	V
26	Over torque 1 (ot1)	V	Not-detectable	Not-detectable
27	Over torque 2 (ot2)	V	Not-detectable	Not-detectable
30	EEPROM write error (cF1)	V	Not-detectable	Not-detectable
31	EEPROM read error (cF2)	V	V	Not-detectable
33	U phase current sensor detection error (cd1)	V	V	Not-detectable
34	V phase current sensor detection error (cd2)	V	V	Not-detectable

Code	Error name	Normal mode	Fire Mode	Enable bypass function
35	W phase current sensor detection error (cd3)	V	V	Not-detectable
36	Hardware Logic error 0 (Hd0) - cc	V	V	Not-detectable
37	Hardware Logic error 1 (Hd1) - oc	V	V	Not-detectable
38	Hardware Logic error 2 (Hd2) - ov	V	V	Not-detectable
39	Hardware Logic error 3 (Hd3) – occ	V	V	Not-detectable
40	Motor auto tuning error (AuE)	V	Not-detectable	Not-detectable
41	ACI feedback loss (AFE)	V	Not-detectable	Not-detectable
48	ACI Loss	V	Not-detectable	Not-detectable
49	External fault (EF)	V	Not-detectable	Not-detectable
50	Emergency stop (EF1)	V	Not-detectable	Not-detectable
51	base block (bb)	V	Not-detectable	Not-detectable
52	PcodE (Password)	V	Not-detectable	Not-detectable
53	Software code error	V	V	Not-detectable
54	Communication error 1 (cE1)	V	Not-detectable	Not-detectable
55	Communication error 2 (cE2)	V	Not-detectable	Not-detectable
56	Communication error 3 (cE3)	V	Not-detectable	Not-detectable
57	Communication error 4 (cE4)	V	Not-detectable	Not-detectable
58	cE10 (Communication Time Out)	V	Not-detectable	Not-detectable
59	Communication time out (cP10)	V	Not-detectable	Not-detectable
60	Braking Transistor Fault (bf)	V	Not-detectable	Not-detectable
61	Y-Delta connected Error (ydc)	V	Not-detectable	Not-detectable
62	Decel. Energy Backup Error (dEb)	V	Not-detectable	Not-detectable
63	Over Slip Error (oSL)	V	Not-detectable	Not-detectable
64	Electromagnet switch error (ryF)	V	Not-detectable	Not-detectable
72	STO Loss 1	V	Not-detectable	Not-detectable
73	External safety gate S1	V	V	Not-detectable
74	Fire Mode	V	V(keeps on operating)	V(keeps on operating)
76	STO	V	Not-detectable	Not-detectable
77	STO Loss 2	V	Not-detectable	Not-detectable
78	STO Loss 3	V	Not-detectable	Not-detectable
79	U phase over current (Uocc)	V	V(able to auto-reset)	V
80	V phase over current (Vocc)	V	V(able to auto-reset)	V
81	W phase over current (Wocc)	V	V(able to auto-reset)	V
82	OPHL U phase output phase loss	V	V(able to auto-reset)	V
83	OPHL Vphase output phase loss	V	V(able to auto-reset)	V
84	OPHL Wphase output phase loss	V	V(able to auto-reset)	V

Code	Error name	Normal mode	Fire Mode	Enable bypass function
90	Inner PLC function is forced to stop	V	Not-detectable	Not-detectable
99	CPU Trap error	V	V	Not-detectable
101	CGdE CANopen software disconnect1	V	Not-detectable	Not-detectable
102	CHbE CANopen software disconnect2	V	Not-detectable	Not-detectable
103	CSYE CANopen synchronous error	V	Not-detectable	Not-detectable
104	CbFE CANopen hardware disconnect	V	Not-detectable	Not-detectable
105	CIdE CANopen index setting error	V	Not-detectable	Not-detectable
106	CAdE CANopen slave station number setting error	V	Not-detectable	Not-detectable
107	CFrE CANopen index setting exceed limit	V	Not-detectable	Not-detectable
111	InrCOM Internal communication overtime error	V	Not-detectable	Not-detectable

07 Special Parameters

✎ The parameter can be set during operation

✎ 07 - 00 Software Brake Level

Factory Setting: 380.0/760.0

Settings 230V models：350.0~450.0Vdc

460V models：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.

✎ 07 - 02 DC Brake Time at Start-up

Factory Setting: 0.0

Settings 0.00~60.0 seconds

- When the drive doesn't have any output, the motor may be in the rotation status due to external force or its 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 0.0~60.0 seconds

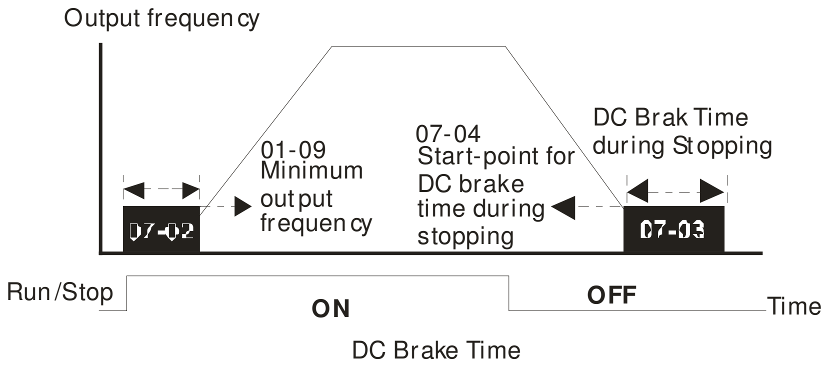
- The motor may be in the rotation status after drive stop outputting due to external force or its inertia and can't stop accurately. This parameter can output DC current to force the motor drive stop after drive stops to make sure that the motor is stop
- This parameter determines the duration of the DC Brake current during stopping. To DC brake at stop, this function will be valid when Pr.00-22 is set to 0. 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 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 Voltage Increasing Percentage

Factory Setting: 100%

Settings 1~200%

📖 When the user is using speed tracking, adjust Pr07-05 to slow down the increasing of voltage if there are errors such as oL or oc.

⚡ 07 - 06 Restart after Momentary Power Down

Factory Setting: 0

Settings 0: Disable

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.

07 - 07 Maximum Power Loss Duration

Factory Setting: 2.0

Settings 0~20.0 seconds

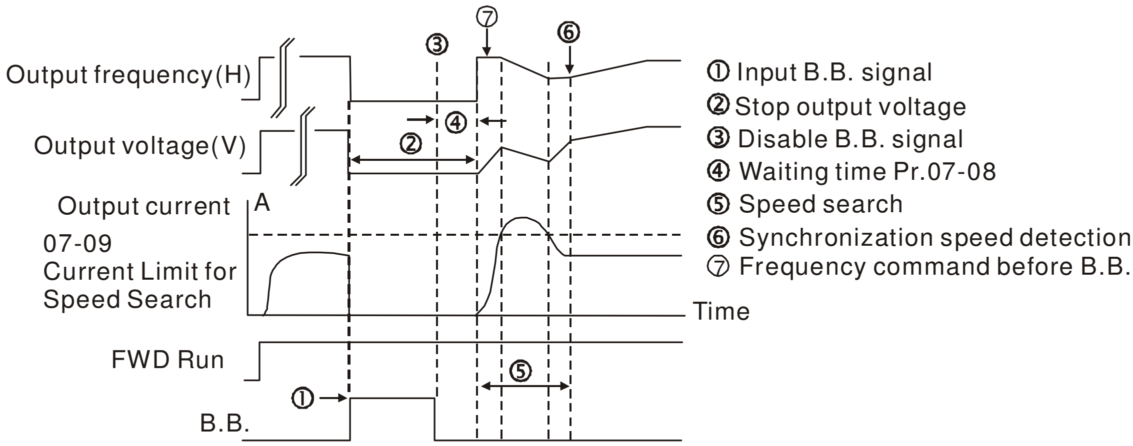
- If the duration of a power loss is less than this parameter setting, the AC motor drive will resume operation. If it exceeds the Maximum Allowable Power Loss Time, the AC motor drive output is then turned off (coast stop).
- The selected operation after power loss in Pr.07-06 is only executed when the maximum allowable power loss time is ≤ 20 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

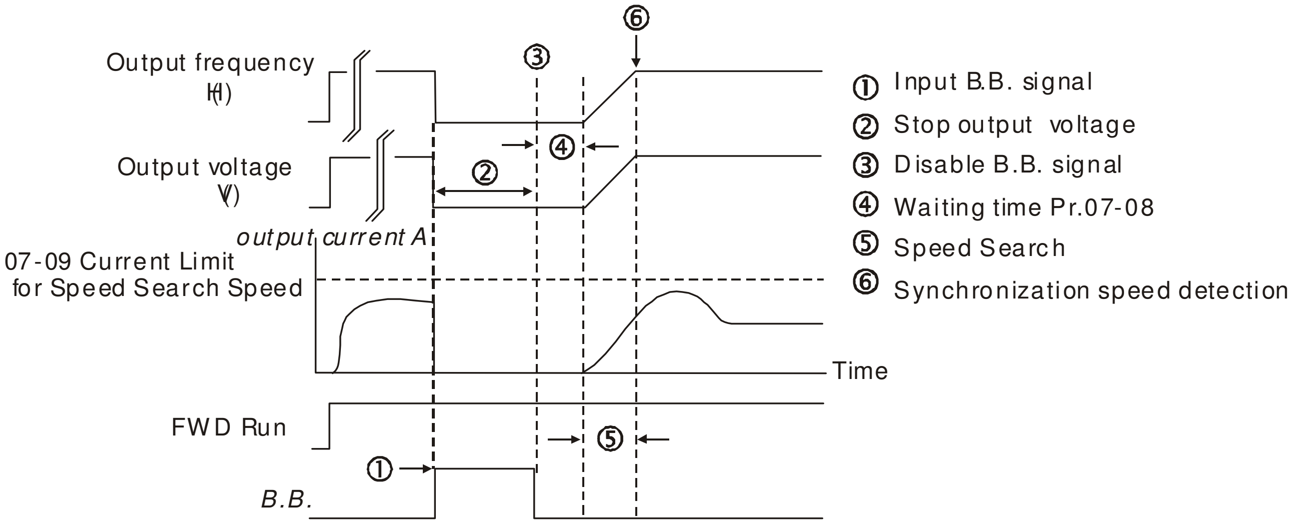
Factory Setting: 0.5

Settings 0.1~5.0 seconds

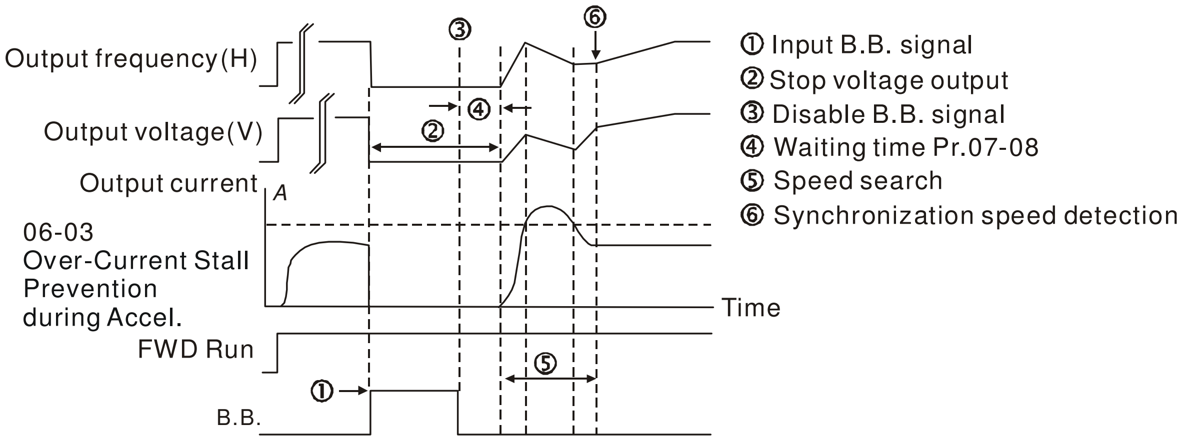
- When momentary power loss is detected, the AC drive will block its output and then wait for a specified period of time (determined by Pr.07-08, called Base-Block Time) before resuming operation. This parameter should be set at a value to ensure that any residual regeneration voltage from the motor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

07 - 10 Treatment after Fault

Factory Setting: 0

Settings 0: Disable

1: Speed search starts with current speed

2: Speed search starts with minimum output frequency

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

07 - 11 Auto Reset Times After Fault

Factory Setting: 0

Settings 0~10

- After fault (oc, ov, occ) occurs, the AC motor drive can be reset/restarted automatically up to 10 times.
- Setting this parameter to 0 will disable the reset/restart operation after any fault has occurred. When enabled, the AC motor drive will restart with Pr07-10 setting after fault auto reset.
- If the time of reset/restart exceeds Pr.07-11 setting, the fault will not be restart /reset until user reset manually and run the motor drive again.

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. The output current is set by the Pr.07-09.

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.

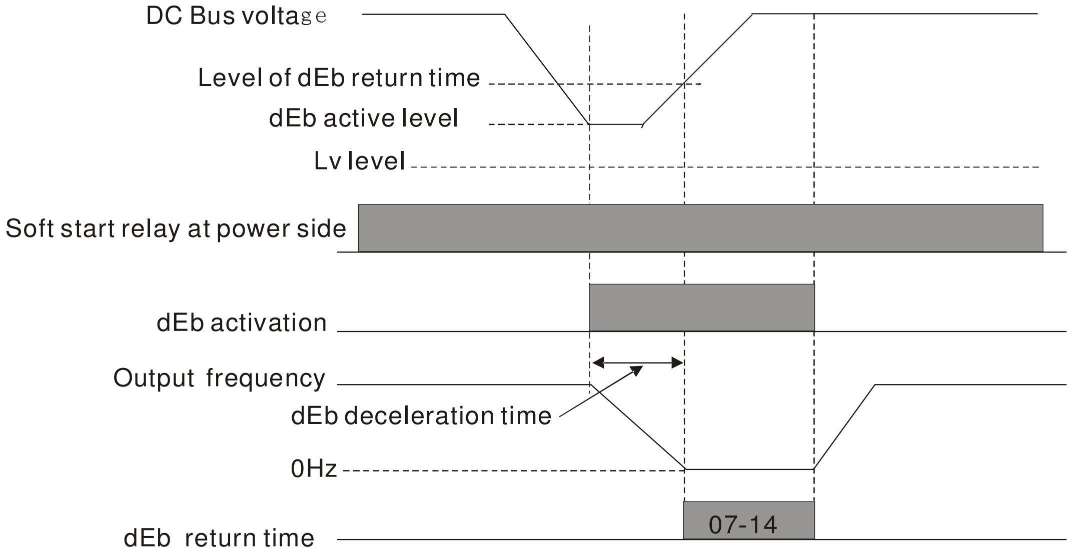
07 - 14 dEb Return Time

Factory Setting: 0.0

Settings 0.0~25.0 seconds

- This function allows 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)

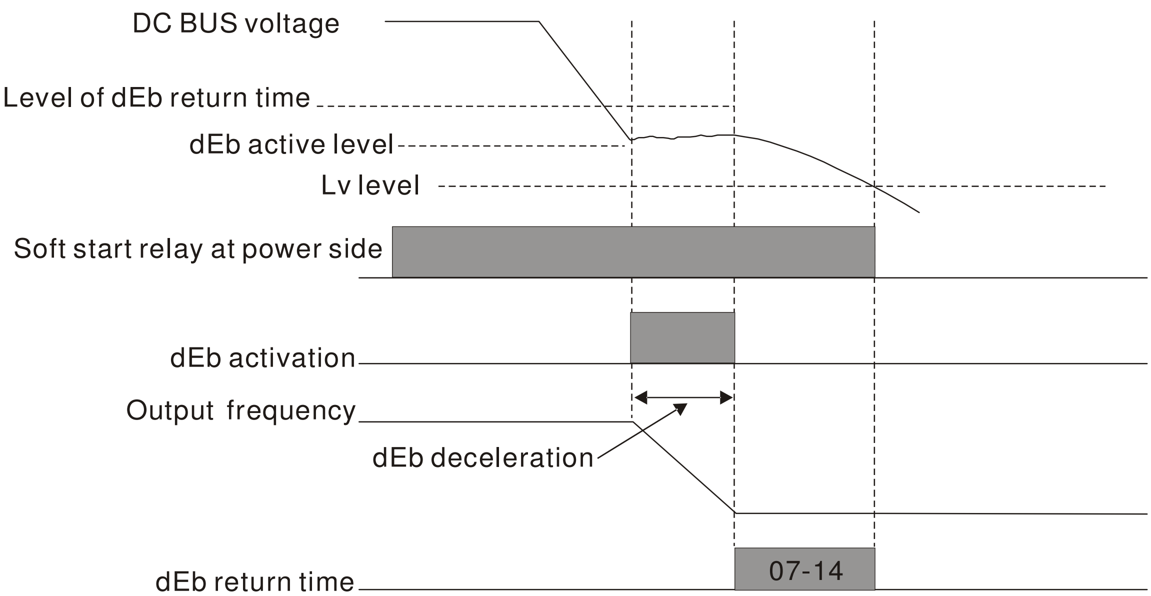
Situation 1: Insufficient power supply due to momentary power-loss/unstable power (due to low voltage)/sudden loading.



NOTE If Pr07-14 is set to 0, then a STOP command will be given. Besides the motor drive will not accelerate to reach the frequency before dEb even if the power is on again. If Pr07-14 is not set to 0, a command of zero speed will be given and wait for the power on.

NOTE dEb active level is when DC BUS' voltage lower than:
230V series: Lv level + 20Vdc or 460V series: Lv level + 40Vdc

Situation 2: Unexpected power off, such as momentary power loss



NOTE
There are always several machines run at the same time in a textile factory. To prevent broken stitching when power down, these machines have to decelerate to stop. So when there is a sudden power loss, the host controller will notify the motor drive to use dEb function with deceleration time via EF.

NOTE dEb active level is when DC BUS' voltage lower than:
230V series: Lv level + 20Vdc or 460V series: Lv level + 40Vdc

07 - 15 Dwell Time at Accel.

Factory Setting: 0.00

Settings 0.00~600.00 seconds

07 - 16 Dwell Frequency at Accel

Factory Setting: 0.00

Settings 0.00~600.00 seconds

07 - 17 Dwell Frequency at Decel.

Factory Setting: 0.00

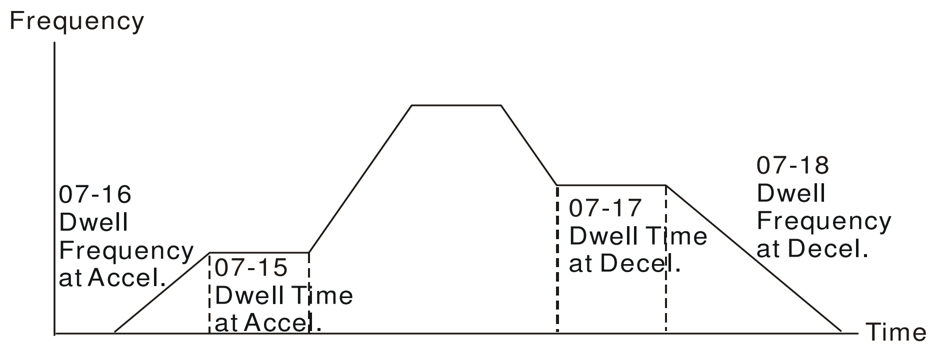
Settings 0.00~600.00Hz

07 - 18 Dwell Frequency at Decel.

Factory Setting: 0.00

Settings 0.00~600.00 Hz

- 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

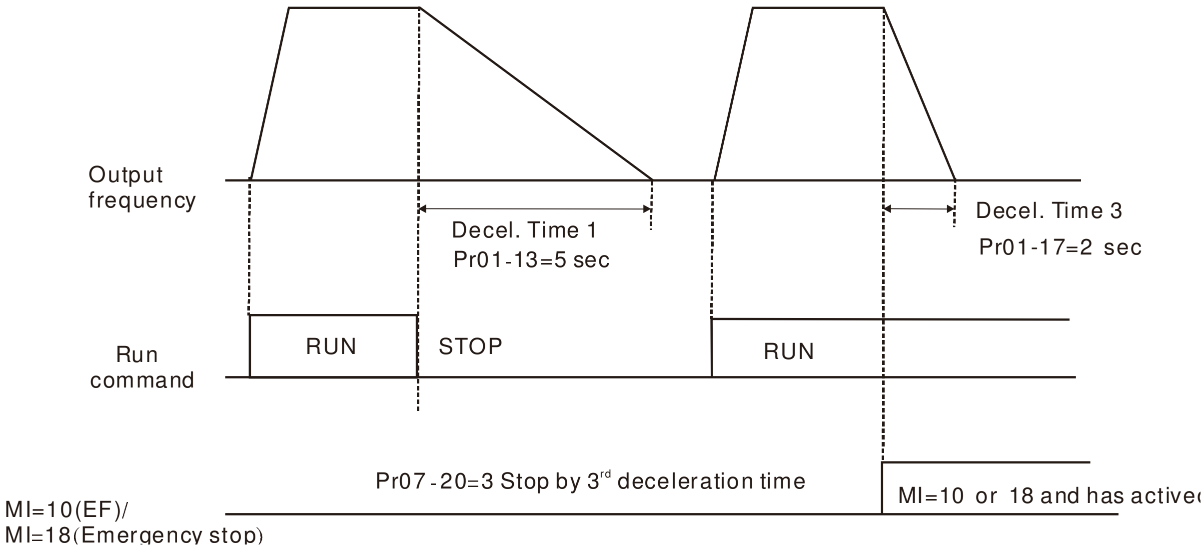
- This parameter is used for the fan control.
- Setting 0: Fan will be ON as the drive's power is turned ON.
- Setting 1: 1 minute after AC motor drive stops, fan will be OFF
- Setting 2: AC motor drive runs and fan will be ON. AC motor drive stops and fan will be OFF.
- Setting 3: Fan run according to IGBT and capacitance temperature. Fan will be ON when preliminary capacitance temperature is higher than 60°C. Fan will be OFF, when temperature is lower than 40°C.
- Setting 4: Fan is always OFF

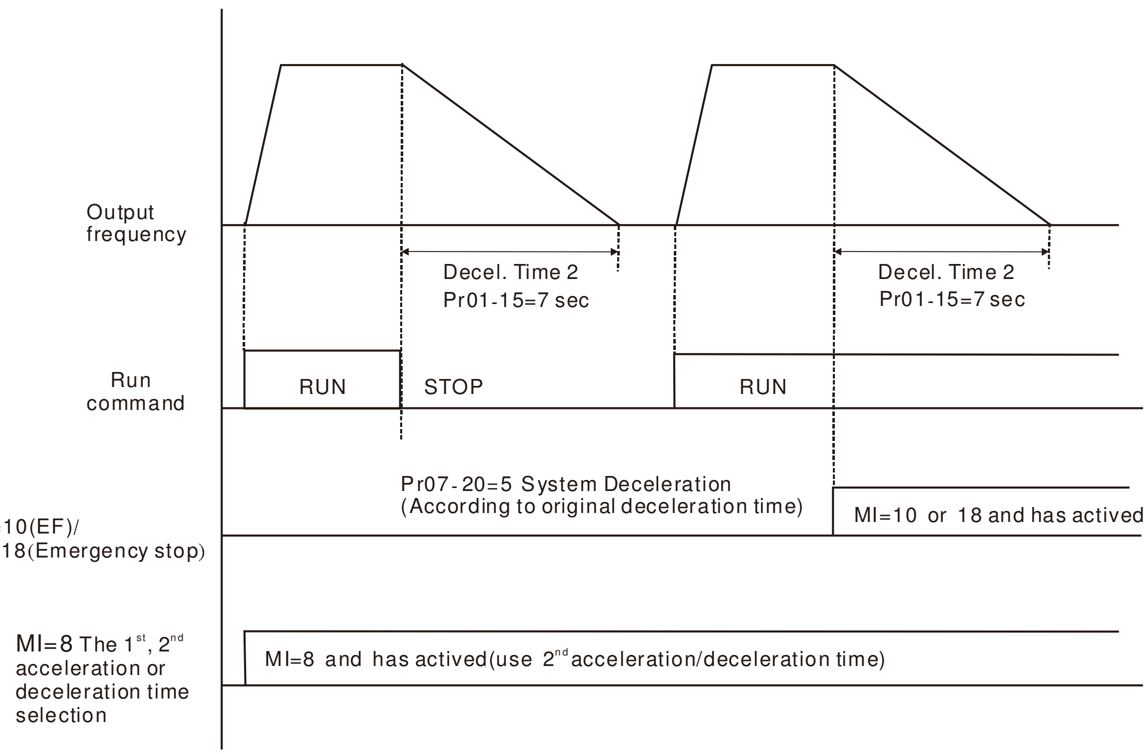
07 - 20 Emergency Stop (EF) & Force Stop

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 (According to original deceleration time)
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 Setting

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. 07-21 is set to 1, this parameter can be used to adjust the gain of energy-saving. The factory setting is 100%. If the result is not good, it can adjust by decreasing the setting. If the motor oscillates, it should increase the setting value.
- At some special application such as High speed spindle, the motor temperature rise is been highly concern. Thus, when the motor is not working with load, the motor current will requested to reduce to a lower level. To Lowering this parameter setting can meet this requirement.

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.

✓ 07 - 24 Filter Time of Torque Compensation (V/F and SVC control mode)

Factory Setting: 0.020

Settings 0.001~10.000 seconds

- 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 seconds

- It can set Pr.07-24 and 07-25 to change the response time of compensation.
- If Pr.07-24 and 07-25 are set to 10seconds, the response time of compensation is the slowest. But the system may be unstable when the setting is too short.

✓ 07 - 26 Torque Compensation Gain (V/F 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

(1 in SVC mode)

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: 0.0

Settings 0~100.0%

0：Not-detectable

07 - 30 Detection Time of Slip Deviation

Factory Setting: 1.0

Settings 0.0~10.0 seconds

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, it can be set to 0. When the current wave motion happens in the low frequency, please increase Pr.07-32.)

07 - 33 Autorestart interval of Fault

Factory Setting: 60.0

Settings 00~6000.0 seconds

📖 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

〆 The parameter can be set during operation.

〆 **08 - 00** Input Terminal for PID Feedback

Factory Setting: 0

Settings 0: No function

1: Negative PID feedback: input from external terminal AVI1 (Pr.03-00)

4: Positive PID feedback from external terminal AVI1 (Pr.03-00)

- 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.

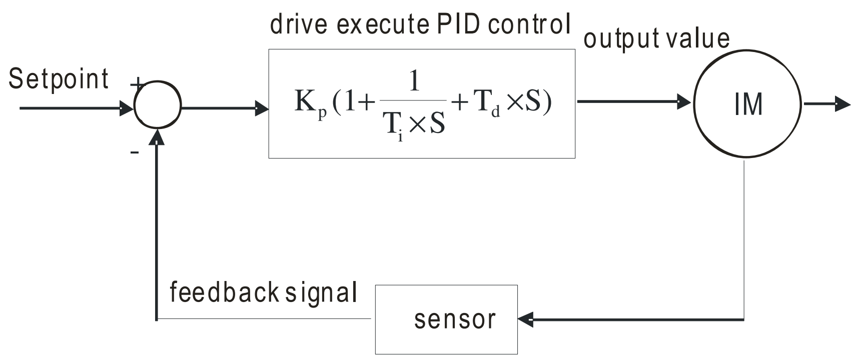
3. Air volume control: An air volume sensor is used to feedback the air volume data to have excellent air volume regulation.

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

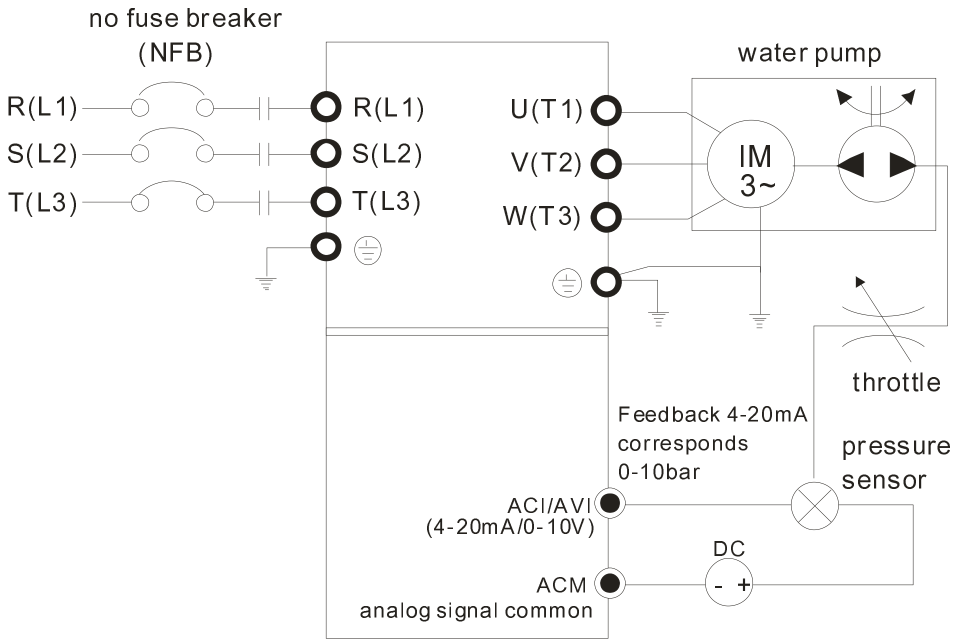
- Concept of PID control

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))

📖 Refer to Pr.08-00 to 08-21 for PID parameters settings.

08 - 01 Proportional Gain (P)

Factory Setting: 1.0

Settings 0.0~100.0%

📖 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 seconds
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 seconds

- 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 PID Feedback Value

Factory Setting: Read Only

Settings 0.00 ~ 200.00%

- When PID feedback input is set as communication (Pr08-00=7 or 8), PID feedback value can be set by this value.

08 - 07 PID Delay Time

Factory Setting: 0.0

Settings 0.0~35.0 seconds

08 - 20 PID Mode Selection

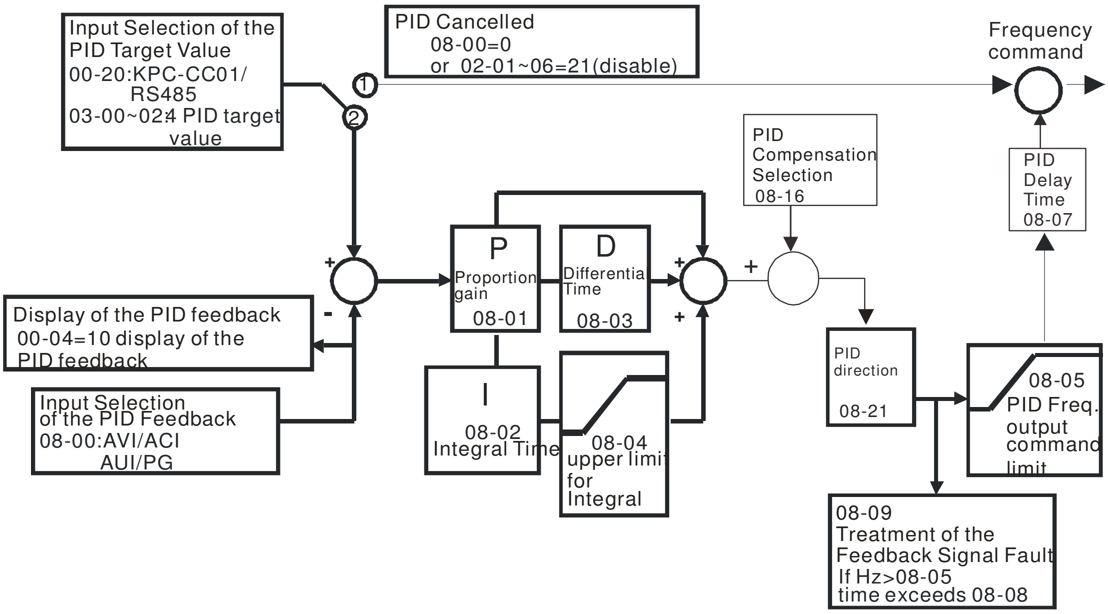
Factory Setting: 0

Settings 0: Serial connection

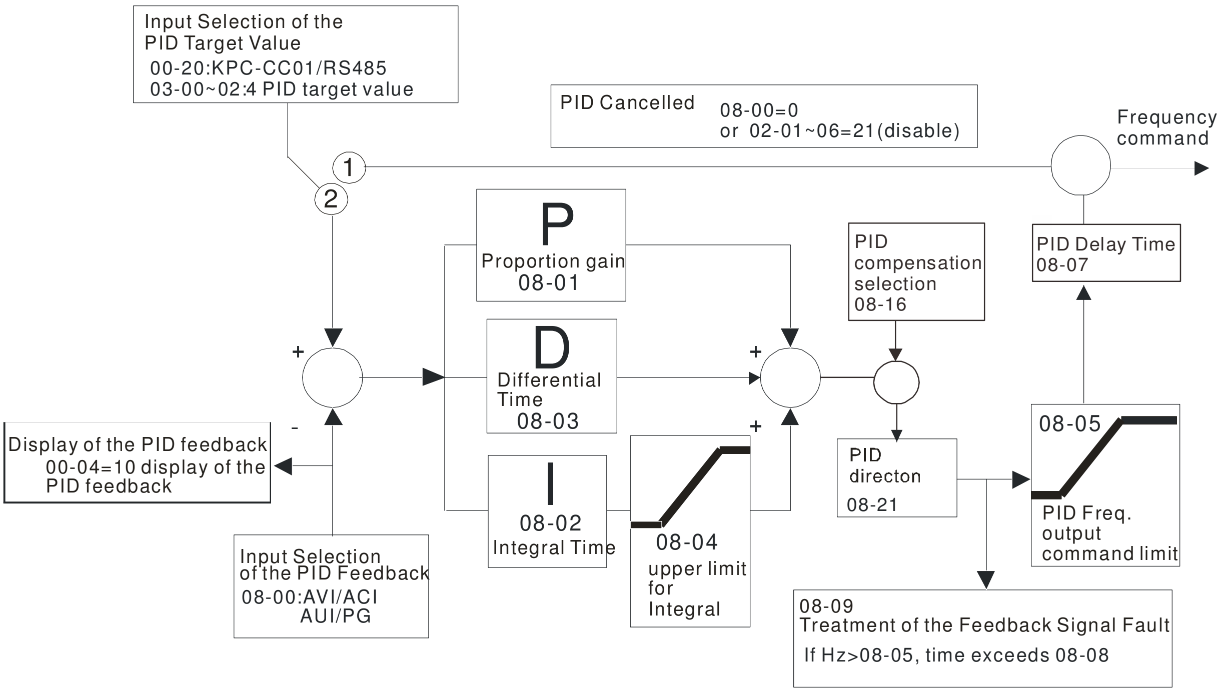
1: Parallel connection

- When setting is 0, it uses conventional PID control structure.
- When setting is 1, proportional gain, integral gain and derivative gain are independent. The P, I and D can be customized to fit users' demand.
- Pr.08-07 determines the primary low pass filter time when in PID control. Setting a large time constant may slow down the response rate of drive.
- Output frequency of PID control will filter by primary low pass function. This function could filtering a mix frequencies. A long primary low pass time means filter degree is high and vice versa.
- Inappropriate setting of delay time may cause system error.
- PI Control: controlled by the P action only, and thus, the deviation cannot be eliminated entirely. To eliminate residual deviations, the P + I control will generally be utilized. And when the PI control is utilized, it could eliminate the deviation incurred by the targeted value changes and the constant external interferences. However, if the I action is excessively powerful, it will delay the responding toward the swift variation. The P action could be used solely on the loading system that possesses the integral components.
- PD Control: when deviation occurred, the system will immediately generate some operation load that is greater than the load generated single handedly by the D action to restrain the increment of the deviation. If the deviation is small, the effectiveness of the P action will be decreasing as well. The control objects include occasions with integral component loads, which are controlled by the P action only, and sometimes, if the integral component is functioning, the whole system will be vibrating. On such occasions, in order to make the P action's vibration subsiding and the system stabilizing, the PD control could be utilized. In other words, this control is good for use with loadings of no brake functions over the processes.
- PID Control: Utilize the I action to eliminate the deviation and the D action to restrain the vibration, thereafter, combine with the P action to construct the PID control. Use of the PID method could obtain a control process with no deviations, high accuracies and a stable system.

📖 Serial connection



📖 Parallel connection



08 - 08 Feedback Signal Detection Time

Factory Setting: 0.0

Settings 0.0~3600.0 seconds

📖 This parameter is only valid when the feedback signal is ACI 4-20mA.

📖 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) are abnormal.
- 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.

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 seconds

08 - 15 Filter Time for PID Feedback

Factory Setting: 5.0

Settings 0.1~300.0 seconds

- 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, it will be judged as the PID control fault. Multiple-funtion output MO=15 (PID feedback error) will activate.

08 - 16 PID Compensation Selection

Factory Setting: 0

Settings 0: Parameter setting
1: Analog input

08 - 17 PID Offset

Factory Setting: 0

Settings -100.0~+100.0%

08 - 21 Enable PID to Change the Operation Direction

Factory Setting: 0

Settings 0: Disable change of direction
1: Enable change of direction

⌿ 08 - 10 Sleep Reference Point

Factory Setting: 0.00

Settings 0.00~600.00Hz or 0~200.00%

⌿ 08 - 11 Wake-up Reference Point

Factory Setting: 0.00

Settings 0.00~600.00Hz or 0~200.00%

📖 When 08-18= 0, the unit of Pr08-10 and Pr08-11 is Hz, settings 0~600.00Hz

📖 When 08-18= 1, the unit of Pr08-10 and Pr08-11 is percentage, settings 0~200.00%

⌿ 08 - 12 Sleep Time

Factory Setting：0.0

Settings 0.00~600.00 seconds

08 - 18 Setting of Sleep Mode Function

Factory Setting: 0

Settings 0: Follow PID output command; 1: Follow PID feedback signal

⌿ 08 - 19 Integral Limit during Wake-up

Factory Setting: 50.0%

Settings 0~ 200.0%

📖 This upper integral limit of the motor drive is to avoid running at high speed right after being waken up.

⌿ 08 - 22 Wake-up Delay Time

Factory Setting: 0

Settings 0~ 600.00 sec

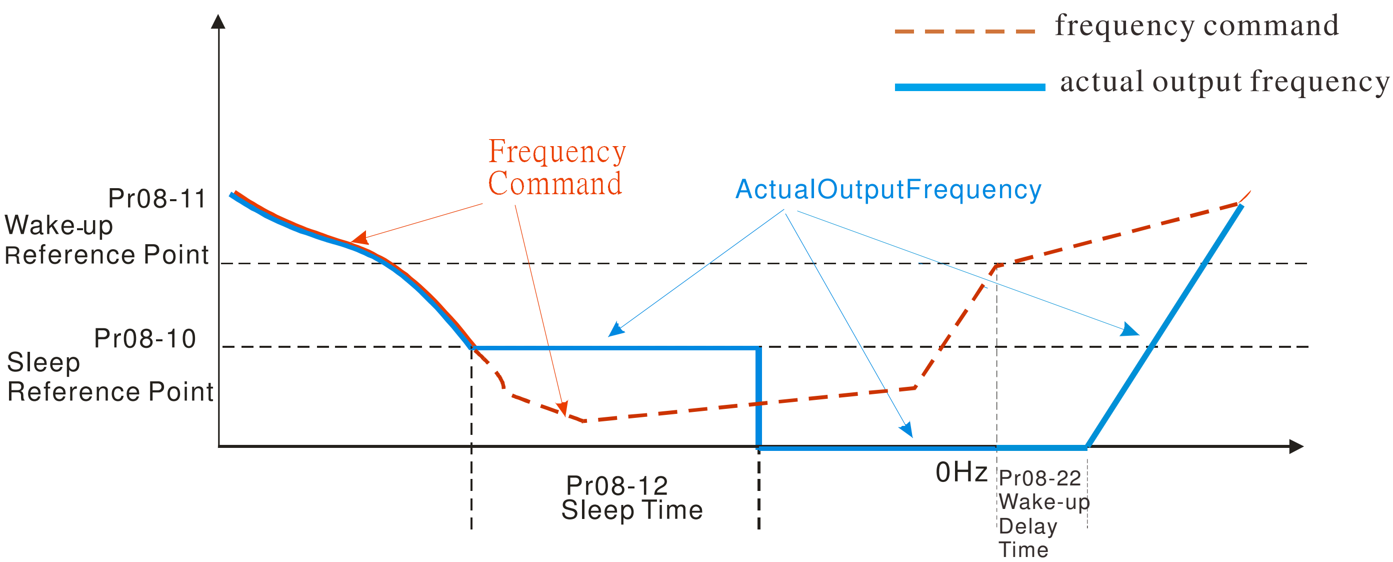
There are three types of Sleep mode and Wakeup mode.

01: Frequency Command (Not using PID, Pr08-00=0)

When the Frequency Command < Sleep Frequency, the output frequency will remain at the sleep frequency.

Once reaches the setting of Pr08-12 Sleep Time, the motor drive will go to sleep at 0Hz.

Sleep Mode diagram

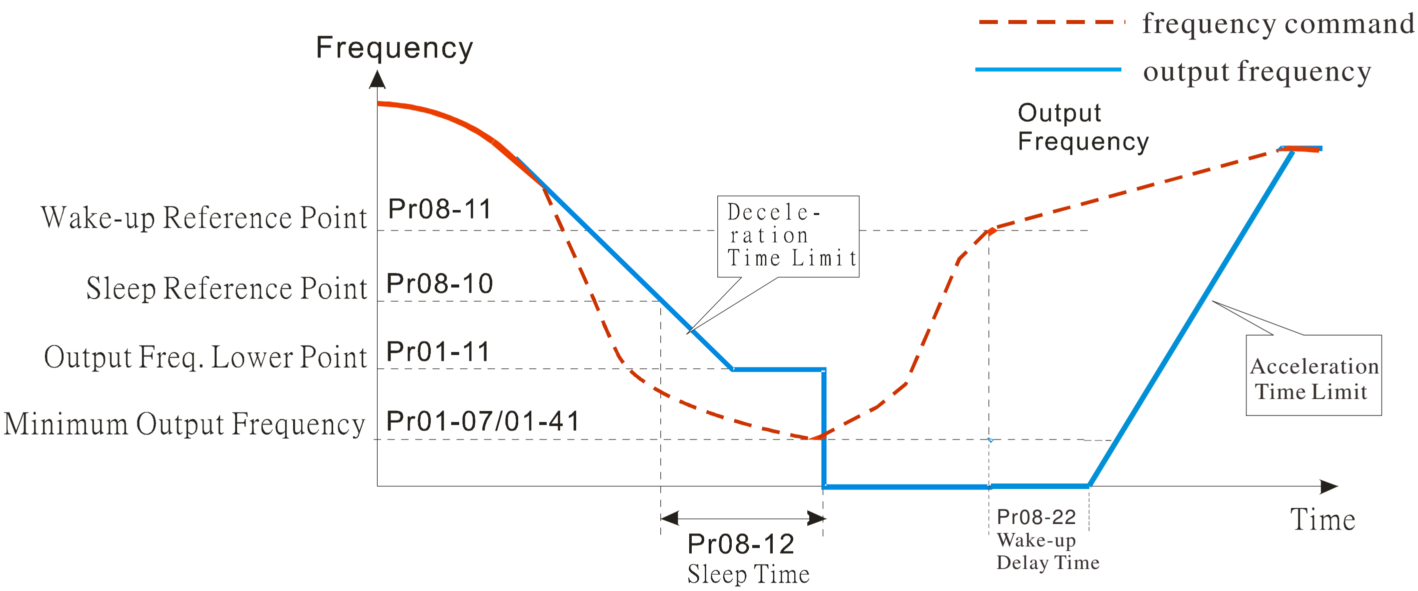


02: Internal PID Frequency Calculation Command (Using PID, Pr08 ≠ 0)

Once reaching the sleep frequency, the system starts to calculate the sleep time and the output frequency starts to decrease immediately with desired deceleration (Pr01-13). If passing the preset sleep time during deceleration, the frequency will continue to decrease until 0 and the motor drive will go to sleep at 0Hz.

If not yet reaching the preset sleep time during deceleration (if there is a preset), the motor drive will remain at the lower frequency (Pr01-11) or will stay at Pr01-07 Minimum Output Frequency. Then the motor drive waits to reach the sleep time then go to sleep at 0Hz.

Internal PID Calculation Frequency Command



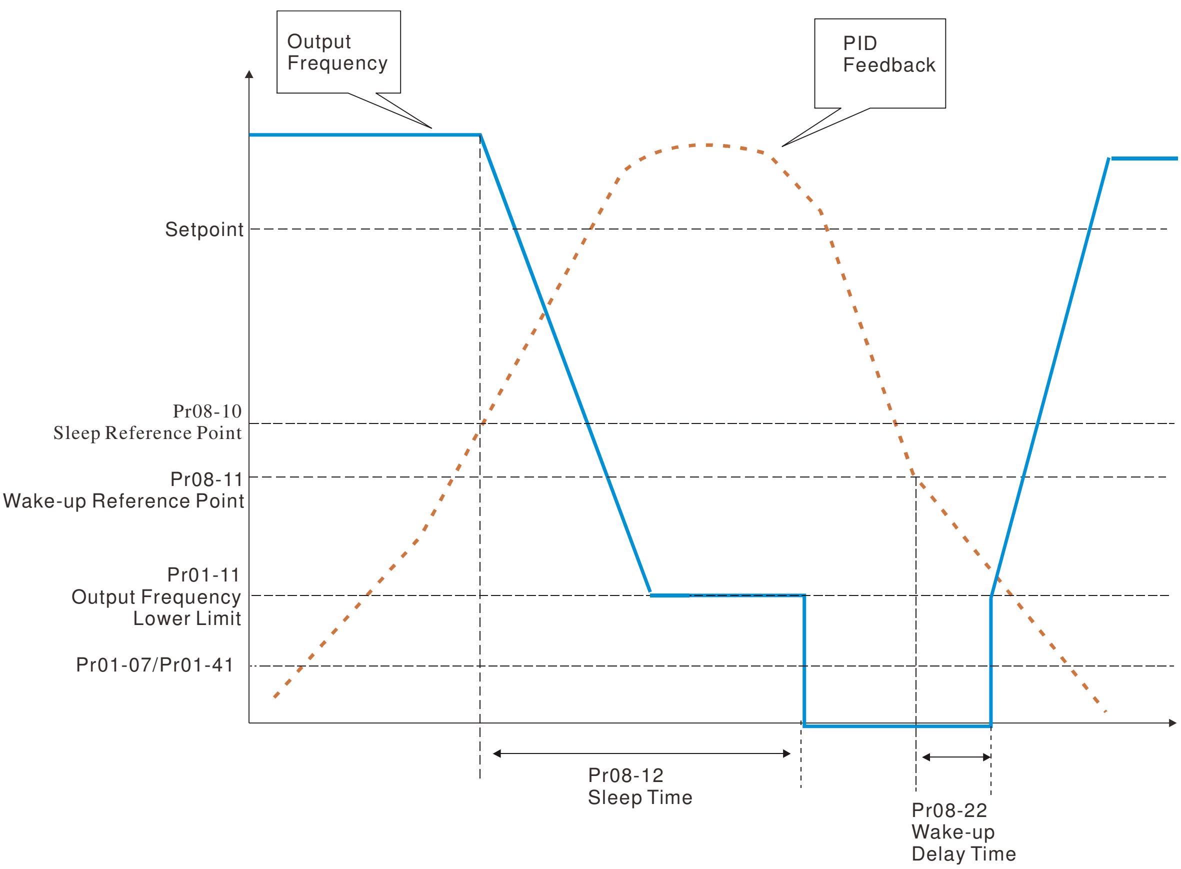
03: Percentage of PID's Target Value (Set PID, Pr08-00 ≠ 0)

Once reaching the percentage of PID's target value and the percentage of the feedback value, the motor drive
starts to calculate the sleep time. The output frequency decreases immediately with desired deceleration (Pr01-13). If the motor drive passes the preset sleep time, it will go to sleep at 0Hz. However, if it doesn't reach the preset sleep time during deceleration, it will remain at lower frequency (if there is a preset (Pr01-11)) or Pr01-07 Minimum Output Frequency. Then the motor drive waits to reach the sleep time and go to sleep at 0Hz

Example01 — Negative PID Feedback
Example02 — Positive PID Feedback

※ Pr08-10 must be **bigger** than the Pr08-11.
※ 30kg is the set point.
Set the following parameters:
Pr03-00 = 5 (AVI1 as feedback signal);
Pr08-00 = 1 (Negative PID feedback: input from external terminal AVI1 of Pr03-00);
Pr08-10 = 40% (Sleep reference 12kg = 40%*30kg);
Pr08-11 = 20% (Wake-up reference 6kg = 20%*30kg);
Case01: If feedback > 12kg, frequency decreases.
Case02: If feedback < 6kg, frequency increases.

Zone	PID Physical Quantity
Sleep zone	When larger than 12kg, the motor drive goes to sleep.
Transition Zone	When between 6kg~12kg, the motor drive remains the same status.
Wake-up zone	When smaller than 6kg, the motor drive wakes up.



※ Pr08-10 must be **smaller** than the Pr08-11.

※ 30kg is the setpoint

Set the following parameters:

Pr03-00 = 5 (AVI1 as feedback signal);

Pr08-00 = 4 (Positive PID feedback from external terminal AVI1 of Pr03-00);

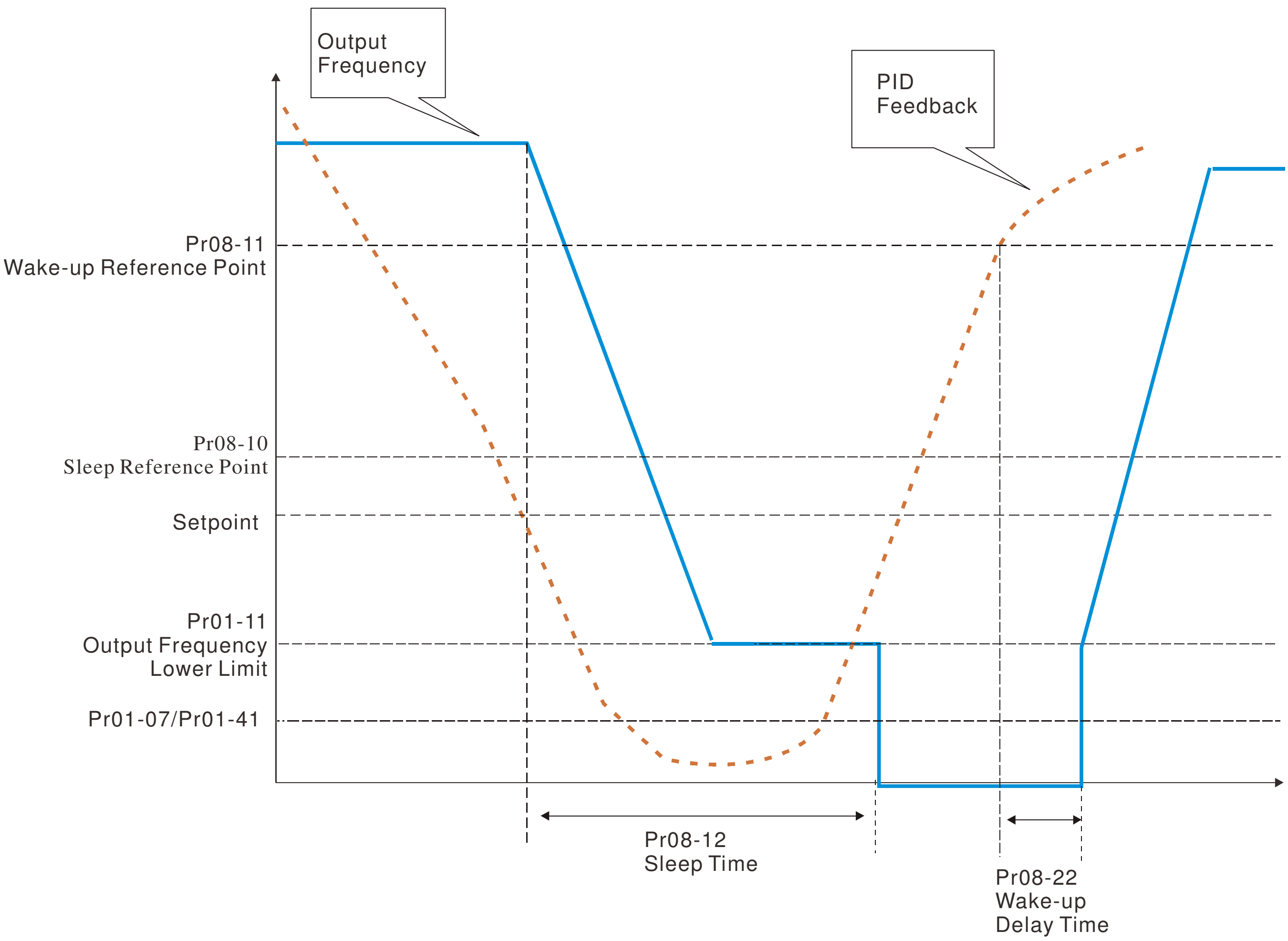
Pr08-10=110% (Sleep reference: 33kg = 110%*30kg)

Pr08-11=120% (Wake-up reference: 36Kg = 120%*30kg)

Case01: If feedback <33kg, frequency decreases

Case02: feedback >36kg, frequency increases

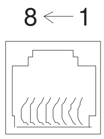
Zone	**PID Physical Quantity**
Sleep zone	When larger than 36kg, the motor drive goes to sleep.
Transition Zone	When between 33kg and 36kg, the motor drive remains the same status.
Wake-up zone	When smaller than 33kg, The 30kg is the setpoint.



09 Communication Parameters

⚡ The parameter can be set during the operation.

When using communication devices, connects AC drive with PC by using Delta IFD6530 or IFD6500.



RS-485

Modbus RS-485
Pin 1~2,7,8: Reserved
Pin 3, 6: GND
Pin 4: SG-
Pin 5: SG+

⚡ 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 4.8~115.2kbps

📖 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 to set the reaction of MODBUS transmission errors with the host. Detection time can be set in Pr09-03

⚡ 09 - 03 COM1 Time-out Detection

Factory Setting: 0.0

Settings 0.0~100.0 seconds
0.0：Disable

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

⚡ 09 - 04 COM1 Communication Protocol

Factory Setting: 1

Settings 1：7，N，2 for ASCII
2：7，E，1 for ASCII
3：7，O，1 for ASCII
4：7，E，2 for ASCII
5：7，O，2 for ASCII
6：8，N，1 for ASCII
7：8，N，2 for ASCII

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

- Computer Link Control by PC or PLC (Computer Link)
- A VFD-CP2000 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 represents ASCII code. For example:

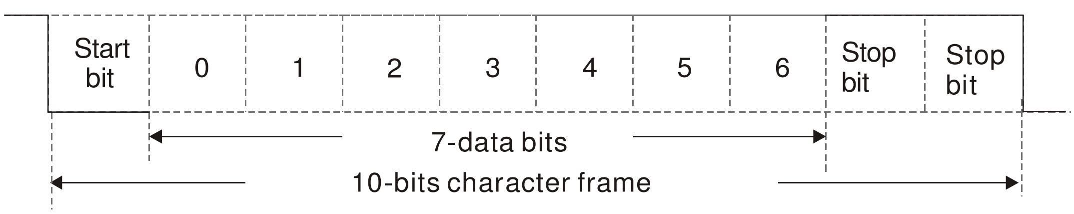
Character	‘0’	‘1’	‘2’	‘3’	‘4’	‘5’	‘6’	‘7’
ASCII code	30H	31H	32H	33H	34H	35H	36H	37H

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

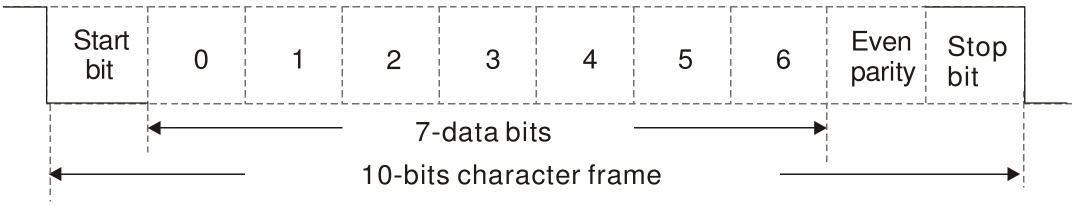
Data Format

10-bit character frame（For ASCII）

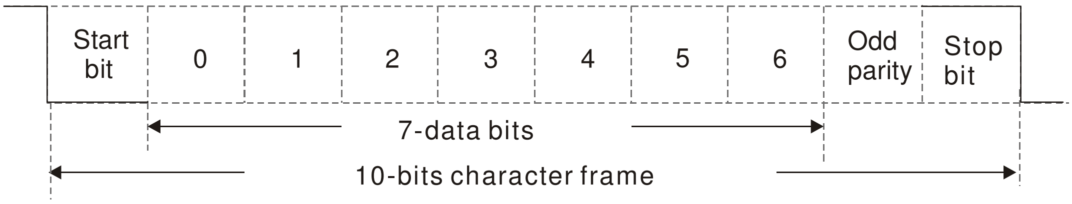
（Data Format 7 , N , 2）



（Data Format 7 , E , 1）

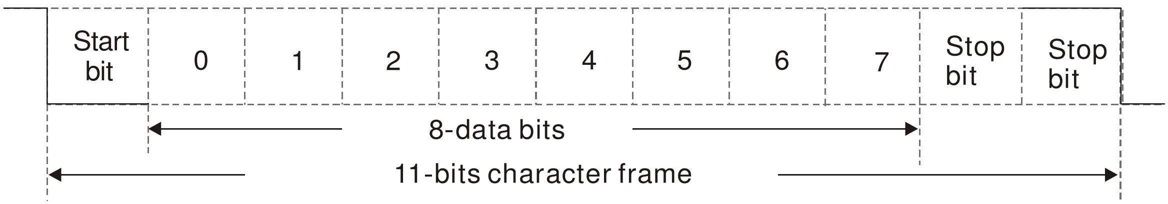


（Data Format 7 , O , 1）

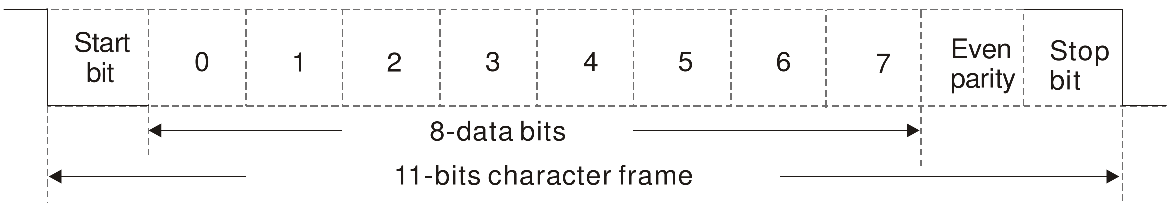


11-bit character frame（For RTU）

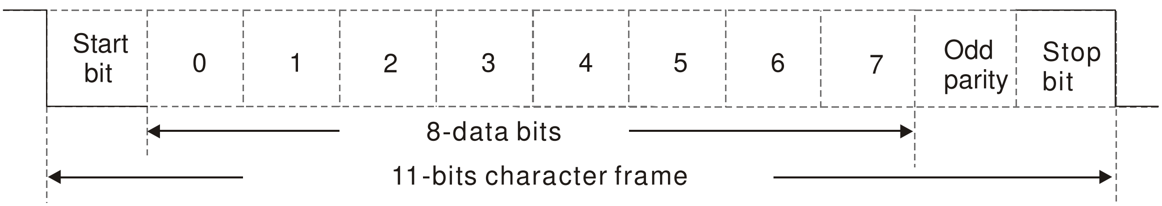
（Data Format 8 , N , 2）



（Data Format 8 , E , 1）



（Data Format 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 n<=16, maximum of 32 ASCII codes
…….	
DATA 0	
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'
LRC Check	'D'
	'7'
END	CR
	LF

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'
	'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

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 +1 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	Bit1~0	00B：No function
				01B：Stop
				10B：Run
				11B：JOG+RUN
			Bit3~2	Reserved
			Bit5~4	00B: No function
				01B: FWD
				10B: REV
				11B: Change direction
			Bit7~6	00B: 1st accel/decel
				01B: 2nd accel/decel
				10B: 3rd accel/decel
				11B: 4th accel/decel
			Bit11~8	0000B: master speed
				0001B: 1st step accel/decel.
				0010B: 2nd step accel/decel
				0011B: 3rd step accel/decel
				0100B: 4th step accel/decel
				0101B: 5th step accel/decel
				0110B: 6th step accel/decel
				0111B: 7th step accel/decel
				1000B: 8th step accel/decel
				1001B: 9th step accel/decel
				1010B: 10th step accel/decel

			1011B: 11th step accel/decel
			1100B: 12th step accel/decel
			1101B: 13th step accel/decel
			1110B: 14th step accel/decel
			1111B: 15th step accel/decel
		Bit12	1: enable bit06-11 function
		Bit14~13	00B: No function
			01B: operated by digital keypad
			10B: operated by Pr.00-21 setting
			11B: change operation source
		Bit15	Reserved
	2001H	Frequency command (XXX.XXHz)	
	2002H	Bit 0	1：EF (external fault) on
		Bit 1	1：Reset
		Bit 2	1：B.B ON
		Bit 15~3	Reserved
Status monitor Read only	2100H	High byte: Warn Code Low Byte: Error Code	
	2101H	Bit0	AC Drive Operation Status
		Bit1	00b: Drive stops 01b: Drive decelerating 10b: Drive standby 11b: Drive operating
		Bit2	1: Jog command
		Bit4~3	Operation Direction 00b: FWD run 01b: from REV run to FWD run 10b: REV run 11b: from FWD run to REV run
		Bit8	1: Master frequency Controlled by communication interface
		Bit9	1: Master frequency controlled by analog signal
		Bit10	1: Operation command controlled by communication interface
		Bit11	1: Parameters have been locked
		Bit12	1: enable to copy parameter from keypad
		Bit15~13	Reserved
	2102H	Frequency command (F)	
	2103H	Output frequency (H)	
	2104H	Output current (AXXX.X)	
	2105H	DC-BUS Voltage (UXXX.X)	
	2106H	Output voltage (EXXX.X)	
	2107H	Current step number of Multi-Step Speed Operation	
	2109H	Counter value	
	210AH	Power Factor Angle (XXX.X)	
	210BH	Output Torque (%)	
	210CH	Actual motor speed (rpm)	
	210DH	Reserved	
	210EH	Reserved	
	210FH	Power output (X.XXX)	
	2116H	Multi-function display (Pr.00-04)	

	211BH	Max. operation frequency (Pr.01-00) or Max. user defined value (Pr.00-26) When Pr.00-26 is 0, this value is equal to Pr.01-00 setting. When Pr.00-26 is not 0, and the command source is Keypad, this value = Pr.00-24 * Pr.00-26 / Pr.01-00 When Pr.00-26 is not 0, and the command source is RS485 communication, this value = Pr.09-10 * Pr.00-26 / Pr.01-00
	2200H	Display output current (A)
	2201H	Display counter value of TRG terminal (c)
	2202H	Display actual output frequency (XXXXX Hz)
	2203H	Display DC-BUS voltage (XXX.X V)
	2204H	Display output voltage of U, V, W (XXX.X V)
	2205H	Display output power fator angle of U, V, W (XXXXX kW)
	2206H	Display actual motor speed kW of U, V, W (XXXXX rpm)
	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) (XXX.X %)
	2209H	Reserved
	220AH	Display PID feedback value after enabling PID function in % (XXX.XX %)
	220BH	Display signal of AVI1 analog input terminal, 0-10V corresponds to 0-100% (1.) (as NOTE 2)
	220CH	Display signal of ACI analog input terminal, 4-20mA/0-10V corresponds to 0-100% (2.) (as NOTE 2)
	220DH	Display signal of AVI2 analog input terminal, 0V~10V corresponds to 0~100% (3.) (as NOTE 2)
	220EH	Display the IGBT temperature of drive power module in °C (XXX.X ℃)
	220FH	Display the temperature of capacitance in °C (XXX.X ℃)
	2210H	The status of digital input (ON/OFF), refer to Pr.02-12.
	2211H	The status of digital output (ON/OFF), refer to Pr.02-18.
	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	Reserved
	2216H	Reserved
	2217H	Reserved
	2218H	Reserved
	2219H	Display overload counter value (XXX.XX %)
	221AH	Display GFF in % (XXX.XX %)
	221BH	Reserved
	221CH	Display PLC register D1043 data (C)
	221DH	Reserved
	221EH	User page displays the value in physical measure
	221FH	Output Value of Pr.00-05 (XXX.XX Hz)
	2220H	Reserved
	2221H	Reserved
	2222H	Fan speed of the drive（XXX%）
	2223H	Control mode of the drive 0: speed mode
	2224H	Carrier frequency of the drive（XXKHZ）
	2225H	Reserve

2226H	Drive status bit 1~0 00b: No direction 01b: Forward 10b: Reverse bit 3~2 01b: Driver ready 10b: Error bit 4 0b: Motor drive does output 1b: Motor drive does output bit 5 0b: No alarm 1b: Have Alarm
2227H	Drive's estimated output torque(positive or negative direction)（XXXX Nt-m）
2228H	Reserved
2229H	KWH display（XXXX.X）
222AH	Reserved
222BH	Reserved
222CH	Reserved
222DH	Reserved
222EH	PID reference（XXX.XX%）
222FH	PID offset（XXX.XX%）
2230H	PID output frequency（XXX.XXHz）
2231H	Hardware ID

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.

For 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.

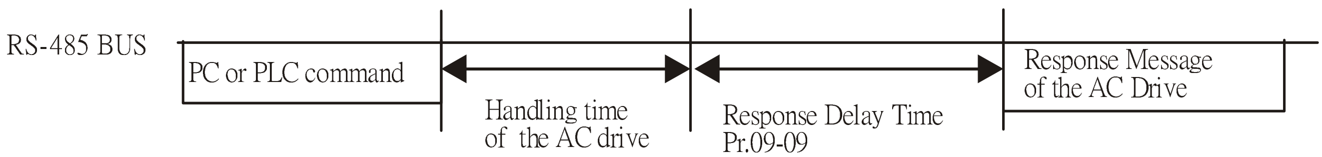
09 - 05 ~ 09 - 08 Reserved

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

Factory Setting: 010Ch

Settings 0~65535

09 - 12 Block Transfer 2

Factory Setting: 010Dh

Settings 0~65535

09 - 13 Block Transfer 3

Factory Setting: 010Ah

Settings 0~65535

09 - 14 Block Transfer 4

Factory Setting: 010Bh

Settings 0~65535

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：Decoding Method 1

1：Decoding Method 2

		Decoding Method 1	Decoding Method 2
Source of Operation Control	Digital Keypd	Digital keypad controls the drive action regardless decoding method 1 or 2.	
	External Terminal	External terminal controls the drive action regardless decoding method 1 or 2.	
	RS-485	Refer to address: 2000h~20FFh	Refer to address: 6000h ~ 60FFh
	CANopen	Refer to index: 2020-01h~2020-FFh	Refer to index:2060-01h ~ 2060-FFh

		Decoding Method 1	Decoding Method 2
	Communication Card	Refer to address: 2000h ~ 20FFh	Refer to address: 6000h ~ 60FFh
	PLC	PLC commands the drive action regardless decoding method 1 or 2.	

09 - 31 Internal Communication Protocol

Factory Setting: 0

Settings 0: Modbus 485

1: BACnet

-1: Internal Communication Slave 1

-2: Internal Communication Slave 2

-3: Internal Communication Slave 3

-4: Internal Communication Slave 4

-5: Internal Communication Slave 5

-6: Internal Communication Slave 6

-7: Internal Communication Slave 7

-8: Internal Communication Slave 8

-9: Reserve

-10: Internal Communication Master

-11: Reserve

-12: Internal PLC Control

📖 When it is defined as internal communication, see Page17-10 for information on Main Control Terminal of Internal Communication.

📖 When it is defined as internal PLC control, see Page17-11 for Remote IO control application (by using MODRW)

09 - 32 Reserved

09 - 33 PLC command force to 0

Factory Setting: 1

Settings 0：Decoding Method 1

1：Decoding Method 2

📖 It defines the action that before PLC scans time sequence, the frequence command or speed command needs to be cleared as 0 or not.

Bit	Explanation
Bit0	Before PLC scan, set up PLC target frequency=0
Bit1	Before PLC scan, set up the PLC target torque=0
Bit2	Before PLC scan, set up the speed limit of torque control mode=0

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 (Data only)

5: 50k

09 - 38 Reserved

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

bit 7：Reserved

bit 8：The setting values of CANopen index fail

bit 9：The setting value of CANopen address fails.

bit10：The checksum value of CANopen index fails

09 - 40 CANopen Decoding Method

Factory Setting: 1

Settings 0：Delta defined decoding method

1：CANopen Standard DS402 protocol

09 - 41 CANopen Status

Factory Setting: Read Only

Settings 0: Node Reset State
1: Com Reset State
2: Boot up State
3: Pre Operation State
4: Operation State
5: Stop State

09 - 42 CANopen Control Status

Factory Setting: Read Only

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: Error reaction activation state
14: Error state

09 - 43 Rrserved

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 - 49 Reserved

09 - 50 BACnet MAC ID

Factory Setting: 10

Settings 0~127

09 - 51 BACnet Baud Rate

Factory Setting: 38.4

Settings 9.6 ~ 76.8 Kbps

09 - 52 BACnet Device ID L

Factory Setting: 1

Settings 0~65535

09 - 53 BACnet Device ID H

Factory Setting: 0

Settings 0~63

09 - 54 Rrserved

09 - 55 BACnet Polling Address

Factory Setting: 127

Settings 0~127

09 - 56 BACnet Password

Factory Setting: 0

Settings 0~65535

09 - 57 ~ 09 - 59 Reserved

09 - 60 Identifications for Communication Card

Factory Setting: Read Only

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: ##

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 Device net Speed

Factory Setting: 1

Settings 0：Disable

1：Enable

- This parameter needs to co-work with Pr09-71.
- 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：Dynamic IP (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 Gateway Address 1 of the Communication Card
09 - 85 Gateway Address 2 of the Communication Card
09 - 86 Gateway Address 3 of the Communication Card
09 - 87 Gateway 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 0~99

09 - 90 Reset Communication Card

Factory Setting: 0

Settings 0：Disable

1：Reset to the factory setting

09 - 91 Additional Setting for Communication Card

Factory Setting: 1

Settings Bit 0: Enable IP Filter

Bit 1: Internet parameters enable(1bit)

When IP address is set up, this bit need to be enabled to write down the parameters. This bit will change to disable when it finishes saving the update of internet parameters.

Bit 2: Login password enable(1bit)

When enter login password, this bit will be enabled. After updating the parameters of communication card, this bit will change to disable.

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 Parameters

Group 10 PID Control Parameters are reserved.

11 Advanced Parameters

Group 11 Advanced parameters are reserved.

12 Pump Parameters

✗ The parameter can be set during operation.

12 - 00 Circulative Control

Factory Setting: 0

Settings 0: No operation

1: Fixed Time Circulation (by time)

2: Fixed Quantity

3: Fixed quantity control

4: Fixed **Time** Circulation + Fixed **Quantity** Circulation

5: Fixed Time **Circulation** + Fixed Quantity **Control**

- In this mode, CP2000 can control up to 8 motors at a time. The total number of the motors can be determined by Pr.12-01. In accordance with the Fixed Time Circulation of Pr12-02, you can adjust the switching time between Start/Stop of each motor. That means when an operating motor reaches the time setting of Pr12-02, CP2000 will stop that motor. Then after the delay time setting of Pr12-03, next motor will start operating. See diagram below.

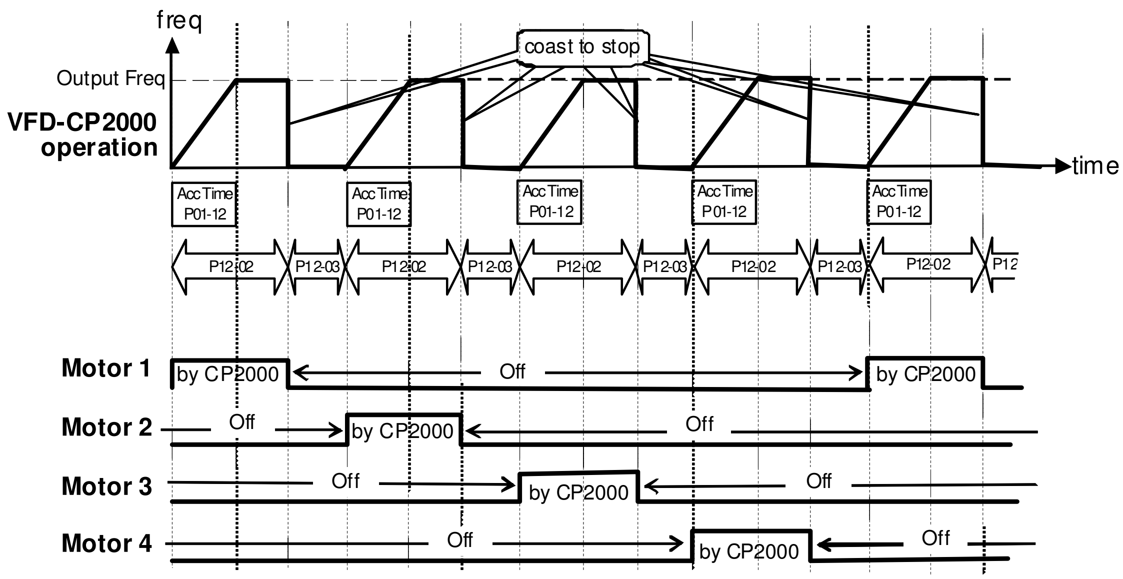


Diagram 12-1: Sequential Diagram of the Fixed Time Circulation (by time)

- Disable Motors' Output

Set the Multifunction Input Commands as Disable Motors' Output can stop corresponding motors. The settings are:

P02-01~P02-06=	60	61	62	63	64	65	66	67	68
Disable Motors' Output	ALL	1	2	3	4	5	6	7	8

When a motor's output is disabled, this motor will park freely.

Wiring: Fixed Time Circulation (by time) Control can control up to 8 motors. The diagram 12-2 is an example of controlling 4 motors at the same time.

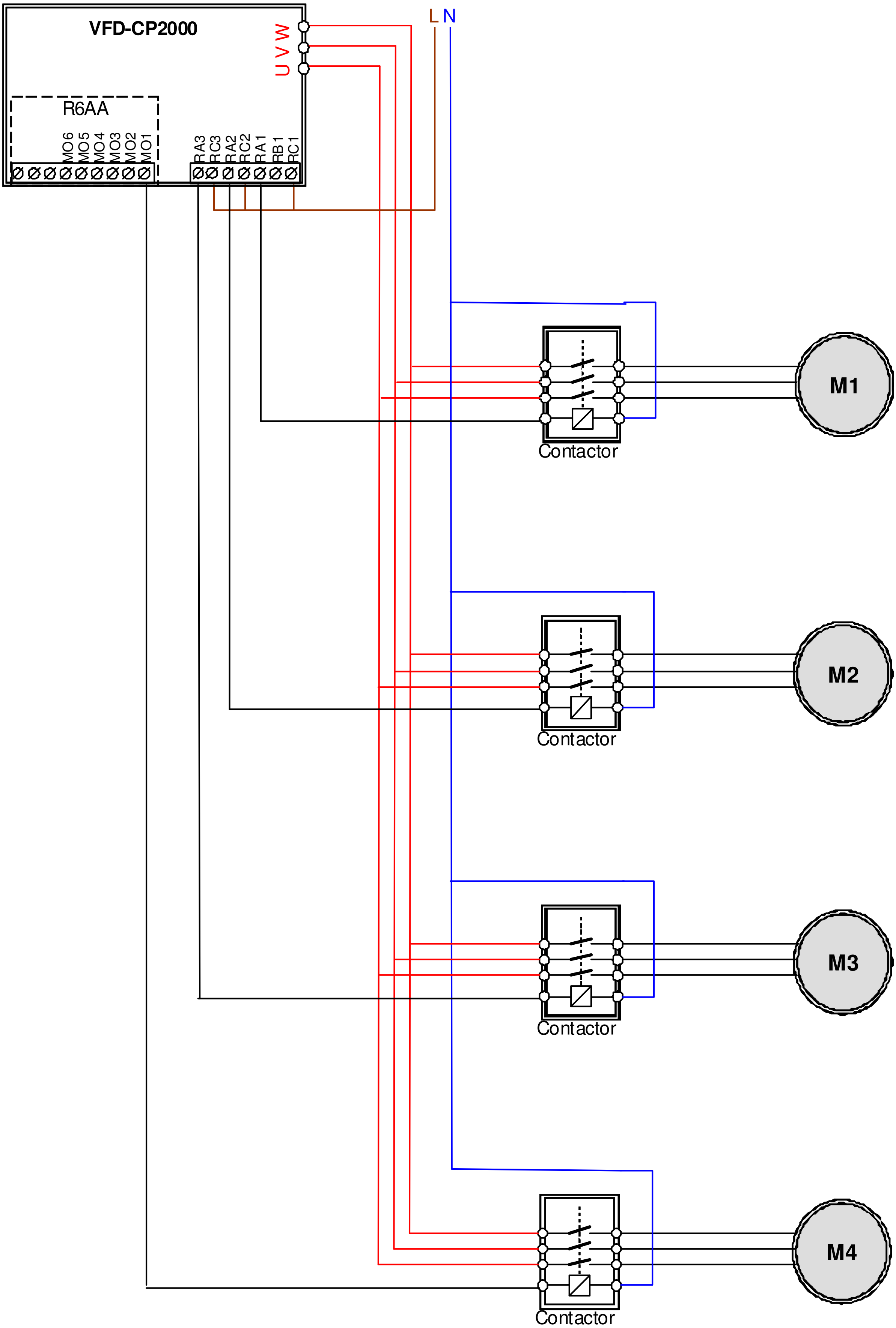


Diagram 12-2: Wiring

12 - 01 Number of Motors to be connected

Factory Setting: 1

Settings 1 to 8

Number of Motors: Maximum 8 motors. After setting number of motor to be connected at the same time, multi-function output terminals will follow automatically the setting as shown in the table below.

P12-01	01	02	03	04	05	06	07	08
P02-13	55	55	55	55	55	55	55	55
P02-14		56	56	56	56	56	56	56
P02-15			57	57	57	57	57	57
P02-36				58	58	58	58	58
P02-37					59	59	59	59
P02-38						60	60	60
P02-39							61	61
P02-40								62

Table 1: Setting of Multi-function Output Terminal on Circulating Motors

12 - 02 Operating time of each motor (minutes)

Factory Setting: 0

Settings 0 to 65500 minutes

Setting of Fixed Time Circulation by minute. If Pr12-02 = 0, that means stop timing, the current running motors will keep on operating until a stop command is given.

12 - 03 Delay Time due to the Acceleration (or the Increment) at Motor Switching (seconds)

Factory Setting: 10

Settings 0.0 to 3600.0 seconds

Delay time when switching motors in seconds. When the current running motors reach the time setting of Pr12-02, CP2000 will follow the delay time setting of Pr12-03 and then switch to run the next motors.

12 - 04 Delay Time due to the Deceleration (or the Decrement) at Motor Switching (seconds)

Factory Setting: 10

Settings 0.0 to 3600.0 seconds

12 - 05 Delay time while fixed quantity circulation at Motor Switching (seconds)

Factory Setting: 100

Settings 0.0 to 3600.0 seconds

Fixed quantity circulation with PID

Sequential Diagram

In this mode, CP2000 can control up to 4 motors to increase controlling flow quantity and pressure range. When controlling flow quantity, motors will be in parallel connection. When controlling pressure range, motors will be in series connection

If need to increase flow quantity or pressure range, CP2000 will increase first motor's pressure from 0Hz to the largest operating frequency. If output frequency reaches the frequency setting of Pr12-06 and delay time of Pr12-05, then CP2000 will delay the time setting of Pr12-03. Then CP2000 will switch the motor to use mains electricity and delay the time setting of Pr12-03 to run next motor. If necessary, other motors will be activated in sequence. See sequential diagram of 12-3 and 12-4

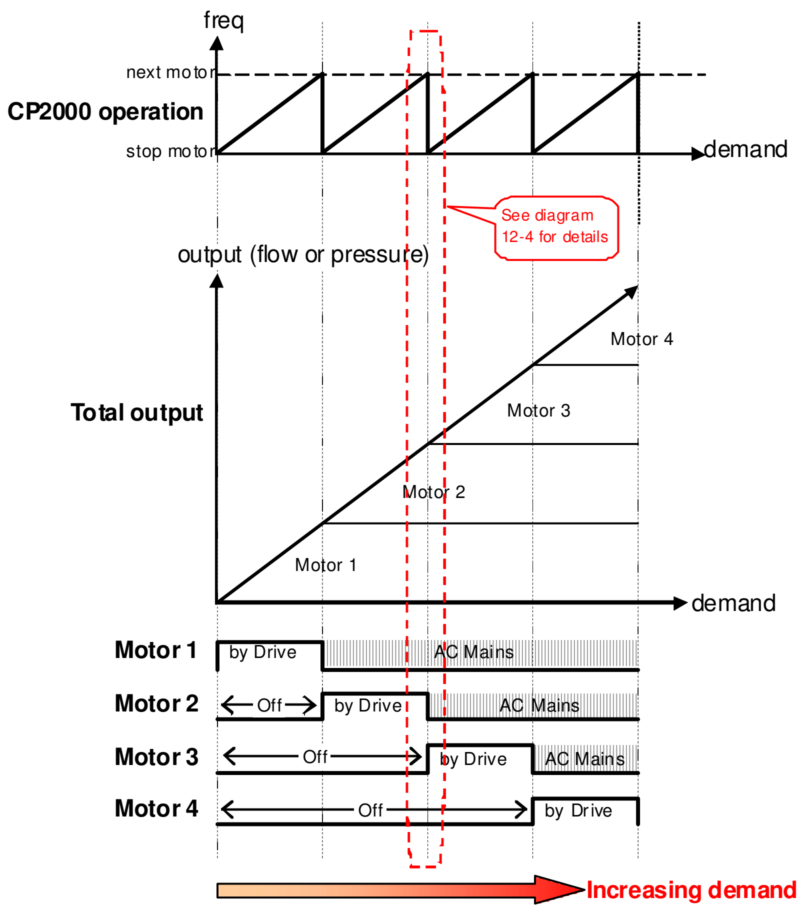


Diagram 12-3: Sequence of Fixed quantity circulation with PID – Increasing Demand

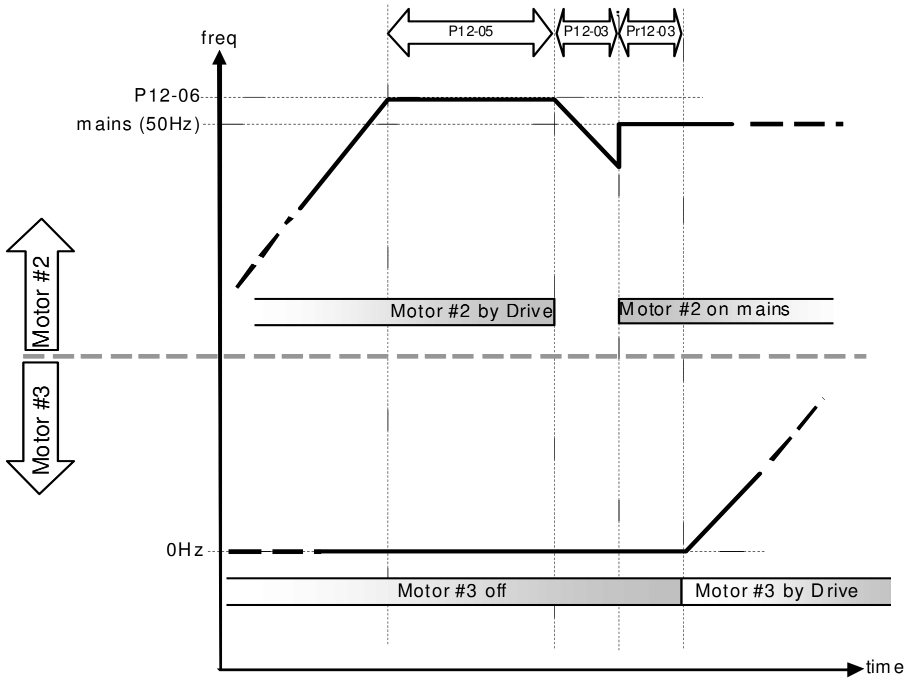


Diagram 12-4: Sequence of switching motors at Fixed quantity circulation with PID – Increasing Demands

However if decreasing demands when flow quantity and pressure are too big, CP2000 will stop the current operating motors and wait for the delay time setting of Pr12-04. Then keep on doing this until the last motor stop using mains electricity. See sequential diagram 12-5 and 12-6 below.

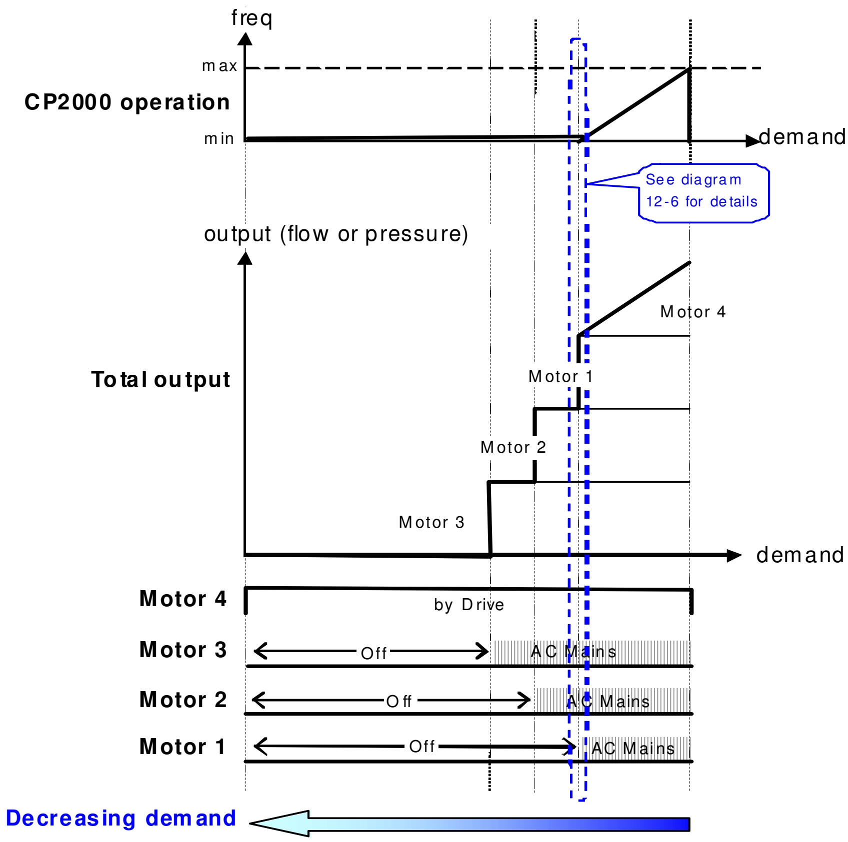


Diagram 12-5: Sequence of switching motors at Fixed quantity circulation with PID – Decreasing Demands

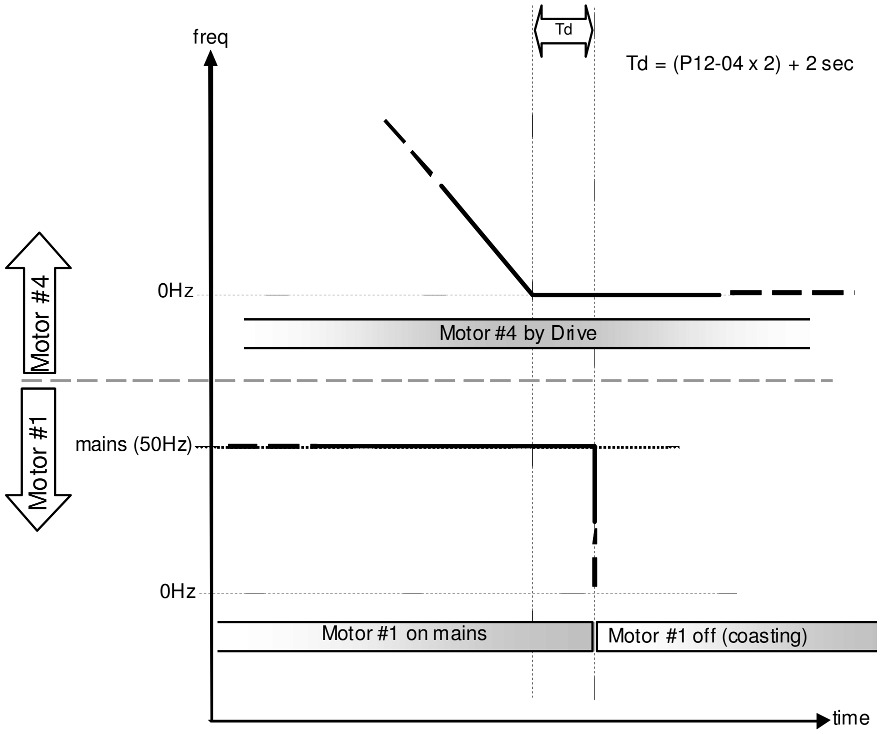


Diagram 12-6: Sequence of switching motors at Fixed quantity circulation with PID – Decreasing Demands

📖 Parameter Setting

Parameter setting	Description
P12-00=2	Choose F**ixed quantity circulation with PID**
P12-01=X	Number of Motors: Maximum 4 motors. After setting number of motor to be connected at the same time, multi-function output terminals will follow automatically the setting as shown in the table below.

P12-01	01	01	02	02	03	03	04	04	
P02-13	55	55	55	55	55	55	55	55	Motor #1 by Drive
P02-14		56	56	56	56	56	56	56	Motor #1 by Mains
P02-15			57	57	57	57	57	57	Motor #2 by Drive
P02-36				58	58	58	58	58	Motor #2 by Mains
P02-37					59	59	59	59	Motor #3 by Drive
P02-38						60	60	60	Motor #3 by Mains
P02-39							61	61	Motor #4 by Drive
P02-40								62	Motor #4 by Mains

Table 2: Setting of Multi-function Output Terminal on Circulating Motors

Parameter setting	Description
P12-03=X	Delay Time due to the Acceleration (or the Increment) at Motor Switching (unit: second)
P12-04=X	Delay Time due to the Deceleration (or the Decrement) at Motor Switching (unit: sec)
P12-05=X	Delay time while fixed quantity circulation at Motor Switching with PID (unit: seconds)
P12-06=X	Frequency when switching motors at fixed quantity circulation (Hz)

🕮 Disable Motor Output

Set the Multifunction Input Commands as Disable Motors' Output can stop corresponding motors. The settings are:

P02-01~P02-06=	60	61	62	63	64	65	66	67	68
Disable Motor Output	ALL	1	2	3	4	5	6	7	8

When a motor's output is disabled, this motor will park freely

📖 **Fixed quantity circulation with PID can control up to 4 motors. The Diagram 12-7 below is an example of controlling 4 motors.**

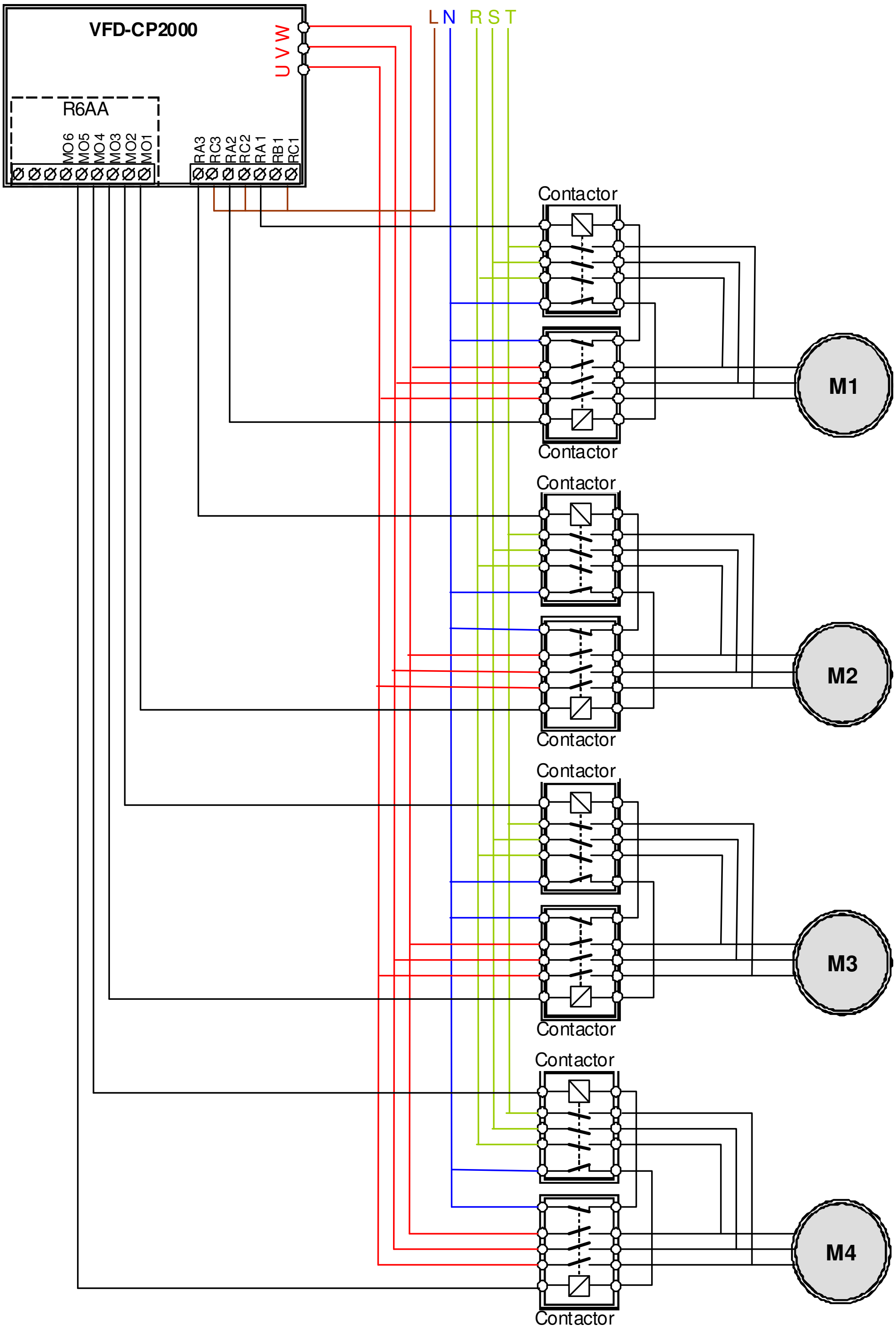


Diagram 12-7

✐ 12 - 06 Frequency when switching motors at fixed quantity circulation (Hz)

Factory Setting: 6000

Settings 0.0 to 600.00 Hz

When the drive's output frequency reaches the setting value of Pr12-06, the system will start preparing to switch motors.

12 - 07 Action to do when Fixed Quantity Circulation breaks down

Factory Setting: 0

Settings 0: Turn off all output
1: Motors powered by mains electricity continues to operate

✐ 12 - 08 Frequency when stopping auxiliary motor (Hz)

Factory Setting: 0

Settings 0.00 to 600.00 Hz

When the output frequency is smaller than the setting value of Pr12-08 and remains at the time setting of Pr12-04, motors will be shut down one by one.

Fixed quantity control with PID

In this mode, CP2000 can control up to 8 motors to increase controlling flow quantity and pressure range.

CP2000 connects directly to a main motor while the rest of motors are using mains electricity and controlled by a relay. When controlling flow quantity, motors will be in parallel connection. When controlling pressure range, motors will be in series connection

If need to increase flow quantity or pressure range, CP2000 will increase the main motor's pressure from 0Hz to the largest operating frequency. If necessary, CP2000 will switch in sequence the motors to use mains electricity. See sequential diagram of 12-8 and 12-9.

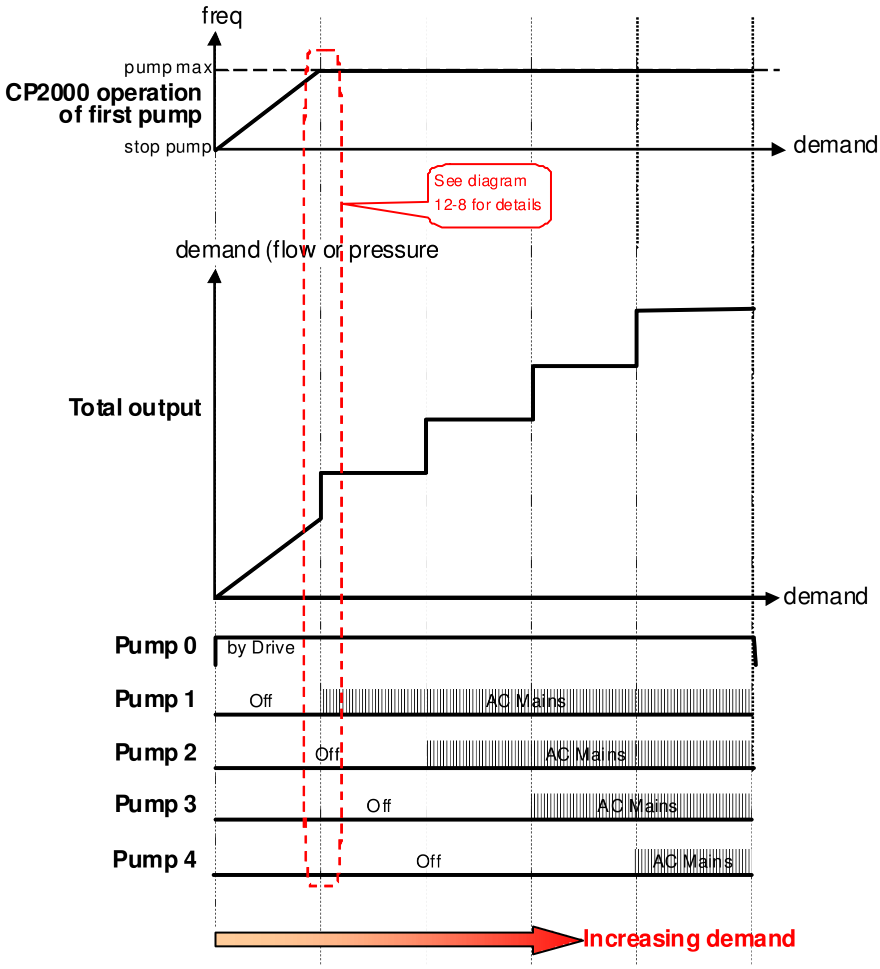


Diagram 12-8: Fixed quantity control with PID – Increasing Demand

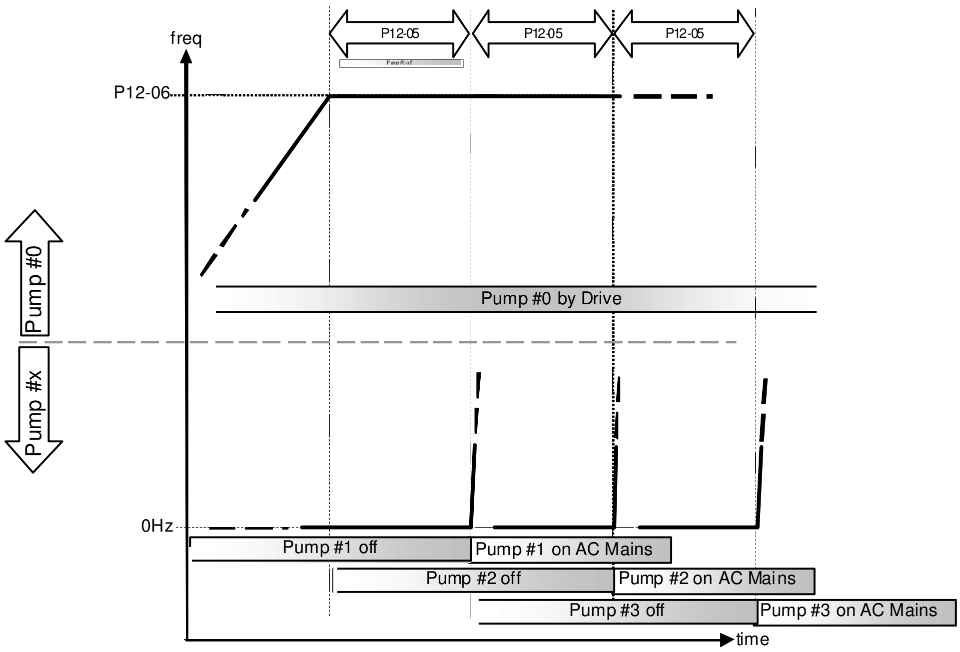


Diagram 12-9: Sequence of switching motors at Fixed quantity control with PID – Increasing Demand

However, if the flow quantity or pressure is too big, CP2000 will stop, one by one, the motors from using mains electricity until CP2000 decrease the main motor's frequency to 0Hz.

See diagram 12-10 and diagram 12-11.

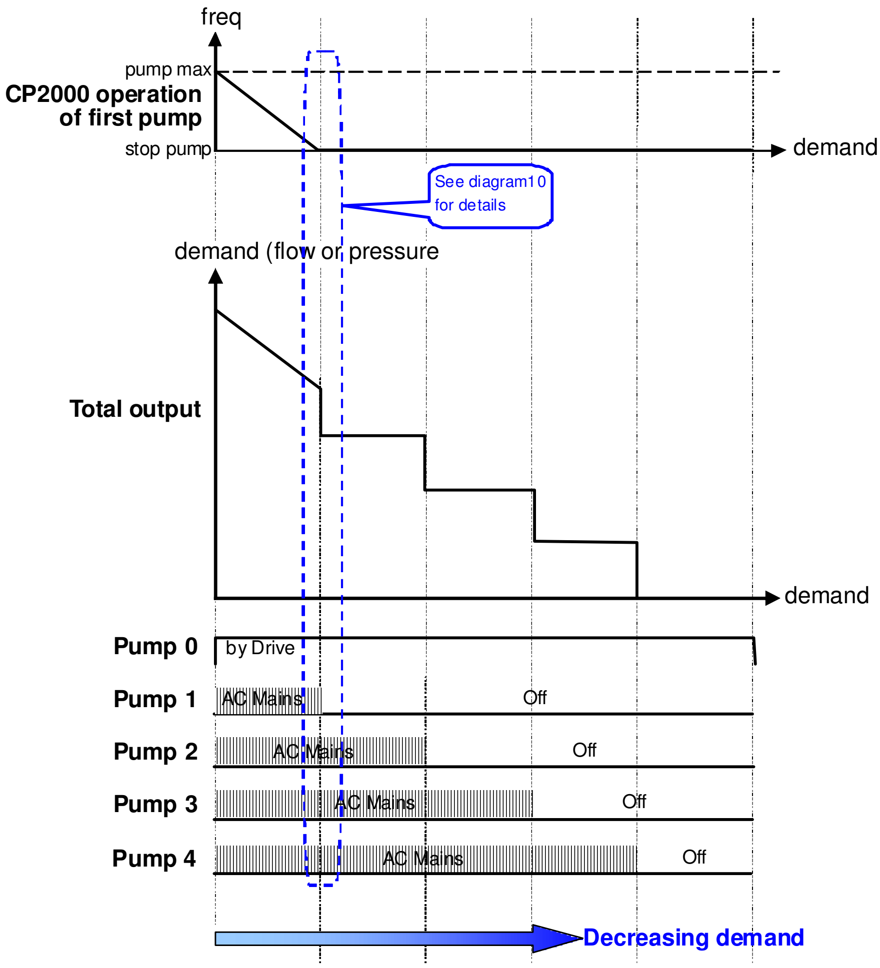


Diagram 12-10: Sequence of switching motors at Fixed quantity control with PID – Decreasing Demand

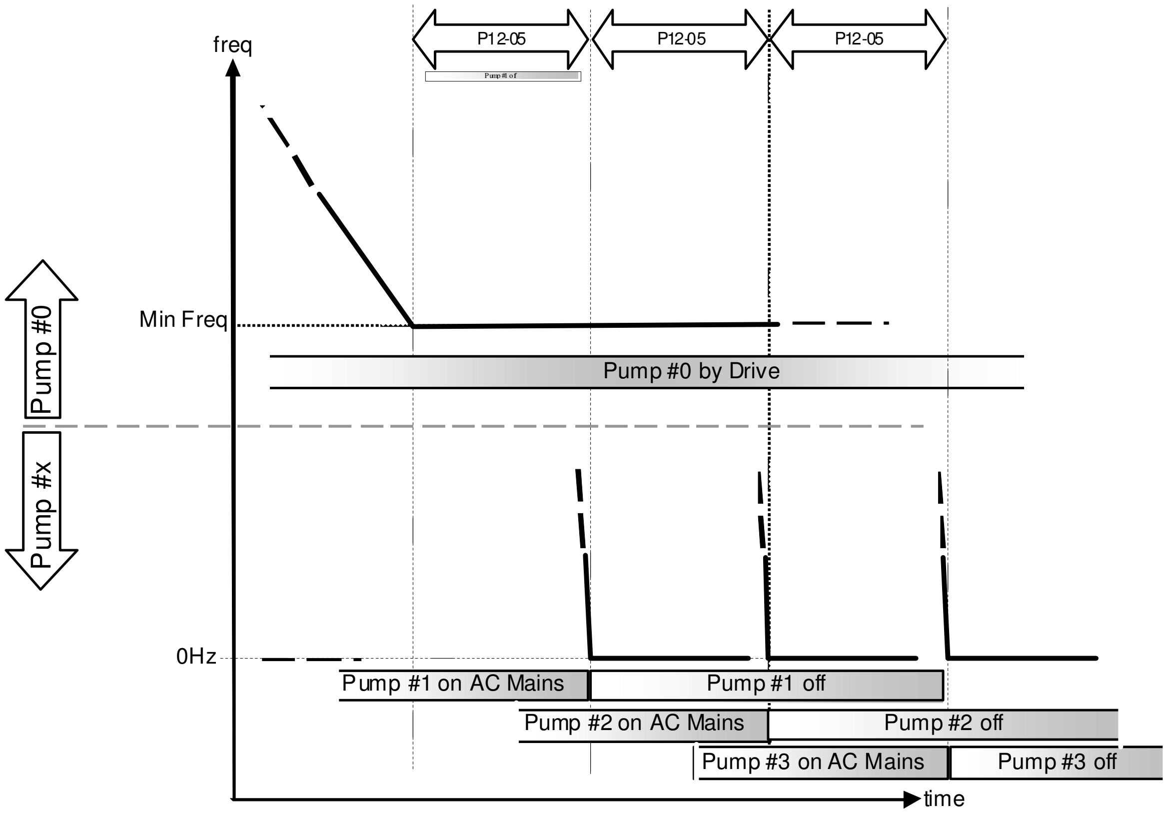


Diagram 12-10: Sequence of switching motors at Fixed quantity control with PID – Decreasing Demand

<table>
<tr><th>Parameter Setting</th><th>Description</th></tr>
<tr><td>P12-00=3</td><td>Choose Fixed quantity control</td></tr>
<tr><td>P12-01=X</td><td>Number of Motors: Maximum 8 motors. After setting number of motor to be connected at the same time, multi-function output terminals will follow automatically the setting as shown in the table below.
<table>
<tr><td>P12-01</td><td>01</td><td>02</td><td>03</td><td>04</td><td>05</td><td>06</td><td>07</td><td>08</td><td></td></tr>
<tr><td>P02-13</td><td>55</td><td>55</td><td>55</td><td>55</td><td>55</td><td>55</td><td>55</td><td>55</td><td>Motor #1 by Mains</td></tr>
<tr><td>P02-14</td><td></td><td>56</td><td>56</td><td>56</td><td>56</td><td>56</td><td>56</td><td>56</td><td>Motor #2 by Mains</td></tr>
<tr><td>P02-15</td><td></td><td></td><td>57</td><td>57</td><td>57</td><td>57</td><td>57</td><td>57</td><td>Motor #3 by Mains</td></tr>
<tr><td>P02-36</td><td></td><td></td><td></td><td>58</td><td>58</td><td>58</td><td>58</td><td>58</td><td>Motor #4 by Mains</td></tr>
<tr><td>P02-37</td><td></td><td></td><td></td><td></td><td>59</td><td>59</td><td>59</td><td>59</td><td>Motor #5 by Mains</td></tr>
<tr><td>P02-38</td><td></td><td></td><td></td><td></td><td></td><td>60</td><td>60</td><td>60</td><td>Motor #6 by Mains</td></tr>
<tr><td>P02-39</td><td></td><td></td><td></td><td></td><td></td><td></td><td>61</td><td>61</td><td>Motor #7 by Mains</td></tr>
<tr><td>P02-40</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>62</td><td>Motor #8 by Mains</td></tr>
</table>
Table 2: Setting of Multi-function Output Terminal on Circulating Motors</td></tr>
<tr><td>P12-05=X</td><td>Delay time while fixed quantity circulation at Motor Switching (seconds)</td></tr>
<tr><td>P12-06=X</td><td>Frequency when switching motors at fixed quantity circulation (Hz)</td></tr>
</table>

📖 Disable Motor's Output

Set the Multifunction Input Commands as Disable Motors' Output can stop corresponding motors.

The settings are: :

P02-01~P02-06=	60	61	62	63	64	65	66	67	68
Disable Motor's Output	ALL	1	2	3	4	5	6	7	8

When a motor's output is disabled, this motor will park freely

Wiring: Fixed Quantity Control can control up to 8 motors. The diagram 12-12 is an example of controlling 4 motors at the same time.

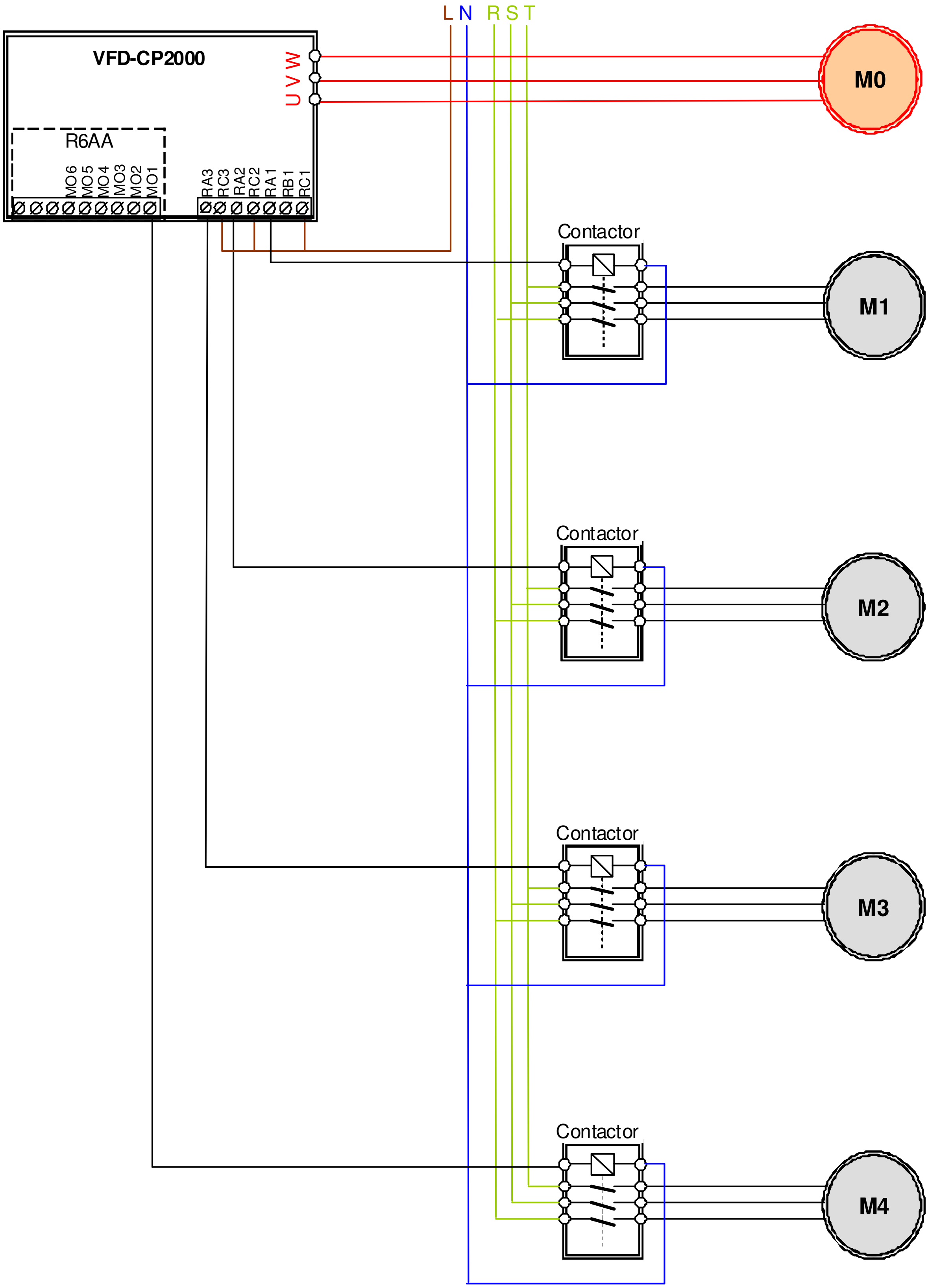


Diagram 12-12

🕮 Fixed Time circulation and Fixed quantity circulation with PID

This mode combines **Fixed Time circulation and Fixed quantity circulation with PID**. It is to prevent motors to become rusty if they are not in use for a long period of time. If some motors are not activated, set the fixed time circulation to run motors one by one to make sure each of them has the chance to run.

While all the motors are running and water pressure is enough, the time circulation will not be enabled. Suppose that motor1 and motor2 run to reach a balance in water pressure and when the time reaches the setting at Pr12-02, the motor1 will be running without using mains electricity and the motor2 will decelerate to stop.

When the motor2 reaches the frequency setting at Pr12-06 and the time setting at Pr12-05, it will be separating from the motor drive. Then when time reaches the setting at Pr12-03, the motor2 will run by using the mains electricity. Then when the time pases the setting at Pr12-03 , the motor3 will be enabled by the motor drive. The time sequence diagram is as shown below.

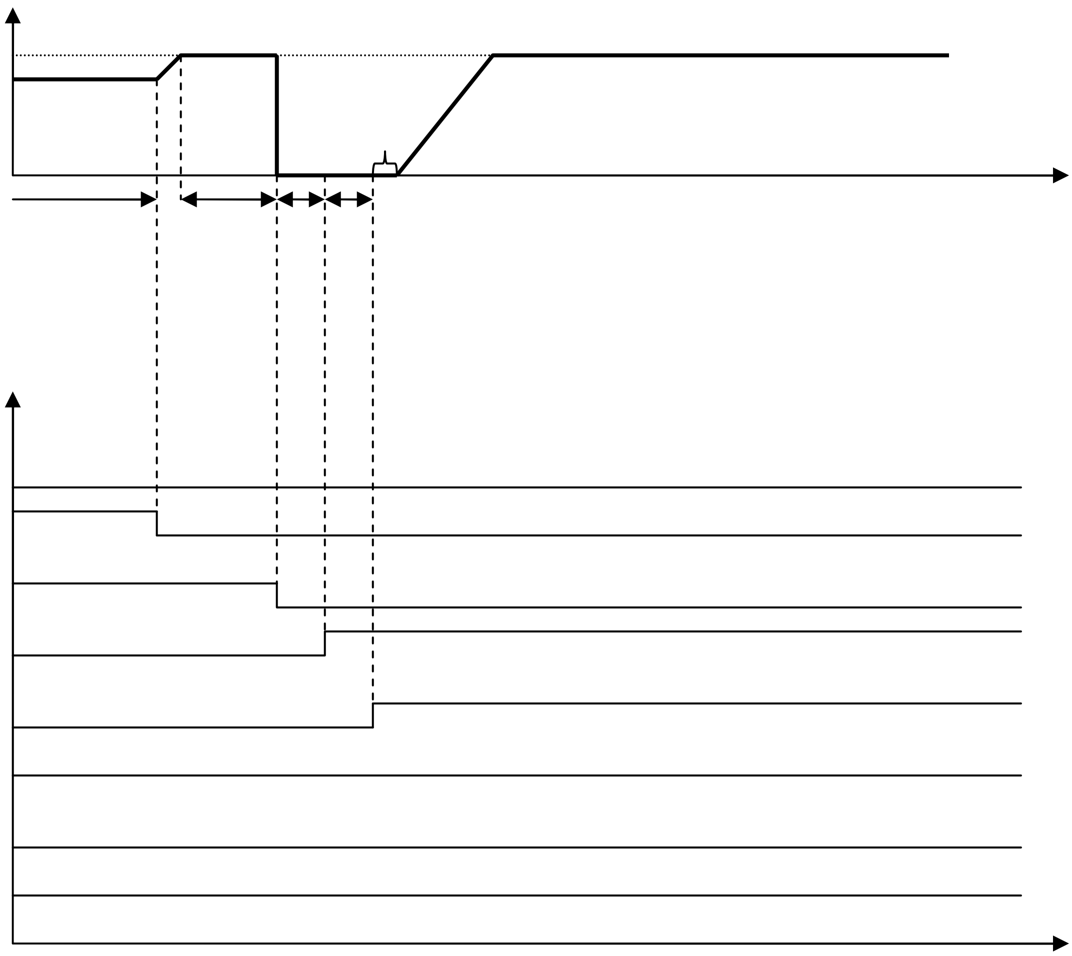


Diagram 12-13 Enabling Fixed Time Circulation under Fixed Amount Circulation Blance

Fixed Time Circulation and Fixed Quantity Control with PID

This mode combines **Fixed Time circulation and Fixed quantity control with PID**. It is to prevent motors to become rusty if they are not in use for a long period of time. If some motors are not activated, set the fixed time circulation to run motors one by one to make sure each of them has the chance to run.

When all the motors are running and water pressure is enough, the fixed time circulation will not be enabled. Suppose that the motor1 and motor2 run to reach a balance in water pressure and when time reach the setting at Pr12-02, the motor1 will be running without using mains electricity. Then when time reaches the setting at Pr12-03, the motor3 will be running by using mains electricity. At this moment, the operating time of each motor will be reset, once reach the time setting at Pr12-02 again, the motor2 will be running without using mains electricity. Then when time reaches the setting at Pr12-03, the fourth motor4 will be running by using mains electricity. The time sequence diagram 12-14 is as shown below

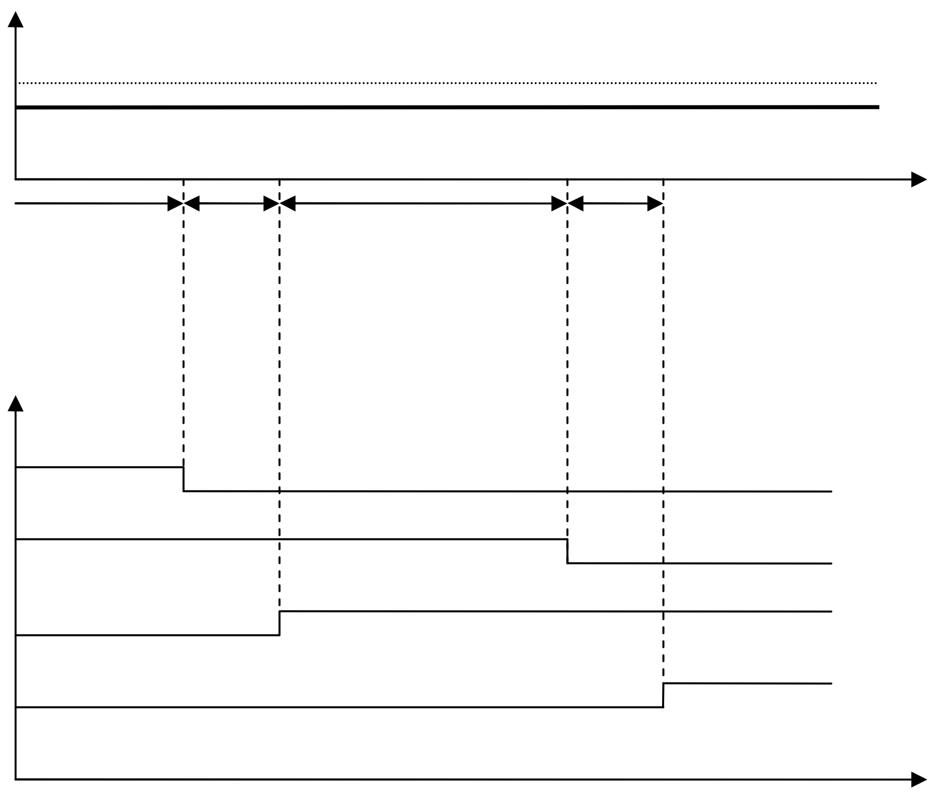


Diagram 12-14: Enabling Fixed Time Circulation under Fixed Amount Control Balance

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Chapter 13 Warning Codes

HAND
① Warning
② CE01
③ Comm. Error 1

① Display error signal
② Abbreviate error code
The code is displayed as shown on KPC-CE01.
③ Display error description

ID No.	Display on LCM Keypad	Descriptions
1	HAND Warning CE01 Comm. Error 1	Modbus function code error
2	HAND Warning CE02 Comm. Error 2	Address of Modbus data is error
3	HAND Warning CE03 Comm. Error 3	Modbus data error
4	HAND Warning CE04 Comm. Error 4	Modbus communication error
5	HAND Warning CE10 Comm. Error 10	Modbus transmission time-out
6	HAND Warning CP10 Keypad time out	Keypad transmission time-out
7	HAND Warning SE1 Save Error 1	Keypad COPY error 1 Keypad simulation error, including communication delays, communication error (keypad recived error FF86) and parameter value error.
8	HAND Warning SE2 Save Error 2	Keypad COPY error 2 Keypad simulation done, parameter write error
9	HAND Warning oH1 Over heat 1 warn	IGBT over-heating warning

ID No.	Display on LCM Keypad	Descriptions
10	HAND Warning oH2 Over heat 2 warn	Capacity over-heating warning
11	HAND Warning PID PID FBK Error	PID feedback error
12	HAND Warning ANL Analog loss	ACI signal error When Pr03-19 is set to 1 and 2.
13	HAND Warning uC Under Current	Low current
14	HAND Warning AUE Auto-tune error	Auto tuning error
15	Reserved	
16	Reserved	
17	Reserved	
18	Reserved	
19	HAND Warning PHL Phase Loss	Phase loss
20	HAND Warning ot1 Over Torque 1	Over torque 1
21	HAND Warning ot2 Over Torque 2	Over torque 2
22	HAND Warning oH3 Motor Over Heat	Motor over-heating
23	HAND Warning c.c cc Warn	Current control
24	HAND Warning oSL Over Slip Warn	Over slip

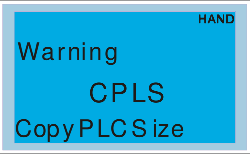
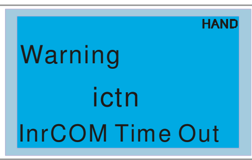
ID No.	Display on LCM Keypad	Descriptions
25	HAND Warning tUn Auto tuning	Auto tuning processing
26	Reserved	
27	Reserved	
28	HAND Warning OPHL Output PHL Warn	Output phase loss
29	Reserved	
30	HAND Warning SE3 Copy Model Err 3	Keypad COPY error 3 Keypad copy between different power range drive
31	Reserved	
32	Reserved	
33	Reserved	
34	Reserved	
35	Reserved	
36	HAND Warning CGdn Guarding T-out	CAN guarding time-out 1
37	HAND Warning CHbn Heartbeat T-out	CAN heartbeat time-out 2
38	HAND Warning CSYn SYNC T-out	CAN synchrony time-out
39	HAND Warning CbFn Can Bus Off	CAN bus off
40	HAND Warning CIdn CAN/S Idx exceed	CAN index error
41	HAND Warning CAdn CAN/S Addres set	CAN station address error
42	HAND Warning CFrn CAN/S FRAM fail	CAN memory error

ID No.	Display on LCM Keypad	Descriptions
43	HAND Warning CSdn SDO T-out	CAN SDO transmission time-out
44	HAND Warning CSbn Buf Overflow	CAN SDO received register overflow
45	HAND Warning Cbtn Boot up fault	CAN boot up error
46	HAND Warning CPtn Error Protocol	CAN format error
47	HAND Warning Plra RTC Adjust	Adjust RTC
48	Reserved	
49	HAND Warning Plrt Keypad RTC TOut	Keypad RTC time out
50	HAND Warning PLod Opposite Defect	PLC download error
51	HAND Warning PLSv Save mem defect	Save error of PLC download
52	HAND Warning PLdA Data defect	Data error during PLC operation
53	HAND Warning PLFn Function defect	Function code of PLC download error
54	HAND Warning PLor Buf overflow	PLC register overflow
55	HAND Warning PLFF Function defect	Function code of PLC operation error

ID No.	Display on LCM Keypad	Descriptions
56	HAND Warning PLSn Check sum error	PLC checksum error
57	HAND Warning PLEd No end command	PLC end command is missing
58	HAND Warning PLCr PLC MCR error	PLC MCR command error
59	HAND Warning PLdF Download fail	PLC download fail
60	HAND Warning PLSF Scane time fail	PLC scan time exceed
61	HAND Warning PCGd CAN/M Guard err	CAN Master guarding error
62	HAND Warning PCbF CAN/M bus off	CAN Master bus off
63	HAND Warning PCnL CAN/M Node Lack	CAN Master node error
64	HAND Warning PCCt CAN/M Cycle Time	CAN/M cycle time-out
65	HAND Warning PCSF CAN/M SDO over	CAN/M SDOover
66	HAND Warning PCSd CAN/M Sdo Tout	CAN/M SDO time-out
67	HAND Warning PCAd CAN/M Addres set	CAN/M station address error

ID No.	Display on LCM Keypad	Descriptions
68	HAND Warning PCTo CAN/M T-Out	PLC/CAN Master Slave communication time out
69	Reserved	
70	HAND Warning ECid ExCom ID failed	Duplicate MAC ID error Node address setting error
71	HAND Warning ECLv ExCom pwr loss	Low voltage of communication card
72	HAND Warning ECtt ExCom Test Mode	Communication card in test mode
73	HAND Warning ECbF ExCom Bus off	DeviceNet bus-off
74	HAND Warning ECnP ExCom No power	DeviceNet no power
75	HAND Warning ECFF ExCom Facty def	Factory default setting error
76	HAND Warning ECiF ExCom Inner err	Serious internal error
77	HAND Warning ECio ExCom IONet brk	IO connection break off
78	HAND Warning ECPP ExCom Pr data	Profibus parameter data error
79	HAND Warning ECPi ExCom Conf data	Profibus configuration data error
80	HAND Warning ECEF ExCom Link fail	Ethernet Link fail

ID No.	Display on LCM Keypad	Descriptions
81	HAND Warning ECto ExCom Inr T-out	Communication time-out for communication card and drive
82	HAND Warning ECCS ExCom Inr CRC	Check sum error for Communication card and drive
83	HAND Warning ECrF ExCom Rtn def	Communication card returns to default setting
84	HAND Warning ECo0 ExCom MTCP over	Modbus TCP exceed maximum communication value
85	HAND Warning ECo1 ExCom EIP over	EtherNet/IP exceed maximum communication value
86	HAND Warning ECiP ExCom IP fail	IP fail
87	HAND Warning EC3F ExCom Mail fail	Mail fail
88	HAND Warning Ecby ExCom Busy	Communication card busy
89	Reserved	
90	HAND Warning CPLP Copy PLC PassWd	Copy PLC password error
91	HAND Warning CPL0 Copy PLC Mode Rd	Copy PLC Read mode error
92	HAND Warning CPL1 Copy PLC Mode Wt	Copy PLC Write mode error
93	HAND Warning CPLv Copy PLC Version	Copy PLC Version error

ID No.	Display on LCM Keypad	Descriptions
94		Copy PLC Capacity size error
95		Copy PLC: Disable PLC functions to copy
96		Copy PLC time out
97	Reserved	
98	Reserved	
99	Reserved	
100	Reserved	
101		Internal communication is off

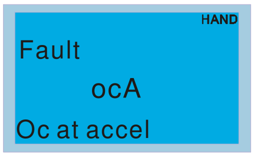
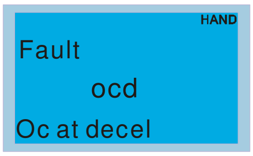
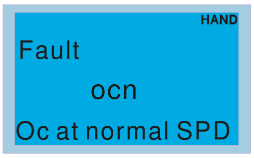
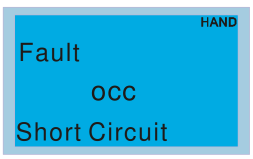
Chapter 14 Fault Codes and Descriptions

① Display error signal

② Abbreviate error code
The code is displayed as shown on KPC-CE01.

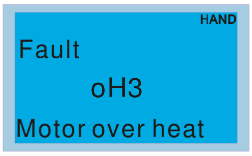
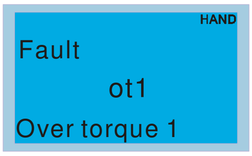
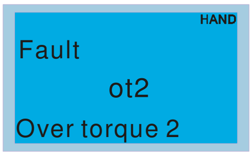
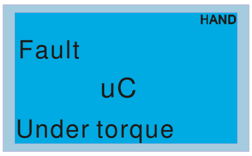
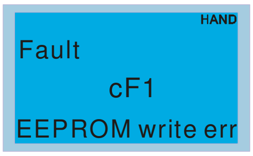
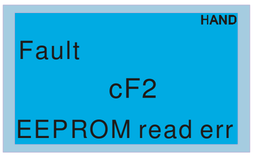
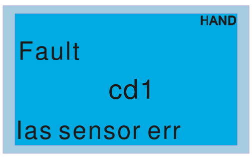
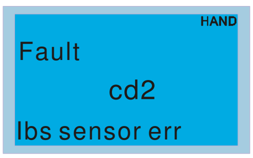
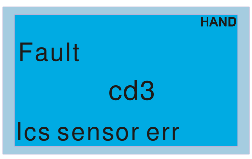
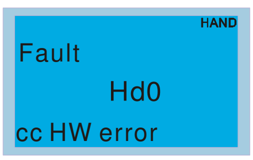
③ Display error description

* Refer to setting of Pr06-17~Pr06~22.

ID*	Fault Name	Fault Descriptions	Corrective Actions
1		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.
2		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.
3		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.
4		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.
5		Short-circuit is detected between upper bridge and lower bridge of the IGBT module	Return to the factory

ID*	Fault Name	Fault Descriptions	Corrective Actions
6	HAND Fault ocS Oc at stop	Hardware failure in current detection	Return to the factory
7	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 acceleration time or add an optional brake resistor.
8	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.
9	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.
10	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.
11	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
12	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
13	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
14	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

ID*	Fault Name	Fault Descriptions	Corrective Actions
15	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.
16	HAND Fault oH1 IGBT over heat	IGBT overheating IGBT temperature exceeds protection level	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.
17	HAND Fault oH2 Heat Sink oH	Heatsink overheating Capacitance temperature exceeds 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.
18	HAND Fault tH1o Thermo 1 open	IGBT Hardware Error	Return to the factory
19	HAND Fault tH2o Thermo 2 open	Capacitor Hardware Error	Return to the factory
21	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.
22	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
23	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

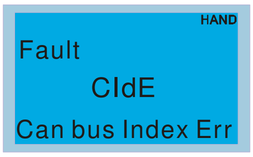
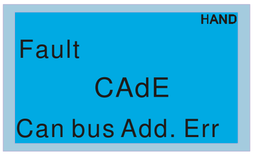
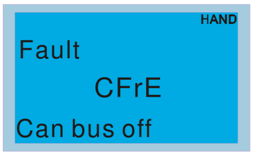
ID*	Fault Name	Fault Descriptions	Corrective Actions
24		Motor overheating The AC motor drive detecting internal temperature exceeds the setting of Pr.06-30 (PTC level) or Pr.06-57 (PT100 level 2).	1. Make sure that the motor is not obstructed. 2. Ensure that the ambient temperature falls within the specified temperature range. 3. Change to a higher power motor.
26		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.
27			
28		Low current detection	Check Pr.06-71, Pr.06-72, Pr.06-73.
30		Internal EEPROM can not be programmed.	1. Press "RESET" key to the factory setting 2. Return to the factory.
31		Internal EEPROM can not be read.	1. Press "RESET" key to the factory setting 2. Return to the factory.
33		U-phase error	Reboots the power. If fault code is still displayed on the keypad please return to the factory
34		V-phase error	Reboots the power. If fault code is still displayed on the keypad please return to the factory
35		W-phase error	Reboots the power. If fault code is still displayed on the keypad please return to the factory
36		CC (current clamp)	Reboots the power. If fault code is still displayed on the keypad please return to the factory

ID*	Fault Name	Fault Descriptions	Corrective Actions
37	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
38	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
39	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
40	HAND Fault AUE Auto tuning err	Auto tuning error	1. Check cabling between drive and motor 2. Try again.
41	HAND Fault AFE PID Fbk error	PID loss (ACI)	1. Check the wiring of the PID feedback 2. Check the PID parameters settings
48	HAND Fault ACE ACI loss	ACI loss	1. Check the ACI wiring 2. Check if the ACI signal is less than 4mA
49	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.
50	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.
51	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.
52	HAND Fault Pcod Password error	Password is locked.	Keypad will be locked. Turn the power ON after power OFF to re-enter the correct password. See Pr.00-07 and 00-08.

ID*	Fault Name	Fault Descriptions	Corrective Actions
53	HAND Fault ccod SW Code Error	Software version error	
54	HAND Fault CE1 PC err command	Illegal function code	Check if the function code is correct (function code must be 03, 06, 10, 63)
55	HAND Fault CE2 PC err address	Illegal data address (00H to 254H)	Check if the communication address is correct
56	HAND Fault CE3 PC err data	Illegal data value	Check if the data value exceeds max./min. value
57	HAND Fault CE4 PC slave fault	Data is written to read-only address	Check if the communication address is correct
58	HAND Fault CE10 PC time out	Modbus transmission time-out	
59	HAND Fault CP10 PU time out	Keypad transmission time-out	
60	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.
61	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
62	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

ID*	Fault Name	Fault Descriptions	Corrective Actions
63	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
64	HAND Fault ryF MC Fault	Electric valve switch error when executing Soft Start. (This warning is for frame E and higher frame of AC drives) Do not disconnect RST when drive is still operating.	
72	HAND Fault STL1 STO Loss 1	STO1~SCM1 internal hardware detect error	
73	HAND Fault S1 S1-emergy stop	Emergency stop for external safety	
74	HAND Fault Fire On Fire	Fire mode	
76	HAND Fault STO STO	Safety Torque Off function active	
77	HAND Fault STL2 STO Loss 2	STO2~SCM2 internal hardware detect error	
78	HAND Fault STL3 STO Loss 3	STO1~SCM1 and STO2~SCM2 internal hardware detect error	
79	HAND Fault Uoc U phase oc	Phase U short circuit	
80	HAND Fault Voc V phase oc	Phase V short circuit	

ID*	Fault Name	Fault Descriptions	Corrective Actions
81	HAND Fault Woc W phase oc	W phase short circuit	
82	HAND Fault OPHL U phase lacked	Output phase loss (Phase U)	
83	HAND Fault OPHL V phase lacked	Output phase loss (Phase V)	
84	HAND Fault OPHL W phase lacked	Output phase loss (Phase W)	
90	HAND Fault Fstp For ce Stop	Internal PLC forced to stop Verify the setting of Pr.00-32	
99	HAND Fault TRAP CPU Trap Error	CPU trap error	
101	HAND Fault CGdE Guarding T-out	CANopen guarding error	
102	HAND Fault CHbE Heartbeat T-out	CANopen heartbeat error	
103	HAND Fault CSYE SYNC T-out	CANopen synchronous error	
104	HAND Fault CbFE Can bus off	CANopen bus off error	

ID*	Fault Name	Fault Descriptions	Corrective Actions
105		CANopen index error	
106		CANopen station address error	
107		CANopen memory error	
111		Internal communication time-out	

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Chapter 15 CANopen Overview

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~ PDO4
- 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.

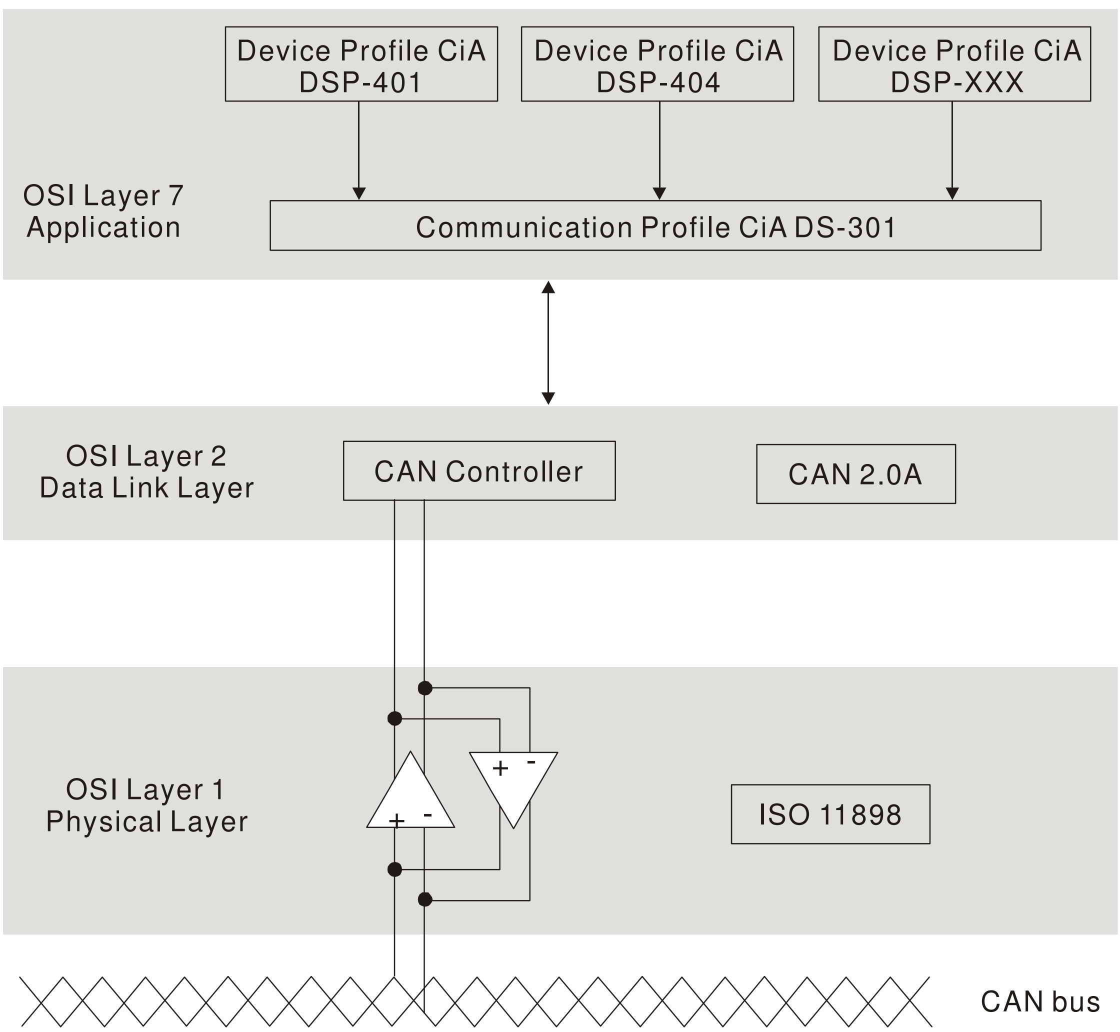
Delta CANopen not supporting service:

- Time Stamp service

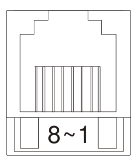
15.1 CANopen Overview

CANopen Protocol

CANopen is a CAN-based higher layer protocol, and was designed for motion-oriented machine control networks, such as handling systems. Version 4.02 of CANopen (CiA DS301) is standardized as EN50325-4. The CANopen specifications cover application layer and communication profile (CiA DS301), as well as a framework for programmable devices (CiA 302), recommendations for cables and connectors (CiA 303-1) and SI units and prefix representations (CiA 303-2).



RJ-45 Pin Definition



plug

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

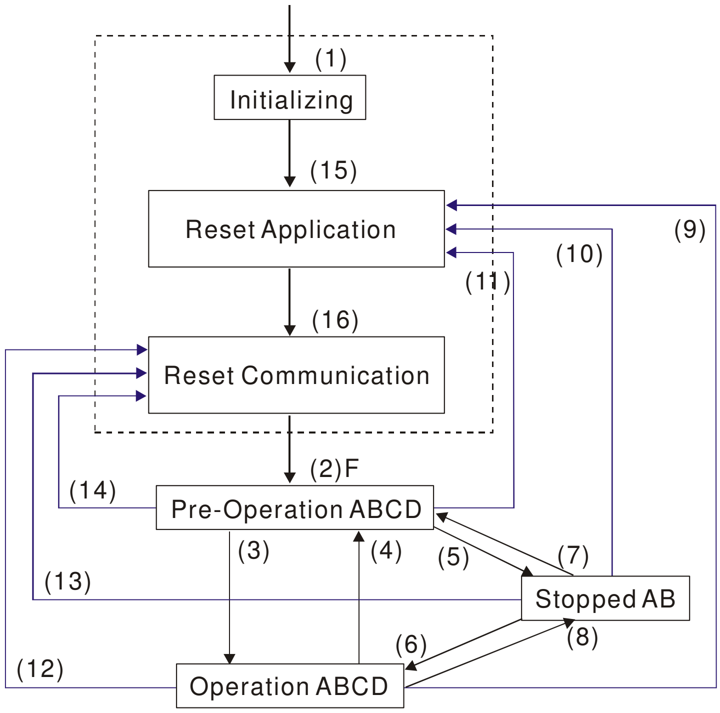
CANopen Communication Protocol

It has services as follows:

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

NMT (Network Management Object)

The Network Management (NMT) follows a Master/Slave structure for executing NMT service. Only one NMT master is in a network, and other nodes are regarded as slaves. All CANopen nodes have a present NMT state, and NMT master can control the state of the slave nodes. The state diagram of a node is shown as follows:



(1) After power is applied, it is auto in initialization state
(2) Enter pre-operational state automatically
(3) (6) Start remote node
(4) (7) Enter pre-operational state
(5) (8) Stop remote node
(9) (10) (11) Reset node
(12) (13) (14) Reset communication
(15) Enter reset application state automatically
(16) Enter reset communication state automatically

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		○	○	○

SDO (Service Data Objects)

SDO is used to access the Object Dictionary in every CANopen node by Client/Server model. One SDO has two COB-ID (request SDO and response SDO) to upload or download data between two nodes. No data limit for SDOs to transfer data. But it needs to transfer by segment when data exceeds 4 bytes with an end signal in the last segment.

The Object Dictionary (OD) is a group of objects in CANopen node. Every node has an OD in the system, and OD contains all parameters describing the device and its network behavior. The access path of OD is the index and sub-index, each object has a unique index in OD, and has sub-index if necessary. The request and response frame structure of SDO communication is shown as follows:

PDO (Process Data Object)

PDO communication can be described by the producer/consumer model. Each node of the network will listen to the messages of the transmission node and distinguish if the message has to be processed or not after receiving the message. PDO can be transmitted from one device to one another device or to many other devices. Every PDO has two PDO services: a TxPDO and a RxPDO. PDOs are transmitted in a non-confirmed mode.

PDO Transmission type is defined in the PDO communication parameter index (1400h for the 1st RxPDO or 1800h for the 1st TxPDO), and all transmission types are listed in the following table:

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

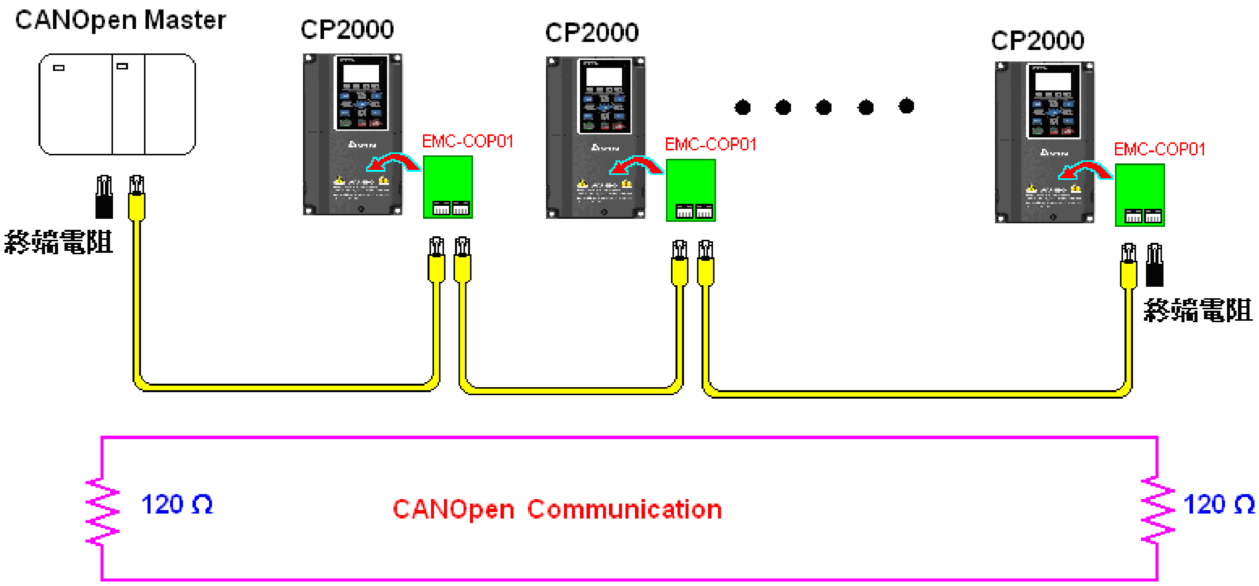
Type number 1-240 indicates the number of SYNC message between two PDO transmissions.
Type number 252 indicates the data is updated (but not sent) immediately after receiving SYNC.
Type number 253 indicates the data is updated immediately after receiving RTR.
Type number 254: Delta CANopen doesn't support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

EMCY (Emergency Object)

When errors occurred inside the hardware, an emergency object will be triggered an emergency object will only be sent when an error is occurred. As long as there is nothing wrong with the hardware, there will be no emergency object to be served as a warning of an error message.

15.2 Wiring for CANopen

An external adapter card: EMC-COP01 is used for CANopen wiring to connect CANopen to VFD CP2000. The link is enabled by using RJ45 cable. The two farthest ends must be terminated with 120Ω terminating resistors.



15.3 CANopen Communication Interface Description

15.3.1 CANopen Control Mode Selection

There are two control modes for CANopen; Pr.09-40 set to 1 is the factory setting mode DS402 standard and Pr.09-40 set to 0 is Delta's standard setting mode.

Actually, there are two control modes according to Delta's standard, one is the old control mode (Pr09-30=0).

This control mode can only control the motor drive under frequency control. Another mode is a new standard (Pr09-30=1)

This new control mode allows the motor drive to be controlled under all sorts of mode. Currently, C2000 support speed, torque, position and home mode.

The definition of relating control mode are:

CANopen Control Mode Selection	**Control Mode**	
	Speed	
	Index	Description
DS402 standard Pr09-40=1	6042-00	Target rotating speed (RPM)
	-----	-----
Delta Standard (Old definition) Pr09-40=0 Pr09-30=0	2020-02	Target rotating speed (Hz)
Delta Standard (New definition) Pr09-40=0, Pr09-30=1	2060-03	Target rotating speed (Hz)
	2060-04	Torque Limit (%)

CANopen Control Mode Selection	**Operation Control**	
	Index	Description
DS402 standard Pr. 09-40=1	6040-00	Operation Command
	-----	-----
Delta Standard (Old definition) P09-40=0, P09-30=0	2020-01	Operation Command
Delta Standard (New definition) Pr09-40=0, Pr09-30=1	2060-01	Operation Command
	-----	-----

CANopen Control Mode Selection	**Other**	
	Index	Description
DS402 standard Pr. 09-40=1	605A-00	Quick stop processing method
	605C-00	Disable operation processing method
Delta Standard (Old definition) Pr09-40=1, Pr09-30=0	-----	-----
Delta Standard (New definition) Pr09-40=0, Pr09-30=1	-----	-----
	-----	-----

However, you can use some index regardless DS402 or Delta's standard.

For example:

1. Index which are defined as RO attributes.
2. Index correspond to parameters such as (2000 ~200B-XX)
3. Accelerating/Decelerating Index: 604F 6050
4. Control mode: Index : 6050

15.3.2 DS402 Standard Control Mode

15.3.2.1 Related set up of ac motor drive (by following DS402 standard)

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

1. Wiring for hardware (refer to chapter 16-2 Wiring for CANopen)
2. Operation source setting: set Pr.00-21 = 3 for CANopen communication card control.
3. Frequency source setting: set Pr.00.20 = 6. (Choose source of frequency commend from CANopen setting.)
4. Set DS402 as control mode: Pr09-40=1
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 arise (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.)

15.3.2.2 The status of the motor drive (by following DS402 standard)

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

3 blocks

Power Disable: That means without PWM output
Power Enable: That means with PWM output
Fault: One or more than one error has occurred.

9 status

Start: Power On
Not ready to switch on: The motor drive is initiating.
Switch On Disable: When the motor drive finishes the initiation, it will be at this mode.
Ready to switch on: Warming up before running.
Switch On: The motor derive has the PWM output now, but the reference commend is not effective.
Operate Enable: Able to control normally.
Quick Stop Active: When there is a Quick Stop request, you have to stop running the motor drive.
Fault Reaction Active: The motor drive detects conditions which might trigger error(s).
Fault: One or more than errors has occurred to the motor drive.

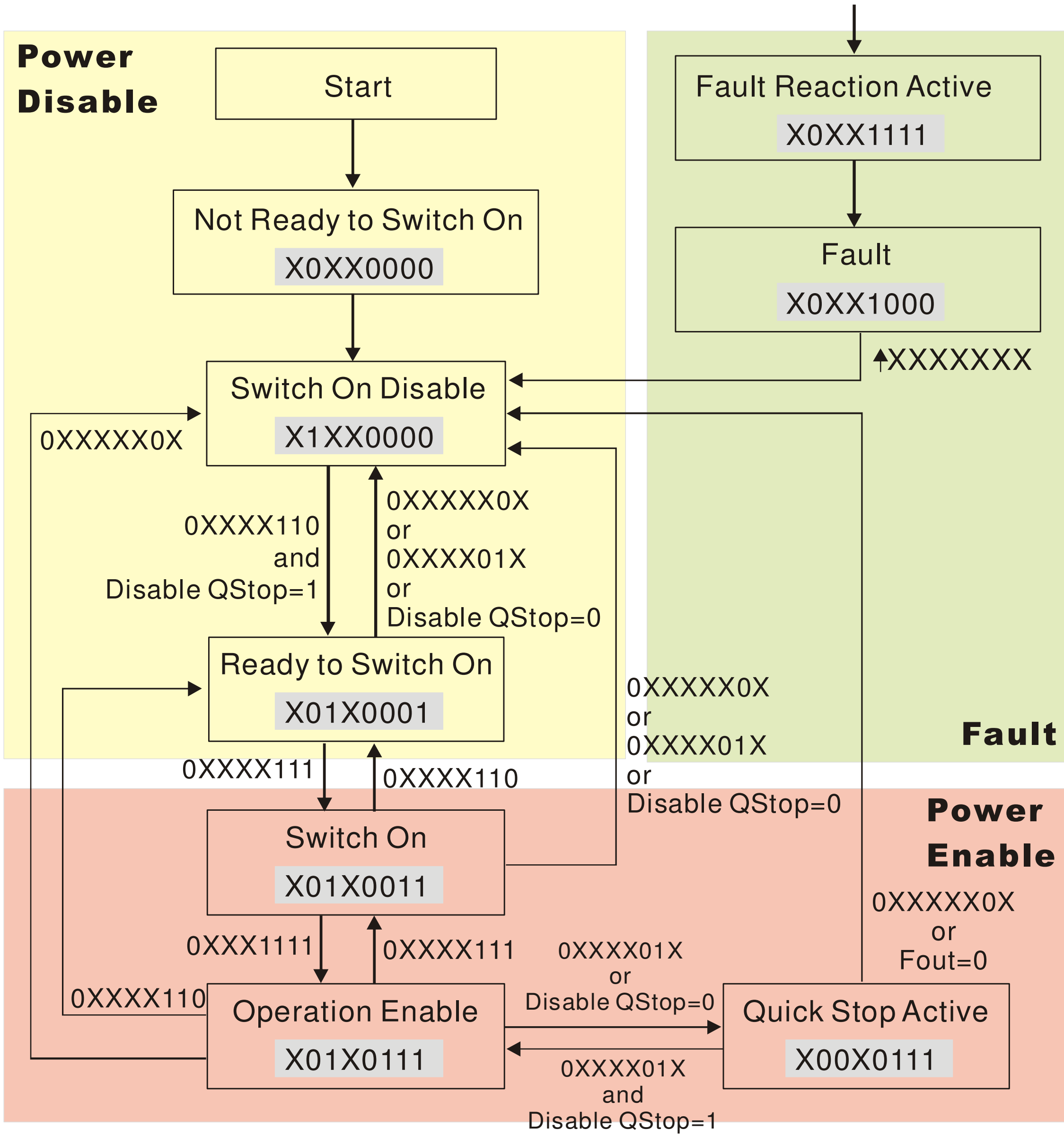
Therefore, when the motor drive is turned on and finishes the initiation, it will remain at Ready to Switch on status. To control the operation of the motor drive, you need to change this status to Operate Enable status. The way to change it is to commend the control word's bit0 ~ bit3 and bit7 of the Index 6040H and to pair with Index Status Word (Status Word 0X6041). The control steps and index definition are described as below:

Index 6040

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

Index 6041

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



Set command 6040 =0xE, then set another command 6040 =0xF. Then the motor drive can be switched to Operation Enable. The Index 605A decides the dashed line of Operation Enable when the control mode changes from Quick Stop Active. (When the setting value is 1~3, this dashed line is active. But when the setting value of 605A is not 1~3, once he motor derive is switched to Quick Stop Active, it will not be able to switch back to Operation Enable.)

Index	Sub	Definition	Factory Setting	R/W	Size	Unit	PDO Map	Mode	note
605Ah	0	Quick stop option code	2	RW	S16		No		0: disable drive function 1:slow down on slow down ramp 2: slow down on quick stop ramp 3: slow down on the current limit 5 slow down on slow down ramp and stay in QUICK STOP 6 slow down on quick stop ramp and stay in QUICK STOP 7 slow down on the current limit and stay in Quick stop

Besides, when the control section switches from Power Enable to Power Disable, use 605C to define parking method.

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

15.3.2.3 Various mode control method (by following DS402 standard)

Control mode of C2000, supporting speed, torque, position and home control are described as below:

Speed mode

1. Let Ac Motor Drive be at the speed control mode: Set Index6060 to 2.
2. Switch to Operation Enable mode: Set 6040=0xE, then set 6040 = 0xF.
3. To set target frequency: Set target frequency of 6042, since the operation unit of 6042 is rpm, there is a transformation:

$n = f \times \frac{120}{p}$ n: rotation speed (rpm) (rounds/minute) P: motor's pole number (Pole)

f: rotation frequency (Hz)

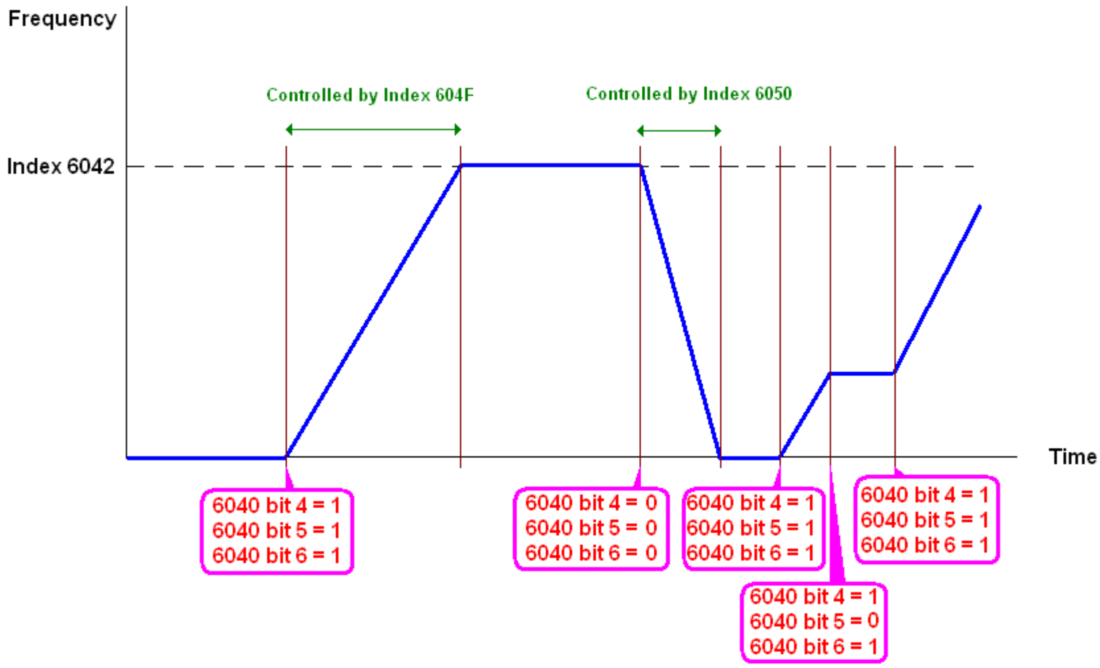
For example:

Set 6042H = 1500 (rpm), if the motor drive's pole number is 4 (Pr05-04 or Pr05-16), then the motor drive's operation frequency is 1500(120/4)=50Hz.

Besides, the 6042 is defined as a signed operation. The plus or minus sign means to rotate clockwise or counter clockwise

4. To set acceleration and deceleration: Use 604F(Acceleration) and 6050(Deceleration).
5. Trigger an ACK signal: In the speed control mode, the bit 6~4 of Index 6040 needs to be controlled. It is defined as below:

	Index 6040			SUM
	Bit 6	Bit 5	Bit 4	
Speed mode (Index 6060=2)	1	0	1	Locked at the current signal.
	1	1	1	Run to reach targeting signal.
	Other			Decelerate to 0Hz.



NOTE 01: To know the current rotation speed, read 6043. (unit: rpm)

NOTE 02: To know if the rotation speed can reach the targeting value; read bit 10 of 6041. (0: Not reached; 1: Reached)

15.3.3 By using Delta Standard (Old definition, only support speed mode)

15-3.3.1 Various mode control method (by following DS402 standard)

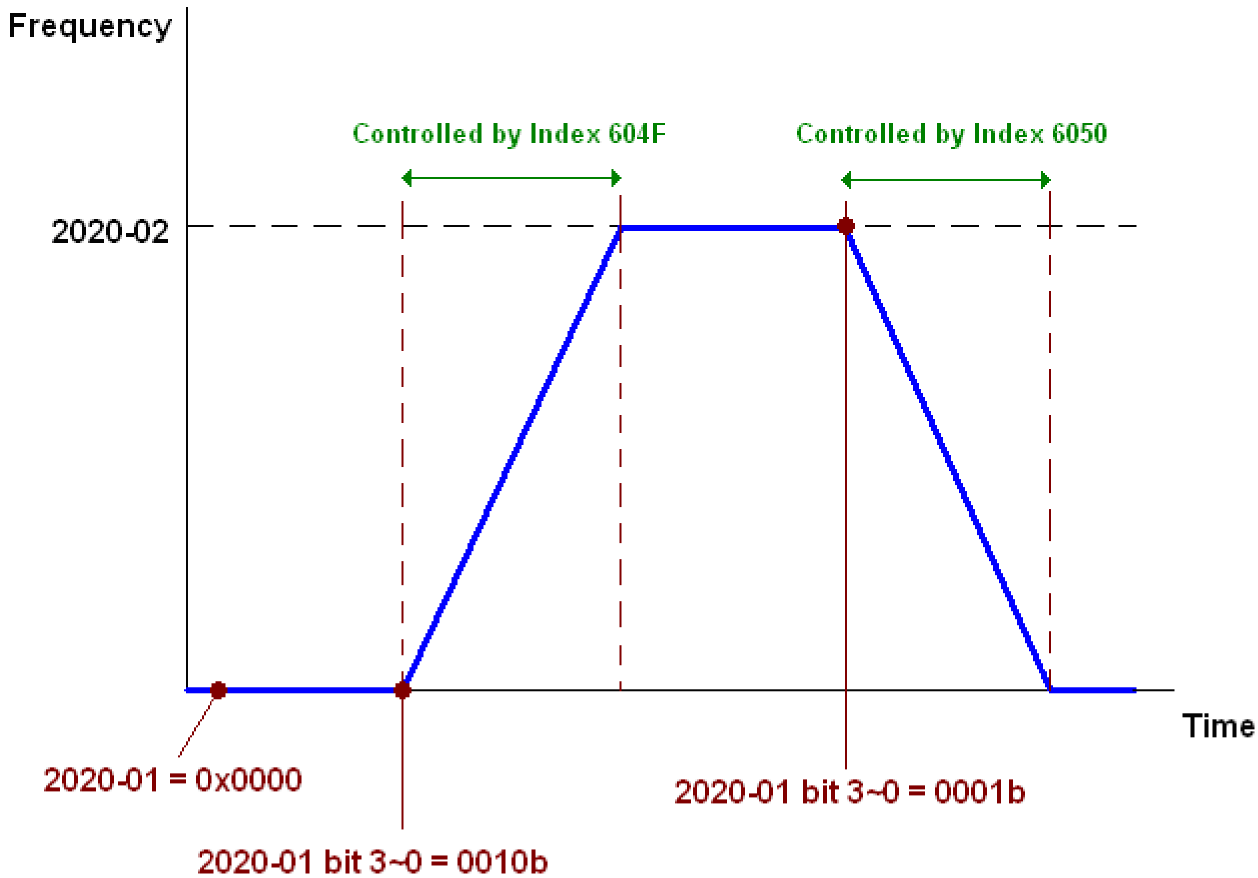
If you want to use DS402 standard to control the motor drive, please follow the steps below:

1. Wiring for hardware (Refer to chapter 15.2 Wiring for CANopen)
2. Operation source setting: set Pr.00-21 to 3 for CANopen communication card control.
3. Frequency source setting: set Pr.00.20 to 6. (Choose source of frequency commend from CANopen setting.)
4. Set Delta Standard (Old definition, only support speed mode) as control mode: Pr. 09-40 = 0 and 09-30 = 0.

   CANopen station setting: set Pr.09-36 (Range of setting is 1~127. When Pr.09-36=0, CANopen slave function is disabled.) (Note: If error arised (CAdE or CANopen memory error) as station setting is completed, press Pr.00-02=7 for reset.)
5. CANopen baud rate setting: set Pr.09.37 (CANBUS Baud Rate: 1M(0), 500K(1), 250K(2), 125K(3), 100K(4) and50K(5))

15-3-3-2 By speed mode

1. Set the target frequency: Set 2020-02, the unit is Hz, with a number of 2 decimal places. For example 1000 is 10.00.
2. Operation control: Set 2020-01 = 0002H for Running, and set 2020-01 = 0001H for Stopping.



15.3.4 By using Delta Standard (New definition)

15-3-4-1 Related set up of ac motor drive (Delta New Standard)

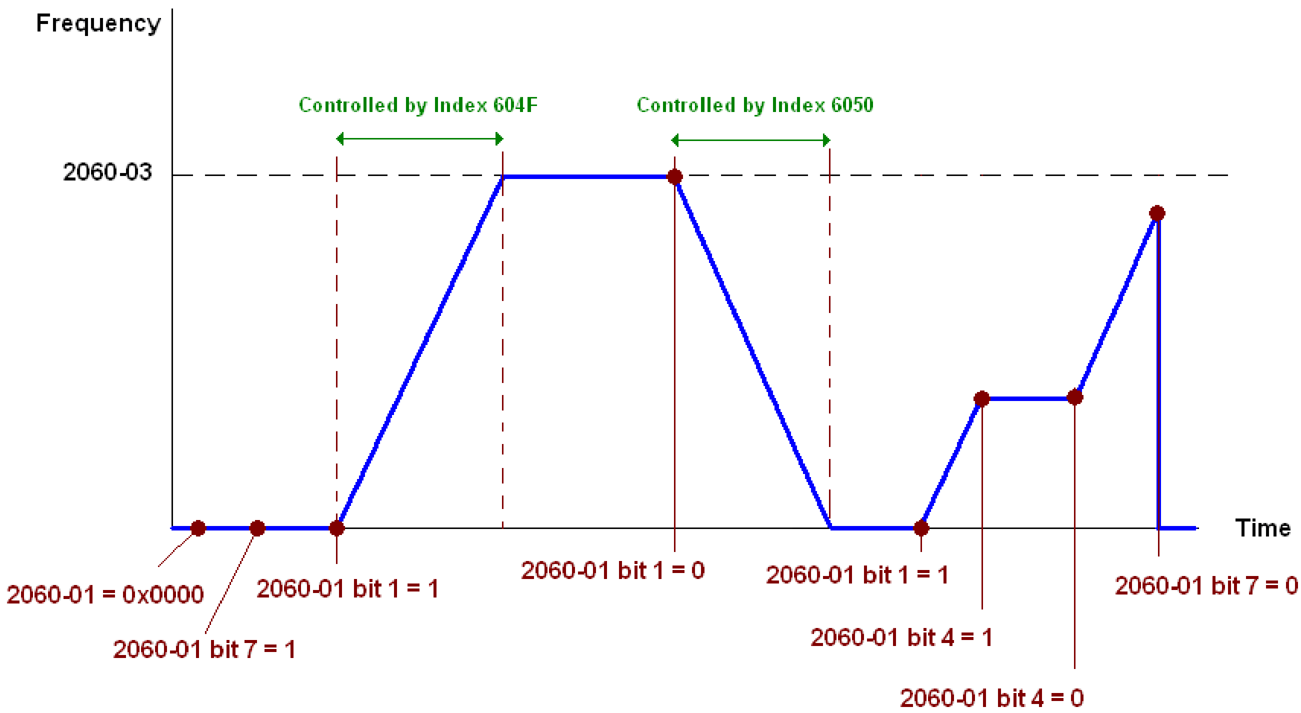
If you want to use DS402 standard to control the motor drive, please follow the steps below:

1. Wiring for hardware (Refer to chapter 15.2 Wiring for CANopen)
2. Operation source setting: set Pr.00-21 to 3 for CANopen communication card control.
3. Frequency source setting: set Pr.00.20 to 6. (Choose source of frequency commend from CANopen setting.)
4. Set Delta Standard (Old definition, only support speed mode) as control mode: Pr. 09-40 = 0 and 09-30 = 0.
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))

15-3-4-2 Various mode control method (Delta New Standard)

Speed Mode

1. Let Ac Motor Drive be at the speed control mode: Set Index6060 = 2.
2. Set the target frequency: set 2060-03, unit is Hz, with a number of 2 decimal places. For example 1000 is 10.00Hz.
3. Operation control: set 2060-01 = 008H for Server on, and set 2060-01 = 0081H for Running.



NOTE01: To know the current position, read 2061-05.

NOTE02: To know if reaching the target position, read bit 0 of 2061 (0: Not reached, 1: Reached).

15-3-5 DI/DO AI AO are controlled via CANopen

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

1. To set the DO to be controlled, define this DO to be controlled by CANopen. For example, set Pr02-14 to control RY2.
2. To set the DO to be controlled, define this AO to be controlled by CANopen. For example, set Pr03-23 to control AFM2.
3. To control the mapping index of CANopen. If you want to control DO, then you will need to control Index2026-41. If you want to control AO, then you will need to control 2026-AX. If you want to set RY2 as ON, set the bit 1 of Index 2026-41 =1, then RY2 will output 1. If you want to control AFM2 output = 50.00%, then you will need to set Index 2026-A2 =5000, then AFM2 will output 50%.

Mapping table of CANopen DI DO AI AO:

DI:

Terminal	Related Parameters	R/W	Mapping Index
FWD	==	RO	2026-01 bit 0
REV	==	RO	2026-01 bit 1
MI 1	==	RO	2026-01 bit 2
MI 2	==	RO	2026-01 bit 3
MI 3	==	RO	2026-01 bit 4
MI 4	==	RO	2026-01 bit 5
MI 5	==	RO	2026-01 bit 6
MI 6	==	RO	2026-01 bit 7
MI 7	==	RO	2026-01 bit 8
MI 8	==	RO	2026-01 bit 9
MI 10	==	RO	2026-01 bit 10
MI 11	==	RO	2026-01 bit 11
MI 12	==	RO	2026-01 bit 12
MI 13	==	RO	2026-01 bit 13
MI 14	==	RO	2026-01 bit 14
MI 15	==	RO	2026-01 bit 15

DO：

Terminal	Related Parameters	R/W	Mapping Index
RY1	P2-13 = 50	RW	2026-41 bit 0
RY2	P2-14 = 50	RW	2026-41 bit 1
	P2-15 = 50	RW	2026-41 bit 2
MO1	P2-16 = 50	RW	2026-41 bit 3
MO2	P2-17 = 50	RW	2026-41 bit 4
MO3	P2-18 = 50	RW	2026-41 bit 5
MO4	P2-19 = 50	RW	2026-41 bit 6
MO5	P2-20 = 50	RW	2026-41 bit 7
MO6	P2-21 = 50	RW	2026-41 bit 8
MO7	P2-22 = 50	RW	2026-41 bit 9
MO8	P2-23 = 50	RW	2026-41 bit 10

AI：

Terminal	Related Parameters	R/W	Mapping Index
AVI	==	RO	Value of 2026-61
ACI	==	RO	Value of 2026-62
AUI	==	RO	Value of 2026-63

AO：

Terminal	Related Parameters	R/W	Mapping Index
AFM1	P3-20 = 20	RW	Value of 2026-A1
AFM2	P3-23 = 20	RW	Value of 2026-A2

15.4 CANopen Supporting Index

CP2000 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(0$\overline{A}$H)	-	15(0FH)

Index = 2000H + 0AH = 200A

Sub Index = 0FH + 1H = 10H

CP2000 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
							11B: JOG Enable
						Bit2~3	Reserved
						Bit4~5	00B:disable
							01B: Direction forward
							10B: Reverse
							11B: Switch Direction
						Bit6~7	00B: 1st step Accel. /Decel.
							01B: 2nd step Accel. /Decel.
							10B: 3rd step Accel. /Decel.
							11B: 4th step Accel. /Decel.
						Bit8~15	0000B: Master speed
							0001B: 1st step speed
							0010B: 2nd step speed
							0011B: 3rd step speed
							0100B: 4th step speed
							0101B: 5th step speed
							0110B: 6th step speed
							0111B: 7th step speed
							1000B: 8th step speed
							1001B: 9th step speed
							1010B: 10th step speed
							1011B: 11th step speed
							1100B: 12th step speed
							1101B: 13th step speed
							1110B: 14th step speed
							1111B: 15th step speed
						Bit12	1: Enable the function of Bit6-11
						Bit13~14	00B: no function
							01B: Operation command by the digital keypad

Index	Sub	Definition	Factory Setting	R/W	Size	Note	
							10B: Operation command by Pr. 00-21 setting
							11B: Switch the source of operation command
						Bit 15	Reserved
	2	Freq. command (XXX.XXHz)	0	RW	U16		
	3	Other trigger	0	RW	U16	Bit0	1: E.F. ON
						Bit1	1: Reset
						Bit15~2	Reserved
2021H	0	Number	10	R	U8		
	1	Error code	0	R	U16		
	2	AC motor drive status	0	R	U16	Bit 1~0	00B: stop
							01B: decelerate to stop
							10B: waiting for operation command
							11B: in operation
						Bit 2	1: JOG command
						Bit 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	Freq. command (XXX.XXHz)	0	R	U16		
	4	Output freq. (XXX.XXHz)	0	R	U16		
	5	Output current (XX.XA)	0	R	U16		
	6	DC bus voltage (XXX.XV)	0	R	U16		
	7	Output voltage (XXX.XV)	0	R	U16		
	8	the current segment run by the multi-segment speed commend	0	R	U16		
	9	Reserved	0	R	U16		
	A	Display counter value（c）	0	R	U16		
	B	Display output power angle (XX.X°)	0	R	U16		
	C	Display output torque (XXX.X%)	0	R	U16		
	D	Display actual motor speed (rpm)	0	R	U16		
	-	-	-	-	-		
	-	-	-	-	-		
	10	power output (X.XXXKWH)	0	R	U16		

Index	Sub	Definition	Factory Setting	R/W	Size	Note
2022H	0	Reserved	0	R	U16	
	1	Display output current	0	R	U16	
	2	Display counter value	0	R	U16	
	3	Display actual output frequency (XXX.XXHz)	0	R	U16	
	4	Display DC-BUS voltage (XXX.XV)	0	R	U16	
	5	Display output voltage (XXX.XV)	0	R	U16	
	6	Display output power angle (XX.X°)	0	R	U16	
	7	Display output power in kW	0	R	U16	
	8	Display actual motor speed (rpm)	0	R	U16	
	9	Display estimate output torque (XXX.X%)	0	R	U16	
	-	-	-	-	-	-
	B	Display PID feedback value after enabling PID function in % (To 2 decimal places)	0	R	U16	
	C	Display signal of AVI 1 analog input terminal, 0-10V corresponds to 0-100% (To 2 decimal places)	0	R	U16	
	D	Display signal of ACI analog input terminal, 4-V20mA/0-10V corresponds to 0-100% (To 2 decimal places)	0	R	U16	
	E	Display signal of AVI 2 analog input terminal, -10V~10V corresponds to -100~100% (To 2 decimal places)	0	R	U16	
	F	Display the IGBT temperature of drive power module in °C	0	R	U16	
	10	Display the temperature of capacitance in °C	0	R	U16	
	11	The status of digital input (ON/OFF), refer to Pr.02-12	0	R	U16	
	12	The status of digital output (ON/OFF), refer to Pr.02-18	0	R	U16	
	13	Display the multi-step speed that is executing	0	R	U16	
	14	The corresponding CPU pin status of digital input	0	R	U16	
	15	The corresponding CPU pin status of digital output	0	R	U16	
	-	-	-	-	-	
	-	-	-	-	-	
	-	-	-	-	-	
	-	-	-	-	-	
	1A	Display times of counter overload (0.00~100.00%)	0	R	U16	
	1B	Display GFF in %	0	R	U16	
	1C	Display DCbus voltage ripples (Unit: Vdc)	0	R	U16	
	1D	Display PLC register D1043 data	0	R	U16	

Index	Sub	Definition	Factory Setting	R/W	Size	Note	
	1E	Display Pole of Permanent Magnet Motor	0	R	U16		
	1F	User page displays the value in physical measure	0	R	U16		
	20	Output Value of Pr.00-05	0	R	U16		
	21	Number of motor turns when drive operates	0	R	U16		
	22	Operation position of motor	0	R	U16		
	23	Fan speed of the drive	0	R	U16		
	24	Control mode of the drive 0: speed mode 1: torque mode	0	R	U16		
	25	Carrier frequency of the drive	0	R	U16		

CANopen Remote IO mapping

Index	Sub	R/W	Definition
2026H	01h	R	Each bit corresponds to the different input terminals
	02h	R	Each bit corresponds to the different input terminals
	03h~40h	R	Reserved
	41h	RW	Each bit corresponds to the different output terminals
	42h~60h	R	Reserved
	61h	R	AVI (%)
	62h	R	ACI (%)
	63h	R	AUI (%)
	64h~A0h	R	Reserved
	A1h	RW	AFM1 (%)
	A2h	RW	AFM2 (%)

Delta Standard Mode (New definition)

Index	sub	R/W	Size	Descriptions			Speed Mode
				bit	Definition	Priority	
2060h	00h	R	U8				
	01h	RW	U16	0	Ack	4	0:fcmd =0 1:fcmd = Fset(Fpid)
				1	Dir	4	0: FWD run command 1: REV run command
				2			
				3	Halt		0: drive run till target speed is attained 1: drive stop by declaration setting
				4	Hold		0: drive run till target speed is attained 1: frequency stop at current frequency
				5	JOG		0:JOG OFF Pulse 1:JOG RUN
				6	QStop		Quick Stop
				7	Power		0:Power OFF 1:Power ON
				14~8			
				15			Pulse 1: Fault code cleared

Index	sub	R/W	Size	Descriptions			Speed Mode
				bit	Definition	Priority	
	02h	RW	U16				
	03h	RW	U16				Speed command (unsigned decimal)
	04h	RW	U16				
	05h	RW	S32				
	06h	RW					
	07h	RW	U16				
	08h	RW	U16				
2061h	01h	R	U16	0	Arrive		Frequency attained
				1	Dir		0: Motor FWD run 1: Motor REV run
				2	Warn		Warning
				3	Error		Error detected
				4			
				5	JOG		JOG
				6	QStop		Quick stop
				7	Power On		Switch ON
				15~8			
	02h	R					
	03h	R	U16				Actual output frequency
	04h	R					
	05h	R	S32				Actual position (absolute)
	06h	R					
	07h	R	S16				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

Index	Sub	Definition	Factory Setting	R/W	Size	Unit	PDO Map	Mode	Note
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
6071h	0	tq Target torque	0	RW	S16	0.1%	Yes	tq	Valid unit: 1%
6072h	0	tq Max torque	150	RW	U16	0.1%	No	tq	Valid unit: 1%
6075h	0	tq Motor rated current	0	RO	U32	mA	No	tq	
6077h	0	tq torque actual value	0	RO	S16	0.1%	Yes	tq	
6078h	0	tq current actual value	0	RO	S16	0.1%	Yes	tq	
6079h	0	tq DC link circuit voltage	0	RO	U32	mV	Yes	tq	

15.5 CANopen Fault Code

Display	Fault code	Description	CANopen fault code	CANopen fault register (bit 0~7)
HAND Fault ocA Oc at accel	0001H	Over-current during acceleration	2213 H	1
HAND Fault ocd Oc at decel	0002H	Over-current during deceleration	2213 H	1
HAND Fault ocn Oc at normal SPD	0003H	Over-current during steady status operation	2214H	1
HAND Fault GFF Ground fault	0004H	Ground fault. When (one of) the output terminal(s) is grounded, short circuit current is more than 50% of AC motor drive rated current. NOTE: The short circuit protection is provided for AC motor drive protection, not for protection of the user.	2240H	1
HAND Fault occ Short Circuit	0005H	Short-circuit is detected between upper bridge and lower bridge of the IGBT module.	2250H	1
HAND Fault ocS Oc at stop	0006H	Over-current at stop. Hardware failure in current detection	2314H	1
HAND Fault ovA Ov at accel	0007H	Over-current during acceleration. Hardware failure in current detection	3210H	2
HAND Fault ovd Ov at decel	0008H	Over-current during deceleration. Hardware failure in current detection.	3210H	2
HAND Fault ovn Ov at normal SPD	0009H	Over-current during steady speed. Hardware failure in current detection.	3210H	2
HAND Fault ovS Ov at stop	000AH	Over-voltage at stop. Hardware failure in current detection	3210H	2

Display	Fault code	Description	CANopen fault code	CANopen fault register (bit 0~7)
HAND Fault LvA Lv at accel	000BH	DC BUS voltage is less than Pr.06.00 during acceleration.	3220H	2
HAND Fault Lvd Lv at decel	000CH	DC BUS voltage is less than Pr.06.00 during deceleration.	3220H	2
HAND Fault Lvn Lv at normal SPD	000DH	DC BUS voltage is less than Pr.06.00 in constant speed.	3220H	2
HAND Fault LvS Lv at stop	000EH	DC BUS voltage is less than Pr.06-00 at stop	3220H	2
HAND Fault OrP Phase Lacked	000FH	Phase Loss Protection	3130H	2
HAND Fault oH1 IGBT over heat	0010H	IGBT overheat IGBT temperature exceeds protection level. 1~15HP: 90℃ 20~100HP: 100℃	4310H	3
HAND Fault oH2 Hear Sink oH	0011H	Heat sink overheat Heat sink temperature exceeds 90oC	4310H	3
HAND Fault tH1o Thermo 1 open	0012H	Temperature detection circuit error (IGBT) IGBT NTC	FF00H	3
HAND Fault tH2o Thermo 2 open	0013H	Temperature detection circuit error (capacity module) CAP NTC	FF01H	3
HAND Fault PWR Power RST OFF	0014H	Power RST off	FF02H	2

Display	Fault code	Description	CANopen fault code	CANopen fault register (bit 0~7)
HAND Fault oL Inverter oL	0015H	Overload. The AC motor drive detects excessive drive output current. NOTE: The AC motor drive can withstand up to 150% of the rated current for a maximum of 60 seconds.	2310H	1
HAND Fault EoL1 Thermal relay 1	0016H	Electronics thermal relay 1 protection	2310H	1
HAND Fault EoL2 Thermal relay 2	0017H	Electronics thermal relay 2 protection	2310H	1
HAND Fault ot1 Over torque 1	001AH	These two fault codes will be displayed when output current exceeds the over-torque detection level (Pr.06.07 or 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	001BH		8311H	3
HAND Fault uC Under torque 1	001CH	Low current	8321H	1
HAND Fault cF1 EEPROM write Err	001EH	Internal EEPROM can not be programmed.	5530H	5
HAND Fault cF2 EEPROM read Err	001FH	Internal EEPROM can not be read.	5530H	5
HAND Fault cd1 Ias sensor Err	0021H	U-phase error	FF04H	1
HAND Fault cd2 Ibs sensor Err	0022H	V-phase error	FF05H	1
HAND Fault cd3 Ics sensor Err	0023H	W-phase error	FF06H	1

Display	Fault code	Description	CANopen fault code	CANopen fault register (bit 0~7)
HAND Fault Hd0 cc HW Error	0024H	cc (current clamp) hardware error	FF07H	5
HAND Fault Hd1 oc HW Error	0025H	oc hardware error	FF08H	5
HAND Fault Hd2 ov HW Error	0026H	ov hardware error	FF09H	5
HAND Fault Hd3 GFF HW Error	0027H	GFF hardware error	FF0AH	5
HAND Fault AUE Auto tuning Err	0028H	Auto tuning error	FF21H	1
HAND Fault AFE PID Fbk Error	0029H	PID loss (ACI)	FF22H	7
HAND Fault ACE ACI loss	0030H	ACI loss	FF25H	1
HAND Fault EF External Fault	0031H	External Fault When input EF (N.O.) on external terminal is closed to GND, AC motor drive stops output U, V, and W.	9000H	5
HAND Fault EF1 Emergency stop	0032H	Emergency stop When the multi-function input terminals MI1 to MI6 are set to emergency stop, the AC motor drive stops output U, V, W and the motor coasts to stop.	9000H	5
HAND Fault bb Base block	0033H	External Base Block When the external input terminals MI1 to MI16 are set as bb and active, the AC motor drive output will be turned off	9000H	5

Display	Fault code	Description	CANopen fault code	CANopen fault register (bit 0~7)
HAND Fault Pcod Password Error	0034H	Password will be locked if three fault passwords are entered	FF26H	5
HAND Fault ccod SW code Error	0035H	Software error	6100H	5
HAND Fault cE1 Modbus CMD err	0036H	Illegal function code	7500H	4
HAND Fault cE2 Modbus ADDR err	0037H	Illegal data address (00H to 254H)	7500H	4
HAND Fault cE3 Modbus DATA err	0038H	Illegal data value	7500H	4
HAND Fault cE4 Modbus slave FLT	0039H	Data is written to read-only address	7500H	4
HAND Fault cE10 Modbus time out	003AH	Modbus transmission timeout.	7500H	5
HAND Fault cP10 Keypad time out	003BH	Keypad transmission timeout.	7500H	4
HAND Fault bF Braking fault	003CH	Brake resistor fault	7110H	4
HAND Fault ydc Y-delta connect	003DH	Motor Y-Δ switch error	3330H	2
HAND Fault dEb Dec. Energy back	003EH	Energy regeneration when decelerating	FF27H	2

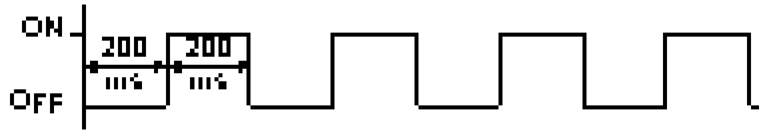
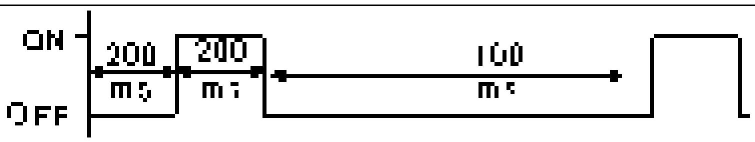
Display	Fault code	Description	CANopen fault code	CANopen fault register (bit 0~7)
HAND Fault oSL Over slip Error	003FH	Over slip error. Slip exceeds Pr.05.26 limit and slip duration exceeds Pr.05.27 setting.	FF28H	7
HAND Fault ocU Unknow Over Apm	0042H	over current caused by unknown reason	2310H	1
HAND Fault ovU Unknow Over volt.	0043H	over voltage caused by unknown reason	3210H	2
HAND Fault S1 S1-Emergy stop	0049H	external safety emergency stop	FF2AH	5
HAND Fault OPHL U phase lacked	0052H	U phase output phase loss	2331H	2
HAND Fault OPHL U phase lacked	0053H	V phase output phase loss	2332H	2
HAND Fault OPHL U phase lacked	0054H	W phase output phase loss	2333H	2
HAND Fault aocc A phase short	004FH	A phase short	FF2BH	1
HAND Fault bocc B phase short	0050H	B phase short	FF2CH	1
HAND Fault cocc C phase short	0051H	C phase short	FF2DH	1
HAND Fault CGdE Guarding T-out	0065H	Guarding time-out 1	8130H	4

Display	Fault code	Description	CANopen fault code	CANopen fault register (bit 0~7)
HAND Fault CHbE Heartbeat T-out	0066H	Heartbeat time-out	8130H	4
HAND Fault CSyE SYNC T-out	0067H	CAN synchrony error	8700H	4
HAND Fault CbFE CAN/S bus off	0068H	CAN bus off	8140H	4
HAND Fault CIdE CAN/S Idx exceed	0069H	Can index exceed	8110H	4
HAND Fault CAdE CAN/S add. set	006AH	CAN address error	0x8100	4
HAND Fault CFdE CAN/S FRAM fail	006BH	CAN frame fail	0x8100	4
HAND Fault ictE InrCom Time Out	006FH	Internal communication error	7500H	4

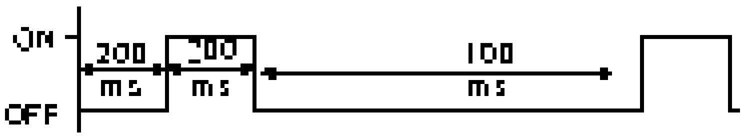
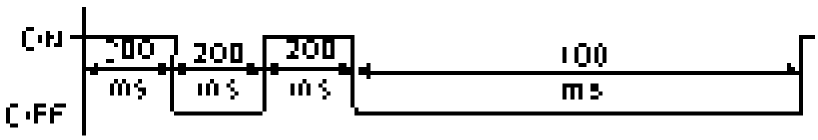
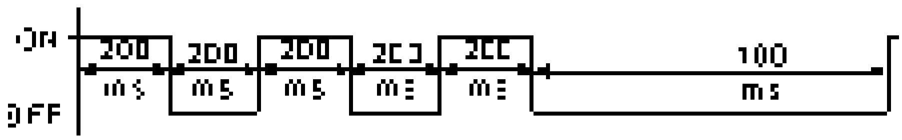
15.6 CANopen LED Function

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 Applications

16-1 PLC Summary

16-1-1 Introduction

The commands provided by the CP2000's built-in PLC functions, including the ladder diagram editing tool WPLSoft, as well as the usage of basic commands and applications commands, chiefly retain the operating methods of Delta's PLC DVP series.

16-1-2 WPLSoft ladder diagram editing tool

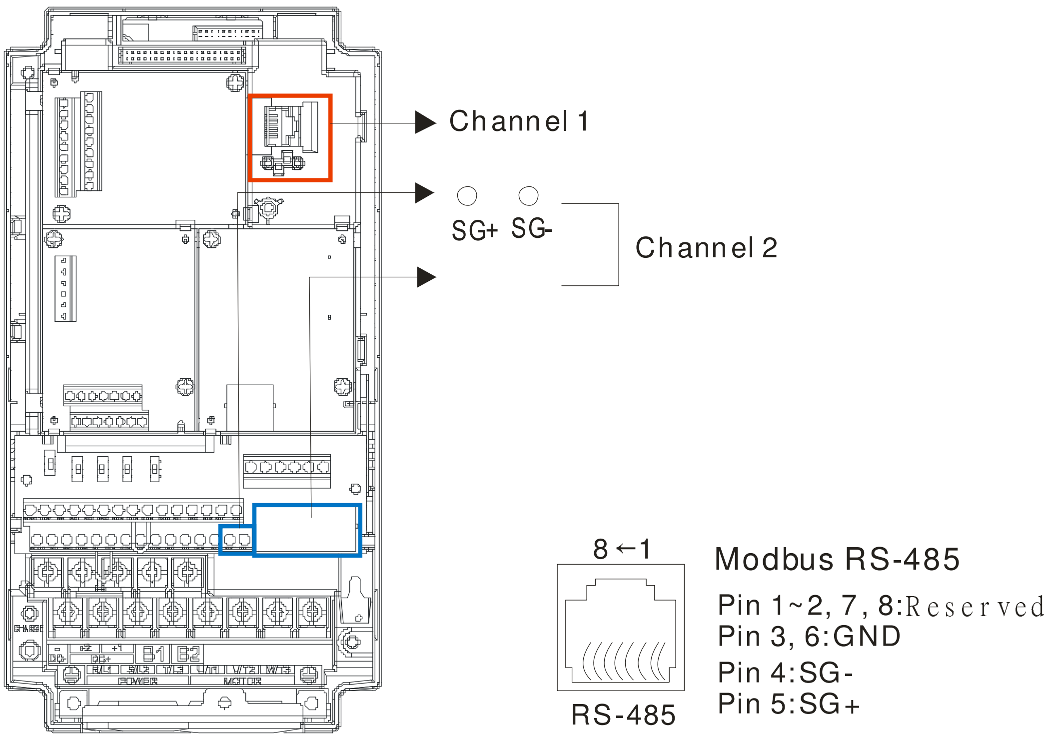
WPLSoft is Delta's program editing software for the DVP and CP2000 programmable controllers in the Windows operating system environment. Apart from general PLC program design general Windows editing functions (such as cut, paste, copy, multiple windows, etc.), WPLSoft also provides many Chinese/English annotation editing and other convenience functions (such as registry editing, settings, file reading, saving, and contact graphic monitoring and settings, etc.).

The following basic requirements that need to install WPLSoft editing software:

Item	System requirements
Operating system	Windows 95/98/2000/NT/ME/XP
CPU	At least Pentium 90
Memory	At least 16MB (we recommend at least 32MB)
Hard drive	Hard drive capacity: at least 100MB free space One optical drive (for use in installing this software)
Display	Resolution: 640×480, at least 16 colors; it is recommended that the screen area be set at 800×600 pixels
Mouse	Ordinary mouse or Windows-compatible device
Printer	Printer with a Windows driver program
RS-485 port	Must have at least an RS-485 port to link to the PLC

16-2 Notes before PLC use

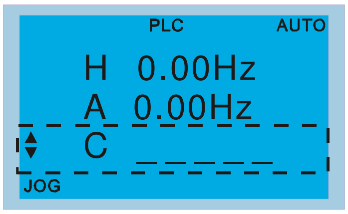
1. The PLC has a preset communications format of 7,N,2,9600, with node 2; the PLC node can be changed in parameter 09-35, but this address may not be the same as the converter's address setting of 09-00.
2. The CP2000 provides 2 communications serial ports that can be used to download PLC programs (see figure below). Channel 1 has a fixed communications format of 19200,8,N,2 RTU.



3. The client can simultaneously access data from the converter and internal PLC, which is performed through identification of the node. For instance, if the converter node is 1 and the internal PLC node is 2, then the client command will be
   01 (node) 03 (read) 0400 (address) 0001 (1 data item), indicating that it must read the data in converter parameter 04-00
   02 (node) 03 (read) 0400 (address) 0001 (1 data item), indicating that it must read the data in internal PLC X0
4. The PLC program will be disabled when uploading/downloading programs.
5. Please note when using WPR commands to write in parameters, values may be modified up to a maximum of 10^9 times, otherwise a memory write error will occur. The calculation of modifications is based on whether the entered value has been changed. If the entered value is left unchanged, the modifications will not increase afterwards. But if the entered value is different from before, the number of modifications will increase by one. Those parameters in the table below are exceptions, please proceed to the next page for details:

	CP2000
Pr00-10, Control mode	-----
Pr00-11, Velocity mode;	Yes
Pr00-12, P2P mode	-----
Pr00-13, Torque mode	-----
Pr01-12~P01-19, 1st ~ 4th Acc/Dec time;	Yes
Pr02-12, MULTI-Input ACT;	Yes
Pr02-18,MULTI-Output ACT	Yes
Pr04-50~Pr04-59 PLC buffer 1~10;	Yes
Pr08-04,Up Limit for I	Yes
Pr08-05,PID Out-Limit %;	Yes
Pr10-17, Electrical Gear A	-----

6. When parameter 00-04 is set as 28, the displayed value will be the value of PLC register D1043 (see figure below):

Digital Keypad KPC-CC01	Digital Keypad KPC-CE01
Can display 0~65535  	0~9999  When more than 9999 

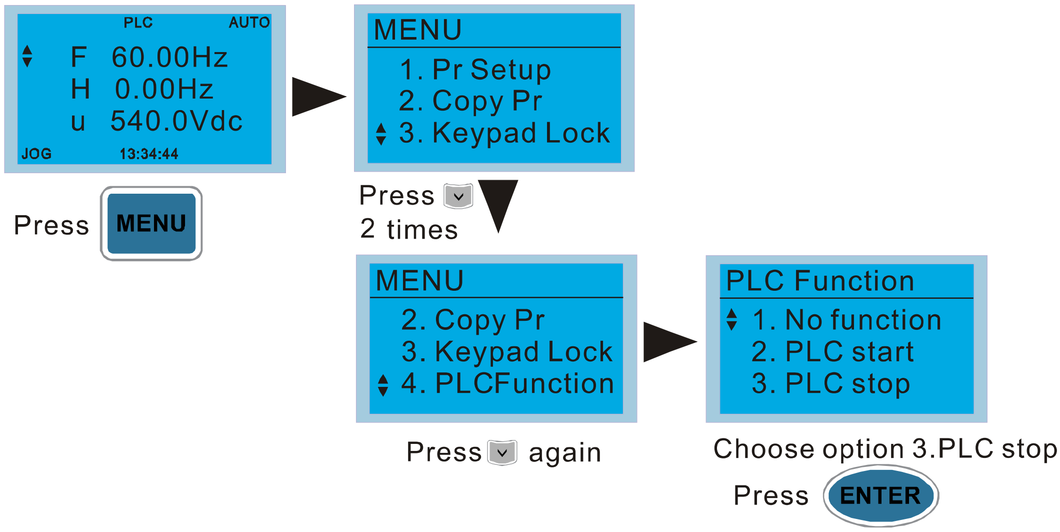
7. In the PLC Run and PLC Stop mode, the content 9 and 10 of parameter 00-02 cannot be set and cannot be reset to the default value.
8. The PLC can be reset to the default value when parameter 00-02 is set as 6.
9. The corresponding MI function will be disabled when the PLC writes to input contact X.
10. When the PLC controls converter operation, control commands will be entirely controlled by the PLC and will not be affected by the setting of parameter 00-21.
11. When the PLC controls converter frequency commands (FREQ commands), frequency commands will be entirely controlled by the PLC, and will not be affected by the setting of parameter 00-20 or the Hand ON/OFF configuration.
12. When the PLC controls converter frequency (TORQ commands), torque commands will be entirely controlled by the PLC, and will not be affected by the setting of parameter 11-33 or the Hand ON/OFF configuration.
13. When the PLC controls converter frequency (POS commands), position commands will be entirely controlled by the PLC, and will not be affected by the setting of parameter 11-40 or the Hand ON/OFF configuration.
14. When the PLC controls converter operation, if the keypad Stop setting is valid, this will trigger an FStP error and cause stoppage.

16-3 Turn on

16-3-1 Connect to PC

Start operation of PLC functions in accordance with the following four steps

1. After pressing the Menu key and selecting 4: PLC Function on the KPC-CC01 digital keypad, press the Enter key (see figure below).



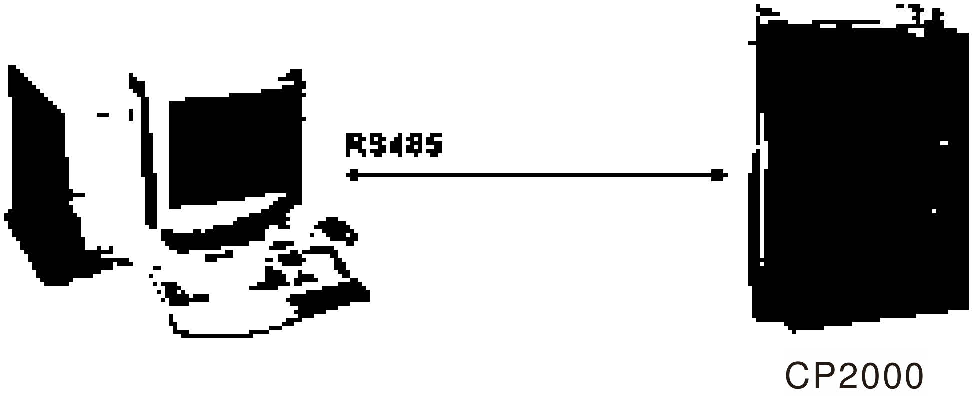
NOTE

If the optional KPC-CE01 digital keypad is used, employ the following method:

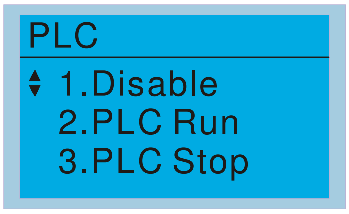
Switch to the main PLC2 screen: After powering up the drivers, press the  key on the KPC-CE01 once to switch to the function screen, which will then display "PrSET." After using the  up or down button to switch to the "PLC" screen, and then press  to enter PLC function settings. Afterwards, press the Up key to switch to "PLC2," and then press . The screen will now display "PLSn" and flash, indicating that the internal PLC currently has no program, and this error message can be ignored. If the PLC has an editing program, the screen will display "End," and will jump back to "PLC2" after 1 to 2 seconds. When no program has been downloaded to the drivers, the program can continue to run even if a PLC warning message appears.

Disable PLC RUN PLC STOP

2. Wiring: Connect the driver's RJ-45 communications interface to a PC via the RS485



3. PLC function usage



- PLC functions are as shown in the figure on the left; select item 2 and implement PLC functions.

1: No function (Disable)
2: Enable PLC (PLC Run)
3: Stop PLC functions (PLC Stop)

Optional product: PLC function display method on KPC-CE01 digital keypad	PLC 0 : Do not implement PLC functions PLC 1 : Initiate PLC Run PLC 2 : Initiate PLC Stop

- When the external multifunctional input terminals (MI1 to MI8) are in PLC Mode select bit0 (51) or PLC Mode select bit1 (52), and the terminal contact is closed or open, it will compulsorily switch to the PLC mode, and keypad switching will be ineffective. Corresponding actions are as follows:

PLC mode		PLC Mode select bit1(52)	PLC Mode select bit0 (51)
Using KPC-CC01	Using KPC-CE01		
Disable	PLC 0	OFF	OFF
PLC Run	PLC 1	OFF	ON
PLC Stop	PLC 2	ON	OFF
Maintain previous state	Maintain previous state	ON	ON

Use of KPC-CE01 digital keypad to implement PLC functions

☑ When the PLC screen switches to the PLC1 screen, this will trigger one PLC action, and the PLC program start/stop can be controlled by communications via the WPL.

☑ When the PLC screen switches to the PLC2 screen, this will trigger one PLC stop, and the PLC program start/stop can be controlled by communications via the WPL.

☑ The external terminal control method is the same as shown in the table above.

NOTE

- When input/output terminals (FWD REV MI1 to MI8 MI10 to 15, Relay1~3RY10 to RY15, MO10 to MO11,) are included in the PLC program, these input/output terminals will only be used by the PLC. As an example, when the PLC program controls Y0 during PLC operation (PLC1 or PLC2), the corresponding output terminal relay(RA/RB/RC) will operate in accordance with the program. At this time, the multifunctional input/output terminal setting will be ineffective. Because these terminal functions are already being used by the PLC, the DI DO AO in use by the PLC can be determined by looking at parameter 02-52, 02-53, and 03-30.

- When the PLC's procedures use special register D1040, the corresponding AO contact AFM1 will be occupied, and AFM2 corresponding to special register D1045 will have the same situation.
- Parameter 03-30 monitors the state of action of the PLC function analog output terminal; Bit0 corresponds to the AFM1 action state, and Bit1 corresponds to the AFM2 action state.

16-3-2 I/O device explanation

Input devices:

Serial No.	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: Control I/O |

2: Expansion card EMC-D611A (D1022=4)

3: Expansion card EMC-D42A (D1022=5)

Output devices:

Serial No.	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17
1	RY1	RY2	RY3													
2						MO10	MO11									
3						RY10	RY11	RY12	RY13	RY14	RY15					

1: Control I/O |

2: Expansion card EMC-D42A (D1022=5)

3: Expansion card EMC-R6AA (D1022=6)

16-3-3 Installation WPLSoft

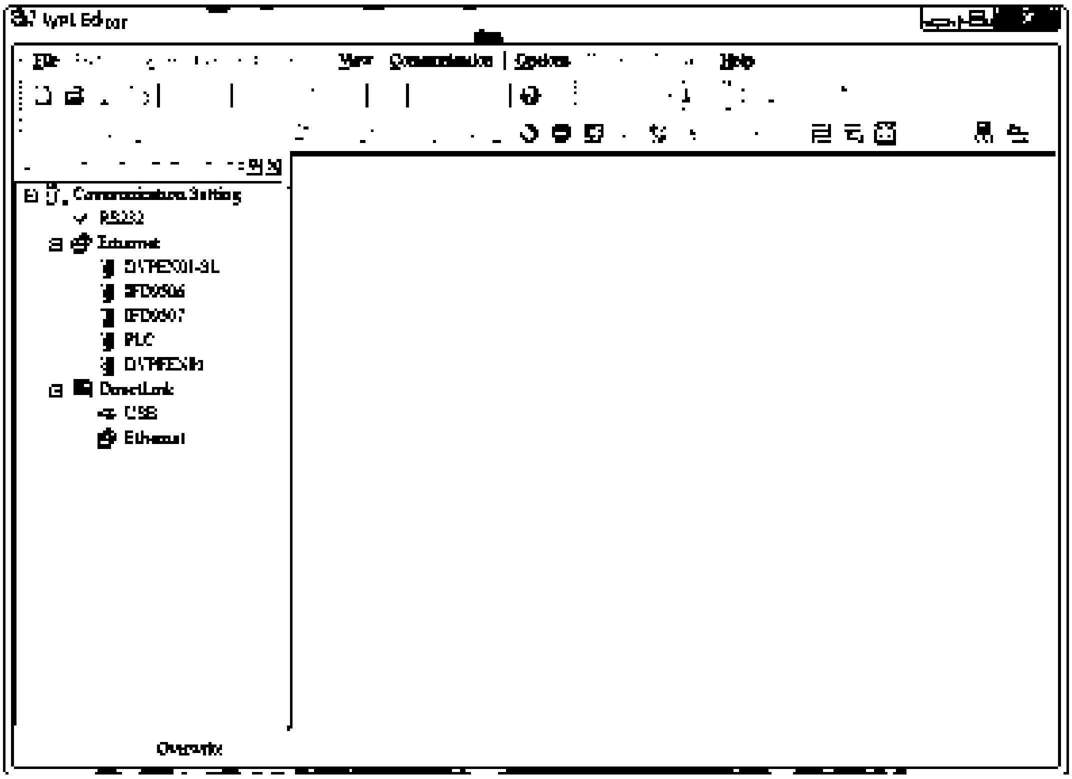
See Delta's website for WPLSoft editing software:

http://www.delta.com.tw/product/em/download/download_main.asp?act=3&pid=3&cid=1&tpid=3

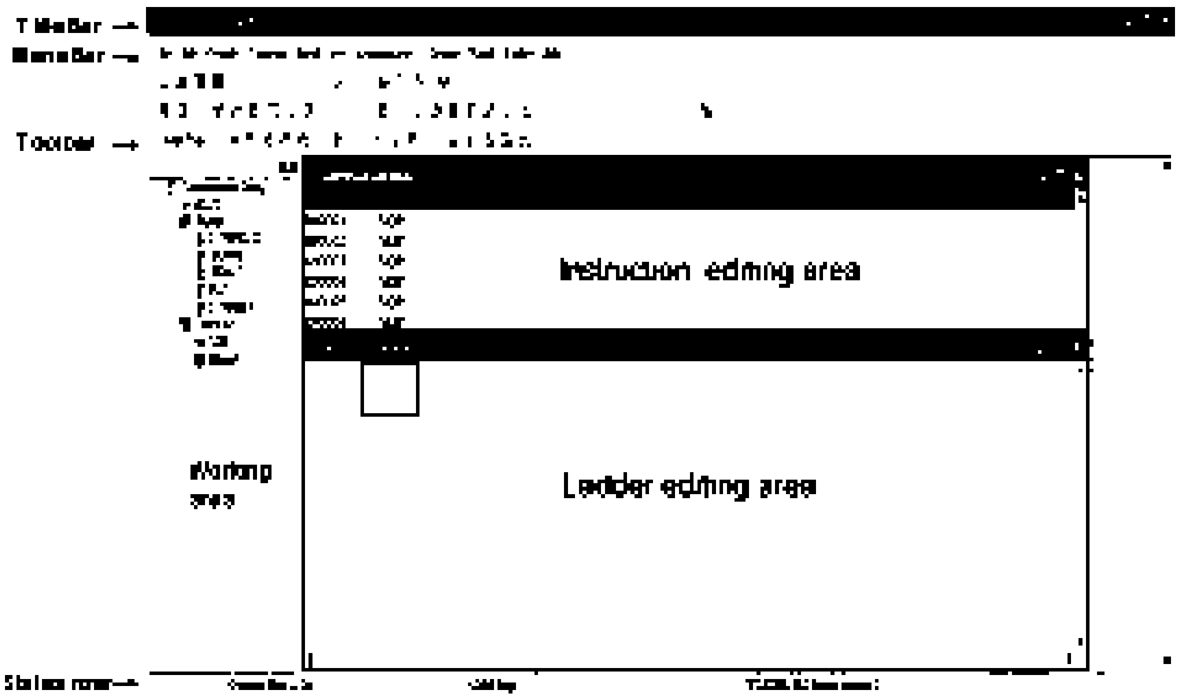
16-3-4 Program writing

After completing installation, the WPLSoft program will be installed in the designated subfolder "C:\Program Files\Delta Industrial Automation\WPLSoft x.xx." The editing software can now be run by clicking on the WPL icon using the mouse.

The WPL editing window will appear after 3 seconds (see figure below). When running WPLSoft for the first time, before "New file" has been used, only the "File (F)," "Communications (C)," View (V)," "Options (O)," and "Help (H)" columns will appear on the function toolbar.

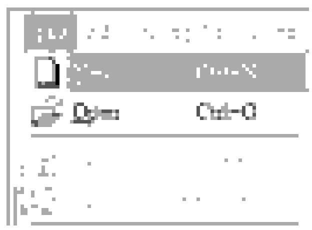


After running WPLSoft for the second time, the last file edited will open and be displayed in the editing window. The following figure provides an explanation of the WPLSoft editing software window:



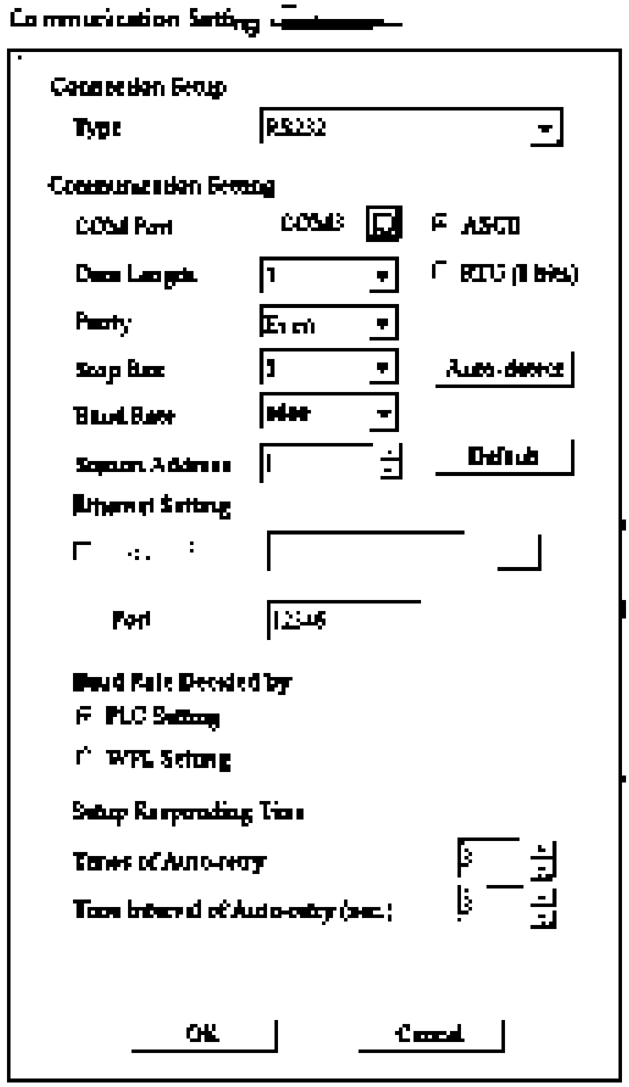
Click on the icon on the toolbar in the upper left part of the screen: opens new file (Ctrl+N)

You can also use "File (F)"=> New file (N) (Ctrl+N)

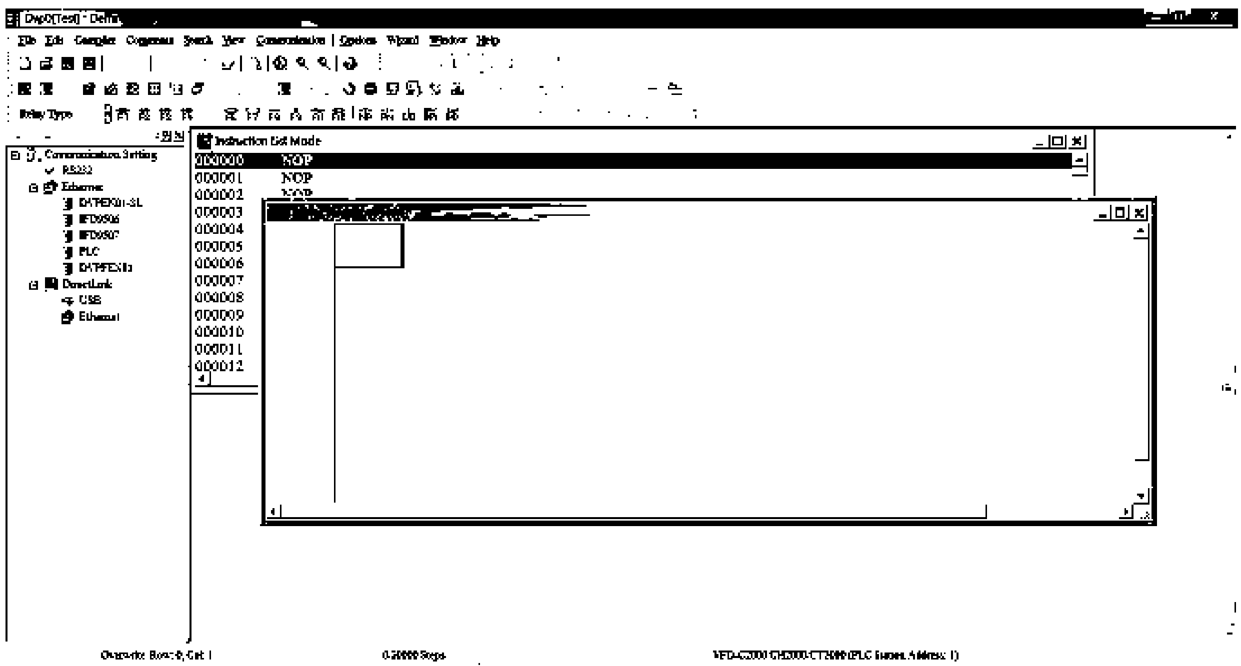


The "Device settings" window will appear after clicking. You can now enter the project title and filename, and select the device and communication settings to be used

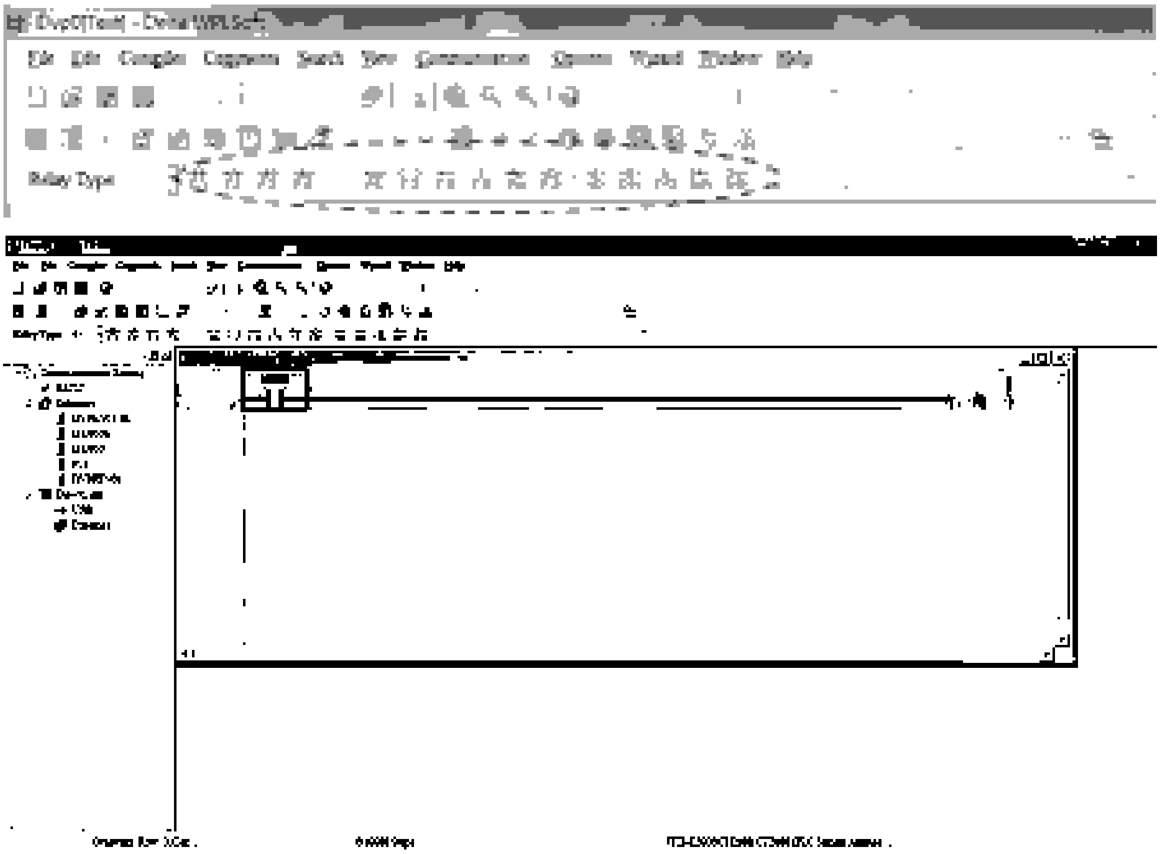
Communications settings: Perform settings in accordance with the desired communications method



Press Confirm after completing settings and begin program editing. There are two program editing methods; you can choose whether to perform editing in the command mode or the ladder diagram mode.

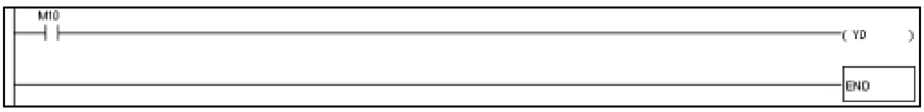


In ladder diagram mode, you can perform program editing using the buttons on the function icon row



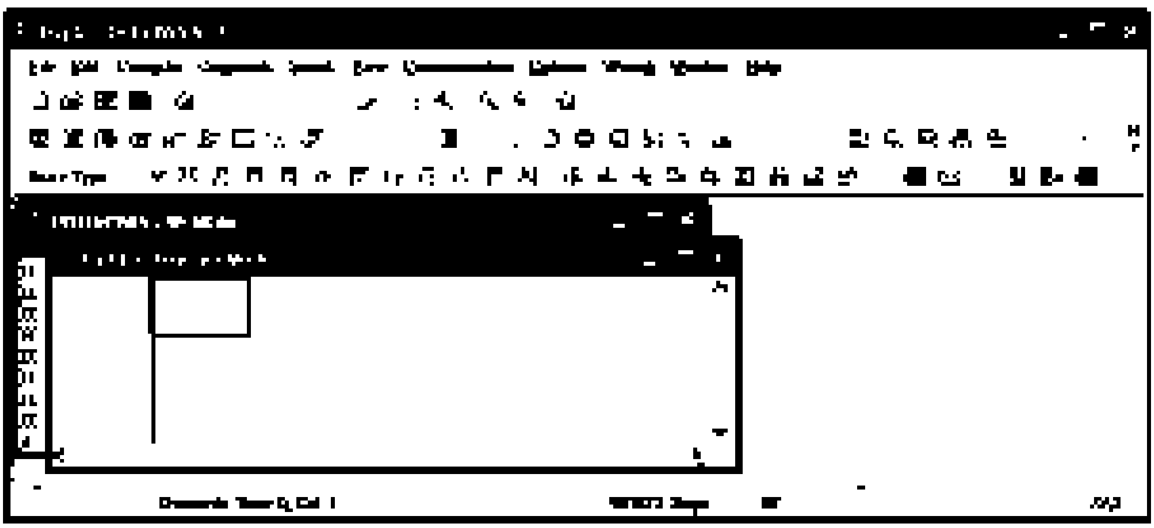
Basic Operation

Example: Input the ladder diagram in the following figure

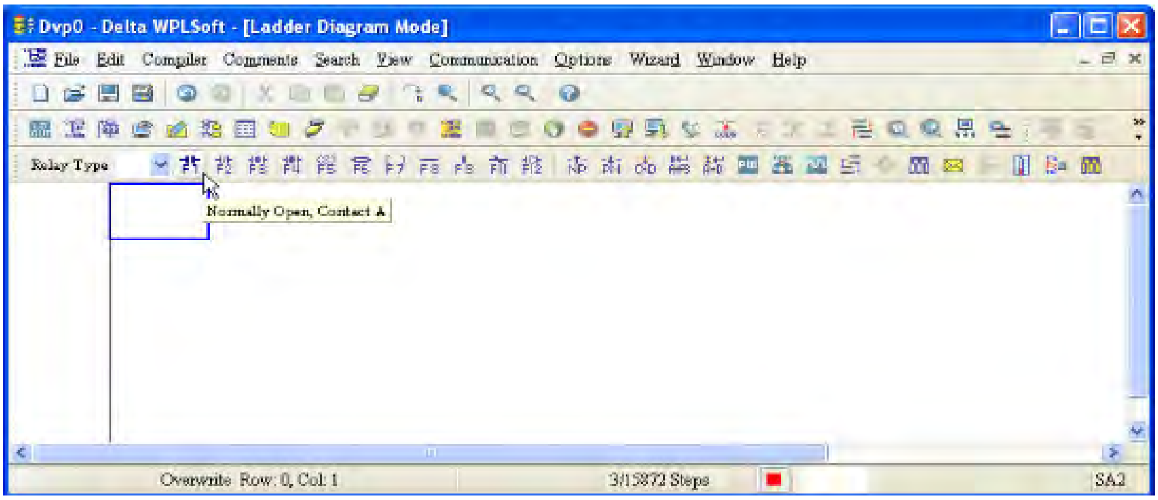


Mouse operation and keyboard function key (F1 to F12) operation

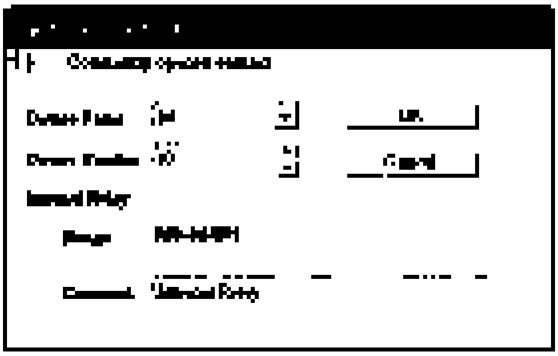
1. The following screen will appear after a new file has been established:



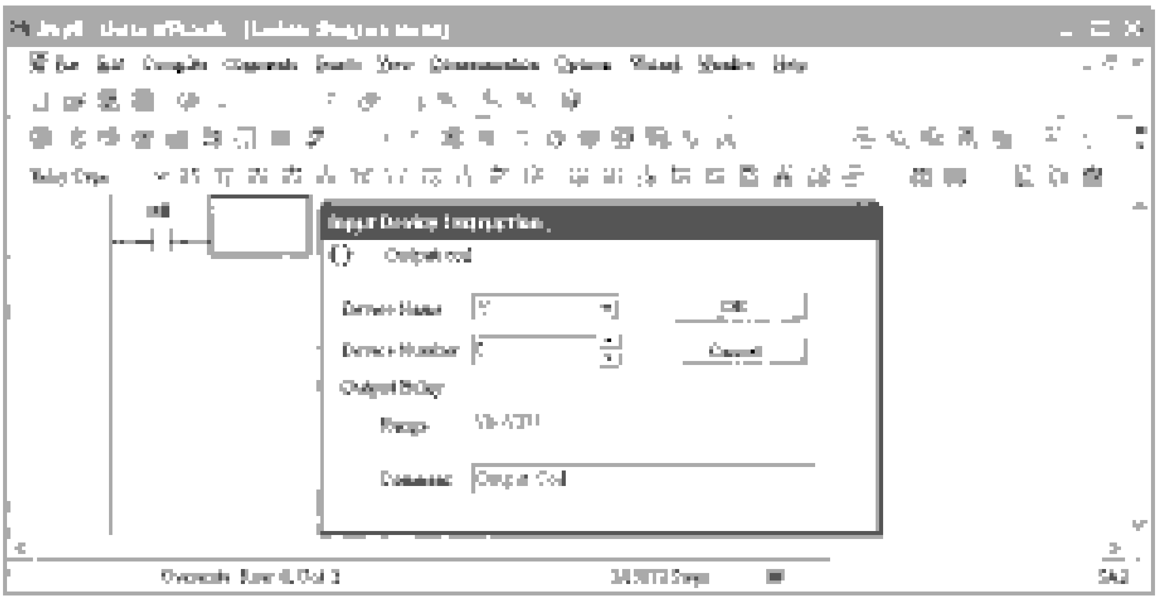
2. Use the mouse to click on the always-open switch icon or press the function key F1:



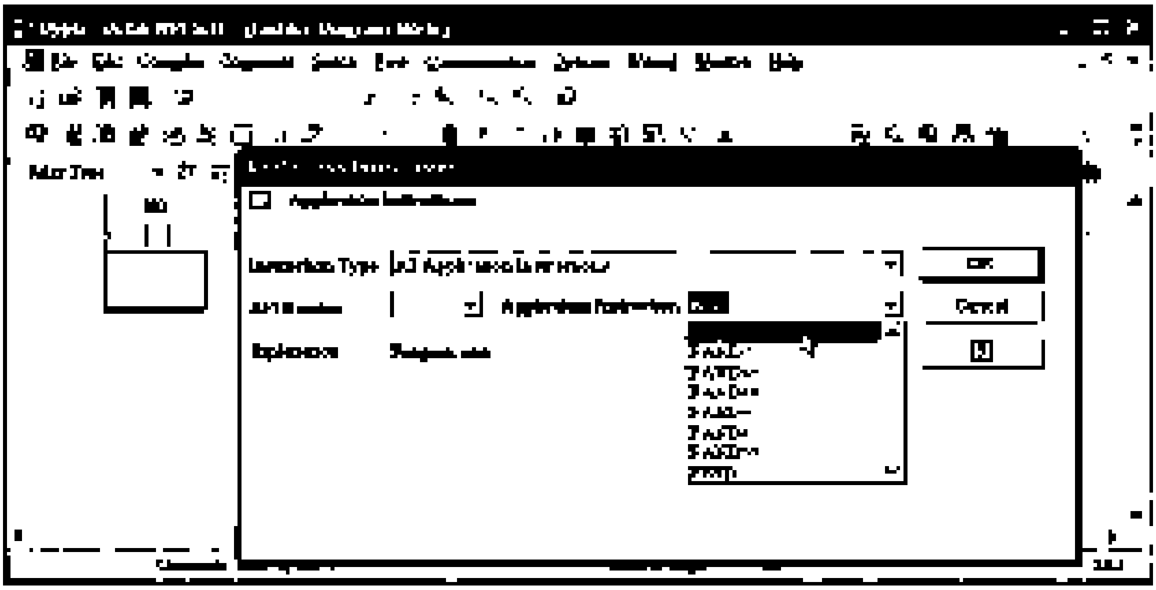
3. After the name of the input device and the comment dialog box have appeared, the device name (such as "M"), device number (such as "10"), and input comments (such as "auxiliary contact") can be selected; press the Confirm button when finished.



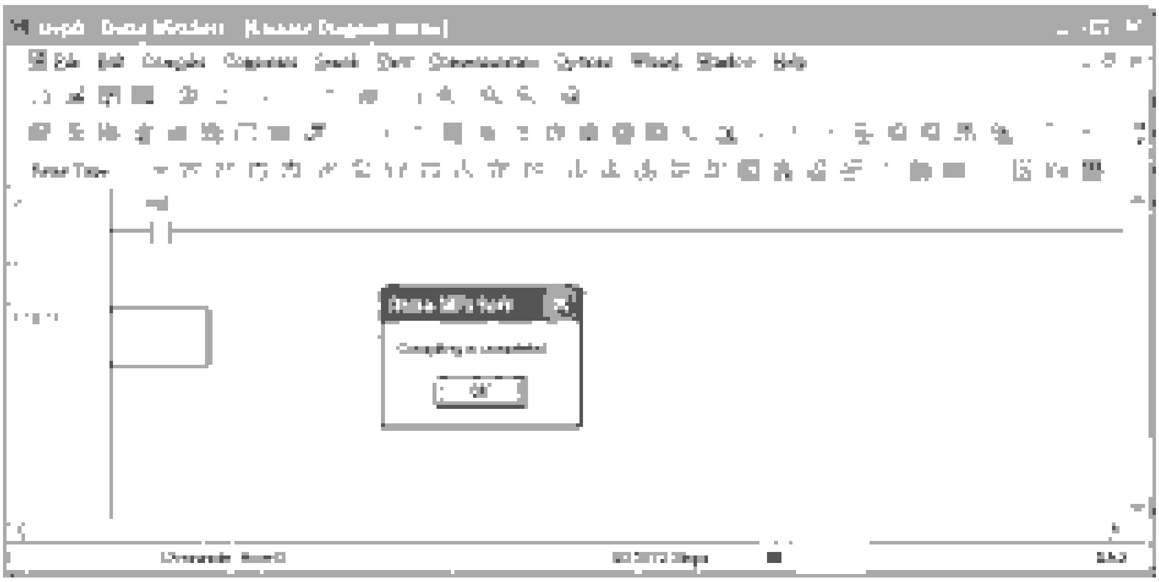
4. Click on the output coil icon or press function key F7. After the name of the input device and the comment dialog box have appeared, the device name (such as "Y"), device number (such as "0"), and input comments (such as "output coil") can be selected; press the Confirm button when finished.



5. Click on application command icon  or press function key F6. Click on "All application commands" in the function classification field, and click on the End command in the application command pull-down menu, or use the keyboard to key in "End" in that field, and press the confirm button.



6. Click on the  icon, which will compile the edited ladder diagram as a command program. After compiling, the number of steps will appear on the left side of the busbar.



16-3-5 Program download

After inputting a program using WPLSoft, select compile . After completing compilation, select the to download a program. WPLSoft will perform program download with the online PLC in the communications format specified in communications settings.

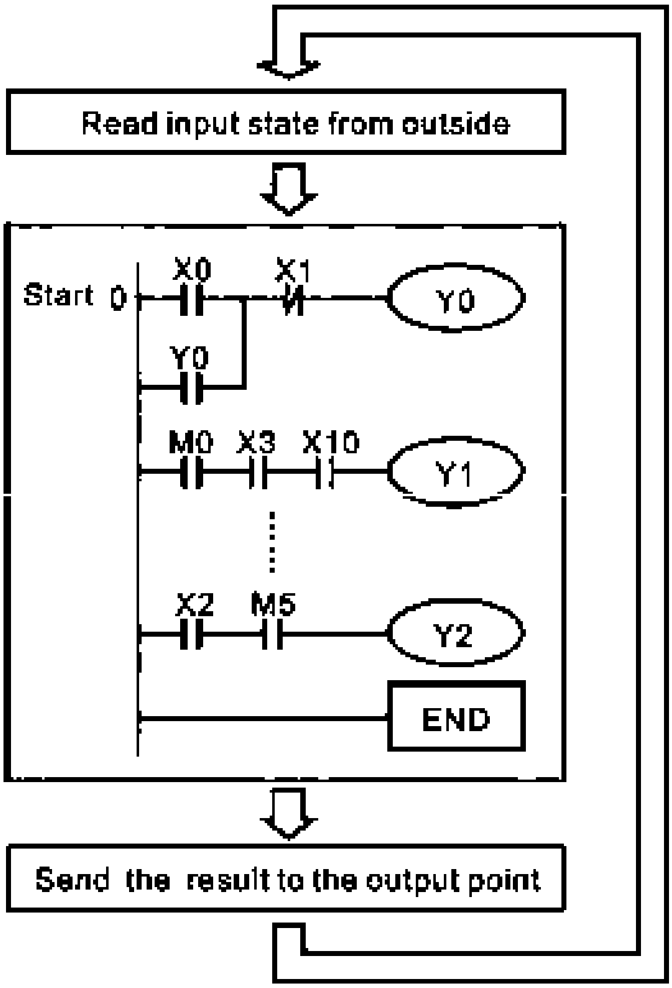
16-3-6 Program monitoring

While confirming that the PLC is in the Run mode, after downloading a program, click on in the communications menu and select start ladder diagram control (see figure below)

16-4 Basic principles of PLC ladder diagrams

16-4-1 Schematic diagram of PLC ladder diagram program scanning

Output results are calculated on the basis of the ladder diagram configuration (internal devices will have real-time output before results are sent to an external output point)



Repeated implementation

16-4-2 Introduction to ladder diagrams

Ladder diagrams comprise a graphic language widely applied in automatic control, and employs common electrical control circuit symbols. After a ladder diagram editor has been used to create a ladder pattern, PLC program designed is completed. The use of a graphic format to control processes is very intuitive, and is readily accepted by personnel who are familiar with electrical control circuit technology. Many of the basic symbols and actions in a ladder diagram comprise commonly-seen electrical devices in conventional automatic control power distribution panels, such as buttons, switches, relays, timers, and counters.

Internal PLC devices: The types and quantities of internal PLC devices vary in different brands of products. Although these internal devices use the same names as conventional electrical control circuit elements such as relays, coils, and contacts, a PLC does not actually contain these physical devices, and they instead correspond to basic elements in the PLC's internal memory (bits). For instance, if a bit is 1, this may indicate that a coil is electrified, and if that bit is 0, it will indicate that the coil is not electrified. An NO contact (Normal Open, or contact a) can be used to directly read the value of the corresponding bit, and an NC contact (Normal Close, or contact b) can be used to obtain the inverse of the bit's value. Multiple relays occupy multiple bits, and 8 bits comprise one byte; two bytes comprise one word, and two words comprise a double word. When multiple relays are processing at the same time (such as addition/subtraction or displacement, etc.), a byte, word, or double word can be used. Furthermore, a PLC contains two types of internal devices: a timer and a counter. It not only has a coil, but can count time and numerical values. Because of this, when it is necessary to process some numerical values, these values are usually in the form of bytes, words, or double words.

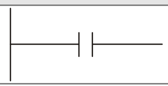
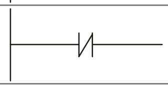
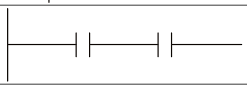
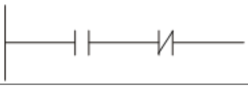
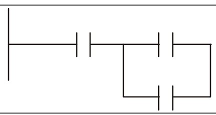
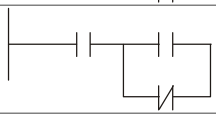
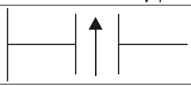
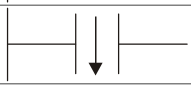
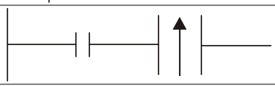
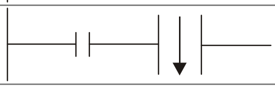
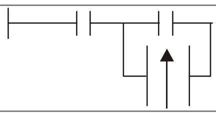
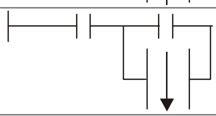
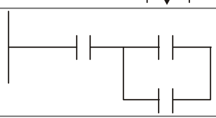
The various internal devices in a PLC all account for a certain quantity of storage units in the PLC's storage area. When these devices are used, the content of the corresponding storage area is red in the form of bits, bytes, or words.

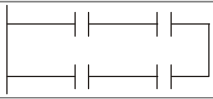
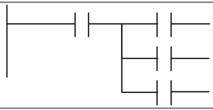
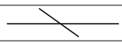
Introduction to the basic internal devices in a PLC

Device type	Description of Function
Input Relay	An input relay constitutes the basic unit of storage in a PLC's internal memory corresponding to an external input point (which serves as a terminal connecting with an external input switch and receiving external input signals). It is driven by external input signals, to which it assigns values of 0 or 1. A program design method cannot change the input relay status, and therefore cannot rewrite the corresponding basic units of an input relay, and WPLSoft cannot be used to perform compulsory On/Off actions. A relay's contacts (contacts a and b) can be used an unlimited number of times. An input relay with no input signal must be left idle and cannot be used for some other purpose. ☑ Device indicated as: X0, X1, X7, X10, X11, etc. This device is expressed with the symbol "X," and a device's order is indicated with an octal number. Input point numbers are indicated in Page 16-8. I/O devices explanation.
Output Relay	An output relay constitutes the basic unit of storage in a PLC's internal memory corresponding to an external output point (which connects with an external load). It may be driven by an input relay contact, a contact on another internal device, or its own contacts. It uses one NO contact to connect with external loads or other contacts, and, like input contacts, can use the contact an unlimited number of times. An output relay with no input signal will be idle, but may be used an internal relay if needed. ☑ Device indicated as: Y0, Y1, Y7, Y10, Y11, etc. This device is expressed with the symbol "Y," and a device's order is indicated with an octal number. Output point numbers are indicated in Page 16-8. I/O devices explanation.
Internal Relay	Internal relays have no direct connection with the outside. These relays are auxiliary relays inside a PLC. Their function is the same as that of an auxiliary (central) relay in an electrical control circuit: Each auxiliary relay corresponding to a basic unit of internal storage; they can be driven by input relay contacts, output relay contacts, and the contacts of other internal devices. An internal auxiliary relay's contact can also be used an unlimited number of times. Internal relays have no outputs to outside, and must output via an output point. ☑ Device indicated as: M0, M1 to M799, etc. This device is expressed as the symbol "M," expressed, and its order is expressed as a decimal number.
Counter	A counter is used to perform counting operations. A count setting value (such as the number of pulses to be counted) must be assigned when a counter is used. A counter contains a coil, contact, and a counting storage device. When the coil goes from Off →to On, this indicates that the counter has an input pulse, and one is added to its count. There are 16 bits that can be employed by the user. ☑ Device indicated as: C0, C1 to C79, etc. This device is expressed as the symbol "C," expressed, and its order is expressed as a decimal number.

Device type	Description of Function
Timer	A timer is used to complete control of timing. The timer contains a coil, contact, and a time value register. When the coil is electrified, if the preset time is reached, the contact will be actuated (contact a will close, contact b will open), and the timer's fixed value be given by the set value. Timer has a regulated clock cycle (timing units: 100 ms). As soon as power to the coil is cut off, the contact will no longer be actuated (contact a will open, contact b will close), and the original timing value will return to zero. ☑ Device indicated as: T0, T1 to T159, etc. The device is expressed as the symbol "T," and its order is expressed as a decimal number.
Data register	When a PLC is used to perform various types of sequence control and set time value and count value control, it most commonly perform data processing and numerical operations, and data registers are used exclusively for storage of data and various parameters. Each data register contains 16 bits of binary data, which means that it can store one word. Two data registers with adjacent numbers can be used to process double words. ☑ Device indicated as: D0, D1 to D399, etc. The device is expressed as the symbol "D," and its order is expressed as a decimal number.

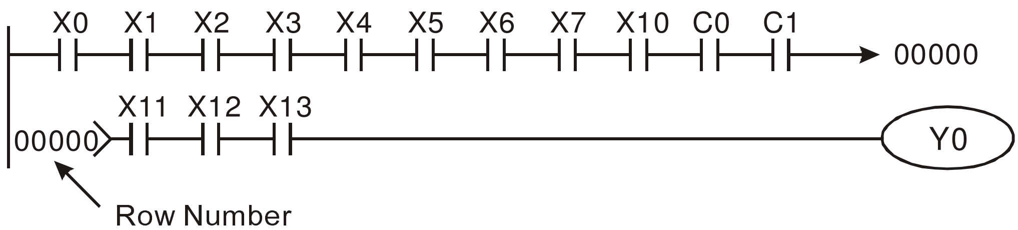
Ladder diagram images and their explanation

Ladder diagram structures	Explanation of commands	Command	Using Device
	NO switch, contact a	LD	X、Y、M、T、C
	NC switch, contact b	LDI	X、Y、M、T、C
	Series NO	AND	X、Y、M、T、C
	Series NC	ANI	X、Y、M、T、C
	Parallel NO	OR	X、Y、M、T、C
	Parallel NC	ORI	X、Y、M、T、C
	Positive edge-triggered switch	LDP	X、Y、M、T、C
	Negative edge-triggered switch	LDF	X、Y、M、T、C
	Positive edge-triggered series	ANDP	X、Y、M、T、C
	Negative edge-triggered series	ANDF	X、Y、M、T、C
	Positive edge-triggered parallel	ORP	X、Y、M、T、C
	Negative edge-triggered parallel	ORF	X、Y、M、T、C
	Block series	ANB	N/A

Ladder diagram structures	Explanation of commands	Command	Using Device
	Block parallel	ORB	N/A
	Multiple outputs	MPS MRD MPP	N/A
	Coil driven output commands	OUT	Y、M
	Some basic commands, applications commands	Some basic commands Applications commands	
	Inverted logic	INV	N/A

16-4-3 Overview of PLC ladder diagram editing

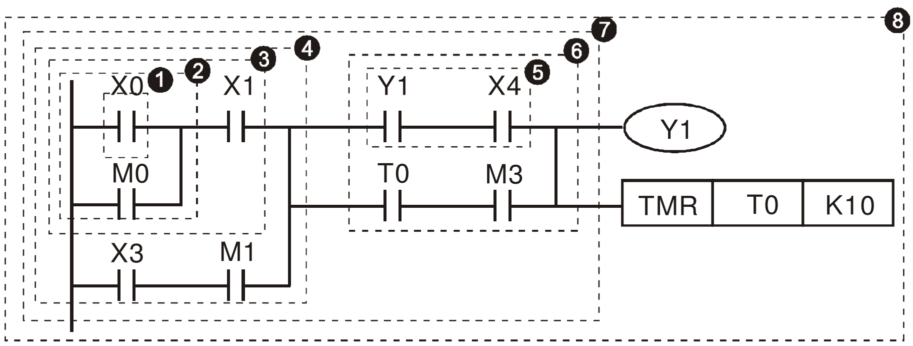
The program editing method begins from the left busbar and proceeds to the right busbar (the right busbar is omitted when editing using WPLSoft). Continue to the next row after completing each row; there is a maximum of 11 contacts on each row. If this is not sufficient, a continuous line will be will be generated to indicate the continued connection and more devices can be added. A continuous series of numbers will be generated automatically and identical input points can be used repeatedly. See figure below:



The ladder diagram programming method involves scanning from the upper left corner to the lower right corner. The coils and applications command computing box are handled in the output, and the ladder diagram is placed on the farthest right. Taking the figure below as an example, we can gradually analyze the procedural sequence of the ladder diagram. The number in the upper right corner gives the sequential order.

Explanation of command sequence

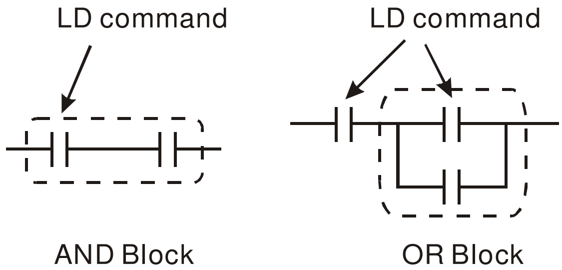
1	LD	X0
2	OR	M0
3	AND	X1
4	LD	X3
	AND	M1
	ORB	
5	LD	Y1
	AND	X4



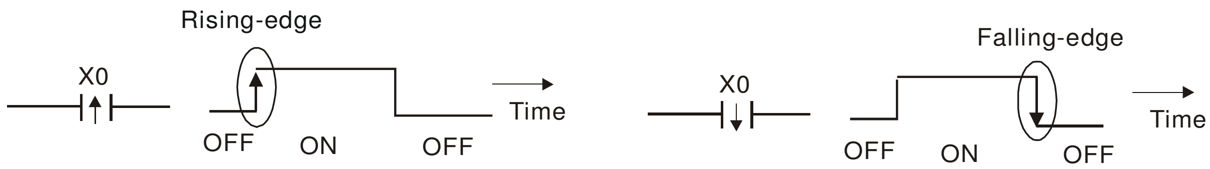
6	LD	T0	
	AND	M3	
	ORB		
7	ANB		
8	OUT	Y1	
	TMR	T0	K10

Explanation of basic structure of ladder diagrams

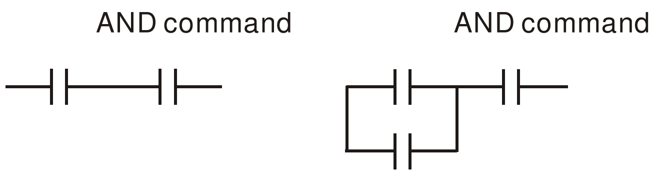
LD (LDI) command: An LD or LDI command is given at the start of a block.



LDP and LDF have this command structure, but there are differences in their action state. LDP, LDF only act at the rising or falling edge of a conducting contact. (see figure below):

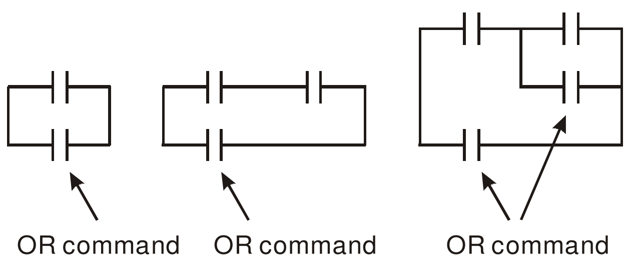


AND (ANI) command: A series configuration in which a single device is connected with one device or a block.



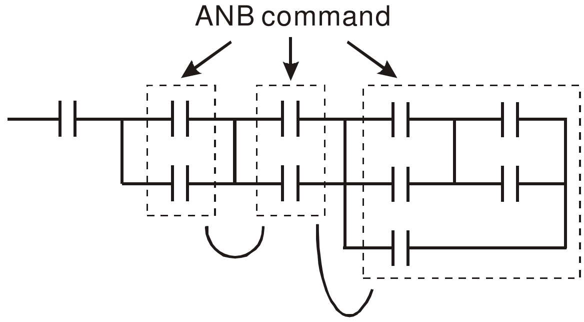
ANDP, ANDF also have structures like this, but their action occurs at the rising and falling edge.

OR (ORI) command: A single device is connected with one device or a block.

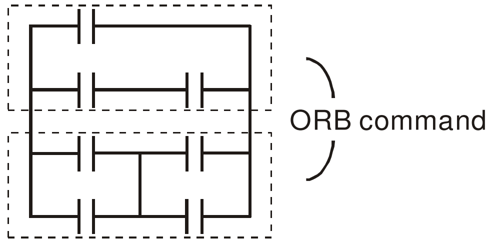


ORP, ORF also have identical structures, but their action occurs at the rising and falling edge.

ANB command: A configuration in which one block is in series with one device or block.



ORB command: A configuration in which one block is in parallel with one device or block.



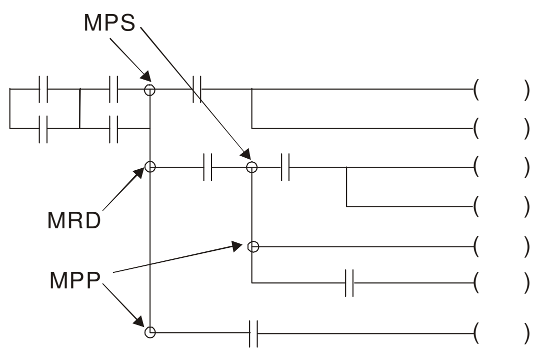
In the case of ANB and ORB operations, if a number of blocks are connected, they should be combined to form a block or network from the top down or from left to right.

MPS, MRD, MPP commands: Branching point memory for multiple outputs, enabling multiple, different outputs. The MPS command begins at a branching point, where the so-called branching point refers to the intersection of horizontal and vertical lines. We have to rely on the contact status along a single vertical line to determine whether the next contact can give a memory command. While each contact is basically able to give memory commands, in view of convenience and the PLC's capacity restrictions, this can be omitted from some places when converting a ladder diagram. The structure of the ladder diagram can be used to judge what kinds of contact memory commands are used.

MPS can be distinguished by use of the "┬" symbol; this command can be used consecutively for up to 8 times. The MRD command is read from branching point memory; because logic states along any one vertical line must be the same, in order to continue analysis of other ladder diagrams, the original contact status must be read.

MRD can be distinguished by use of the "├" symbol. The MPP command is read from the starting state of the uppermost branching point, and it is read from the stack (pop); because it is the final command along a vertical line, it indicates that the state of the vertical line can be concluded.

MPP can be distinguished by use of the "└" symbol. Although there should basically be no errors when using the foregoing analytical approach, the compiling program may sometimes omit identical state output, as shown in the following figure:



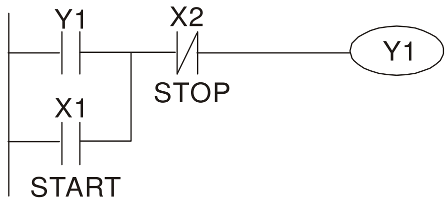
16-4-4 Commonly-used basic program design examples

Start, stop, and protection

Some applications may require a brief close or brief break using the buttons to start and stop equipment. A protective circuit must therefore be designed to maintain continued operation in these situations; this protective circuit may employ one of the following methods:

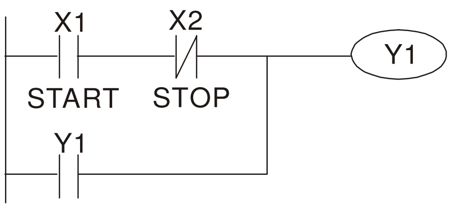
Example 1: Priority stop protective circuit

When the start NO contact X1=On, and the stop NC contact X2=Off, Y1=On; if X2=On at this time, coil Y1 will no longer be electrified, and this is therefore referred to as priority stop.



Example 2: Priority start protective circuit

When start NO contact X1=On, and the stop NC contact X2=Off, Y1=On, and coil Y1 will be electrified and protected. At this time, if X2=On, coil Y1 will still protect the contact and continue to be electrified, and this is therefore priority start.

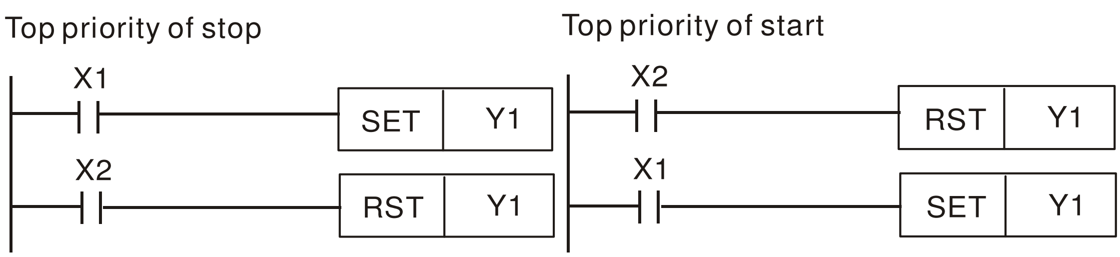


Example 3: Setting (SET) and reset (RST) command protective circuit

The following figure shows a protective circuit composed of RST and SET commands.

Priority stop occurs when the RST command is placed after the SET command. Because the PLC executes programs from the top down, at the end of the program, the state of Y1 will indicate whether coil Y1 is electrified. When X1 and X2 are both actuated, Y1 will lose power, and this is therefore priority stop.

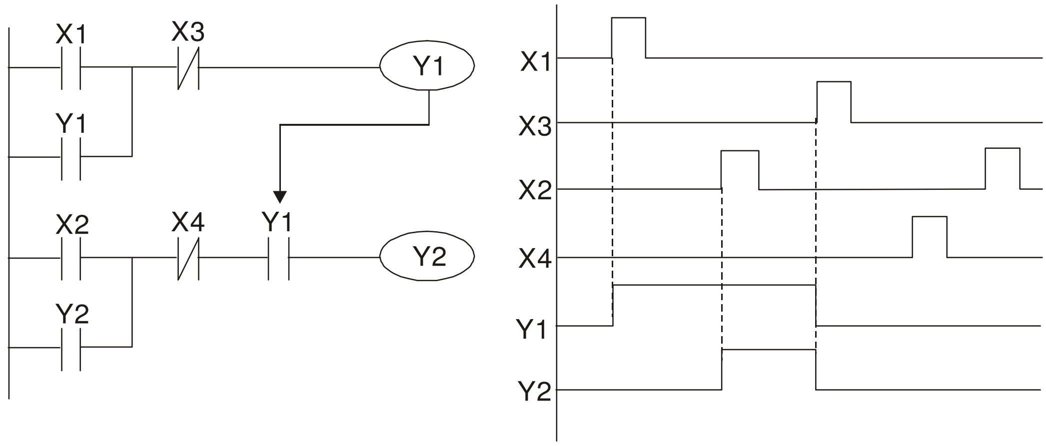
Priority start occurs when the SET command is placed after the RST command. When X1 and X2 are both actuated, Y1 will be electrified, and this is therefore priority start.



Commonly-used control circuits

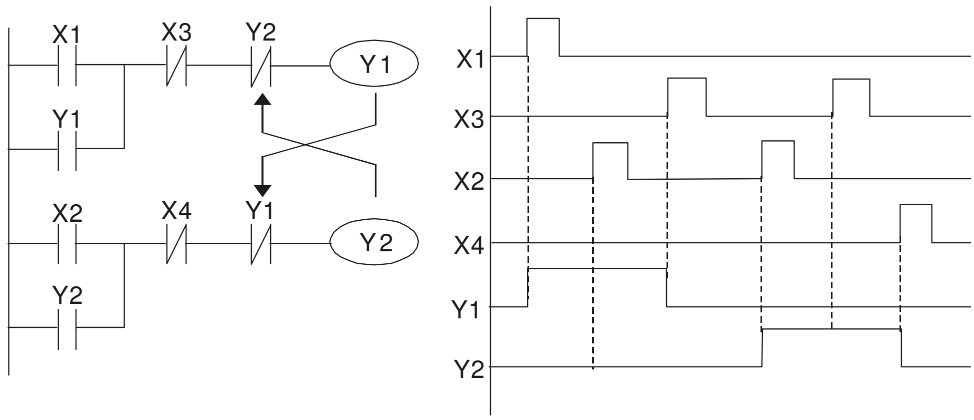
Example 4: Conditional control

X1, X3 are respectively start/stop Y1, and X2, X4 are respectively start/stop Y2; all have protective circuits. Because Y1's NO contact is in series with Y2's circuit, it becomes an AND condition for the actuation of Y2. The action of Y1 is therefore a condition for the action of Y2, and Y1 must be actuated before Y2 can be actuated.



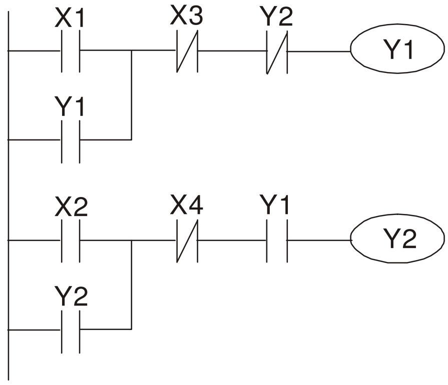
Example 5: Interlocking control

The figure below shows an interlocking control circuit. Depending on which of the start contacts X1, X2 is valid first, the corresponding output Y1 or Y2 will be actuated, and when one is actuated, the other will not be actuated. This implies that Y1 and Y2 cannot be actuated at the same time (interlocking effect). Even if both X1 and X2 are valid at the same time, because the ladder diagram program is scanned from the top down, it is impossible for Y1 and Y2 to be actuated at same time. This ladder diagram assigns priority only to Y1.



Example 6: Sequence control

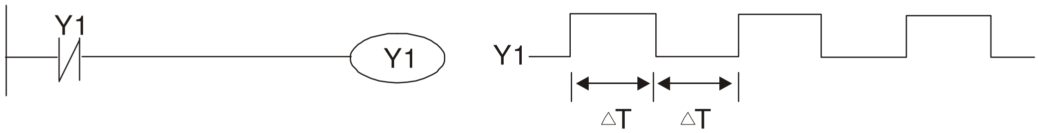
If the NC contact of Y2 in the interlocking control configuration of example 5 is put in series with the Y1 circuit, so that it is an AND condition for actuation of Y1 (see figure below), not only is Y1 a condition for the actuation of Y2 in this circuit, the actuation of Y2 will also stop the actuation of Y1. This configuration confirms the actuation order of Y1 and Y2.



Example 7: Oscillating circuit

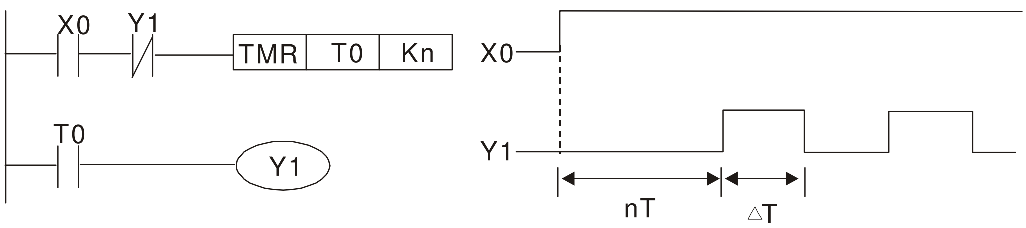
Oscillating circuit with a period of ΔT+ΔT

The figure below shows a very simple ladder diagram. When starting to scan the Y1 NC contact, because the Y1 coil has lost power, the Y1 NC contact will be closed. When the Y1 coil is then scanned, it will be electrified, and the output will be 1. When the Y1 NC contact is scanned in the scanning cycle, because Y1 coil is electrified, the Y1 NC contact will be open, the Y1 coil will then lose power, and the output will be 0. Following repeated scanning, the output of Y1 coil will have an oscillating waveform with a period of ΔT(On)+ΔT(Off).



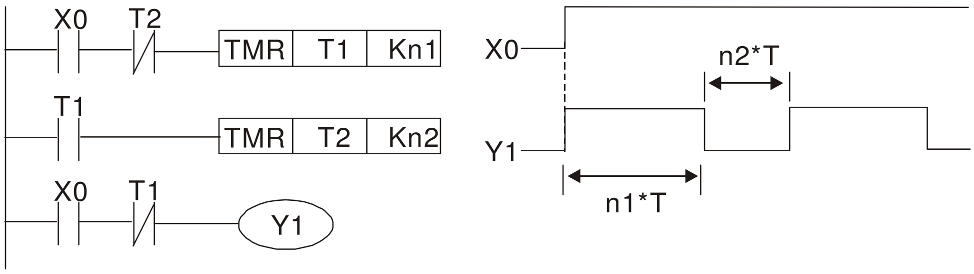
Oscillating circuit with a period of nT+ΔT

The program of the ladder diagram shown below uses timer T0 to control coil Y1's electrified time. After Y1 is electrified, it causes timer T0 to close during the next scanning cycle, which will cause the output from Y1 to have the oscillating waveform shown in the figure below. Here n is the timer's decimal setting value, and T is the clock cycle of the timer.



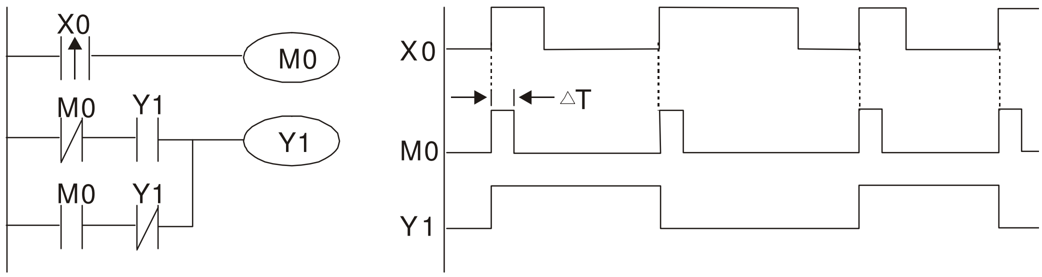
Example 8: Flashing circuit

The following figure shows an oscillating circuit of a type commonly used to cause an indicator light to flash or a buzzers to buzz. It uses two timers to control the On and Off time of Y1 coil. Here n1, n2 are the timing set values of T1 and T2, and T is the clock cycle of the timer.



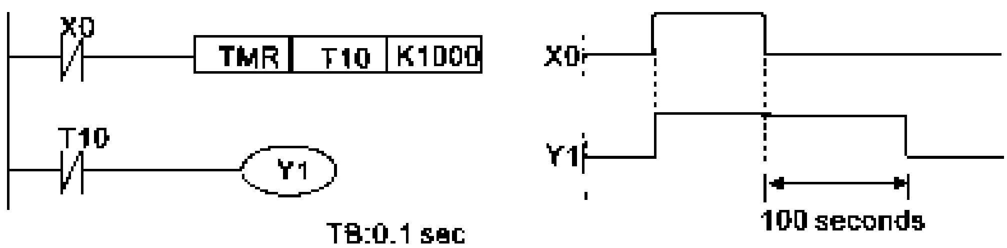
Example 9: Triggering circuit

In the figure below, a command consisting of the differential of the rising edge of X0 causes coil M0 to generate a single pulse for ΔT (length of one scanning cycle), and coil Y1 is electrified during this scanning cycle. Coil M0 loses power during the next scanning cycle, and NC contact M0 and NC contact Y1 are both closed. This causes coil Y1 to stay in an electrified state until there is another rising edge in input X0, which again causes the electrification of coil M0 and the start of another scanning cycle, while also causing coil Y1 to lose power, etc. The sequence of these actions can be seen in the figure below. This type of circuit is commonly used to enable one input to perform two actions in alternation. It can be seen from the time sequence in the figure below that when input X0 is a square wave signal with a period of T, the output of coil Y1 will be a square wave signal with a period of 2T.

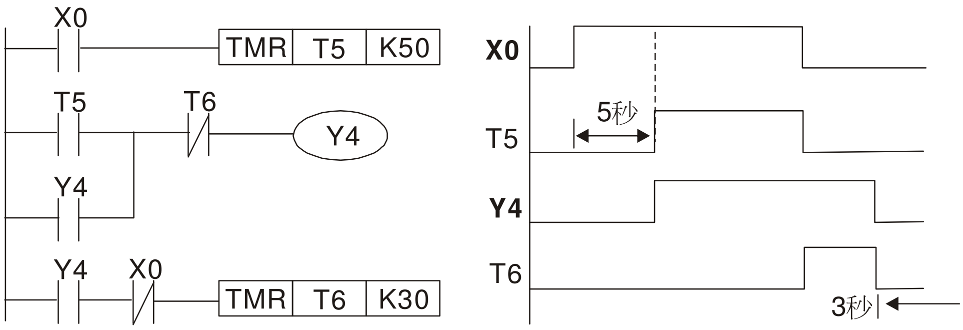


Example 10: Delay circuit

When input X0 is On, because the corresponding NC contact will be Off, the timer T10 will be in no power status, and output coil Y1 will be electrified. T10 will receive power and begin timing only after input X0 is Off, and output coil Y1 will be delayed for 100 sec. (K1000*0.1 sec. =100 sec.) before losing power; please refer to the sequence of actions in the figure below.

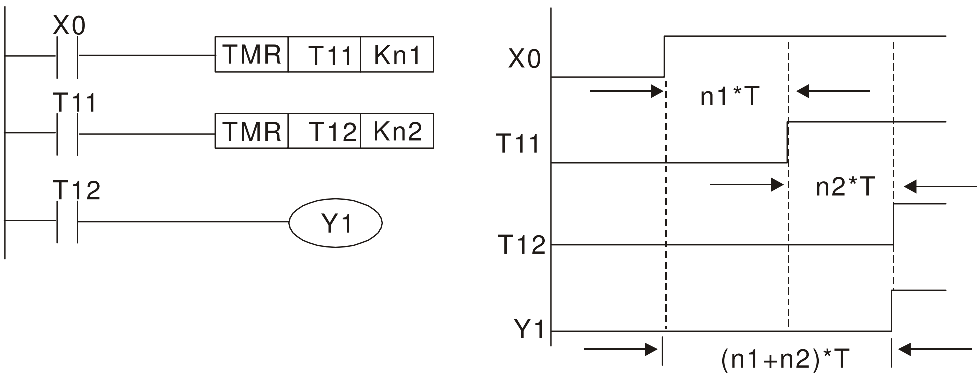


Example 11: The open/close delay circuit is composed of two timers; output Y4 will have a delay whether input X0 is On or Off.



Example 12: Extended timing circuit

In the circuit in the figure on the left, the total delay time from the moment input X0 closes to the time output Y1 is electrified is (n1+n2)*T, where T is the clock cycle. Timers: T11, T12; clock cycle: T.



16-5 Various PLC device functions

Item	Specifications	Notes
Algorithmic control method	Program stored internally, alternating back-and-forth scanning method	
Input/output control method	When it starts again after ending (after execution to the END command), the input/output has an immediate refresh command	
Algorithmic processing speed	Basic commands (several us);	Applications command (1-several tens of us)
Programming language	Command + ladder diagram	
Program capacity	10000 steps	
Input/output terminal	Input (X): 10, output (Y): 3	This number of contacts constitutes CP2000 input/output contacts; other devices have different correspondences

<table>
<tr><th>Type</th><th>Device</th><th colspan="2">Item</th><th colspan="2">Range</th><th>Function</th></tr>
<tr><td rowspan="7">Relay bit form</td><td>X</td><td colspan="2">External input relay</td><td>X0~X17, 16 points, octal number</td><td rowspan="2">Total 32 points</td><td>Corresponds to external input point</td></tr>
<tr><td>Y</td><td colspan="2">External output relay</td><td>Y0~Y17, 16 points, octal number</td><td>Corresponds to external output point</td></tr>
<tr><td rowspan="2">M</td><td rowspan="2">Auxiliary Relay</td><td>General Use</td><td>M0~M799, 800 points</td><td rowspan="2">Total 880 points</td><td rowspan="2">Contact can switch On/Off within the program</td></tr>
<tr><td>Special purpose</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 160 points</td><td>Timers referred to by the TMR command; contact of the T with the same number will go On when the time is reached</td></tr>
<tr><td>C</td><td>Counter</td><td>16-bit counter, general use</td><td>C0~C79, 80 points</td><td>Total 80 points</td><td>Counter referred to by the CNT command; contact of the C with the same number will go On when the count is reached</td></tr>
<tr><td colspan="6"></td></tr>
<tr><td rowspan="4">Register word data</td><td>T</td><td colspan="2">Current timer value</td><td colspan="2">T0~T159, 160 points</td><td>The contact will be On when the time is reached</td></tr>
<tr><td>C</td><td colspan="2">Current counter value</td><td colspan="2">C0~C79, 16-bit counter 80 points</td><td>The counter contact will come On when the count is reached</td></tr>
<tr><td rowspan="2">D</td><td rowspan="2">Data Register</td><td>Used to maintain power Off</td><td>D0~D399, 400 points</td><td rowspan="2">Total 1400 points</td><td rowspan="2">Used as data storage memory area</td></tr>
<tr><td>Special purpose</td><td>D1000~D1199, 200 points
D2000~D2799, 800 points</td></tr>
<tr><td rowspan="2">Constant</td><td rowspan="2">K</td><td rowspan="2">Decimal</td><td>Single-byte</td><td colspan="3">Setting Range: K-32,768 ~ K32,767</td></tr>
<tr><td>Double-byte</td><td colspan="3">Setting Range: K-2,147,483,648~K2,147,483,647</td></tr>
</table>

	H	Hexadecimal	Single-byte	Setting Range:H0000 ~ HFFFF
			Double-byte	Setting Range: H00000000 ~ HFFFFFFFF
Serial communications port (program write/read)				RS-485/keypad port
Input/output				Built-in three analog inputs and two analog outputs
Function expansion module			Optional Accessories	EMC-D42A; EMC-R6AA; EMCD611A
Communication Expansion Module			Optional Accessories	EMC-COP01,(CANOpen)

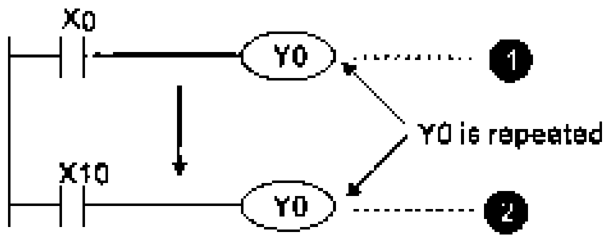
16-5-1 Introduction to device functions

Input/output contact functions

Input contact X functions: Input contact X is connected with an input device, and reads input signals entering the PLC. The number of times that contact a or b of input contact X is used in the program is not subject to restrictions. The On/Off state of input contact X will change as the input device switches On and Off; a peripheral device (WPLSoft) cannot be used to force contact X On or Off.

Output contact Y functions

The job of output contact Y is to send an On/Off signal to drive the load connected with output contact Y. Output contacts consist of two types: relays and transistors. While number of times that contact a or b of each output contact Y is used in the program is not subject to restrictions, it is recommended that the number of output coil Y be used only once in a program, otherwise the right to determine the output state when the PLC performs program scanning will be assigned to the program's final output Y circuit.



The output of Y0 will be decided by circuit 2 , i.e. decided by On/Off of X10.

Numerical value, constant [K]/[H]

Constant	Single-byte	K	Decimal	K-32,768 ~ K32,767
	Double-byte			K-2,147,483,648~K2,147,483,647
	Single-byte	H	Hexadecimal	H0000 ~ HFFFF
	Double-byte			H00000000 ~ HFFFFFFFF

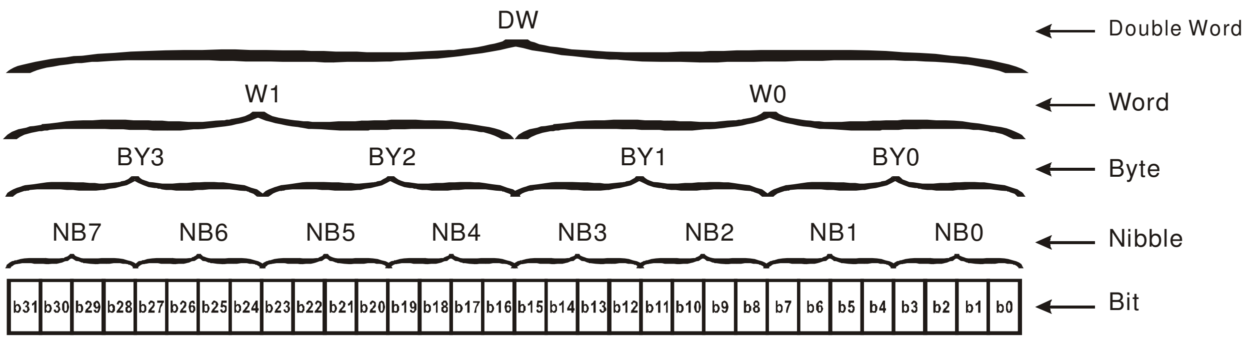
The PLC can use five types of numerical values to implement calculations based on its control tasks; the following is an explanation of the missions and functions of different numerical values.

Binary Number, BIN

The PLC's numerical operations and memory employ binary numbers. Binary nibbles and relevant terms are explained as follows:

Bit	Bits are the fundamental units of binary values, and have a state of either 1 or 0
Nibble	Comprised of a series of 4 bits (such as b3-b0); can be used to express a one-nibble decimal number 0-9 or hexadecimal number: 0-F.
Byte	Comprised of a series of two nibbles (i.e. 8 bits, b7-b0); can express a hexadecimal number: 00-FF.
Word	Comprised of a series of two bytes (i.e. 16 bits, b15-b0); can express a hexadecimal number with four nibbles: 0000-FFFF.
Double Word	Comprised of a series of two words (i.e. 32 bits, b31-b0); can express a hexadecimal number with eight nibbles: 00000000-FFFFFFFF

Relationship between bits, digits, nibbles, words, and double words in a binary system (see figure below):



Octal Number, OCT

The external input and output terminals of a DVP-PLC are numbered using octal numbers

Example: External input: X0~X7，X10~X17…(Device number table);

External output: Y0~Y7，Y10~Y17…(Device number table)

Decimal Number, DEC

Decimal numbers are used for the following purposes in a PLC system:

The setting values of timer T or counter C, such as TMR C0 K50. (K constant)

The numbers of devices including M, T, C, or D, such as M10 or T30. (device number)

Used as a operand in an application command, such as MOV K123 D0. (K constant)

Binary Code Decimal, BCD

Uses one nibble or 4 bits to express the data in a decimal number; a series of 16 bits can therefore express a decimal number with 4 nibbles. Chiefly used to read the input value of a fingerwheel numerical switch input or output a numerical value to a seven-segment display driver.

Hexadecimal Number, HEX

Applications of hexadecimal numbers in a PLC system: Used as operands in application commands, such as MOV H1A2B D0. (H constant)

Constant K

Decimal numbers are usually prefixed with a "K" in a PLC system, such as K100. This indicates that it is a decimal number with a numerical value of 100.

Exceptions: K can be combined with bit device X, Y, M, or S to produce data in the form of a nibble, byte, word, or double word, such as in the case of K2Y10 or K4M100. Here K1 represents a 4-bit combination, and K2-K4 variously represent 8-, 12-, and 16-bit combinations.

Constant H

Hexadecimal numbers are usually prefixed with the letter "H" in a PLC system, such as in the case of H100, which indicates a hexadecimal number with a numerical value of 100.

Functions of auxiliary relays

Like an output relay Y, an auxiliary relay M has an output coil and contacts a and b, and the number of times they can be used in a program is unrestricted. Users can use an auxiliary relay M to configure the control circuit, but cannot use it to directly drive an external load. Auxiliary relays have the following two types of characteristics:

Ordinary auxiliary relays: Ordinary auxiliary relays will all revert to the Off state if a power outage occurs while the PLC is running, and will remain in the Off state if power is again turned down.

Special purpose auxiliary relays: Each special purpose auxiliary relay has its own specific use. Do not use any undefined special purpose auxiliary relays.

Timer functions

Timers take 100 ms as their timing units. When the timing method is an upper time limit, when the current timer value = set value, power will be sent to the output coil. Timer setting values consist of decimal K values, and the data register D can also serve as a setting value.

Actual timer setting time = timing units * set value

Counter features

Item	16-bit counter
Type	General Type
CT Direction:	Score:
Setting	0~32,767
Designation of set value	Constant K or data register D
Change in current value	When the count reaches the set value, there is no longer a count
Output contact	When the count reaches the set value, the contact comes On and stays On
Reset	The current value reverts to 0 when an RST command is executed, and the contact reverts to Off
Contact actuation	All are actuated after the end of scanning

Counter functions

When a counter's counting pulse input signal goes Off→On, if the counter's current value is equal to the set value, the output coil will come On. The setting value will be a decimal K values, and the data register D can also serve as a setting value.

16-bit counter C0-C79:

☑ 16-bit counter setting range: K0-K32,767. (when K0 and K1 are identical, the output contact will immediately be On during the first count.)

☑ The current counter value will be cleared from an ordinary counter when power is shut off to the PLC.

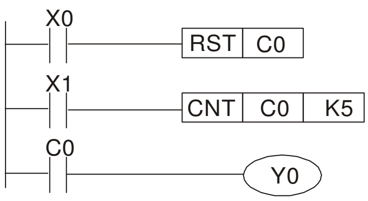
☑ If the MOV command or WPLSoft is used to transmit a value greater than the set value to the C0 current value register, when the next X1 goes from Off→On, the C0 counter contact will change to On, and the current value will change to the set value.

☑ A counter's setting value may be directly set using a constant K or indirectly set using the value in register D (not including special data registers D1000- D1199 或 D2000 ~ D2799).

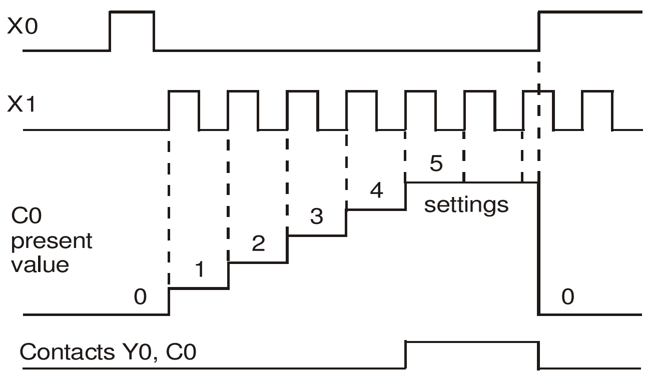
☑ If the set value employs a constant K, it may only be a positive number; the set value may be either a positive or negative number if the value in data register D is used. The current counter value will change from 32,767 to -32,768 as the count continues to accumulate.

Example

LD	X0
RST	C0
LD	X1
CNT	C0 K5
LD	C0
OUT	Y0



1. When X0=On and the RST command is executed, the current value of C0 will revert to 0, and the output contact will revert to Off.
2. When X1 changes from Off→On, the current value of the counter will execute an increase (add one).
3. When the count of counter C0 reaches the set value K5, the contact C0 will come On, and the current value of C0＝ set value =K5. Afterwards, signal C0 triggered by X1 cannot be received, and the current value of C0 will remain K5.



16-5-2 Introduction to special relay functions (special M)

R/W items: RO: read only function; RW: read and write function

Special M	Description of Function	R/W *
M1000	Operates monitor NO contact (contact a). NO while RUN, contact a. This contact is On while in the RUN state.	RO
M1001	Operates monitor NC contact (contact b). NC while RUN, contact b. This contact is Off while in the RUN state.	RO
M1002	Initiates a forward (the instant RUN is On) pulse. Initial pulse, contact a. Produces a forward pulse the moment RUN begins; its width = scan cycle	RO
M1003	Initiates a reverse (the instant RUN is Off) pulse. Initial pulse, contact a. Produces a reverse pulse the moment RUN ends; the pulse width = scan cycle	RO
M1004	Reserved	RO
M1005	Driver malfunction instructions	RO
M1006	Converter has no output	RO
M1007	Driver direction FWD(0)/REV(1)	RO
M1008 ~ M1010	--	--
M1011	10 ms clock pulse ，5ms On/5ms Off	RO
M1012	100 ms clock pulse ，50ms On / 50ms Off	RO
M1013	1 sec. clock pulse ，0.5s On / 0.5s Off	RO
M1014	1 min. clock pulse ，30s On / 30s Off	RO
M1015	Frequency attained (when used together with M1025)	RO
M1016	Parameter read/write error	RO
M1017	Parameter write successful	RO
M1018	--	--
M1019	--	--
M1020	Zero flag	RO
M1021	Borrow flag	RO
M1022	Carry flag	RO
M1023	Divisor is 0	RO
M1024	--	--
M1025	Driver frequency = set frequency (ON) Driver frequency =0(OFF)	RW
M1026	Driver operating direction FWD(OFF)/REV(ON)	RW
M1027	Driver Reset	RW
M1028	--	--
M1029	--	--
M1030	--	--
M1031	Compulsory setting of the current PID integral value equal to D1019 (0 change, 1 valid)	RW
M1032	Compulsory definition of FREQ command after PID control	RW
M1033	--	--
M1034	Initiates CANopen real-time control	RW
M1035	Initiates internal communications control	RW
M1036	Ignore calendar error	RW
M1037	--	--
M1038	--	--
M1039	--	--
M1040	Hardware power (Servo On)	RW
M1041	--	--
M1042	Quick stop	RW

Special M	Description of Function	R/W *
M1043	--	--
M1044	Pause	RW
M1045 ~ M1047	--	--
M1048	--	--
M1049	--	--
M1050	--	--
M1051	--	--
M1052	Lock frequency (lock, frequency locked at the current operating frequency)	RW
M1053	--	--
M1054	--	--
M1055	--	--
M1056	Hardware already has power (Servo On Ready)	RO
M1057	--	--
M1058	On Quick Stopping	RO
M1059	CANopen Master setting complete	RO
M1060	CANopen Currently initializing slave station	RO
M1061	CANopen Slave station initialization failure	RO
M1062	--	--
M1063	--	--
M1064	--	--
M1065	Read/write CANOpen data time out	RO
M1066	Read/write CANopen data complete	RO
M1067	Read/write CANopen data successful	RO
M1068	Calendar calculation error	RO
M1069	--	--
M1070	--	--
M1071	--	--
M1072 ~ M1075	--	--
M1076	Calendar time error or refresh time out	RO
M1077	485 Read/write complete	RO
M1078	485 Read-write error	RO
M1079	485 Communications time out	RO

16-5-3 Introduction to special register functions (special D)

Special D	Description of Function	R/W *
D1000	--	--
D1001	Device system program version	RO
D1002	Program capacity	RO
D1003	Total program memory content	RO
D1004 ~ D1009	--	--
D1010	Current scan time (units: 0.1 ms)	RO
D1011	Minimum scan time (units: 0.1 ms)	RO
D1012	Maximum scan time (units: 0.1 ms)	RO
D1013 ~ D1017	--	--
D1018	Current integral value	RO
D1019	Compulsory setting of PID I integral	RW
D1020	Output frequency (0.00~600.00Hz)	RO
D1021	Output current (####.#A)	RO
D1022	AI AO DI DO Expansion card number 0：No expansion card 4：AC input card (6 in) (EMC-D611A) 5：I/O Card (4 in 2 out) (EMC-D42A) 6：Relay card(6 out) (EMC-R6AA)	RO
D1023	Communication expansion card number 0：No expansion card 1：DeviceNet Slave 2：Profibus-DP Slave 3：CANopen Slave 4：Modbus-TCP Slave 5：EtherNet/IP Slave	RO
D1024 ~ D1026	--	--
D1027	PID calculation frequency command (frequency command after PID calculation)	RO
D1028	AVI1value (0.00~100.00%)	RO
D1029	ACI value (0.0~100.00%)	RO
D1030	AVI2 value (0.00~100.00%)	RO
D1031 ~ D1035	--	--
D1036	Servo error bit	RO
D1037	Driver output frequency	RO
D1038	DC BUS voltage	RO
D1039	Output voltage	RO
D1040	Analog output value AFM1(-100.00~100.00%)	RW
D1041 ~ D1042	--	--
D1043	Can be user-defined (will be displayed on panel when parameter 00-04 is set as 28; display method is C xxx)	RW
D1044	--	-

Special D	Description of Function	R/W *
D1045	Analog output value AFM2(-100.00~100.00%)	RW
D1046 ~ D1049	--	--
D1050	Actual Operation Mode 0：Speed	RO
D1051	--	--
D1052	--	--
D1053	--	--
D1054	--	--
D1055	--	--
D1056	--	--
D1057	--	--
D1058	--	--
D1059	--	--
D1060	Operation Mode setting 0：Speed	RW
D1061	485 COM1 communications time out time (ms)	RW
D1062	Torque command (torque limit in speed mode)	RW
D1063	Year (Western calendar) (display range 2000-2099) (must use KPC-CC01)	RO
D1064	Week (display range 1-7) (must use KPC-CC01)	RO
D1065	Month (display range 1-12) (must use KPC-CC01)	RO
D1066	Day (display range 1-31) (must use KPC-CC01)	RO
D1067	Hour (display range 0-23) (must use KPC-CC01)	RO
D1068	Minute (display range 0-59) (must use KPC-CC01)	RO
D1069	Second (display range 0-59) (must use KPC-CC01)	RO
D1100	Target frequency	RO
D1101	Target frequency (must be operating)	RO
D1102	Reference frequency	RO
D1103	--	--
D1104	--	--
D1105	--	--
D1106	--	--
D1107	π(Pi) Low word	RO
D1108	π(Pi) High word	RO
D1109	Random number	RO
D1110	Internal node communications number (set number of slave stations to be controlled)	RW
D1111	--	--
D1112	--	--
D1113	--	--
D1114	--	--
D1115	Internal node synchronizing cycle (ms)	RO
D1116	Internal node error (bit0 = Node 0, bit1 = Node 1,…bit7 = Node 7)	RO
D1117	Internal node online correspondence (bit0 = Node 0, bit1 = Node 1,…bit7 = Node 7)	RO
D1118	--	--
D1119	--	--
D1120	Internal node 0 control command	RW
D1121	Internal node 0 mode	RW
D1122	Internal node 0 reference command L	RW
D1123	Internal node 0 reference command H	RW

Special D	Description of Function	R/W *
D1124	--	--
D1125	--	--
D1126	Internal node 0 status	RO
D1127	Internal node 0 reference status L	RO
D1128	Internal node 0 reference status H	RO
D1129	--	--
D1130	Internal node 1 control command	RW
D1131	Internal node 1 mode	RW
D1132	Internal node 1 reference command L	RW
D1133	Internal node 1 reference command H	RW
D1134	--	--
D1135	--	--
D1136	Internal node 1 status	RO
D1137	Internal node 1 reference status L	RO
D1138	Internal node 1 reference status H	RO
D1139	--	--
D1140	Internal node 2 control command	RW
D1141	Internal node 2 mode	RW
D1142	Internal node 2 reference command L	RW
D1143	Internal node 2 reference command H	RW
D1144	--	--
D1145	--	--
D1146	Internal node 2 status	RO
D1147	Internal node 2 reference status L	RO
D1148	Internal node 2 reference status H	RO
D1149	--	--
D1150	Internal node 3 control command	RW
D1151	Internal node 3 mode	RW
D1152	Internal node 3 reference command L	RW
D1153	Internal node 3 reference command H	RW
D1154	--	--
D1155	--	--
D1156	Internal node 3 status	RO
D1157	Internal node 3 reference status L	RO
D1158	Internal node 3 reference status H	RO
D1159	--	--
D1160	Internal node 4 control command	RW
D1161	Internal node 4 mode	RW
D1162	Internal node 4 reference command L	RW
D1163	Internal node 4 reference command H	RW
D1164	--	--
D1165	--	--
D1166	Internal node 4 status	RO
D1167	Internal node 4 reference status L	RO
D1168	Internal node 4 reference status H	RO
D1169	--	--
D1170	Internal node 5 control command	RW
D1171	Internal node 5 mode	RW
D1172	Internal node 5 reference command L	RW
D1173	Internal node 5 reference command H	RW
D1174	--	RW
D1175	--	--
D1176	Internal node 5 status	--
D1177	Internal node 5 reference status L	RO

Special D	Description of Function	R/W *
D1178	Internal node 5 reference status H	RO
D1179	--	--
D1180	Internal node 6 control command	RW
D1181	Internal node 6 mode	RW
D1182	Internal node 6 reference command L	RW
D1183	Internal node 6 reference command H	RW
D1184	--	--
D1185	--	--
D1186	Internal node 6 status	RO
D1187	Internal node 6 reference status L	RO
D1188	Internal node 6 reference status H	RO
D1189	--	--
D1190	Internal node 7 control command	RW
D1191	Internal node 7 mode	RW
D1192	Internal node 7 reference command L	RW
D1193	Internal node 7 reference command H	RW
D1194	--	--
D1195	--	--
D1196	Internal node 7 status	RO
D1197	Internal node 7 reference status L	RO
D1198	Internal node 7 reference status H	RO
D1199	--	--

The following is CANopen Master's special D (can be written in only with PLC in Stop state)

n = 0 ~ 7

Special D	Description of Function	PDO Map	Power off Memory	Default:	R/W
D1070	Channel opened by CANopen initialization (bit0=Machine code0 …….)	NO	NO	0	R
D1071	Error channel occurring in CANopen initialization process (bit0=Machine code0 …….)	NO	NO	0	R
D1072	Reserved	-	-		-
D1073	CANopen break channel (bit0=Machine code0 …….)	NO	NO		R
D1074	Error code of master error 0: No error 1: Slave station setting error 2: Synchronizing cycle setting error (too small)	NO	NO	0	R
D1075	Reserved	-	-		-
D1076	SDO error message (main index value)	NO	NO		R
D1077	SDO error message (secondary index value)	NO	NO		R
D1078	SDO error message (error code)	NO	NO		R
D1079	SDO error message (error code)	NO	NO		R
D1080	Reserved	-	-		-
D1081 ~ D1086	Reserved	-	-		-
D1087 ~ D1089	Reserved	-	-		-
D1090	Synchronizing cycle setting	NO	YES	4	RW
D1091	Sets slave station On or Off (bit 0-bit 7 correspond to slave stations number 0-7)	NO	YES	FFFFH	RW

Special D	Description of Function	PDO Map	Power off Memory	Default:	R/W
D1092	Delay before start of initialization	NO	YES	0	RW
D1093	Break time detection	NO	YES	1000ms	RW
D1094	Break number detection	NO	YES	3	RW
D1095 ~ D1096	Reserved	-	-		-
D1097	Corresponding real-time transmission type (PDO) Setting range: 1~240	NO	YES	1	RW
D1098	Corresponding real-time receiving type (PDO) Setting range: 1~240	NO	YES	1	RW
D1099	Initialization completion delay time Setting range: 1 to 60000 sec	NO	YES	15 sec.	RW
D2000+100*n	Station number n of slave station Setting range: 0~127 0: No CANopen function	NO	YES	0	RW

The CP2000 supports 8 slave stations under the CANopen protocol; each slave station occupies 100 special D locations; stations are numbered 1-8, total of 8 stations.

Explanation of slave station number and

Slave station no. 1	D2000 D2001 ~ D2099	Node ID Slave station no. 1 torque restrictions ~ Address 4(H) corresponding to receiving channel 4
Slave station no. 2	D2100 D2101 ~ D2199	Node ID Slave station no. 2 torque restrictions ~ Address 4(H) corresponding to receiving channel 4
Slave station no. 3	D2200 D2201 ~ D2299	Node ID Slave station no. 3 torque restrictions ~ Address 4(H) corresponding to receiving channel 4
	⇩	
Slave station no. 8	D2700 D2701 ~ D2799	Node ID Slave station no. 8 torque restrictions ~ Address 4(H) corresponding to receiving channel 4

1. The range of n is 0-7
2. ●Indicates PDOTX, ▲Indicates PDORX; unmarked special D can be refreshed using the CANFLS command

Special D	Description of Function	Default:	R/W
D2000+100*n	Station number n of slave station Setting range: 0~127 0: No CANopen function	0	RW
D2002+100*n	Manufacturer code of slave station number n (L)	0	R
D2003+100*n	Manufacturer code of slave station number n (H)	0	R
D2004+100*n	Manufacturer's product code of slave station number n (L)	0	R
D2005+100*n	Manufacturer's product code of slave station number n (H)	0	R

Basic definitions

Special D	Description of Function	Default:	CAN Index	PDO Default: 1	2	3	4	R/W
D2006+100*n	Communications break handling method of slave station number n	0	6007H-0010H					RW
D2007+100*n	Error code of slave station number n error	0	603FH-0010H					R
D2008+100*n	Control word of slave station number n	0	6040H-0010H	●		●	●	RW
D2009+100*n	Status word of slave station number n	0	6041H-0010H	▲		▲	▲	R
D2010+100*n	Control mode of slave station number n	2	6060H-0008H					RW
D2011+100*n	Actual mode of slave station number n	2	6061H-0008H					R

Velocity Control

Slave station number n=0-7

Special D	Description of Function	Default:	CAN Index	PDO Default: 1	2	3	4	R/W
D2001+100*n	Torque restriction on slave station number n	0	6072H-0010H					RW
D2012+100*n	Target speed of slave station number n	0	6042H-0010H	●				RW
D2013+100*n	Actual speed of slave station number n	0	6043H-0010H	▲				R
D2014+100*n	Error speed of slave station number n	0	6044H-0010H					R
D2015+100*n	Acceleration time of slave station number n	1000	604FH-0020H					R
D2016+100*n	Deceleration time of slave station number n	1000	6050H-0020H					RW

Torque control

Slave station number n=0-7

Special D	Description of Function	Default:	CAN Index	PDO Default: 1	2	3	4	R/W
D2017+100*n	Target torque of slave station number n	0	6071H-0010H				●	RW
D2018+100*n	Actual torque of slave station number n	0	6077H-0010H				▲	R
D2019+100*n	Actual current of slave station number n	0	6078H-0010H					R

Position control

Slave station number n=0-7

Special D	Description of Function	Default:	CAN Index	PDO Default: 1	2	3	4	R/W
D2020+100*n	Target of slave station number n (L)	0	607AH-0020H			●		RW
D2021+100*n	Target of slave station number n (H)	0						RW
D2022+100*n	Actual position of slave station number n (L)	0	6064H-0020H			▲		R
D2023+100*n	Actual position of slave station number n (H)	0						R
D2024+100*n	Speed chart of slave station number n (L)	10000	6081H-0020H					RW
D2025+100*n	Speed chart of slave station number n (H)	0						RW

20XXH correspondences: MI MO AI AO

Slave station number n=0-7

Special D	Description of Function	Default:	CAN Index	PDO Default: 1	2	3	4	R/W
D2026+100*n	MI status of slave station number n	0	2026H-0110H		▲			RW
D2027+100*n	MO setting of slave station number n	0	2026H-4110H		●			RW
D2028+100*n	AI1 status of slave station number n	0	2026H-6110H		▲			RW
D2029+100*n	AI2 status of slave station number n	0	2026H-6210H		▲			RW
D2030+100*n	AI3 status of slave station number n	0	2026H-6310H		▲			RW
D2031+100*n	AO1 status of slave station number n	0	2026H-A110H		●			RW
D2032+100*n	AO2 status of slave station number n	0	2026H-A210H		●			RW
D2033+100*n	AO3 status of slave station number n	0	2026H-A310H		●			RW

PDO reflection length setting:

Special D	Description of Function	Default:	R/W
D2034+100*n	Real-time transmission setting of slave station number n	000AH	RW
D2067+100*n	Real-time reception setting of slave station number n	0000H	RW

16-5-4 PLC Communication address

Device	Range	Type	Address (Hex)
X	00~37 (Octal)	bit	0400~041F
Y	00~37 (Octal)	bit	0500~051F
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	1000~1199	word	13E8~14AF
D	2000~2799	word	17D0~1AEF

Command code that can be used

Function Code	Description of Function	Function target
01	Coil status read	Y,M,T,C
02	Input status read	X,Y,M,T,C
03	Read single unit of data	T,C,D
05	Compulsory single coil status change	Y,M,T,C
06	Write single unit of data	T,C,D
0F	Compulsory multiple coil status change	Y,M,T,C
10	Write multiple units of data	T,C,D

NOTE

When PLC functions have been activated, the CP2000 can match PLC and driver parameters; this method employs different addresses, drivers (default station number is 1, PLC sets station number as 2)

16-6 Introduction to the Command Window

16-6-1 Overview of basic commands

Ordinary commands

Command code	Function	OPERAND	Execution speed (us)
LD	Load contact a	X、Y、M、T、C	0.8
LDI	Load contact b	X、Y、M、T、C	0.8
AND	Connect contact a in series	X、Y、M、T、C	0.8
ANI	Connect contact b in series	X、Y、M、T、C	0.8
OR	Connect contact a in parallel	X、Y、M、T、C	0.8
ORI	Connect contact b in parallel	X、Y、M、T、C	0.8
ANB	Series circuit block	N/A	0.3
ORB	Parallel circuit block	N/A	0.3
MPS	Save to stack	N/A	0.3
MRD	Stack read (pointer does not change)	N/A	0.3
MPP	Read stack	N/A	0.3

Output command

Command code	Function	OPERAND	Execution speed (us)
OUT	Drive coil	Y、M	1
SET	Action continues (ON)	Y、M	1
RST	Clear contact or register	Y、M、T、C、D	1.2

Timer, counter

Command code	Function	OPERAND	Execution speed (us)
TMR	16-bit timer	T-K or T-D commands	1.1
CNT	16-bit counter	C-K or C-D (16-bit)	0.5

Main control command

Command code	Function	OPERAND	Execution speed (us)
MC	Common series contact connection	N0~N7	0.4
MCR	Common series contact release	N0~N7	0.4

Contact rising edge/falling edge detection command

Command code	Function	OPERAND	Execution speed (us)
LDP	Start of forward edge detection action	X、Y、M、T、C	1.1
LDF	Start of reverse edge detection action	X、Y、M、T、C	1.1
ANDP	Forward edge detection series connection	X、Y、M、T、C	1.1
ANDF	Reverse edge detection series connection	X、Y、M、T、C	1.1
ORP	Forward edge detection parallel connection	X、Y、M、T、C	1.1
ORF	Reverse edge detection parallel connection	X、Y、M、T、C	1.1

Upper/lower differential output commands

Command code	Function	OPERAND	Execution speed (us)
PLS	Upper differential output	Y、M	1.2
PLF	Lower differential output	Y、M	1.2

Stop command

Command code	Function	OPERAND	Execution speed (us)
END	Program conclusion	N/A	0.2

Other commands

Command code	Function	OPERAND	Execution speed (us)
NOP	No action	N/A	0.2
INV	Inverse of operation results	N/A	0.2
P	Index	P	0.3

16-6-2 Detailed explanation of basic commands

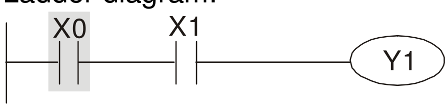
Command	Function					
LD	Load contact a					
Operand	X0~X17	Y0~Y17	M0~M799	T0~159	C0~C79	D0~D399
	✓	✓	✓	✓	✓	—

Explanation

The LD command is used for contact a starting at the left busbar or contact a starting at a contact circuit block; its function is to save current content and save the acquired contact status in the cumulative register.

Example

Ladder diagram:



Command code: Description:

LD	**X0**	Load Contact a of X0
AND	X1	Create series connection to contact a of X1
OUT	Y1	Drive Y1 coil

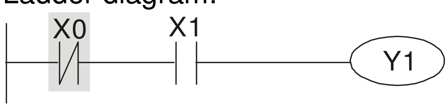
Command	Function					
LDI	Load contact b					
Operand	X0~X17	Y0~Y17	M0~M799	T0~159	C0~C79	D0~D399
	✓	✓	✓	✓	✓	—

Explanation

The LDI command is used for contact b starting at the left busbar or contact b starting at a contact circuit block; its function is to save current content and save the acquired contact status in the cumulative register.

Example

Ladder diagram:



Command code: Description:

LDI	**X0**	Load Contact b of X0
AND	X1	Create series connection to contact a of X1
OUT	Y1	Drive Y1 coil

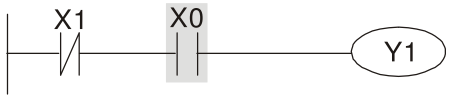
Command	Function					
AND	Connect contact a in series					
Operand	X0~X17	Y0~Y17	M0~M799	T0~159	C0~C79	D0~D399
	✓	✓	✓	✓	✓	—

Explanation

The AND command is used to create a series connection to contact a; first reads current status of the designated series contact and logical operation results before contact in order to perform "AND" operation; saves results in cumulative register.

Example

Ladder diagram:



Command code:		Description:
LDI	X1	Load Contact b of X1
AND	**X0**	Create series connection to contact a of X0
OUT	Y1	Drive Y1 coil

Command	Function					
ANI	Connect contact b in series					
Operand	X0~X17	Y0~Y17	M0~M799	T0~159	C0~C79	D0~D399
	✓	✓	✓	✓	✓	—

Explanation

The ANI command is used to create a series connection to contact b; its function is to first read current status of the designated series contact and logical operation results before contact in order to perform "AND" operation; saves results in cumulative register.

Example

Ladder diagram:

Command code:		Description:
LD	X1	Load Contact a of X1
ANI	**X0**	Create series connection to contact b of X0
OUT	Y1	Drive Y1 coil

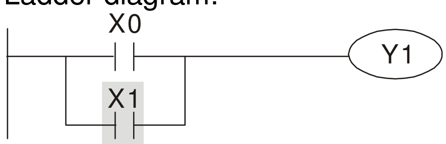
Command	Function					
OR	Connect contact a in parallel					
Operand	X0~X17	Y0~Y17	M0~M799	T0~159	C0~C79	D0~D399
	✓	✓	✓	✓	✓	—

Explanation

The OR command is used to establish a parallel connection to contact a; its function is to first read current status of the designated series contact and logical operation results before contact in order to perform "OR" operation; saves results in cumulative register.

Example

Ladder diagram:

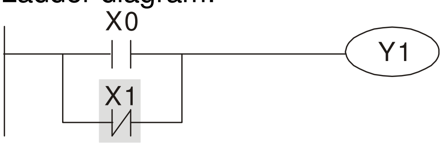


Command code:		Description:
LD	X0	Load Contact a of X0
OR	**X1**	Create series connection to contact a of X1
OUT	Y1	Drive Y1 coil

Command	Function					
ORI	Connect contact b in parallel					
Operand	X0~X17	Y0~Y17	M0~M799	T0~159	C0~C79	D0~D399
	✓	✓	✓	✓	✓	—

Explanation: The ORI command is used to establish a parallel connection to contact a; its function is to first read current status of the designated series contact and logical operation results before contact in order to perform "OR" operation; saves results in cumulative register.

Example: Ladder diagram:

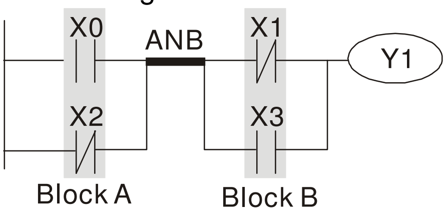


Command code:		Description:
LD	X0	Load Contact a of X0
ORI	**X1**	Create series connection to contact b of X1
OUT	Y1	Drive Y1 coil

Command	Function
ANB	Series circuit block
Operand	N/A

Explanation: ANB performs an "AND" operation on the previously saved logic results and the current cumulative register content.

Example: Ladder diagram:

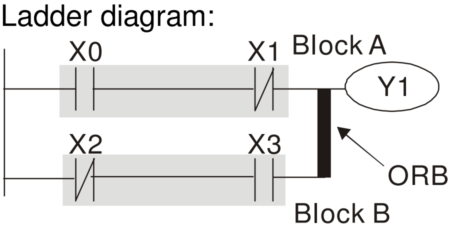


Command code:		Description:
LD	X0	Load Contact a of X0
ORI	X2	Establish parallel connection to contact b of X2
LDI	X1	Load Contact b of X1
OR	X3	Establish parallel connection to contact a of X3
ANB		Series circuit block
OUT	Y1	Drive Y1 coil

Command	Function
ORB	Parallel circuit block
Operand	N/A

Explanation: ORB performs an "OR" operation on the previously saved logic results and the current cumulative register content.

Example: Ladder diagram:



Command code:		Description:
LD	X0	Load Contact a of X0
ANI	X1	Establish parallel connection to contact b of X1
LDI	X2	Load Contact b of X2
AND	X3	Establish parallel connection to contact a of X3
ORB		Parallel circuit block
OUT	Y1	Drive Y1 coil

Command	Function
MPS	Save to stack
Operand	N/A

Explanation: Save current content of cumulative register to the stack. (Add one to stack pointer)

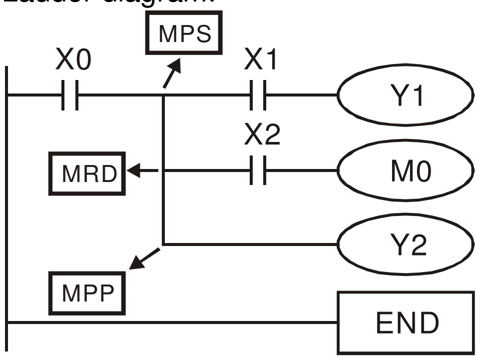
Command	Function
MRD	Read stack (pointer does not change)
Operand	N/A

Explanation: Reads stack content and saves to cumulative register. (Stack pointer does not change)

Command	Function
MPP	Read stack
Operand	N/A

Explanation: Retrieves result of previously-save logical operation from the stack, and saves to cumulative register. (Subtract one from stack pointer)

Example: Ladder diagram:



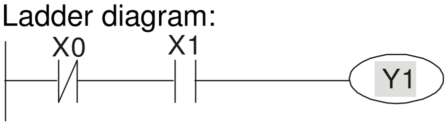
Command code:		Description:
LD	X0	Load Contact a of X0
MPS		Save to stack
AND	X1	Create series connection to contact a of X1
OUT	Y1	Drive Y1 coil
MRD		Read stack (pointer does not change)
AND	X2	Create series connection to contact a of X2
OUT	M0	Drive M0 coil
MPP		Read stack
OUT	Y2	Drive Y2 coil
END		Program conclusion

Command	Function					
OUT	Drive coil					
Operand	X0~X17	Y0~Y17	M0~M799	T0~159	C0~C79	D0~D399
	—	✓	✓	—	—	—

Explanation: Outputs result of logical operation before OUT command to the designated element.
Coil contact action:

Result:	Out command		
	Coil	Access Point:	
		Contact a (NO)	Contact b (NC)
FALSE	Off	Not conducting	Conducting
TRUE	On	Conducting	Not conducting

Example: Ladder diagram:



Command code:		Description:
LD	X0	Load Contact b of X0
AND	X1	Establish parallel connection to contact a of X1
OUT	**Y1**	Drive Y1 coil

Command	Function					
SET	Action continues (ON)					
Operand	X0~X17	Y0~Y17	M0~M799	T0~159	C0~C79	D0~D399
	—	✓	✓	—	—	—

Explanation

When the SET command is driven, the designated element will be set as On, and will be maintained in an On state, regardless of whether the SET command is still driven. The RST command can be used to set the element as Off.

Example

Ladder diagram:

Command code:		Description:
LD	X0	Load Contact a of X0
AN	Y0	Establish parallel connection to contact b of Y0
SET	**Y1**	Action continues (ON)

Command	Function					
RST	Clear contact or register					
Operand	X0~X17	Y0~Y17	M0~M799	T0~159	C0~C79	D0~D399
	—	✓	✓	✓	✓	✓

Explanation

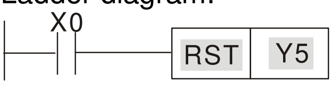
When the RST command is driven, the action of the designated element will be as follows:

Element	Mode
Y, M	Both coil and contact will be set as Off.
T, C	The current timing or count value will be set as 0, and both the coil and contact ill be set as Off.
D	The content value will be set as 0.

If the RST command has not been executed, the status of the designated element will remain unchanged.

Example

Ladder diagram:



Command code:		Description:
LD	X0	Load Contact a of X0
RST	**Y5**	Clear contact or register

Command	Function	
TMR	16-bit timer	
Operand	T-K	T0~T159，K0~K32,767
	T-D	T0~T159，D0~D399

Explanation

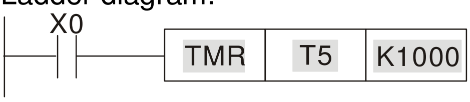
When the TMR command is executed, the designated timer coil will be electrified, and the timer will begin timing. The contact's action will be as follows when the timing value reaches the designated set value (timing value >= set value):

NO (Normally Open) contact	Closed
NC (Normally Close) contact	Open

If the RST command has not been executed, the status of the designated element will remain unchanged.

Example

Ladder diagram:



Command code:		Description:
LD	X0	Load Contact a of X0
TMR	T5 K1000	T5 timer Set value as K1000

Command	Function	
CNT	16-bit counter	
Operand	C-K	C0~C79，K0~K32,767
	C-D	C0~C79，D0~D399

Explanation

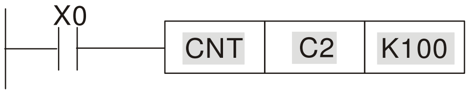
When the CNT command is executed from Off→On, this indicates that the designated counter coil goes from no power → electrified, and 1 will be added to the counter's count value; when the count reaches the designated value (count value = set value), the contact will have the following action:

NO (Normally Open) contact	Closed
NC (Normally Close) contact	Open

After the count value has been reached, the contact and count value will both remain unchanged even if there is continued count pulse input. Please use the RST command if you wish to restart or clear the count.

Example

Ladder diagram:



Command code:		Description:
LD	X0	Load Contact a of X0
CNT	**C2 K100**	C2counter Set value as K100

Command	Function
MC/MCR	Connect/release a common series contact
Operand	N0~N7

Explanation

MC is the main control initiation command, and any commands between MC and MCR will be executed normally. When the MC command is Off, any commands between MC and MCR will act as follows:

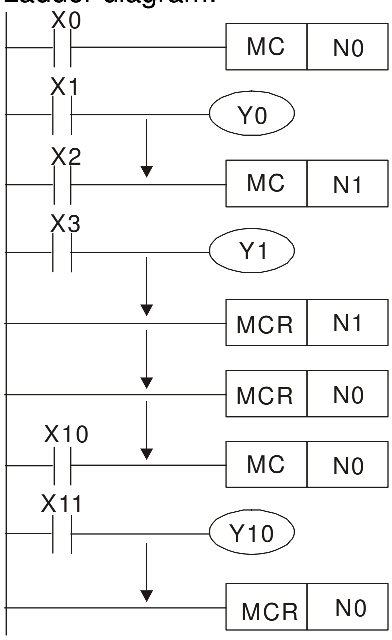
Determination of commands	Description
Ordinary timer	The timing value will revert to 0, the coil will lose power, and the contact will not operate
Counter	The coil will lose power, and the count value and contact will stay in their current state
Coil driven by OUT command	None receive power
Elements driven by SET, RST commands	Will remain in their current state
Applications commands	None are actuated

MCR is the main control stop command, and is placed at the end of the main control program. There may not be any contact commands before the MCR command.

The MC-MCR main control program commands support a nested program structure with a maximum only 8 levels; use in the order N0-N7, please refer to the following program:

Example

Ladder diagram:



Command code:		Description:
LD	X0	Load Contact a of X0
MC	**N0**	Connection of N0 common series contact
LD	X1	Load Contact a of X1
OUT	Y0	Drive Y0 coil
:		
LD	X2	Load Contact a of X2
MC	**N1**	Connection of N1 common series contact
LD	X3	Load Contact a of X3
OUT	Y1	Drive Y1 coil
:		
MCR	**N1**	Release N1 common series contact
:		
MCR	**N0**	Release N0 common series contact
:		
LD	X10	Load Contact a of X10
MC	**N0**	Connection of N0 common series contact
LD	X11	Load Contact a of X11
OUT	Y10	Drive Y10 coil
:		
MCR	**N0**	Release N0 common series contact

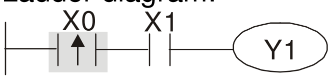
Command	Function					
LDP	Start of forward edge detection action					
Operand	X0~X17	Y0~Y17	M0~M799	T0~159	C0~C79	D0~D399
	✓	✓	✓	✓	✓	—

Explanation

The LDP command has the same usage as LD, but its action is different; its function is to save current content, while also saving the detected state of the rising edge of the contact to the cumulative register.

Example

Ladder diagram:



Command code:		Description:
LDP	**X0**	Start of X0 forward edge detection action
AND	X1	Create series connection to contact a of X1
OUT	Y1	Drive Y1 coil

Remark

Please refer to the function specifications table for each device in series for the scope of usage of each operand.

A rising edge contact will be TRUE after power is turned on if the rising edge contact is On before power is turned on to the PLC.

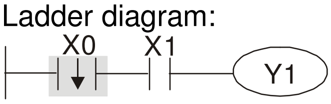
Command	Function					
LDF	Start of reverse edge detection action					
Operand	X0~X17	Y0~Y17	M0~M799	T0~159	C0~C79	D0~D399
	✓	✓	✓	✓	✓	—

Explanation

The LDF command has the same usage as LD, but its action is different; its function is to save current content while also saving the detected state of the falling edge of the contact to the cumulative register.

Example

Ladder diagram:



Command code:		Description:
LDF	**X0**	Start of X0 reverse edge detection action
AND	X1	Create series connection to contact a of X1
OUT	Y1	Drive Y1 coil

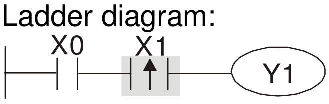
Command	Function					
ANDP	Forward edge detection series connection					
Operand	X0~X17	Y0~Y17	M0~M799	T0~159	C0~C79	D0~D399
	✓	✓	✓	✓	✓	—

Explanation

The ANDP command used for a contact rising edge detection series connection.

Example

Ladder diagram:

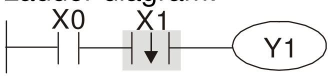


Command code:		Description:
LD	X0	Load Contact a of X0
ANDP	**X1**	X1 Forward edge detection series connection
OUT	Y1	Drive Y1 coil

Command	Function					
ANDF	Reverse edge detection series connection					
Operand	X0~X17	Y0~Y17	M0~M799	T0~159	C0~C79	D0~D399
	✓	✓	✓	✓	✓	—

Explanation: The ANDF command is used for a contact falling edge detection series connection.

Example: Ladder diagram:

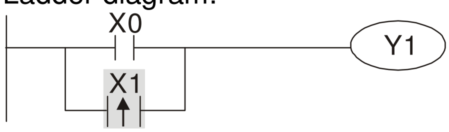


Command code:		Description:
LD	X0	Load Contact a of X0
ANDF	**X1**	X1 Reverse edge detection series connection
OUT	Y1	Drive Y1 coil

Command	Function					
ORP	Forward edge detection parallel connection					
Operand	X0~X17	Y0~Y17	M0~M799	T0~159	C0~C79	D0~D399
	✓	✓	✓	✓	✓	—

Explanation: The ORP command is used for a contact rising edge detection parallel connection.

Example: Ladder diagram:

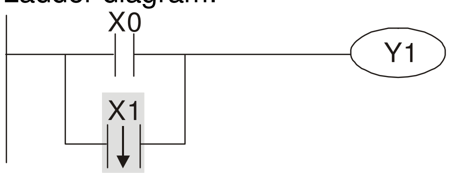


Command code:		Description:
LD	X0	Load Contact a of X0
ORP	**X1**	X1 Forward edge detection parallel connection
OUT	Y1	Drive Y1 coil

Command	Function					
ORF	Reverse edge detection parallel connection					
Operand	X0~X17	Y0~Y17	M0~M799	T0~159	C0~C79	D0~D399
	✓	✓	✓	✓	✓	—

Explanation: The ORF command is used for contact falling edge detection parallel connection.

Example: Ladder diagram:

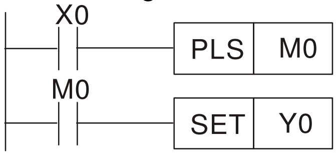


Command code:		Description:
LD	X0	Load Contact a of X0
ORF	**X1**	X1 Reverse edge detection parallel connection
OUT	Y1	Drive Y1 coil

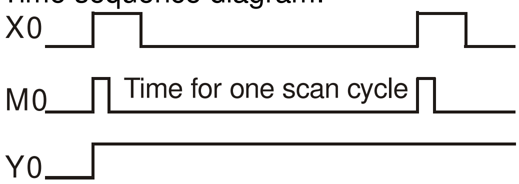
Command	Function					
PLS	Upper differential output					
Operand	X0~X17	Y0~Y17	M0~M799	T0~159	C0~C79	D0~D399
	—	✓	✓	—	—	—

Explanation: Upper differential output commands. When X0=Off→On (positive edge-triggered), the PLS command will be executed, and M0 will send one pulse, with a pulse length consisting of one scanning period.

Example: Ladder diagram:



Time sequence diagram:

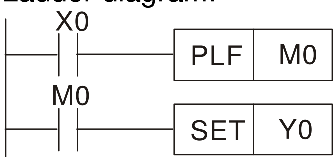


Command code:		Description:
LD	X0	Load Contact a of X0
PLS	**M0**	M0 Upper differential output
LD	M0	Load Contact a of M0
SET	Y0	Y0 Action continues (ON)

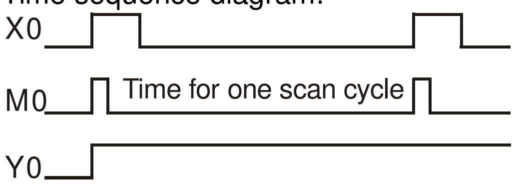
Command	Function					
PLF	Lower differential output					
Operand	X0~X17	Y0~Y17	M0~M799	T0~159	C0~C79	D0~D399
	—	✓	✓	—	—	—

Explanation: Lower differential output command. When X0= On→Off (negative edge-triggered), the PLF command will be executed, and M0 will send one pulse, with pulse length consisting of one scanning period.

Example: Ladder diagram:



Time sequence diagram:



Command code:		Description:
LD	X0	Load Contact a of X0
PLF	**M0**	M0 Lower differential output
LD	M0	Load Contact a of M0
SET	Y0	Y0 Action continues (ON)

Command	Function
END	Program conclusion
Operand	N/A

Explanation: An END command must be added to the end of a ladder diagram program or command program. The PLC will scan from address 0 to the END command, and will return to address 0 and begins scanning again after execution.

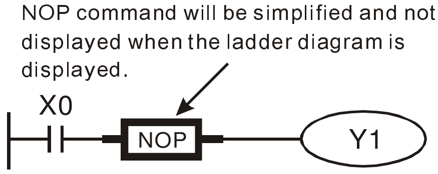
Command	Function
NOP	No action
Operand	N/A

Explanation

The command NOP does not perform any operation in the program. Because execution of this command will retain the original logical operation results, it can be used in the following situation: the NOP command can be used instead of a command that is deleted without changing the program length.

Example

Ladder diagram:



Command code:		Description:
LD	X0	Load Contact b of X0
NOP		No action
OUT	Y1	Drive Y1 coil

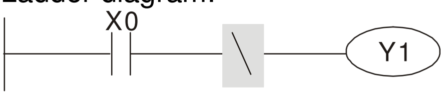
Command	Function
INV	Inverse of operation results
Operand	N/A

Explanation

Saves the result of the logic inversion operation prior to the INV command in the cumulative register.

Example

Ladder diagram:



Command code:		Description:
LD	X0	Load Contact a of X0
INV		Inverse of operation results
OUT	Y1	Drive Y1 coil

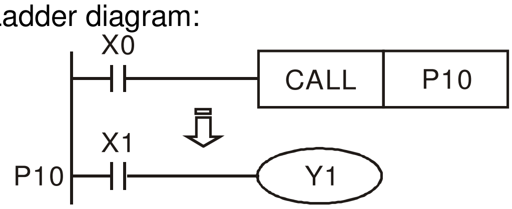
Command	Function
P	Index
Operand	P0~P255

Explanation

Pointer P is used to subprogram call command API 01 CALL. Use does not require starting from zero, but the number cannot be used repeatedly, otherwise an unpredictable error will occur.

Example

Ladder diagram:



Command code:		Description:
LD	X0	Load Contact a of X0
CALL	P10	Call command CALL to P10
:		
P10		Pointer P10
LD	X1	Load Contact a of X1
OUT	Y1	Drive Y1 coil

16-6-3 Overview of application commands

Classification	API	Command code 16 bit	Command code 32 bit	P command	Function	STEPS 16bit	STEPS 32bit
Circuit control	01	CALL	-	✓	Call subprogram	3	-
	02	SRET	-	-	Conclusion of subprogram	1	-
	06	FEND	-	-	Conclusion a main program	1	-
Send comparison	10	CMP	DCMP	✓	Compares set output	7	13
	11	ZCP	DZCP	✓	Range comparison	9	17
	12	MOV	DMOV	✓	Data movement	5	9
	15	BMOV	–	✓	Send all	7	–
Four logical operations	20	ADD	DADD	✓	BIN addition	7	13
	21	SUB	DSUB	✓	BIN subtraction	7	13
	22	MUL	DMUL	✓	BIN multiplication	7	13
	23	DIV	DDIV	✓	BIN division	7	13
	24	INC	DINC	✓	BIN add one	3	5
	25	DEC	DDEC	✓	BIN subtract one	3	5
Rotational displacement	30	ROR	DROR	✓	Right rotation	5	–
	31	ROL	DROL	✓	Left rotation	5	–
Data Process	40	ZRST	–	✓	Clear range	5	-
	49	–	DFLT	✓	BIN whole number → binary floating point number transformation	-	9
communication	150	MODRW	–	✓	MODBUS read/write	7	–
Floating point operation	110	–	DECMP	✓	Comparison of binary floating point numbers	–	13
	111	–	DEZCP	✓	Comparison of binary floating point number range	–	17
	116	–	DRAD	✓	Angle → Radian	–	9
	117	–	DDEG	✓	Radian → Angle	–	9
	120	–	DEADD	✓	Binary floating point number addition	–	13
	121	–	DESUB	✓	Binary floating point number subtraction	–	13
	122	–	DEMUL	✓	Binary floating point number multiplication	–	13
	123	–	DEDIV	✓	Binary floating point number division	–	13
	124	–	DEXP	✓	Binary floating point number obtain exponent	–	9
	125	–	DLN	✓	Binary floating point number obtain logarithm	–	9
	127	–	DESQR	✓	Binary floating point number find square root	–	9
	129	–	DINT	✓	Binary floating point number → BIN whole number transformation	–	9
	130	–	DSIN	✓	Binary floating point number SIN operation	–	9
	131	–	DCOS	✓	Binary floating point number COS operation	–	9
	132	–	DTAN	✓	Binary floating point number TAN operation	–	9
	133	–	DASIN	✓	Binary floating point number ASIN operation	–	9
	134	–	DACOS	✓	Binary floating point number ACOS operation	–	9

Classification	API	Command code		P command	Function	STEPS	
		16 bit	32 bit			16bit	32bit
	135	–	DATAN	✓	Binary floating point number ATAN operation	–	9
Floating point operation	136	–	DSINH	✓	Binary floating point number SINH operation	–	9
	137	–	DCOSH	✓	Binary floating point number COSH operation	–	9
	138	–	DTANH	✓	Binary floating point number TANH operation	–	9
Calendar	160	TCMP	–	✓	Compare calendar data	11	–
	161	TZCP	–	✓	Compare calendar data range	9	–
	162	TADD	–	✓	Calendar data addition	7	–
	163	TSUB	–	✓	Calendar data subtraction	7	–
	166	TRD	–	✓	Calendar data read	3	–
GRAY code	170	GRY	DGRY	✓	BIN→GRY code transformation	5	9
	171	GBIN	DGBIN	✓	GRY code →BIN transformation	5	9
Contact form logical operation	215	LD&	DLD&	-	Contact form logical operation LD#	5	9
	216	LD|	DLD|	-	Contact form logical operation LD#	5	9
	217	LD^	DLD^	-	Contact form logical operation LD#	5	9
	218	AND&	DAND&	-	Contact form logical operation AND#	5	9
	219	ANDI	DANDI	-	Contact form logical operation AND#	5	9
	220	AND^	DAND^	-	Contact form logical operation AND#	5	9
	221	OR&	DOR&	-	Contact form logical operation OR#	5	9
	222	OR|	DOR|	-	Contact form logical operation OR#	5	9
	223	OR^	DOR^	-	Contact form logical operation OR#	5	9
Contact form compare command	224	LD＝	DLD＝	-	Contact form compare LD※	5	9
	225	LD＞	DLD＞	-	Contact form compare LD※	5	9
	226	LD＜	DLD＜	-	Contact form compare LD※	5	9
	228	LD＜＞	DLD＜＞	-	Contact form compare LD※	5	9
	229	LD＜＝	DLD＜＝	-	Contact form compare LD※	5	9
	230	LD＞＝	DLD＞＝	-	Contact form compare LD※	5	9
	232	AND＝	DAND＝	-	Contact form compare AND※	5	9
	233	AND＞	DAND＞	-	Contact form compare AND※	5	9
	234	AND＜	DAND＜	-	Contact form compare AND※	5	9
	236	AND＜＞	DAND＜＞	-	Contact form compare AND※	5	9
	237	AND＜＝	DAND＜＝	-	Contact form compare AND※	5	9
	238	AND＞＝	DAND＞＝	-	Contact form compare AND※	5	9
	240	OR＝	DOR＝	-	Contact form compare OR※	5	9
	241	OR＞	DOR＞	-	Contact form compare OR※	5	9
	242	OR＜	DOR＜	-	Contact form compare OR※	5	9
	244	OR＜＞	DOR＜＞	-	Contact form compare OR※	5	9
	245	OR＜＝	DOR＜＝	-	Contact form compare OR※	5	9
	246	OR＞＝	DOR＞＝	-	Contact form compare OR※	5	9

Classification	API	Command code 16 bit	Command code 32 bit	P command	Function	STEPS 16bit	STEPS 32bit
Floating point contact form	275	-	FLD＝	-	Floating point number contact form compare LD※	-	9
	276	-	FLD＞	-	Floating point number contact form compare LD※	-	9
	277	-	FLD＜	-	Floating point number contact form compare LD※	-	9
Compare command	278	-	FLD＜＞	-	Floating point number contact form compare LD※	-	9
	279	-	FLD＜＝	-	Floating point number contact form compare LD※	-	9
	280	-	FLD＞＝	-	Floating point number contact form compare LD※	-	9
	281	-	FAND＝	-	Floating point number contact form compare AND※	-	9
	282	-	FAND＞	-	Floating point number contact form compare AND※	-	9
	283	-	FAND＜	-	Floating point number contact form compare AND※	-	9
	284	-	FAND＜＞	-	Floating point number contact form compare AND※	-	9
	285	-	FAND＜＝	-	Floating point number contact form compare AND※	-	9
	286	-	FAND＞＝	-	Floating point number contact form compare AND※	-	9
	287	-	FOR＝	-	Floating point number contact form compare OR※	-	9
	288	-	FOR＞	-	Floating point number contact form compare OR※	-	9
	289	-	FOR＜	-	Floating point number contact form compare OR※	-	9
	290	-	FOR＜＞	-	Floating point number contact form compare OR※	-	9
	291	-	FOR＜＝	-	Floating point number contact form compare OR※	-	9
	292	-	FOR＞＝	-	Floating point number contact form compare OR※	-	9
Driver special command	139	RPR	–	✓	Read servo parameter	5	–
	140	WPR	–	✓	Write servo parameter	5	–
	141	FPID	–	✓	Driver PID control mode	9	–
	142	FREQ	–	✓	Driver torque control mode	7	–
	261	CANRX	–	✓	Read CANopen slave station data	9	-
	264	CANTX	–	✓	Write CANopen slave station data	9	-
	265	CANFLS	–	✓	Refresh special D corresponding to CANopen	3	-
	320	ICOMR	DICOMR	✓	Internal communications read	9	17
	321	ICOMW	DICOMW	✓	Internal communications write	9	17

16-6-4 Detailed explanation of applications commands

API				
01	CALL	P	(S)	Call subprogram

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D

Notes on operand usage:
The S operand can designate P
CP2000 series device: The S operand can designate P0-P63

16-bit command (3 STEP)

CALL	Continuous execution type	CALLP	Pulse execution type

32-bit command

–	–	–	–

Flag signal: none

Explanation

- **S**：Call subprogram pointer.
- Write the subprogram after the FEND command.
- The subprogram must end after the SRET command.
- Refer to the FEND command explanation and sample content for detailed command functions.

API				
02	SRET	P	–	Conclusion of subprogram

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D

Notes on operand usage:
No operand
A contact-driven command is not needed

16-bit command (1 STEP)

FEND	Continuous execution type	–	–

32-bit command

–	–	–	–

Flag signal: none

Explanation

- A contact-driven command is not needed. Automatically returns next command after CALL command
- Indicates end of subprogram. After end of subprogram, SRET returns to main program, and executes next command after the original call subprogram CALL command.
- Refer to the FEND command explanation and sample content for detailed command functions.

API 06		FEND		–	Conclusion a main program

	Bit device			Word device								16-bit command (1 STEP)		
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D	FEND	Continuous execution type	–	–

Notes on operand usage:
No operand
A contact-driven command is not needed

32-bit command

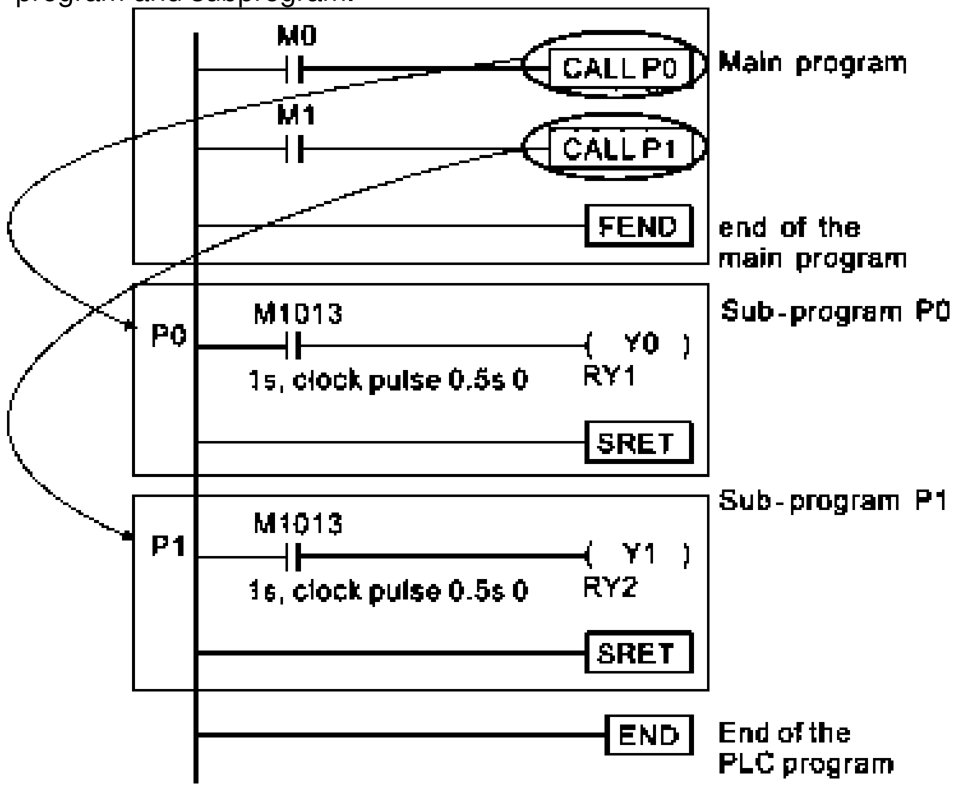
–	–	–	–

Flag signal: none

Explanation

- This command indicates the end of the main program. It is the same as the END command when the PLC executes this command.
- The CALL command program must be written after the FEND command, and the SRET command added to the end of the subprogram.
- When using the FEND command, an END command is also needed. However, the END command must be placed at the end, after the main program and subprogram.

CALL command process



API					
10	D	CMP	P	S1 S2 D	Compares set output

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S1				*	*	*	*	*	*	*	*
S2				*	*	*	*	*	*	*	*
D		*	*								

16-bit command (7 STEP)			
CMP	Continuous execution type	CMPP	Pulse execution type

32-bit command (13 STEP)			
DCMP	Continuous execution type	DCMPP	Pulse execution type

Notes on operand usage:
The operand D occupies three consecutive points

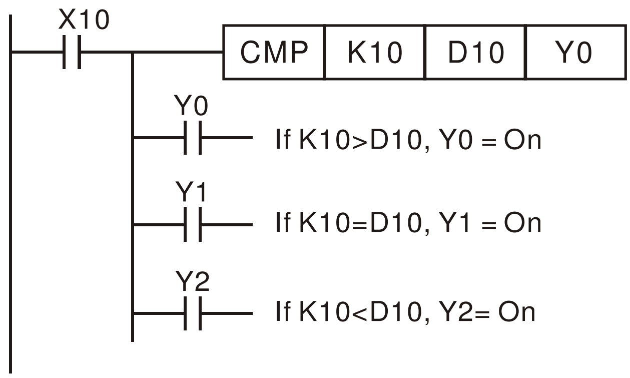
Flag signal: none

Explanation

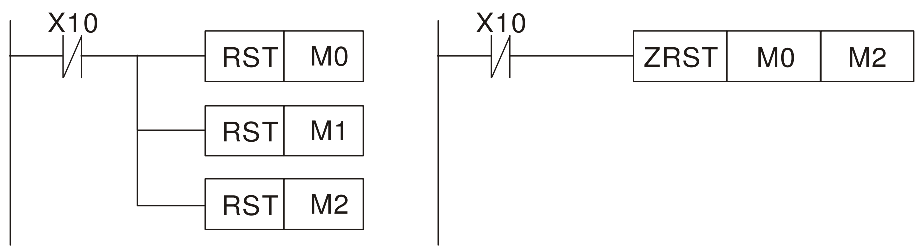
- S1: Compare value 1. S2: Compare value 2. D: Results of comparison.
- Compares the size of the content of operand S1 and S2; the results of comparison are expressed in D.
- Size comparison is performed algebraically. All data is compared in the form of numerical binary values. Because this is a 16-bit command, when b15 is 1, this indicates a negative number.

Example

- When the designated device is Y0, it automatically occupies Y0, Y1 and Y2.
- When X10=On, the CMP command executes, and Y0, Y1 or Y2 will be On. When X10=Off, the CMP command will not execute, and the state of Y0, Y1 and Y2 will remain in the state prior to X10=Off.
- If ≥, ≤, or ≠ results are needed, they can be obtained via series/parallel connections of Y0-Y2.



- To clear results of comparison, use the RST or ZRST command.



API					
11	D	ZCP	P	S1 S2 S D	Range comparison

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S1				*	*	*	*	*	*	*	*
S2				*	*	*	*	*	*	*	*
S				*	*	*	*	*	*	*	*
D		*	*								

Notes on operand usage:
The content value of operand S1 is less than the content value of S2 operand
The operand D occupies three consecutive points

16-bit command (9 STEP)			
ZCP	Continuous execution type	ZCPP	Pulse execution type

32-bit command (17 STEP)			
DZCP	Continuous execution type	DZCPP	Pulse execution type

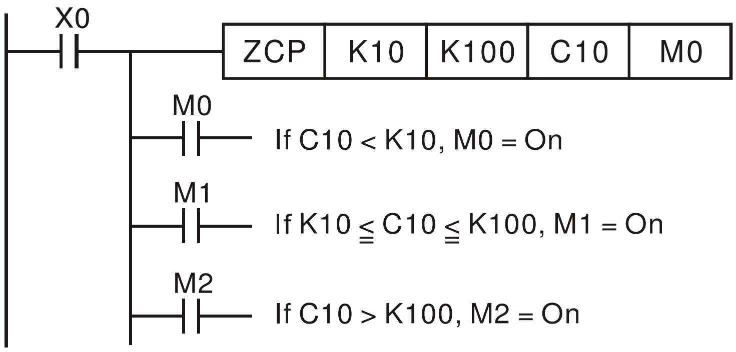
Flag signal: none

Explanation

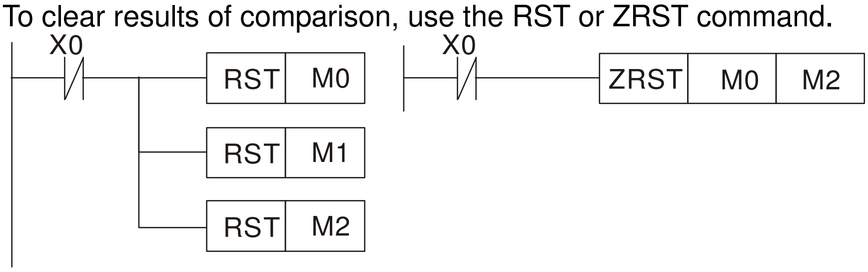
- S1: Lower limit of range comparison. S2: Upper limit of range comparison. S : Comparative value. D: Results of comparison.
- When the comparative value S is compared with the lower limit S1 and upper limit S2, the results of comparison are expressed in D.
- When lower limit S1 > upper limit S2, the command will use the lower limit S1 to perform comparison with the upper and lower limit.
- Size comparison is performed algebraically. All data is compared in the form of numerical binary values. Because this is a 16-bit command, when b15 is 1, this indicates a negative number.

Example

- When the designated device is M0, it automatically occupies M0, M1 and M2.
- When X0=On, the ZCP command executes, and M0, M1 or M2 will be On. When X0=Off, the ZCP command will not execute, and the state of M0, M1 or M2 will remain in the state prior to X0=Off.
- If ≥, ≤, or ≠ results are needed, they can be obtained via series/parallel connections of M0-M2.



- To clear results of comparison, use the RST or ZRST command.



API					
12	D	**MOV**	P	(S) (D)	Data movement

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S				*	*	*	*	*	*	*	*
D							*	*	*	*	*

Notes on operand usage: none

16-bit command (5 STEP)			
MOV	Continuous execution type	MOVP	Pulse execution type

32-bit command (9 STEP)			
DMOV	Continuous execution type	DMOVP	Pulse execution type

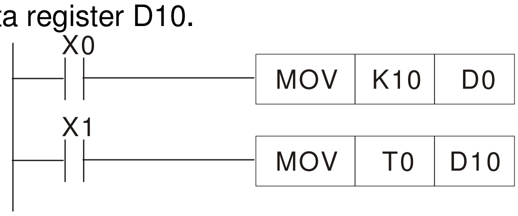
Flag signal:

Explanation

- (S): Data source. (D): Destination of data movement.
- When this command is executed, the content of (S) content will be directly moved to (D). When the command is not executed, the content of (D) will not change.

Example

- When X0=Off, the content of D10 will not change; if X0=On, the value K10 will be sent to data register D10.
- When X1=Off, the content of D10 will not change; if X1=On, the current value of T0 will be sent to data register D10.



API		Mnemonic		Operands	Function
15		BMOV	P	(S) (D) (n)	Send all

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S						*	*	*	*	*	*
D							*	*	*	*	*
n				*	*				*	*	

Notes on operand usage:
n operand scope n ＝ 1 to 512

16-bit command (7 STEP)			
BMOV	Continuous execution type	BMOVP	Pulse execution type
32-bit command			
–	–	–	–

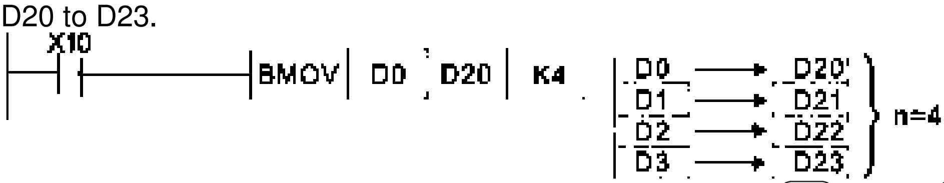
Flag signal: none

Explanation

- (S): Initiate source device. (D): Initiate destination device. (n): Send block length.
- The content of n registers starting from the initial number of the device designated by (S) will be sent to the n registers starting from the initial number of the device designated by (n); if the number of points referred to by n exceeds the range used by that device, only points within the valid range will be sent.

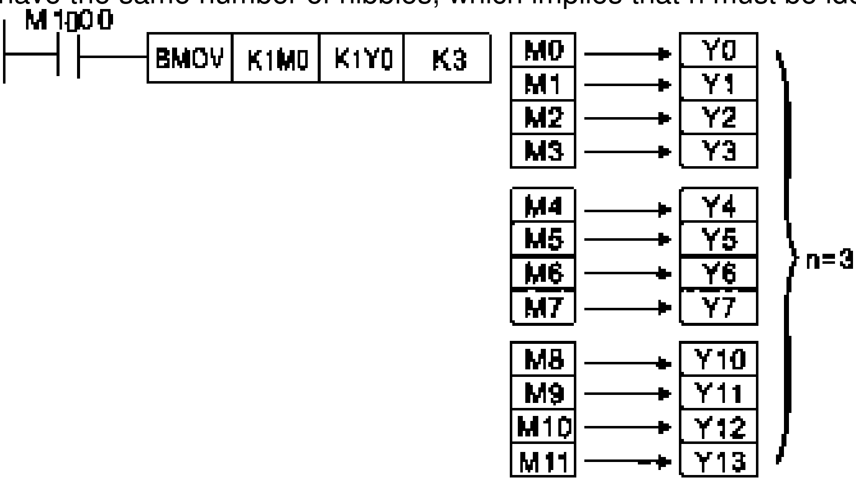
Example 1

- When X10=On, the content of registers D0-D3 will be sent to the four registers D20 to D23.



Example 2

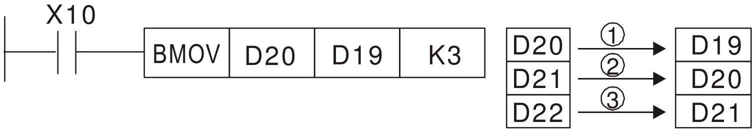
- If the designated bit devices KnX, KnY, and KnM are sent, (S) and (D) must have the same number of nibbles, which implies that n must be identical.



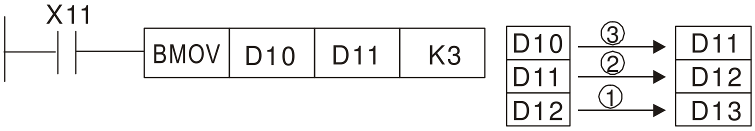
Example 3

- In order to prevent overlap between the transmission addresses of two operands, which would cause confusion, make sure that the addresses designated by the two operands have different sizes, as shown below:

When (S) > (D), send in the order ①→② →③.



When (S) < (D), send in the order ③→② →①.



API					
20	D	ADD	P	S1 S2 D	BIN addition

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S1				*	*	*	*	*	*	*	*
S2				*	*	*	*	*	*	*	*
D							*	*	*	*	*

Notes on operand usage: none

16-bit command (7 STEP)

ADD	Continuous execution type	ADDP	Pulse execution type

32-bit command (13 STEP)

DADD	Continuous execution type	DADDP	Pulse execution type

Flag signal: M1020 Zero flag
M1021 Borrow flag
M1022 Carry flag
Please refer to the following supplementary explanation

Explanation

- S1: Augend. S2: Addend. D: Sum.
- Using two data sources: The result of adding S1 and S2 using the BIN method will be stored in D.
- The highest bit of any data is symbolized as bit 0 indicating (positive) 1 indicating (negative), enabling the use of algebraic addition operations. (for instance: 3+(-9)=-6)
- Flag changes connected with the addition.

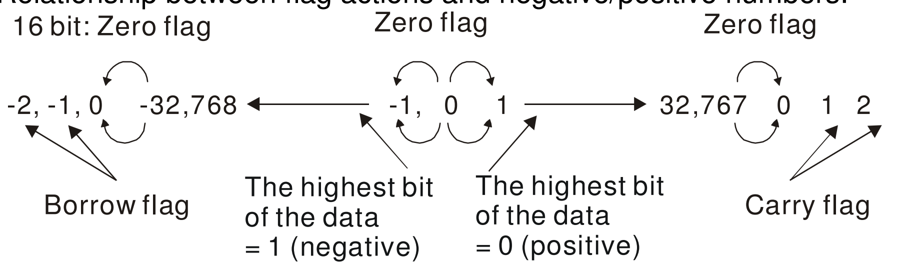
1. When calculation results are 0, the zero flag M1020 will be On.
2. When calculation results are less than –32,768, the borrow flag M1021 will be On.
3. When calculation results are greater than 32,767, the carry flag M1022 will be On.

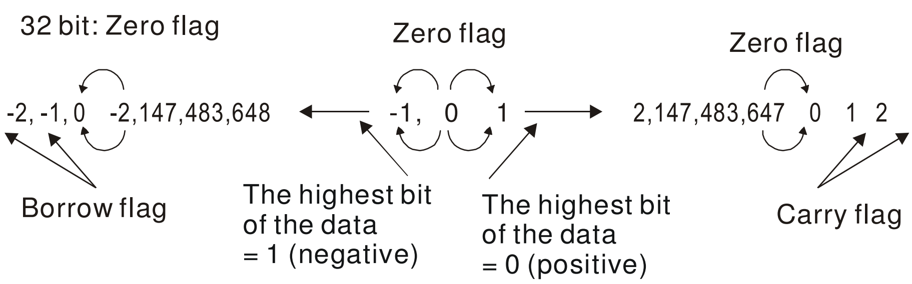
Example

- 16-bit BIN addition: When X0=On, the result of the content of addend D0 plus the content of augend D10 will exist in the content of D20.

Remark

- Relationship between flag actions and negative/positive numbers:





API				
21	D	SUB	P	S1 S2 D	BIN subtraction

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S1				*	*	*	*	*	*	*	*
S2				*	*	*	*	*	*	*	*
D							*	*	*	*	*

Notes on operand usage: none

16-bit command (7 STEP)

SUB	Continuous execution type	SUBP	Pulse execution type

32-bit command (13 STEP)

DSUB	Continuous execution type	DSUBP	Pulse execution type

Flag signal: M1020 Zero flag
M1021 Borrow flag
M1022 Carry flag
Please refer to the following supplementary explanation

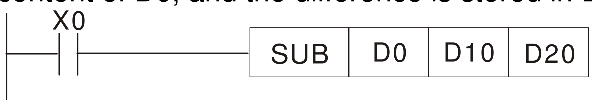
Explanation

- S1: Minuend. S2: Subtrahend. D: Difference.
- Using two data sources: The result of subtraction of S1 and S2 using the BIN method is stored in D.
- The highest bit of any data is symbolized as bit 0 indicating (positive) 1 indicating (negative), enabling the use of algebraic subtraction operations.
- Flag changes connected with subtraction.

1. When calculation results are 0, the zero flag M1020 will be On.
2. When calculation results are less than –32,768, the borrow flag M1021 will be On.
3. When calculation results are greater than 32,767, the carry flag M1022 will be On.

Example

- 16-bit BIN subtraction: When X0=On, the content of D10 is subtracted from the content of D0, and the difference is stored in D20.



API					
22	D	MUL	P	S1 S2 D	BIN multiplication

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S1				*	*	*	*	*	*	*	*
S2				*	*	*	*	*	*	*	*
D							*	*	*	*	*

Notes on operand usage:
The 16-bit command operand D will occupy 2 consecutive points

16-bit command (7 STEP)

MUL	Continuous execution type	MULP	Pulse execution type

32-bit command (13 STEP)

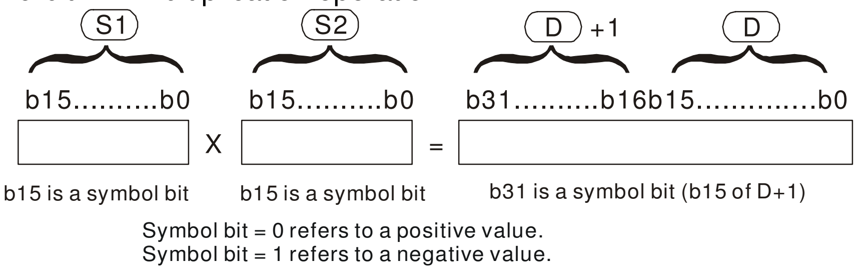
DMUL	Continuous execution type	DMULP	Pulse execution type

Flag signal: none

Explanation

- S1: Multiplicand. S2: Multiplier. D: Product.
- Using two data sources: When S1 and S2 are multiplied using the BIN method, the product is stored in D.

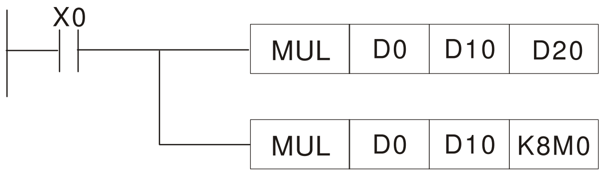
16-bit BIN multiplication operation:



When D is a bit device, K1-K4 can be designated as a hexadecimal number, which will occupy 2 consecutive units.

Example

- When 16-bit DO is multiplied by 16-bit D10, the result will be a 32-bit product; the upper 16 bits will be stored in D21, and the lower 16 bits will be stored in D20. Whether the bit at the farthest left is Off or On will indicate the sign of the result.



API				
23	D	DIV	P	S1 S2 D	BIN division

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S1				*	*	*	*	*	*	*	*
S2				*	*	*	*	*	*	*	*
D							*	*	*	*	*

Notes on operand usage:
The 16-bit command operand D will occupy 2 consecutive points

16-bit command (7 STEP)

DIV	Continuous execution type	DIVP	Pulse execution type

32-bit command (13 STEP)

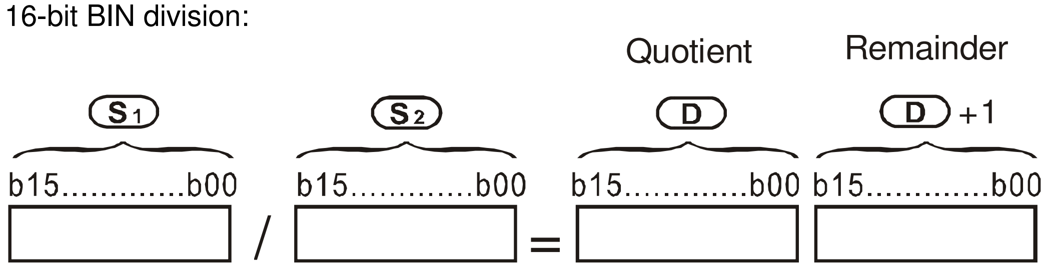
DDIV	Continuous execution type	DDIVP	Pulse execution type

Flag signal: none

Explanation

- S1: Dividend. S2: Divisor. D: Quotient and remainder.
- Using two data sources: The quotient and remainder will be stored in D when S1 and S2 are subjected to division using the BIN method. The sign bit for S1, S2 and D must be kept in mind when performing a 16-bit operation.

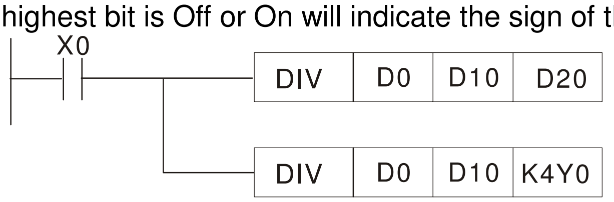
16-bit BIN division:



If D is a bit device, K1-K4 can be designated 16 bits, which will occupy 2 consecutive units and yield the quotient and remainder.

Example

- When X0=On, the quotient resulting from division of dividend D0 by divisor D10 will be placed in D20, and the remainder will be placed in D21. Whether the highest bit is Off or On will indicate the sign of the result.



API					
24	D	INC	P	D	BIN add one

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
D							*	*	*	*	*

Notes on operand usage: none

16-bit command (3 STEP)

INC	Continuous execution type	INCP	Pulse execution type

32-bit command (5 STEP)

DINC	Continuous execution type	DINCP	Pulse execution type

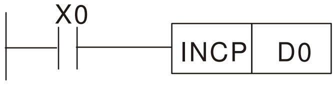
Flag signal: none

Explanation

- D: Destination device.
- If a command is not the pulse execution type, when the command is executed, the program will add 1 to the content of device D for each scanning cycle.
- This command is ordinarily used as a pulse execution type command (INCP).
- During 16-bit operation, 32,767 +1 will change the value to -32,768. During 32 bit operation, 2,147,483,647 +1 will change the value to -2,147,483,648.

Example

- When X0=Off→On, 1 is automatically added to the content of D0.



API					
25	D	**DEC**	P	(D)	BIN subtract one

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
D				*	*	*	*	*			

Notes on operand usage: none

16-bit command (3 STEP)

DEC	Continuous execution type	DECP	Pulse execution type

32-bit command (5 STEP)

DDEC	Continuous execution type	DDECP	Pulse execution type

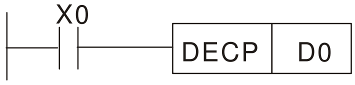
Flag signal: none

Explanation

- (D): Destination device.
- If a command is not the pulse execution type, when the command is executed, the program will add 1 to the content of device (D) for each scanning cycle.
- This command is ordinarily used as a pulse execution type command (DECP).
- During 16-bit operation, -32,768 -1 will change the value to 32,767. During 32 bit operation, -2,147,483,648 -1 will change the value to -2,147,483,647.

Example

- When X0=Off→On, 1 is automatically subtracted from the content of D0.



API	D	ROR	P	(D) (n)	Right rotation
30					

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
D							*	*	*	*	*
n				*	*						

Notes on operand usage:
Only K4 (16-bit) will be valid if the operand D is designated as KnY or KnM.
n operand n=K1-K16 (16-bit)

16-bit command (5 STEP)

ROR	Continuous execution type	RORP	Pulse execution type

32-bit command (9 STEP)

DROR	Continuous execution type	DRORP	Pulse execution type

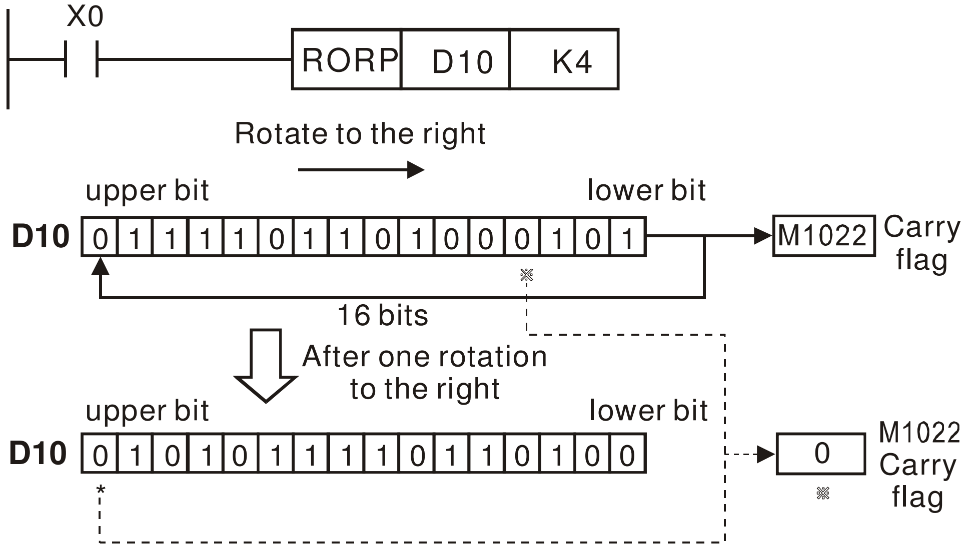
Flag signal: M1022 Carry flag

Explanation

- (D): Device to be rotated. (n): Number of bits for one rotation.
- Rotates the device designated by (D) to the right (n) bits.
- This command is ordinarily used as a pulse execution type command (RORP).

Example

- When X0=Off→On, 4 of the 16 bits in D10 specify a right rotation; the content of the bit indicated with * (see figure below) will be sent to the carry flag signal M1022.



API 31	D	ROL	P	(D) (n)	Left rotation

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
D							*	*	*	*	*
n				*	*						

Notes on operand usage:
Only K4 (16-bit) will be valid if the operand D is designated as KnY or KnM.
n operand n=1 to 16 (16-bit)

16-bit command (5 STEP)

ROL	Continuous execution type	ROLP	Pulse execution type

32-bit command (9 STEP)

DROL	Continuous execution type	DROLP	Pulse execution type

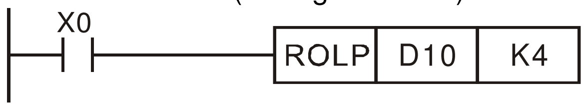
Flag signal: M1022 Carry flag

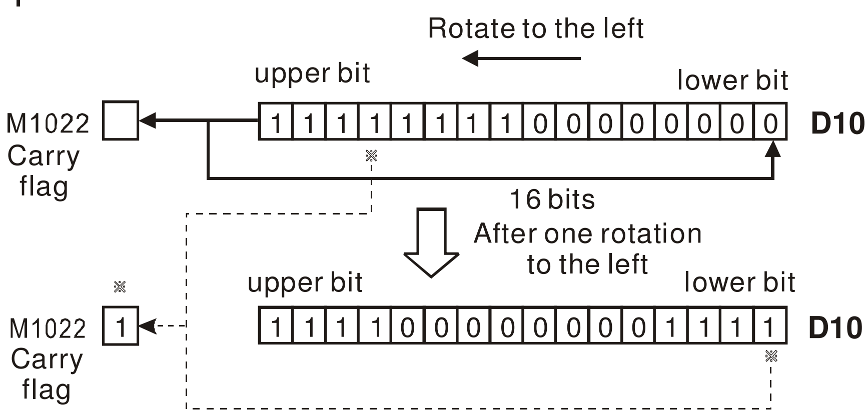
Explanation

- (D): Device to be rotated. (n): Number of bits for one rotation.
- Rotates the device designated by (D) to the left (n) bits.
- This command is ordinarily used as a pulse execution type command (ROLP).

Example

- When X0=Off→On, 4 of the 16 bits in D10 specify a left rotation; the content of the bit indicated with * (see figure below) will be sent to the carry flag signal M1022.





API		ZRST		D1 D2	Clear range
40			P		

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
D1		*	*						*	*	*
D2		*	*						*	*	*

Notes on operand usage:
Number of operand D_1 operand ≤ number of operand D_2
Operands D_1, D_2 must designate the same type of device
Please refer to the function specifications table for each device in series for the scope of device usage

16-bit command (5 STEP)

ZRST	Continuous execution type	ZRSTP	Pulse execution type

32-bit command

—	—	—	—

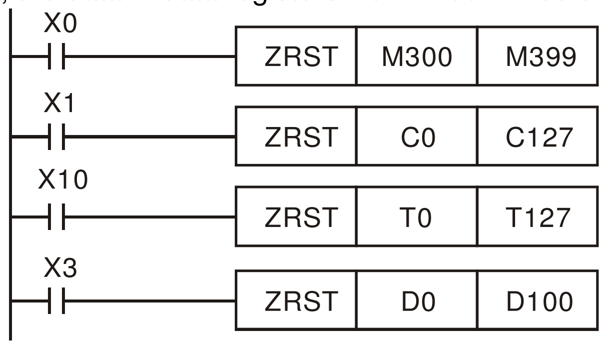
Flag signal: none

Explanation

- **D_1**: Clear range's initial device. **D_2**: Clear range's final device.
- When the number of operand D_1 > number of operand D_2, only the operand designated by D_2 will be cleared.

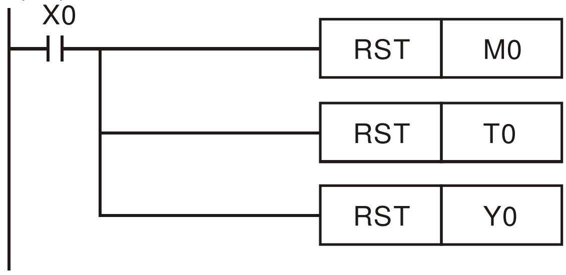
Example

- When X0 is On, auxiliary relays M300 - M399 will be cleared and changed to Off.
- When X1 is On, 16-bit counters C0 - C127 will all be cleared. (Writes 0, and clears and changes contact and coil to Off).
- When X10 is On, timer T0 - T127 will all be cleared. (Writes 0, and clears and changes contact and coil to Off).
- When X3 is On, the data in data registers D0 - D100 will be cleared and set as 0.



Remark

- Devices can independently use the clear command (RST), such as bit device Y, M and word device T, C, D.



API					
49	D	FLT	P	S D	BIN whole number → binary decimal transformation

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S		*	*						*	*	*
D		*	*						*	*	*

Notes on operand usage: Please refer to the function specifications table for each device in series for the scope of device usage
The operand D will occupy 2 consecutive points

16-bit command

–	–	–	–

32-bit command (9steps)

DFLT	Continuous execution type	DFLTP	Pulse execution type

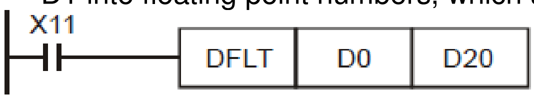
Flag signal: none

Explanation

- **S**: Transformation source device. **D**: Device storing transformation results.
- Transforms BIN whole number into a binary decimal value.

Example

- When X11 is On, converts the whole number of values corresponding to D0 and D1 into floating point numbers, which are placed in D20 and D21.



API				
150		MODRW P	S1 S2 S3 S n	MODBUS data read/write

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S1				*	*						*
S2				*	*						*
S3				*	*						*
S											*
n				*	*						*

16-bit command (5 STEP)

MODRW	Continuous execution type	MODRWP	Pulse execution type

32-bit command

–	–	–	–

Flag signal: M1077 M1078 M1079

Explanation

- S1: online device address. S2: communications function code. S3: address of data to read/write. S: register for data to be read/written is stored. N: length of data to be read/written.
- COM1 must be defined as controlled by the PLC (set P9-31 = -12) before using this command, and the corresponding communications speed and format must also be set (set P09-01 and P09-04). S2: communications function code. Currently only supports the following function code; the remaining function code cannot be executed.

Function	Description
H 02	Input read
H 03	Read word
H 06	Write single word
H 0F	Write multiple coils
H10	Write single word

- After executing this command, M1077, M1078 and M1079 will be immediately changed to 0.
- As an example, when CP2000 must control another converter and PLC, if the converter has a station number of 10 and the PLC has a station number of 20, see the following example:

Control slave device converter

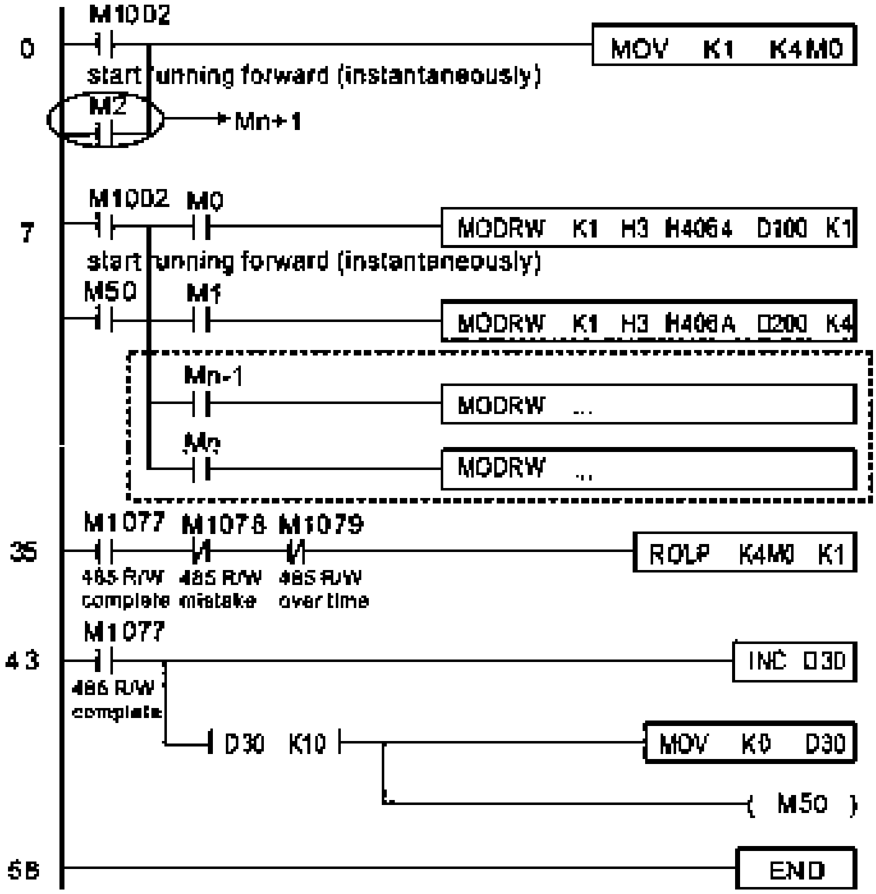
Serial No.	Example	MODRW command				
		S1	S2	S3	S4	n
		Node ID	Function code	Address	Register	Length:
1	Reads 4 sets of data comprising the converter slave device parameters P01-00 to P01-03, and saves the read data in D0 to D3	K10	H3	H100	D0	K4
2	Reads 3 sets of data comprising the converter slave device addresses H2100 to H2102, and saves the read data in D5 to D7	K10	H3	H2100	D5	K3
3	Reads 3 sets of data comprising the converter slave device parameters P05-00 to P05-03, and writes the values as D10 to D12	K10	H10	H500	D10	K3
4	Writes 2 sets of data comprising the converter slave device addresses H2000 to H2001, and writes the values as D15 to D16	K10	H10	H2000	D15	K2

PLC controlling slave device

Serial No.	Example	MODRW command				
		S1	S2	S3	S4	n
		Node ID	Function code	Address	Register	Length:
1	Reads 4 sets of data comprising the PLC slave device's X0 to X3 state, and saves the read data in bits 0 to 3 of D0	K20	H2	H400	D0	K4
2	Reads 4 sets of data comprising the PLC slave device's Y0 to Y3 state, and saves the read data in bits 0 to 3 of D1	K20	H2	H500	D1	K4
3	Reads 4 sets of data comprising the PLC slave device's M0 to M3 state, and saves the read data in bits 0 to 3 of D2	K20	H2	H800	D2	K4
4	Reads 4 sets of data comprising the PLC slave device's T0 to T3 state, and saves the read data in bits 0 to 3 of D3	K20	H2	H600	D3	K4
5	Reads 4 sets of data comprising the PLC slave device's C0 to C3 state, and saves the read data in bits 0 to 3 of D4	K20	H2	HE00	D4	K4
6	Reads 4 sets of data comprising the PLC slave device's T0 to T3 count value, and saves the read data of D10 to D13	K20	H3	H600	D10	K4
7	Reads 4 sets of data comprising the PLC slave device's C0 to C3 count value, and saves the read data of D20 to D23	K20	H3	HE00	D20	K4
8	Reads 4 sets of data comprising the PLC slave device's D0 to D3 count value, and saves the read data of D30 to D33	K20	H3	H1000	D30	K4
9	Writes 4 sets of the PLC slave device's Y0 to Y3 state, and writes the values as bits 0 to 3 of D1	K20	HF	H500	D1	K4
10	Writes 4 sets of the PLC slave device's M0 to M3 state, and writes the values as bits 0 to 3 of D2	K20	HF	H800	D2	K4
11	Writes 4 sets of the PLC slave device's T0 to T3 state, and writes the values as bits 0 to 3 of D3	K20	HF	H600	D3	K4
12	Writes 4 sets of the PLC slave device's C0 to C3 state, and writes the values as bits 0 to 3 of D4	K20	HF	HE00	D4	K4
13	Writes 4 sets of the PLC slave device's T0 to T3 state, and writes the values of D10 to D13	K20	H10	H600	D10	K4
14	Writes 4 sets of the PLC slave device's C0 to C3 state, and writes the values of D20 to D23	K20	H10	HE00	D20	K4
15	Writes 4 sets of the PLC slave device's D0 to D3 state, and writes the values of D30 to D33	K20	H10	H1000	D30	K4

Example

- Will trigger M0 On when the PLC begins to operate, and sends instruction to execute one MODRW command.
- After receiving the slave device's response, if the command is correct, it will execute one ROL command, which will cause M1 to be On.
- After receiving the slave device's response, will trigger M50 = 1 after a delay of 10 PLC scanning cycles, and then execute one MODRW command.
- After again receiving the slave device's response, if the command is correct, it will execute one ROL command, and M2 will change to On at this time (and M2 can be defined as a repeat of M); K4M0 will change to K1, and only M0 will remain 1. Transmission can proceed in a continuous cycle. If you wish to add a command, merely add the desired command in the empty frame, and change repeat M to Mn+1.



API					
110	D	ECMP	P	S1 S2 D	Comparison of binary floating point numbers

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S1				*	*						*
S2				*	*						*
D				*	*						*

Notes on operand usage:
The operand D occupies three consecutive points
Please refer to the function specifications table for each device in series for the scope of device usage

16-bit command

—	—	—	—

32-bit command (13 STEP)

DECMP	Continuous execution type	DECMPP	Pulse execution type

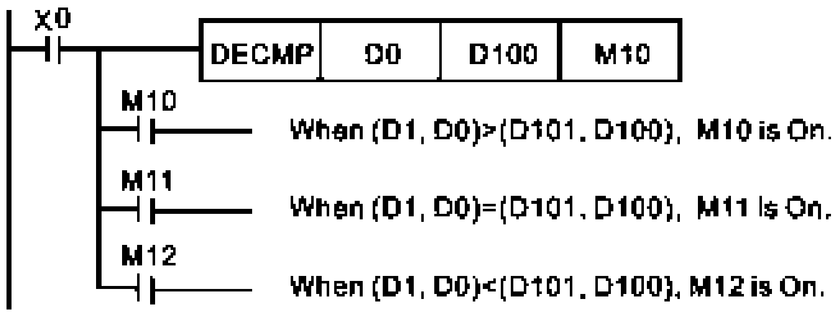
Flag signal: none

Explanation

- **S_1**: Comparison of binary floating point numbers value 1. **S_2**: Comparison of binary floating point numbers value 2. **D**: Results of comparison, occupies 3 consecutive points.
- When binary floating point number 1 is compared with comparative binary floating point number 2, the result of comparison (>, =, <) will be expressed in **D**.
- **If the source operand S_1** or **S_2** designates a constant K or H, the command will transform the constant to a binary floating-point number for the purpose of comparison.

Example

- When the designated device is M10, it will automatically occupy M10-M12.
- When X0=On, the DECMP command executes, and one of M10-M12 will be On. When X0=Off, the DECMP command will not execute, and M10-M12 will remain in the X0=Off state.
- If results in the form of ≥, ≤, or ≠ are needed, they can be obtained by series and parallel connection of M10-M12.
- Please use the RST or ZRST command to clear the result.



API					
111	D	EZCP	P	S1 S2 S D	Comparison of binary floating point number range

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S1				*	*						*
S2				*	*						*
S				*	*						*
D		*	*								

Notes on operand usage:
The operand D occupies three consecutive points
Please refer to the function specifications table for each device in series for the scope of device usage

16-bit command

—	—	—	—

32-bit command (17 STEP)

DEZCP	Continuous execution type	DEZCPP	Pulse execution type

Flag signal: none

Explanation

- S_1: Lower limit of binary floating point number in range comparison. S_2: Upper limit of binary floating point number in range comparison. **S**: Comparison of binary floating point numerical values. **D**: Results of comparison, occupies 3 consecutive points.

- Comparison of binary floating point numerical value **S** with binary floating point number lower limit value S_1 and binary floating point number upper limit value S_2; the results of comparison are expressed in **D**.

- **If the source operand S_1** or S_2 designates a constant K or H, the command will transform the constant to a binary floating-point number for the purpose of comparison.

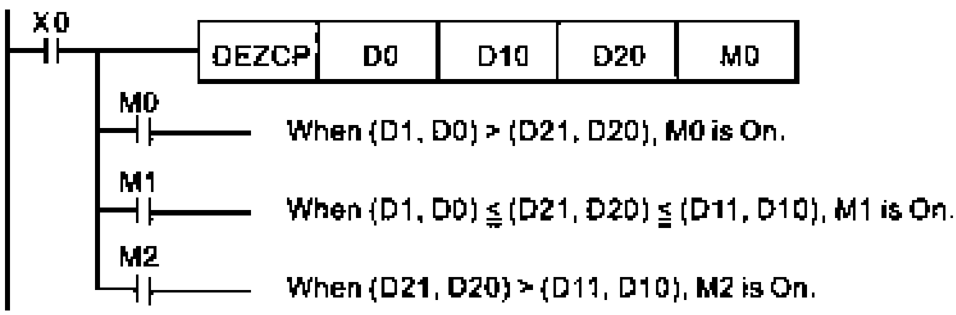
- When the lower limit binary floating point number S_1 is greater than the upper limit binary floating point number S_2, a command will be issued to perform comparison with the upper and lower limits using the binary floating point number lower limit value S_1.

Example

- When the designated device is M0, it will automatically occupy M0- M2.

- When X0=On, the DEZCP command will be executed, and one of M0-M2 will be On. When X0=Off, the EZCP command will not execute, and M0-M2 will continue in the X0=Off state.

- Please use the RST or ZRST command to clear the result.



API					
116	D	RAD	P	(S) (D)	Angle → Radian

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S				*	*						*
D											*

Notes on operand usage:
Please refer to the function specifications table for each device in series for the scope of device usage

16-bit command

–	–	–	–

32-bit command (9 STEP)

DRAD	Continuous execution type	DRADP	脈波執行型

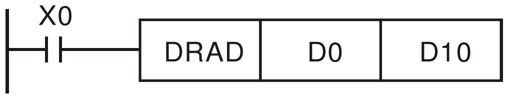
Flag signal: none

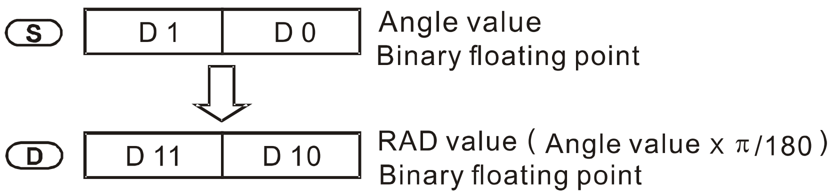
Explanation

- **S**: data source (angle). **D**: result of transformation (radian).
- Uses the following formula to convert angles to radians.
- Radian ＝Angle × (π/180)

Example

- When X0=On, the angle of the designated binary floating point number (D1, D0) will be converted to radians and stored in (D11, D10), with the content consisting of a binary floating point number.





API					
117	D	DEG	P	S D	Radian → Angle

	Bit device			Word device								16-bit command			
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D	–	–	–	–
S				*	*						*	32-bit command (9 STEP)			
D											*	DDEG	Continuous execution type	DDEGP	Pulse execution type

Notes on operand usage:
Please refer to the function specifications table for each device in series for the scope of device usage

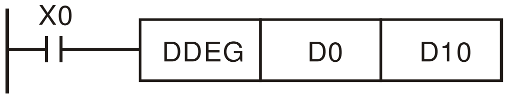
Flag signal: none

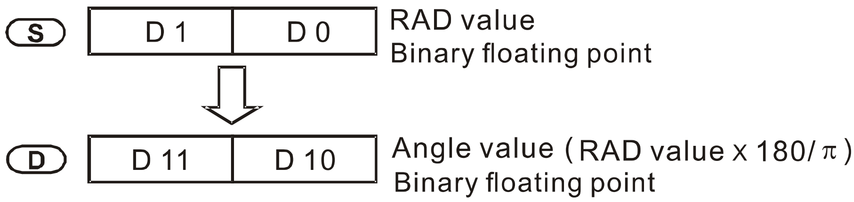
Explanation

- **S**: data source (radian). **D**: results of transformation (angle).
- Uses the following formula to convert radians to an angle.
- Angle = Radian × (180/π)

Example

- When X0=On, angle of the designated binary floating point number (D1, D0) in radians will be converted to an angle and stored in (D11, D10), with the content consisting of a binary floating point number.





API					
120	D	EADD	P	S1 S2 D	Adding binary floating point numbers

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S1				*	*						*
S2				*	*						*
D											*

Notes on operand usage:
Please refer to the function specifications table for each device in series for the scope of device usage

16-bit command

–	–	–	–

32-bit command (9 STEP)

DEADD	Continuous execution type	DEADDP	Pulse execution type

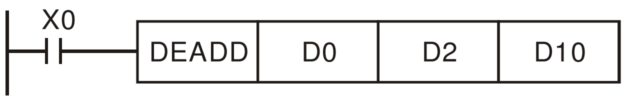
Flag signal: none

Explanation

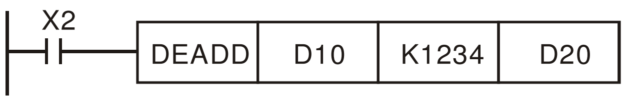
- S_1: addend. S_2: augend. **D**: sum.
- When the content of the register designated by S_2 is added to the content of the register designated by S_1, and the result is stored in the register designated by **D**. Addition is performed entirely using binary floating-point numbers.
- **If the source operand** S_1 or S_2 designates a constant K or H, the command will transform that constant into a binary floating point number for use in addition.
- **In the situation when** S_1 and S_2 designate identical register numbers, if a "continuous execution" command is employed, when conditional contact is On, the register will perform addition once during each scan. Pulse execution type commands (DEADDP) are generally used under ordinary circumstances.

Example

- When X0=On, a binary floating point number (D1, D0) will be added to a binary floating point number (D3, D2), and the results stored in (D11, D10).



- When X2 =On, a binary floating point number (D11, D10) will be added to K1234 (which has been automatically converted to a binary floating-point number), and the results stored in (D21, D20).



API					
121	D	ESUB	P	S1 S2 D	Subtraction of binary floating point numbers

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S1				*	*						*
S2				*	*						*
D											*

Notes on operand usage:
Please refer to the function specifications table for each device in series for the scope of device usage

16-bit command			
–	–	–	–

32-bit command (13 STEP)			
DESUB	Continuous execution type	DESUBP	Pulse execution type

Flag signal: none

Explanation

- $\mathbf{S_1}$: minuend. $\mathbf{S_2}$: subtrahend. **D**: difference.
- When the content of the register designated by $\mathbf{S_2}$ is subtracted from the content of the register designated by $\mathbf{S_1}$, the difference will be stored in the register designated by **D**; subtraction is performed entirely using binary floating-point numbers.
- **If the source operand $\mathbf{S_1}$** or $\mathbf{S_2}$ designates a constant K or H, the command will transform that constant into a binary floating point number for use in subtraction.
- **In the situation when $\mathbf{S_1}$** and $\mathbf{S_2}$ designate identical register numbers, if a "continuous execution" command is employed, when conditional contact is On, the register will perform addition once during each scan. Pulse execution type commands (DESUBP) are generally used under ordinary circumstances.

Example

- When X0=On, a binary floating point number (D1, D0) will be subtracted to a binary floating point number (D3, D2), and the results stored in (D11, D10).

X0				
─┤├─	DESUB	D0	D2	D10

- When X2 =On, the binary floating point number (D1, D0) will be subtracted from K1234 (which has been automatically converted to a binary floating-point number), and the results stored in (D11, D10).

X2				
─┤├─	DESUB	K1234	D0	D10

API					
122	D	EMUL	P	S1 S2 D	Multiplication of binary floating point numbers

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S1				*	*						*
S2				*	*						*
D											*

Notes on operand usage:
Please refer to the function specifications table for each device in series for the scope of device usage

16-bit command			
–	–	–	–

32-bit command (13 STEP)			
DEMUL	Continuous execution type	DEMULP	Pulse execution type

Flag signal: none

Explanation

- **S_1**: multiplicand. **S_2**: multiplier. **D**: product.
- When the content of the register designated by **S_1** is multiplied by the content of the register designated by **S_2**, the product will be stored in the register designated by **D**; multiplication is performed entirely using binary floating-point numbers.
- **If the source operand S_1** or **S_2** designates a constant K or H, the command will transform that constant into a binary floating point number for use in multiplication.
- **In the situation when S_1** and **S_2** designate identical register numbers, if a "continuous execution" command is employed, when conditional contact is On, the register will perform multiplication once during each scan. Pulse execution type commands (DEMULP) are generally used under ordinary circumstances.

Example

- When X1=On, the binary floating point number (D1, D0) will be multiplied by the binary floating point number (D11, D10), and the product will be stored in the register designated by (D21, D20).

X1

DEMUL	D0	D10	D20

- When X2 =On, the binary floating point number (D1, D0) will be multiplied from K1234 (which has been automatically converted to a binary floating-point number), and the results stored in (D11, D10).

X2

DEMUL	K1234	D0	D10

API					
123	D	EDIV	P	S1 S2 D	Division of binary floating point numbers

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S1				*	*						*
S2				*	*						*
D											*

Notes on operand usage:
Please refer to the function specifications table for each device in series for the scope of device usage

16-bit command

–	–	–	–

32-bit command (13 STEP)

DEDIV	Continuous execution type	DEDIVP	Pulse execution type

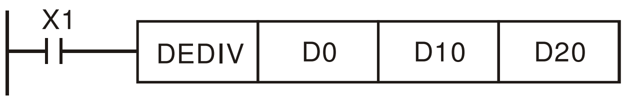
Flag signal: none

Explanation

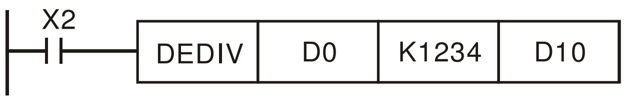
- S_1: dividend. S_2: divisor. **D**: quotient and remainder.
- When the content of the register designated by S_1 is divided by the content of the register designated by S_2, the quotient will be stored in the register designated by **D**; division is performed entirely using binary floating-point numbers.
- **If the source operand** S_1 or S_2 designates a constant K or H, the command will transform that constant into a binary floating point number for use in division.

Example

- When X1=On, the binary floating point number (D1, D0) will be divided by the binary floating point number (D11, D10), and the quotient stored in the register designated by (D21, D20).



- When X2 =On, the binary floating point number (D1, D0) will be divided by K1,234 (which has been automatically converted to a binary floating-point number), and the results stored in (D11, D10).



API					
124	D	EXP	P	S D	Binary floating point number obtain exponent

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S				*	*						*
D											*

Notes on operand usage:
Please refer to the function specifications table for each device in series for the scope of device usage

16-bit command			
–	–	–	–

32-bit command (9 STEP)			
DEXP	Continuous execution type	DEXPP	Pulse execution type

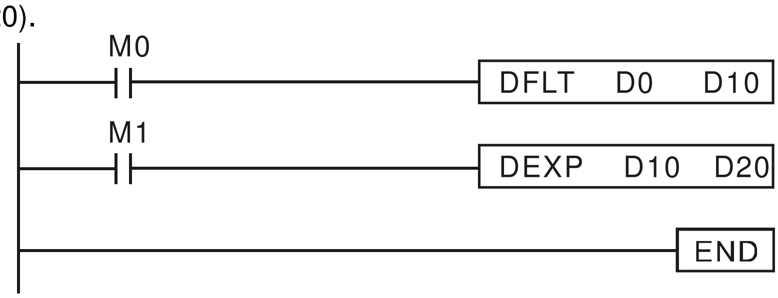
Flag signal: none

Explanation

- **S**: operation source device. **D**: operation results device.
- Taking e =2.71828 as a base, **S** is the exponent in the EXP operation.
- [**D** +1，**D**]=EXP[**S +1**，**S**]
- Valid regardless of whether the content of **S** has a positive or negative value. The designated register D must have a 32-bit data format. This operation is performed using floating-point numbers, and **S** must therefore be converted to a floating point number.
- Content of operand **D** $=e^{S}$; e=2.71828, **S** is the designated source data

Example

- When M0 is On, the value of (D1, D0) will be converted to a binary floating point number, which will be stored in register (D11, D10).
- When M1 is On, the EXP operation is performed on the exponent of (D11, D10); its value is a binary floating point number stored in register (D21, D20).



API					
125	D	LN	P	S D	Binary floating point number obtain logarithm

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S				*	*						*
D											*

Notes on operand usage:
Please refer to the function specifications table for each device in series for the scope of device usage

16-bit command

—	—	—	—

32-bit command (9 STEP)

DLN	Continuous execution type	DLNP	Pulse execution type

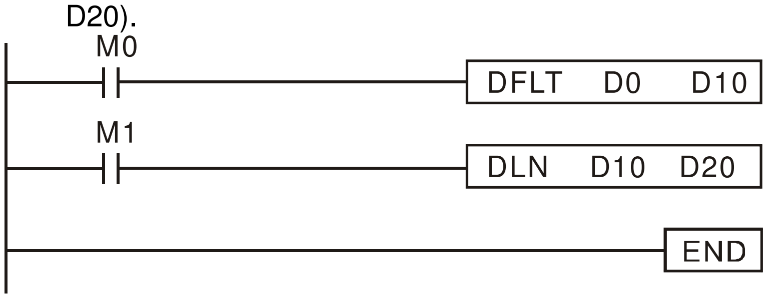
Flag signal: none

Explanation

- **S**: operation source device. **D**: operation results device.
- Taking e =2.71828 as a base, **S** is the exponent in the EXP operation.
- [**D** +1，**D**]=EXP[**S +1，S**]
- Valid regardless of whether the content of **S** has a positive or negative value. The designated register D must have a 32-bit data format. This operation is performed using floating-point numbers, and **S** must therefore be converted to a floating point number.
- Content of operand **D** =e^{S} ; e=2.71828， **S** is the designated source data

Example

- When M0 is On, the value of (D1, D0) will be converted to a binary floating point number, which will be stored in register (D11, D10).
- When M1 is On, the EXP operation is performed on the exponent of (D11, D10); its value is a binary floating point number stored in register (D21, D20).



API 127	D	ESQR	P	(S) (D)	Binary floating point number find square root

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S				*	*						*
D											*

Notes on operand usage:
Please refer to the function specifications table for each device in series for the scope of device usage

16-bit command

–	–	–	–

32-bit command (9 STEP)

DESQR	Continuous execution type	DESQRP	Pulse execution type

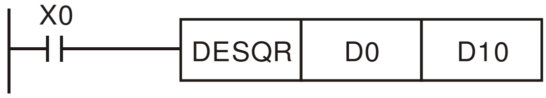
Flag signal: none

Explanation

- **S**: source device for which square root is desired **D**: result of finding square root.
- When the square root is taken of the content of the register designated by **S**, the result is temporarily stored in the register designated by **D**. Taking square roots is performed entirely using binary floating-point numbers.
- If the source operand **S** refers to a constant K or H, the command will transform that constant into a binary floating point number for use in the operation.

Example

- When X0=On, the square root is taken of the binary floating point number (D1, D0), and the result is stored in the register designated by (D11, D10).



$$\sqrt{(D1, D0)} \longrightarrow (D11, D10)$$

Binary floating point → Binary floating point

- When X2 =On, the square root is taken of K1,234 (which has been automatically converted to a binary floating-point number), and the results stored in (D11, D10).

API	D	INT	P	(S) (D)	Binary floating point number → BIN whole number transformation
129					

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S											*
D											*

Notes on operand usage:
Please refer to the function specifications table for each device in series for the scope of device usage

16-bit command

–	–	–	–

32-bit command (9 STEP)

DINT	Continuous execution type	DINTP	Pulse execution type

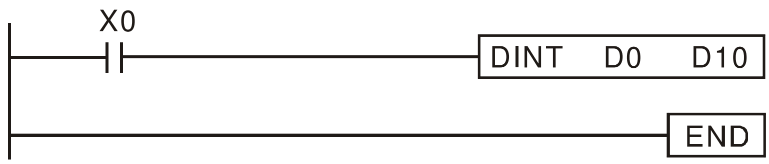
Flag signal: none

Explanation

- **S**: the source device to be transformed. **D**: results of transformation.
- The content of the register designated by **S** is transformed from a binary floating point number format into a BIN whole number, and is temporarily stored in **D**. The BIN whole number floating point number will be discarded.
- The action of this command is the opposite of that of command API 49 (FLT).

Example

- When X0=On, the binary floating point number (D1, D0) is transformed into a BIN whole number, and the result is stored in (D10); the BIN whole number floating point number will be discarded.



API				
130	D	SIN	P	S D	Binary floating point number SIN operation

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S				*	*						*
D											*

Notes on operand usage:
Please refer to the function specifications table for each device in series for the scope of device usage

16-bit command

–	–	–	–

32-bit command (9 STEP)

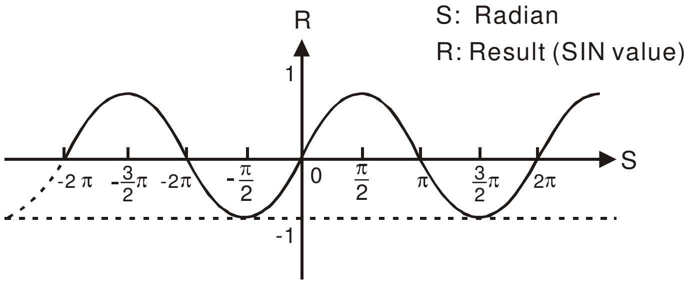
DSIN	Continuous execution type	DSINP	Pulse execution type

Flag signal: none

Explanation

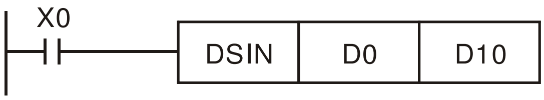
- **S**: the designated source value. **D**: the SIN value result.
- **S** is the designated source in radians.
- The value in radians (RAD) is equal to (angle ×π/180).
- The SIN obtained from the source value designated by **S** is stored in **D**.

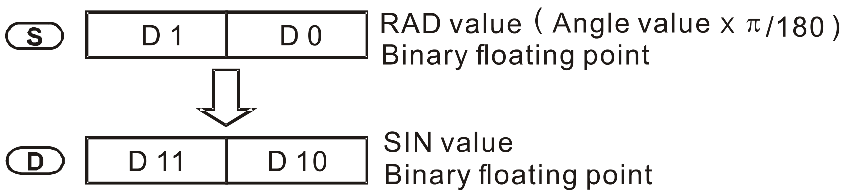
The following figure displays the relationship between the arc and SIN results:



Example

- When X0=On, the SIN value of the designated binary floating point number (D1, D0) in radians (RAD) will be stored in (D11, D10), with the content consisting of a binary floating point number.





API					
131	D	COS	P	S D	Binary floating point number COS operation

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S				*	*						*
D											*

Notes on operand usage:
Please refer to the function specifications table for each device in series for the scope of device usage

16-bit command

–	–	–	–

32-bit command (9 STEP)

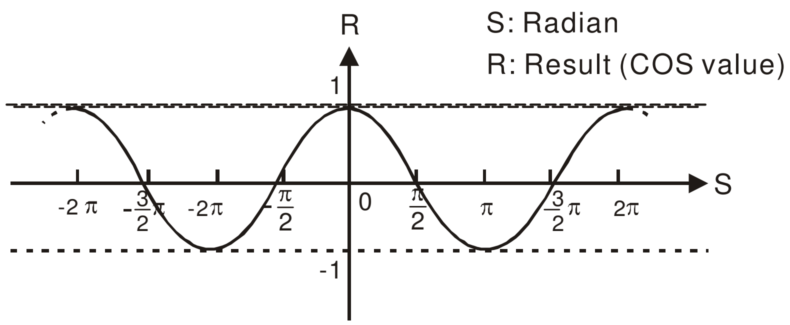
DCOS	Continuous execution type	DCOSP	Pulse execution type

Flag signal: none

Explanation

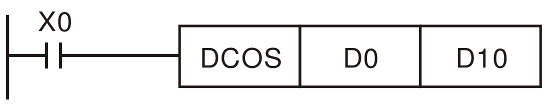
- **S**: the designated source value. **D**: the COS value result.
- **The source designated by S can be given as radians or an angle; this is decided by flag M1018.**
- When M1018=Off, the operation is in radians mode, where the radians (RAD) value is equal to (angle ×π/180).
- When M1018=On, the operation is in the angle mode, where the angular range is 0°≤ angle <360°.
- When calculation results yield 0, M1020=On.
- The COS obtained from the source value designated by **S** is stored in **D**.

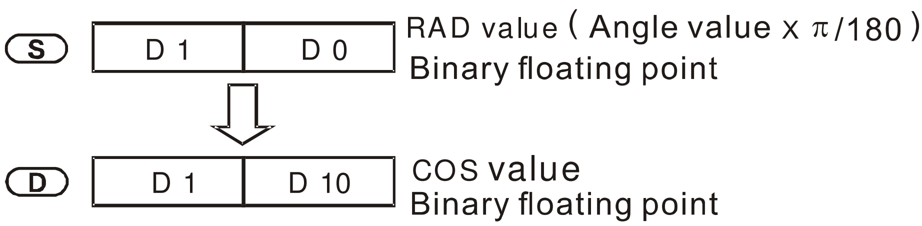
The following figure displays the relationship between the arc and SIN results:



Example

- When X0=On, the COS value of the designated binary floating point number (D1, D0) in radians will be stored in (D11, D10), with the content consisting of a binary floating point number.





API					
132	D	TAN	P	S D	Binary floating point number TAN operation

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S				*	*						*
D											*

Notes on operand usage:
Please refer to the function specifications table for each device in series for the scope of device usage

16-bit command

–	–	–	–

32-bit command (9 STEP)

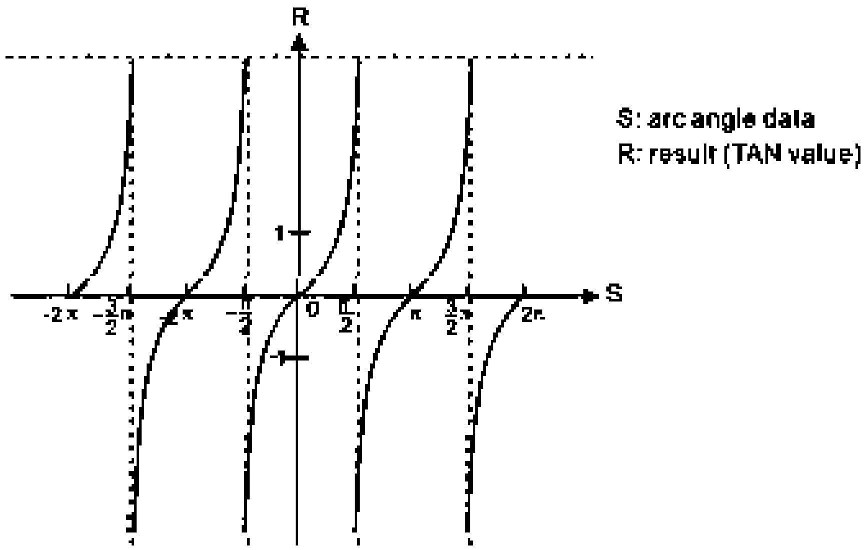
DTAN	Continuous execution type	DTANP	Pulse execution type

Flag signal: none

Explanation

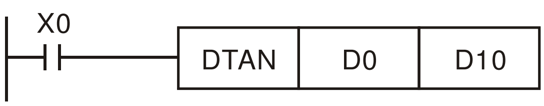
- **S**: the designated source value. **D**: the TAN value result.
- The source designated by **S** can be given as radians or an angle; this is decided by flag M1018.
- When M1018=Off, the operation is in radians mode, where the radians (RAD) value is equal to (angle ×π/180).
- When M1018=On, the operation is in the angle mode, where the angular range is 0°≤ angle <360°.
- When calculation results yield 0, M1020=On.
- The TAN obtained from the source value designated by **S** is stored in **D**.

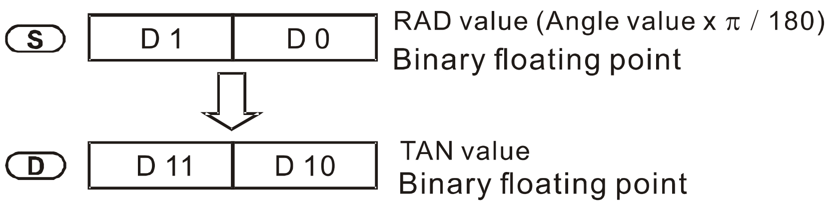
The following figure displays the relationship between the arc and SIN results:



Example

- When X0=On, the TAN value of the designated binary floating point number (D1, D0) in radians (RAD) will be stored in (D11, D10), with the content consisting of a binary floating point number.





API 133	D	ASIN	P	(S) (D)	Binary floating point number ASIN operation

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S				*	*						*
D											*

Notes on operand usage:
Please refer to the function specifications table for each device in series for the scope of device usage

16-bit command

–	–	–	–

32-bit command (9 STEP)

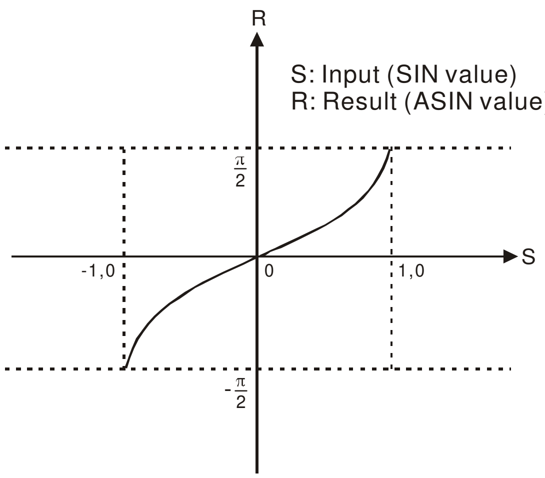
DASIN	Continuous execution type	DASINP	Pulse execution type

Flag signal: none

Explanation

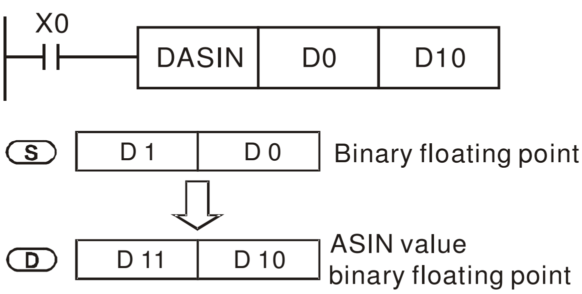
- **S**: the designated source (binary floating point number). **D**: the ASIN value result.
- ASIN value $=\sin^{-1}$

The figure below shows the relationship between input data and result:



Example

◆ When X0=On, the ASIN value obtained from the designated binary floating point number (D1, D0) will be stored in (D11, D10), with the content consisting of a binary floating point number.



API					
134	D	ACOS	P	S D	Binary floating point number ACOS operation

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S				*	*						*
D											*

Notes on operand usage:
Please refer to the function specifications table for each device in series for the scope of device usage

16-bit command

–	–	–	–

32-bit command (9 STEP)

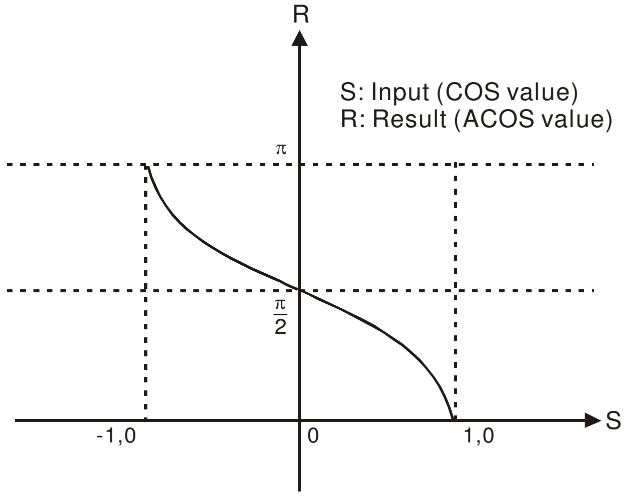
DACOS	Continuous execution type	DACOSP	Pulse execution type

Flag signal: none

Explanation

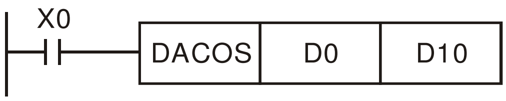
- **S**: the designated source (binary floating point number). **D**: the ACOS value result.
- ACOS value =$\cos^{-1}$

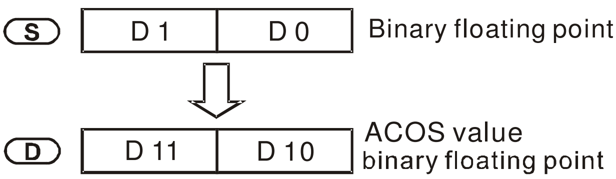
The figure below shows the relationship between input data and result:



Example

- When X0=On, the ACOS value obtained from the designated binary floating point number (D1, D0) will be stored in (D11, D10), with the content consisting of a binary floating point number.





API 135	D	ATAN	P	S D	Binary floating point number ATAN operation

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S				*	*						*
D											*

Notes on operand usage:
Please refer to the function specifications table for each device in series for the scope of device usage

16-bit command

–	–	–	–

32-bit command (9 STEP)

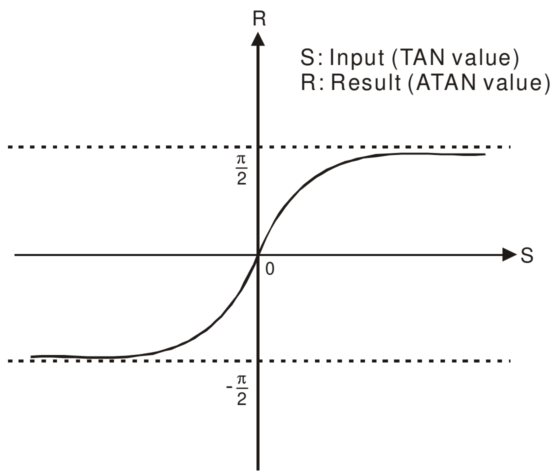
DATAN	Continuous execution type	DATANP	Pulse execution type

Flag signal: none

Explanation

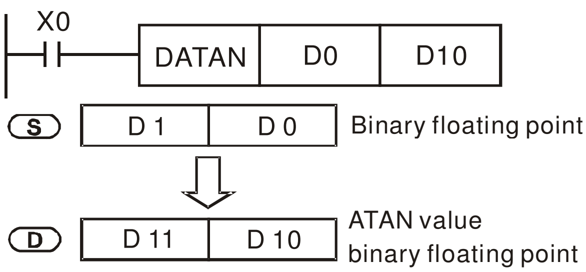
- **S**: the designated source (binary floating point number). **D**: the ATAN value result.
- ATAN value $=\tan^{-1}$

The figure below shows the relationship between input data and result:



Example

- When X0=On, the TAN value obtained from the designated binary floating point number (D1, D0) will be stored in (D11, D10), with the content consisting of a binary floating point number.



API	D	SINH	P	(S) (D)	Binary floating point number SINH operation
136					

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S				∗	∗						∗
D											∗

Notes on operand usage:
Please refer to the function specifications table for each device in series for the scope of device usage

16-bit command

–	–	–	–

32-bit command (9 STEP)

DSINH	Continuous execution type	DSINHP	Pulse execution type

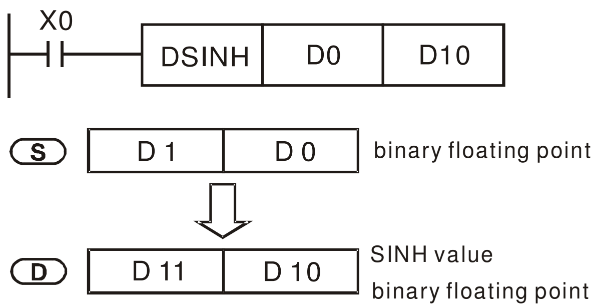
Flag signal: none

Explanation

- **S**: the designated source (binary floating point number). **D**: the SINH value result.
- SINH value $=(e^{s}-e^{-s})/2$

Example

- When X0=On, the SINH value obtained from the designated binary floating point number (D1, D0) will be stored in (D11, D10), with the content consisting of a binary floating point number.



API 137	D	COSH	P	(S) (D)	Binary floating point number COSH operation

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S				*	*						*
D											*

Notes on operand usage:
Please refer to the function specifications table for each device in series for the scope of device usage

16-bit command

–	–	–	–

32-bit command (9 STEP)

DCOSH	Continuous execution type	DCOSHP	Pulse execution type

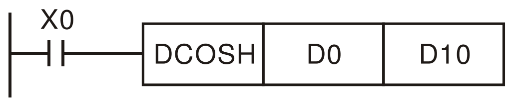
Flag signal: none

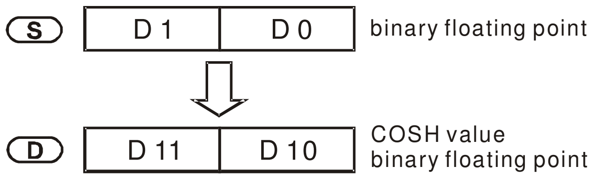
Explanation

- **S**: the designated source (binary floating point number). **D**: the COSH value result.
- COSH value $=(e^{s}+e^{-s})/2$

Example

- When X0=On, the COSH value obtained from the designated binary floating point number (D1, D0) will be stored in (D11, D10), with the content consisting of a binary floating point number.





API 138	D	TANH	P	(S) (D)	Binary floating point number TANH operation

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S				*	*						*
D											*

Notes on operand usage:
Please refer to the function specifications table for each device in series for the scope of device usage

16-bit command

–	–	–	–

32-bit command (9 STEP)

DTANH	Continuous execution type	DTANHP	Pulse execution type

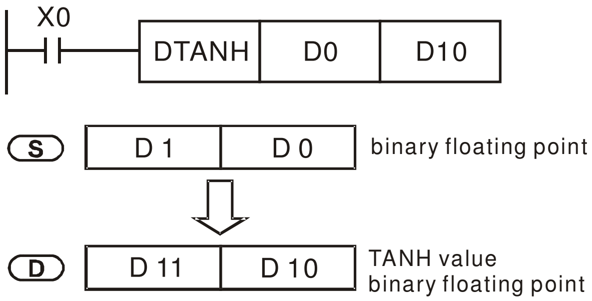
Flag signal: none

Explanation

- **S**: the designated source (binary floating point number). **D**: the TANH value result.
- tanh value $=(e^{s}-e^{-s})/(e^{s}+e^{-s})$

Example

- When X0=On, the TANH value obtained from the designated binary floating point number (D1, D0) will be stored in (D11, D10), with the content consisting of a binary floating point number.



API		Mnemonic		Operands	Function
160		TCMP	P	(S1) (S2) (S3) (S) (D)	Comparison of calendar data

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S1				*	*	*	*	*	*	*	*
S2				*	*	*	*	*	*	*	*
S3				*	*	*	*	*	*	*	*
S									*	*	*
D		*	*								

Notes on operand usage:
Please refer to the function specifications table for each device in series for the scope of device usage

16-bit command (11 STEP)

TCMP	Continuous execution type	TCMPP	Pulse execution type

32-bit command

–	–	–	–

Flag signal: none

Explanation

- S_1: Sets the hours of the comparison time, setting range is "K0-K23." S_2: Sets the minutes of the comparison time, setting range is "K0-K59." S_3: Sets the seconds of the comparison time, setting range is "K0-K59." **S**: current calendar time. **D**: Results of comparison.

- Compares the time in hours, minutes, and seconds set in S_1 - S_3 with the current calendar time in hours, minutes, and seconds, with the results of comparison expressed in **D**.

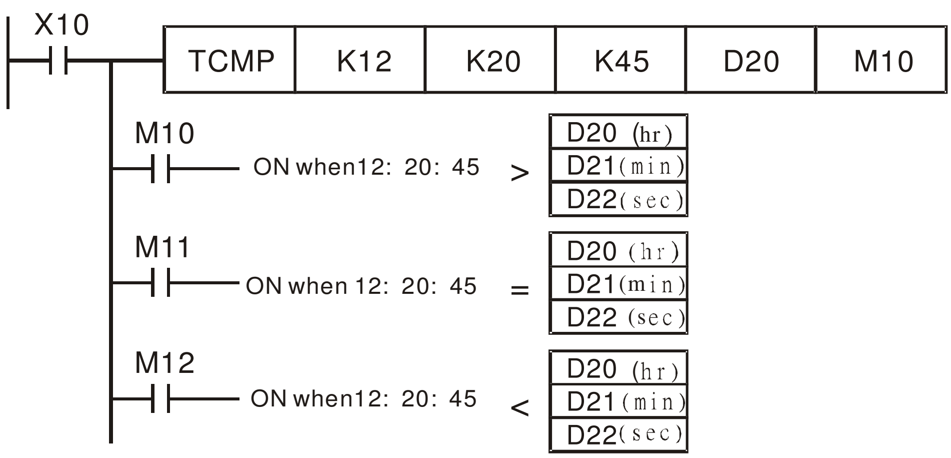
- **S** The hour content of the current calendar time is "K0-K23." **S** +1 comprises the minutes of the current calendar time, and consists of "K0-K59." **S** +2 comprises the seconds of the current calendar time, and consists of "K0-K59."

- The current calendar time designated by **S** is usually compared using the TCMP command after using the TRD command to read the current calendar time. If the content value of **S** exceeds the range, this is considered an operating error, the command will not execute, and M1068=On.

Example

- When X10=On, the command will execute, and the current calendar time in D20-D22 will be compared with the preset value of 12:20:45; the results will be displayed in M10-M12. When X10 On→Off, the command will not be executed, but the On/Off status prior to M10-M12 will be maintained.

- If results in the form of ≥, ≤, or ≠ are needed, they can be obtained by series and parallel connection of M10-M12.



API		Mnemonic		Operands	Function
161		TZCP	P	S1 S2 S D	Comparison of calendar data

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S1									＊	＊	＊
S2									＊	＊	＊
S									＊	＊	＊
D		＊	＊								

Notes on operand usage:
Please refer to the function specifications table for each device in series for the scope of device usage

16-bit command (9 STEP)

TZCP	Continuous execution type	TZCPP	Pulse execution type

32-bit command

–	–	–	–

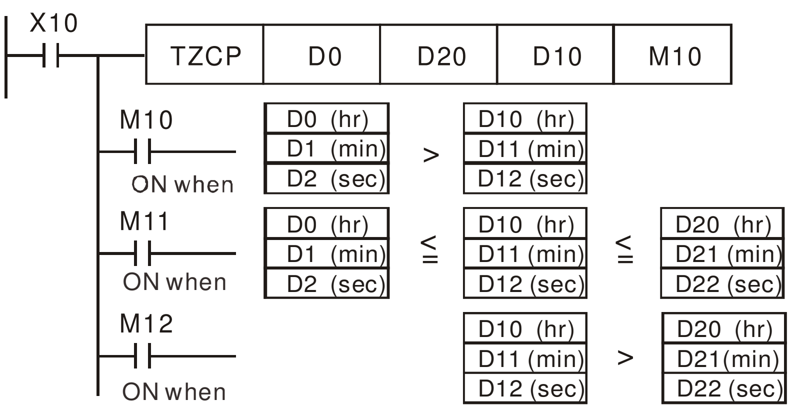
Flag signal: none

Explanation

- **S_1**: Sets the lower limit of the comparison time. **S_2**: Sets the upper limit of the comparison time. **S**: current calendar time. **D**: Results of comparison.
- Performs range comparison by comparing the hours, minutes, and seconds of the current calendar time designated by **S** with the lower limit of the comparison time set as **S_1** and the upper limit of the comparison time set as **S_2**, and expresses the results of comparison in **D**.
- **S_1** 、**S_1** +1 、**S_1** +2: Sets the hours, minutes, and seconds of the lower limit of the comparison time.
- **S_2** 、**S_2** +1 、**S_2** +2: Sets the hours, minutes, and seconds of the upper limit of the comparison time.
- **S** 、**S** +1 、**S** +2: The hours, minutes, and seconds of the current calendar time
- The D0 designated by the **S** listed in this program is usually obtained by comparison using the TZCP command after using the TRD command in advance to read the current calendar time. If the value of **S_1**, **S_2**, or **S** exceeds the range, this is considered an operating error, the command will not execute, and M1068=On.
- When the current time **S** is less than the lower limit value **S_1** and **S** is less than the upper limit value **S_2**, **D** will be On. When the current time **S** is greater than the lower limit value **S_1** and **S** is greater than the upper limit value **S_2**, **D** +2 will be On; **D** +1 will be On under other conditions.

Example

- When X10=On, the TZCP command executes, and one of M10-M12 will be On. When X10=Off, the TZCP command will not execute, and M10-M12 will remain in the X10=Off state.



API		TADD			
162			P	S1 S2 D	Calendar data addition

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S1									*	*	*
S2									*	*	*
D									*	*	*

Notes on operand usage:
Please refer to the function specifications table for each device in series for the scope of device usage

16-bit command (7 STEP)

TADD	Continuous execution type	TADDP	Pulse execution type

32-bit command

–	–	–	–

- Flag signal: M1020 Zero flag
  M1022 Carry flag
  M1068 Calendar error

Explanation

- $\mathbf{S_1}$: time addend. $\mathbf{S_2}$: time augend. **D**: time sum.
- The calendar data in hours, minutes, and seconds designated by $\mathbf{S_2}$ is added to the calendar data in hours, minutes, and seconds designated by $\mathbf{S_1}$, and the result is stored as hours, minutes, and seconds in the register designated by **D**.
- If the value of $\mathbf{S_1}$ or $\mathbf{S_2}$ exceeds the range, this is considered an operating error, the command will not execute, M1067, M1068=On, and D1067 will record the error code 0E1A(HEX).
- If the results of addition are greater than or equal to 24 hours, carry flag M1022=On, and **D** will display the results of addition minus 24 hours.
- If the results of addition are equal to 0 (0 hours, 0 minutes, 0 seconds), zero flag M1020=On.

Example

- When X10=On, the TADD command will be executed, and the calendar data in hours, minutes, and seconds designated by D0 to D2 will be added to the calendar data in hours, minutes, and seconds designated by D10 to D12, and the results are stored as a total number of hours, minutes, and seconds in the registers designated by D20 to D22.

X10	TADD	D0	D10	D20

D0	8(hr)
D1	10(min)
D2	20(sec)

8 : 10 : 20

+

D10	6(hr)
D11	40(min)
D12	6(sec)

6 : 40 : 6

→

D20	14(hr)
D2150	(min)
D22	26(sec)

14: 50: 26

API				
163		**TSUB** P	S1 S2 D	Calendar data subtraction

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S1									*	*	*
S2									*	*	*
D									*	*	*

Notes on operand usage:
Please refer to the function specifications table for each device in series for the scope of device usage

16-bit command (7 STEP)			
TSUB	Continuous execution type	TSUBP	Pulse execution type

32-bit command			
–	–	–	–

- Flag signal: M1020 Zero flag
  M1022 Carry flag
  M1068 Calendar error

Explanation

- $\mathbf{S_1}$: time minuend. $\mathbf{S_2}$: time augend. **D**: time sum.
- Subtracts the calendar data in hours, minutes, and seconds designated by $\mathbf{S_2}$ from the calendar data in hours, minutes, and seconds designated by $\mathbf{S_1}$, and the result is temporarily stored as hours, minutes, and seconds in the register designated by **D**.
- If the value of $\mathbf{S_1}$ or $\mathbf{S_2}$ exceeds the range, this is considered an operating error, the command will not execute, M1067, M1068=On, and D1067 will record the error code 0E1A(HEX).
- If subtraction results in a negative number, borrow flag M1021=On, and the result of that negative number plus 24 hours will be displayed in the register designated by **D**.
- If the results of subtraction are equal to 0 (0 hours, 0 minutes, 0 seconds), zero flag M1020=On.

Example

- When X10=On, the TADD command will be executed, and the calendar data in hours, minutes, and seconds designated by D10 to D12 will be subtracted from the calendar data in hours, minutes, and seconds designated by D0 to D2, and the results are stored as a total number of hours, minutes, and seconds in the registers designated by D20 to D22.

X10

TSUB	D0	D10	D20

D0 20(hr)	–	D10 14(hr)	→	D20 5(hr)
D1 20(min)		D11 30(min)		D21 49(min)
D2 5(sec)		D12 8(sec)		D22 57(sec)
20: 20: 5		14: 30: 8		5: 49: 57

API 166	TRD	P	D	Calendar data read

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
D									*	*	*

Notes on operand usage:
Please refer to the function specifications table for each device in series for the scope of device usage

16-bit command (3 STEP)

TRD	Continuous execution type	120	Pulse execution type

32-bit command

–	–	–	–

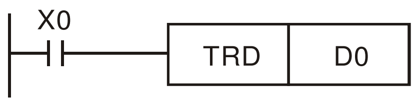
- Flag signal: none

Explanation

- **S**$_1$: time minuend. **S**$_2$: time augend. **D**: time sum.
- **D**: device used to store the current calendar time after reading.
- The EH/EH2/SV/EH3/SV2/SA/SX/SC main units have a built-in calendar clock, and the clock provides seven sets of data comprising year, week, month, day, hour, minute, and second stored in D1063 to D1069. The TRD command function allows program designers to directly read the current calendar time into the designated seven registers.
- D1063 only reads the two right digits of the Western calendar year.

Example

- When X0=On, the current calendar time is read into the designated registers D0 to D6.
- In D1064, 1 indicates Monday, 2 indicates Tuesday, and so on, with and 7 indicating Sunday.



Special D	Item	Content		General D	Item
D1063	Year (Western)	00~99	→	D0	Year (Western)
D1064	Weeks	1~7	→	D1	Weeks
D1065	Month	1~12	→	D2	Month
D1066	Day	1~31	→	D3	Day
D1067	Hour	0~23	→	D4	Hour
D1068	Minute	0~59	→	D5	Minute
D1069	Second	0~59	→	D6	Second

API					
170	D	GRY	P	S D	BIN→GRAY code transformation

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S				*	*	*	*	*	*	*	*
D							*	*	*	*	*

Notes on operand usage:
Please refer to the function specifications table for each device in series for the scope of device usage

16-bit command (5 STEP)

GRY	Continuous execution type	GRYP	Pulse execution type

32-bit command (9 STEP)

DGRY	Continuous execution type	DGRYP	Pulse execution type

- Flag signal: none

Explanation

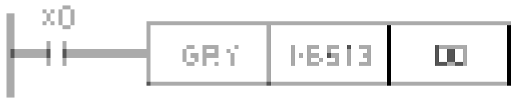
- **S**: source device. **D**: device storing GRAY code.
- Transforms the content value (BIN value) of the device designated by **S** to GRAY code, which is stored in the device designated by **D**.
- The valid range of **S** is as shown below; if this range is exceeded, it will be considered an error, and the command will not execute.

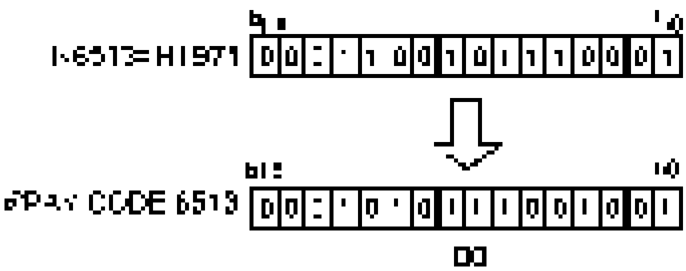
16-bit command: 0~32,767

- 32-bit command: 0~2,147,483,647

Example

- ◆ When X0=On, the constant K6513 will be transformed to GRAY code and stored in D0.





API					
171	D	GBIN	P	S D	GRAY code →BIN transformation

	Bit device			Word device								16-bit command (5 STEP)
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D	GBIN: Continuous execution type; GBINP: Pulse execution type
S				*	*	*	*	*	*	*	*	32-bit command (9 STEP)
D							*	*	*	*	*	DGBIN: Continuous execution type; DGBINP: Pulse execution type

Notes on operand usage:
Please refer to the function specifications table for each device in series for the scope of device usage

- Flag signal: none

Explanation

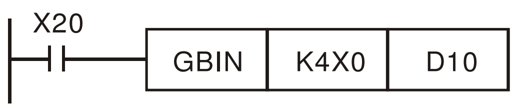
- **S**: source device used to store GRAY code. **D**: device used to store BIN value after transformation.
- The GRAY code corresponding to the value of the device designated by **S** is transformed into a BIN value, which is stored in the device designated by **D**.
- This command will transform the value of the absolute position encoder connected with the PLC's input and (this encoder usually has an output value in the form of GRAY code) into a BIN value, which is stored in the designated register.
- The valid range of **S** is as shown below; if this range is exceeded, it will be considered an error, and the command will not execute.

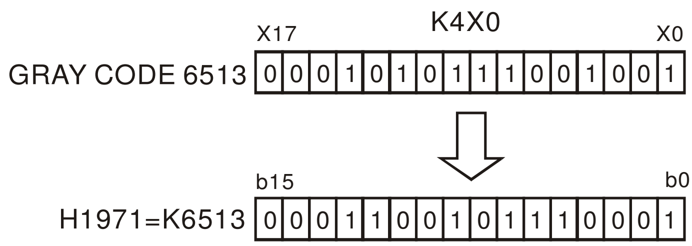
  16-bit command: 0~32,767

- 32-bit command: 0~2,147,483,647

Example

- When X20=On, the GRAY code of the absolute position encoder connected with input points X0 to X17 will be transformed into BIN value and stored in D10.





API 215~217	D	LD#		(S1) (S2)	Contact form logical operation LD#

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S1				*	*	*	*	*	*	*	*
S2				*	*	*	*	*	*	*	*

Notes on operand usage: # : & 、| 、^

Please refer to the function specifications table for each device in series for the range of device usage

16-bit command (5 STEP)

LD#	Continuous execution type	-	-

32-bit command (9 STEP)

DLD#	Continuous execution type	-	-

Flag signal: none

Explanation

- $\mathbf{S_1}$: data source device 1. $\mathbf{S_2}$: data source device 2.
- This command performs comparison of the content of $\mathbf{S_1}$ and $\mathbf{S_2}$; when the result of comparison is not 0, this command will be activated, but this command will not be activated when the result of comparison is 0.
- The LD#This command can be used while directly connected with the busbar

API No.	16-bit commands	32-bit commands	Conditions for activation				Conditions for inactivation			
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^	$\mathbf{S_1}$	^	$\mathbf{S_2}$	$\neq 0$	$\mathbf{S_1}$	^	$\mathbf{S_2}$	$=0$

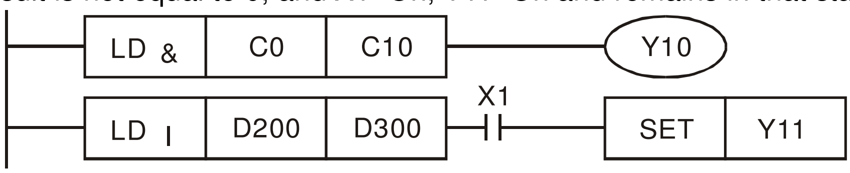
&: logical AND operation.

|: logical OR operation.

^: logical XOR operation.

Example

- When the content of C0 and C10 is subjected to the logical AND operation, and the result is not equal to 0, Y10=On.
- When the content of D200 and D300 is subjected to the logical OR operation, and the result is not equal to 0, and X1=On, Y11=On and remains in that state.



API 218~220	D	AND#		S1 S2	Contact form logical operation AND#

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S1				*	*	*	*	*	*	*	*
S2				*	*	*	*	*	*	*	*

Notes on operand usage: # : & 、| 、^

Please refer to the function specifications table for each device in series for the scope of device usage

16-bit command (5 STEP)

AND#	Continuous execution type	–	–

32-bit command (9 STEP)

DAND#	Continuous execution type	–	–

Flag signal: none

Explanation

- S_1: data source device 1. S_2: data source device 2.
- This command performs comparison of the content of S_1 and S_2; when the result of comparison is not 0, this command will be activated, but this command will not be activated when the result of comparison is 0.
- The AND# command is an operation command in series with the contact.

API No.	16-bit commands	32-bit commands	Conditions for activation				Conditions for inactivation			
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	$=0$

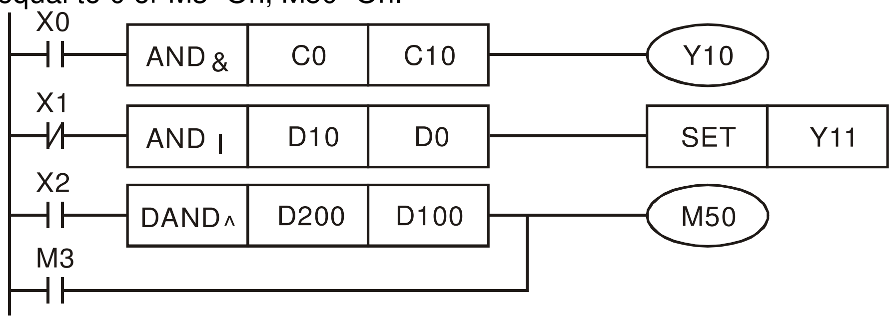
&: logical AND operation.

|: logical OR operation.

^: logical XOR operation.

Example

- When X0=On and the content of C0 and C10 is subjected to the logical AND operation, and the result is not equal to 0, Y10=On.
- When X1=Off and D10 and D0 is subjected to the logical OR operation, and the result is not equal to 0, Y11=On and remains in that state.
- When X2 =On and the content of the 32-bit register D200(D201) and 32-bit register D100(D101) is subjected to the logical XOR operation, and the result is not equal to 0 or M3=On, M50=On.



API	D	OR#	S1 S2	Contact form logical operation OR#
221~223				

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S1				*	*	*	*	*	*	*	*
S2				*	*	*	*	*	*	*	*

Notes on operand usage: # : &、|、^

Please refer to the function specifications table for each device in series for the scope of device usage

16-bit command (5 STEP)

OR#	Continuous execution type	—	—

32-bit command (9 STEP)

DOR#	Continuous execution type	—	—

Flag signal: none

Explanation

- S_1: data source device 1. S_2: data source device 2.
- This command performs comparison of the content of S_1 and S_2; when the result of comparison is not 0, this command will be activated, but this command will not be activated when the result of comparison is 0.
- The OR# command is an operation command in series with the contact.

API No.	16-bit commands	32-bit commands	Conditions for activation				Conditions for inactivation			
221	OR&	DOR&	S_1	&	S_2	$\neq 0$	S_1	&	S_2	$=0$
222	OR|	DOR|	S_1	|	S_2	$\neq 0$	S_1	|	S_2	$=0$
223	OR^	DOR^	S_1	^	S_2	$\neq 0$	S_1	^	S_2	$=0$

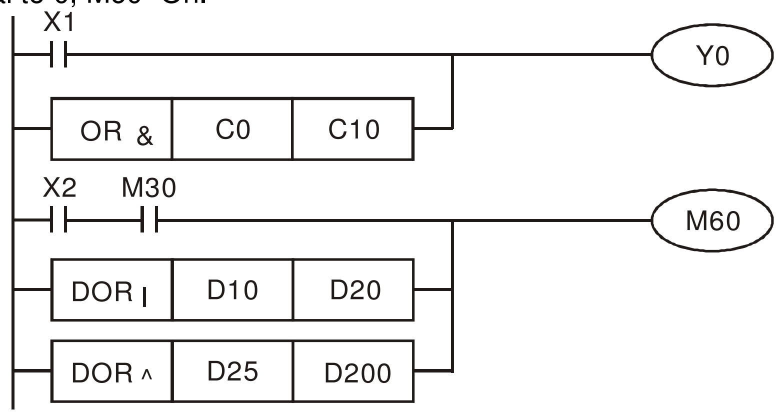
&: logical AND operation.

|: logical OR operation.

^: logical XOR operation.

Example

- When X1=On or the content of C0 and C10 is subjected to the logical AND operation, and the result is not equal to 0, Y0=On.
- When X2 and M30 are both equal to On, or the content of 32-bit register D10 (D11) and 32-bit register D20 (D21) is subjected to the logical OR operation, and the result is not equal to 0, or the content of the 32-bit counter C235 and the 32-bit register D200 (D201) is subjected to the logical XOR operation, and the result is not equal to 0, M60=On.



API 224~230	D	LD※	(S1) (S2)	Contact form compare LD*

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S1				*	*	*	*	*	*	*	*
S2				*	*	*	*	*	*	*	*

Notes on operand usage: ※：=、>、<、<>、≦、≧

Please refer to the function specifications table for each device in series for the scope of device usage

16-bit command (5 STEP)

LD※	Continuous execution type	–	–

32-bit command (9 STEP)

DLD※	Continuous execution type	–	–

Flag signal: none

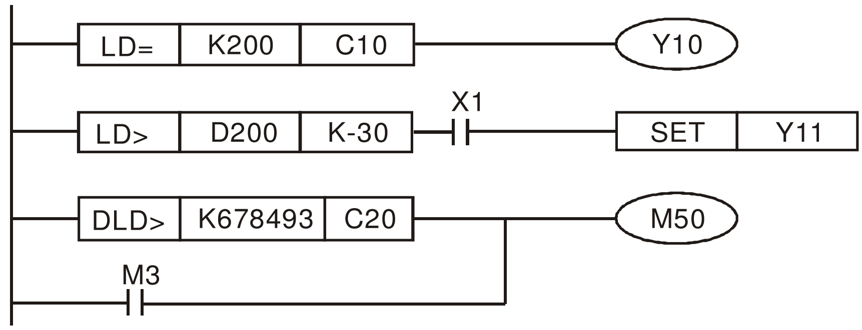
Explanation

- **S_1**: data source device 1. **S_2**: data source device 2.
- This command compares the content of **S_1** and **S_2**. Taking API 224 (LD=) as an example, this command will be activated when the result of comparison is "equal," and will not be activated when the result is "unequal."
- The LD* can be used while directly connected with the busbar

API No.	16-bit commands	32-bit commands	Conditions for activation	Conditions for inactivation
224	LD＝	**D**LD＝	$S_1 = S_2$	$S_1 \neq S_2$
225	LD＞	**D**LD＞	$S_1 > S_2$	$S_1 \leqq S_2$
226	LD＜	**D**LD＜	$S_1 < S_2$	$S_1 \geqq S_2$
228	LD＜＞	**D**LD＜＞	$S_1 \neq S_2$	$S_1 = S_2$
229	LD＜＝	**D**LD＜＝	$S_1 \leqq S_2$	$S_1 > S_2$
230	LD＞＝	**D**LD＞＝	$S_1 \geqq S_2$	$S_1 < S_2$

Example

- When the content of C10 is equal to K200, Y10=On.
- When the content of D200 is greater than K-30, and X1=On, Y11=On and remains in that state.



API				
232~ 238	D	**AND※**	(S1) (S2)	Contact form compare AND*

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S1				*	*	*	*	*	*	*	*
S2				*	*	*	*	*	*	*	*

Notes on operand usage: ※：=、>、<、<>、≦、≧

Please refer to the function specifications table for each device in series for the scope of device usage

16-bit command (5 STEP)

AND※	Continuous execution type	–	–

32-bit command (9 STEP)

DAND※	Continuous execution type	–	–

Flag signal: none

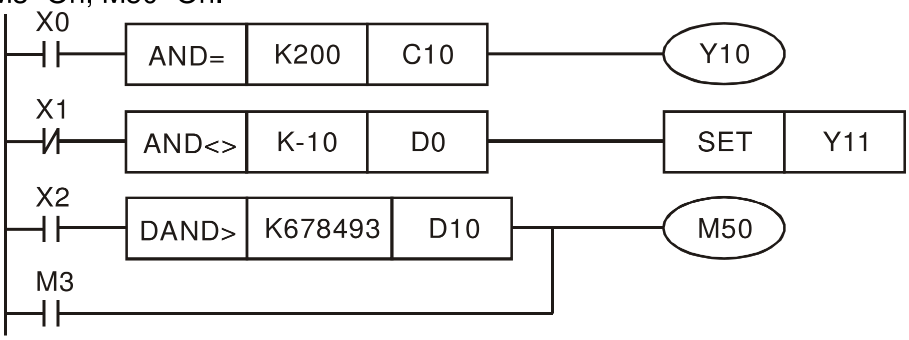
Explanation

- $\mathbf{S_1}$: data source device 1. $\mathbf{S_2}$: data source device 2.
- This command compares the content of $\mathbf{S_1}$ and $\mathbf{S_2}$. Taking API 232 (AND=) as an example, when the result of comparison is equal, this command will be activated; when the result of comparison is unequal, this command will not be activated.
- The AND* command is a comparison command in series with a contact.

API No.	16-bit commands	32-bit commands	Conditions for activation	Conditions for inactivation
232	AND=	**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

- When X0=On and the current value of C10 is also equal to K200, Y10=On.
- When X1=Off and the content of register D0 is not equal to K-10, Y11=On and remains in that state.
- When X2 =On and the content of the 32-bit register D0(D11)is less than 678,493, or M3=On, M50=On.



API 240~246	D	OR※		Ⓢ1 Ⓢ2	Contact form compare OR*

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S1				*	*	*	*	*	*	*	*
S2				*	*	*	*	*	*	*	*

Notes on operand usage: ※：=、>、<、<>、≦、≧

Please refer to the function specifications table for each device in series for the scope of device usage

16-bit command (5 STEP)

OR※	Continuous execution type	–	–

32-bit command (9 STEP)

DOR※	Continuous execution type	–	–

Flag signal: none

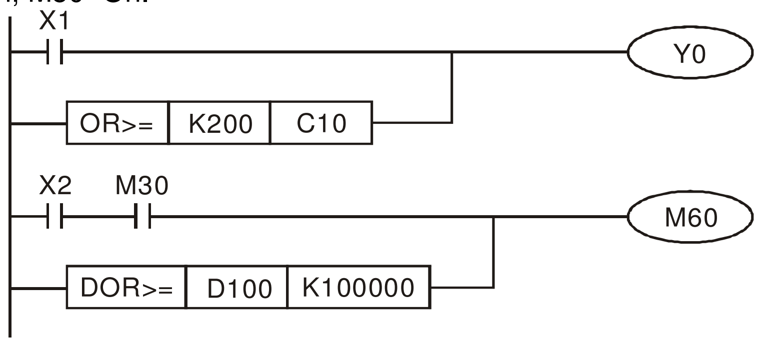
Explanation

- $\mathbf{S_1}$: data source device 1. $\mathbf{S_2}$: data source device 2.
- This command compares the content of $\mathbf{S_1}$ and $\mathbf{S_2}$. Taking API 240 (OR=) as an example, when the result of comparison is equal, this command will be activated; when the result of comparison is unequal, this command will not be activated.
- The OR* command is a compare command in parallel with a contact.

API No.	16-bit commands	32-bit commands	Conditions for activation	Conditions for inactivation
240	OR=	DOR=	$S_1 = S_2$	$S_1 \neq S_2$
241	OR>	DOR>	$S_1 > S_2$	$S_1 \leqq S_2$
242	OR<	DOR<	$S_1 < S_2$	$S_1 \geqq S_2$
244	OR<>	DOR<>	$S_1 \neq S_2$	$S_1 = S_2$
245	OR<=	DOR<=	$S_1 \leqq S_2$	$S_1 > S_2$
246	OR>=	DOR>=	$S_1 \geqq S_2$	$S_1 < S_2$

Example

- When X0=On and the current value of C10 is also equal to K200, Y10=On.
- When X1=Off and the content of register D0 is not equal to K-10, Y11=On and remains in that state.
- When X2 =On and the content of the 32-bit register D0(D11)is less than 678,493, or M3=On, M50=On.



API			
275~280	**FLD※**	(S1) (S2)	Floating point number contact form compare LD*

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S1									*	*	*
S2									*	*	*

Notes on operand usage: # ; & 、 | 、 ^

Please refer to the function specifications table for each device in series for the scope of device usage

16-bit command

–	–	–	–

32-bit command (9 STEP)

FLD※	Continuous execution type	–	–

Flag signal: none

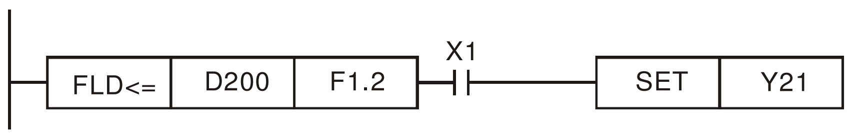
Explanation

- $\mathbf{S_1}$: data source device 1. $\mathbf{S_2}$: data source device 2.
- This command compares the content of $\mathbf{S_1}$ and $\mathbf{S_2}$. Taking "FLD=" as an example, if the result of comparison is "equal," this command will be activated; but it will not be activated when the result is "unequal."
- The FLD* command can directly input floating point numerical values (for instance: F1.2) to the $\mathbf{S_1}$, $\mathbf{S_2}$ operands, or store floating-point numbers in register D for use in operations.
- This command can be used while directly connected with the busbar

API No.	32-bit commands	Conditions for activation	Conditions for inactivation
275	FLD=	$S_1 = S_2$	$S_1 \neq S_2$
276	FLD>	$S_1 > S_2$	$S_1 \leqq S_2$
277	FLD<	$S_1 < S_2$	$S_1 \geqq S_2$
278	FLD<>	$S_1 \neq S_2$	$S_1 = S_2$
279	FLD<=	$S_1 \leqq S_2$	$S_1 > S_2$
280	FLD>=	$S_1 \geqq S_2$	$S_1 < S_2$

Example

- When the floating point number of register D200 (D201) is less than or equal to F1.2, and X1 activated, contact Y21 will be activated and remain in that state.



API 281~286		FAND※		(S1) (S2)	Floating point number contact form compare AND*

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S1									*	*	*
S2									*	*	*

Notes on operand usage: # : & 、| 、^
Please refer to the function specifications table for each device in series for the scope of device usage

16-bit command

–	–	–	–

32-bit command (9 STEP)

FAND※	Continuous execution type	–	–

Flag signal: none

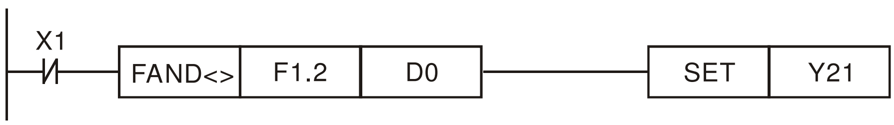
Explanation

- **S_1**: data source device 1. **S_2**: data source device 2.
- This command compares the content of **S_1** and **S_2**. Taking "FAND=" as an example, if the result of comparison is "equal," this command will be activated; but it will not be activated when the result is "unequal."
- The FAND* command can directly input floating point numerical values (for instance: F1.2) to the **S_1**, **S_2** operands, or store floating-point numbers in register D for use in operations.
- This command can be used while directly connected with the busbar

API No.	32-bit commands	Conditions for activation	Conditions for inactivation
281	FAND	$S_1 = S_2$	$S_1 \neq S_2$
282	FAND＞	$S_1 > S_2$	$S_1 \leqq S_2$
283	FAND＜	$S_1 < S_2$	$S_1 \geqq S_2$
284	FAND＜＞	$S_1 \neq S_2$	$S_1 = S_2$
285	FAND＜＝	$S_1 \leqq S_2$	$S_1 > S_2$
286	FAND＞＝	$S_1 \geqq S_2$	$S_1 < S_2$

Example

- When X1=Off, and the floating point number in register D100 (D101) is not equal to F1.2, Y21=On and remains in that state.



API 287~292		FOR※		(S1) (S2)	Floating point number contact form compare OR*

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S1									*	*	*
S2									*	*	*

Notes on operand usage: # : & 、| 、^
Please refer to the function specifications table for each device in series for the scope of device usage

16-bit command

–	–	–	–

32-bit command (9 STEP)

FOR※	Continuous execution type	–	–

Flag signal: none

Explanation

◆ S_1: data source device 1. S_2: data source device 2.

◆ This command compares the content of S_1 and S_2. Taking "FOR=" as an example, if the result of comparison is "equal," this command will be activated; but it will not be activated when the result is "unequal."

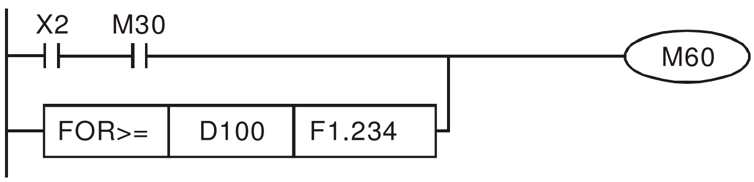
◆ The FOR* command can directly input floating point numerical values (for instance: F1.2) to the S_1, S_2 operands, or store floating-point numbers in register D for use in operations.

◆ This command can be used while directly connected with the busbar

API No.	32-bit commands	Conditions for activation	Conditions for inactivation
287	FOR＝	$S_1 = S_2$	$S_1 \neq S_2$
288	FOR＞	$S_1 > S_2$	$S_1 \leqq S_2$
289	FOR＜	$S_1 < S_2$	$S_1 \geqq S_2$
290	FOR＜＞	$S_1 \neq S_2$	$S_1 = S_2$
291	FOR＜＝	$S_1 \leqq S_2$	$S_1 > S_2$
292	FOR＞＝	$S_1 \geqq S_2$	$S_1 < S_2$

Example

◆ When X2 and M30 are both equal to "On," or the floating point number in register D100 (D101) is greater than or equal to F1.234, M60=On.



16-6-5 Detailed explanation of driver special applications commands

API					
139		RPR	P	S1 S2	Read servo parameter

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S1				*	*						*
S2											*

Notes on operand usage: none

16-bit command (5 STEP)

RPR	Continuous execution type	RPRP	Pulse execution type

32-bit command

–	–	–	–

Flag signal: none

Explanation

- S1: Parameter address of data to be read. S2: Register where data to be read is stored.

API					
140		WPR	P	S1 S2	Write servo parameter

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S1				*	*						*
S2				*	*						*

Notes on operand usage: none

16-bit command (5 STEP)

WPR	Continuous execution type	WPRP	Pulse execution type

32-bit command

–	–	–	–

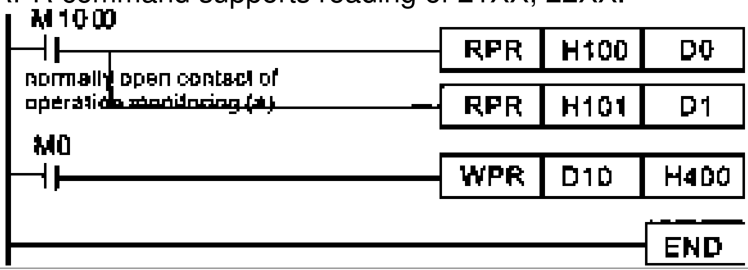
Flag signal: none

Explanation

- S1: Data to write to specified page. S2: Parameter address of data to be written.

Example

- When the data in the CP2000 driver's parameter H01.00 is read and written to D0, data from H01.01 will be read and written to D1.
- When M0=On, the content of D10 will be written to the CP2000 driver parameter 04.00 (first speed of multiple speed levels).
- When the parameter has been written successfully, M1017=On.
- The CP2000's WPR command does not support writing to the 20XX address, but the RPR command supports reading of 21XX, 22XX.



Recommendation Take care when using the WPR command. When writing parameters, because most parameters are recorded as they are written, these parameters may only be revised 109 times; a memory write error may occur if parameters are written more than 10^9 times.

Because the following commonly-used parameters have special processing, there are **no** restrictions on the number of times they may be written.

P00-10: Control method

P00-11: Speed mode selection

P00-12: P2P position mode

P00-13: Torque mode select

P00-27: User-defined value

P01-12: Acceleration time 1

P01-13: Deceleration time 1

P01-14: Acceleration time 2

P01-15: Deceleration time 2

P01-16: Acceleration time 3

P01-17: Deceleration time 3

P01-18: Acceleration time 4

P01-19: Deceleration time 4

P02-12: Select MI Conversion Time mode:

P02-18: Select MO Conversion Time mode:

P04-50 ~ P04-69: PLC register parameter 0 - 19

P08-04: Upper limit of integral

P08-05: PID output upper limit

P10-17: Electronic gear A

P10-18: Electronic gear B

P11-34: Torque command

P11-43: P2P highest frequency

P11-44: Position control acceleration time

P11-45: Position control deceleration time

Calculation of the number of times written is based on whether the written value is modified. For instance, writing the same value 100 times at the same time counts as writing only once.

When writing a PLC program, if unsure of usage of the WPR command, we recommend that you use the WPRP command.

API		FPID	P	S1 S2 S3 S4	Driver PID control mode
141					

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S1				*	*						*
S2				*	*						*
S3				*	*						*
S4				*	*						*

Notes on operand usage: none

16-bit command (9 STEP)			
FPID	Continuous execution type	FPIDP	Pulse execution type
32-bit command			
–	–	–	–

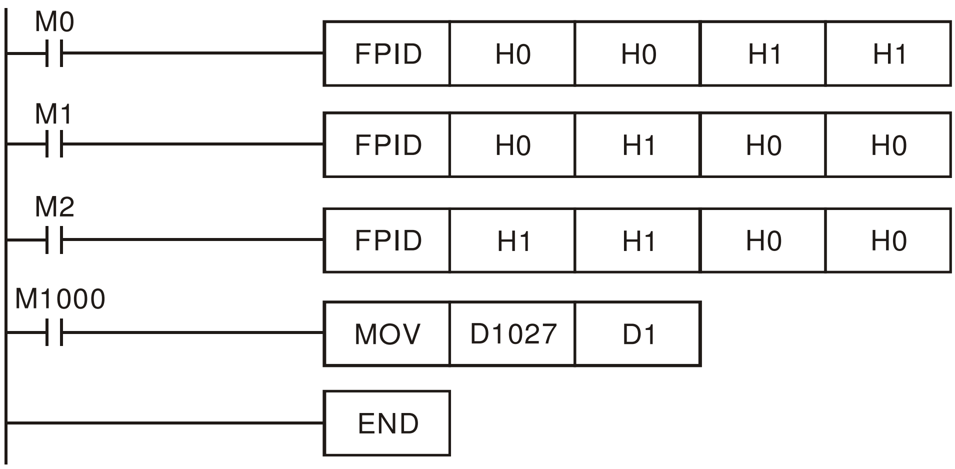
Flag signal: none

Explanation

- S1: PID reference target value input terminal select. S2: PID function proportional gain P. S3: PID function integral time I. S4: PID function differential time D.
- The FPID command can directly control the driver's feedback control of PID parameter 08-00 PID reference target value input terminal selection, 08-01 proposal gain P, 08-02 integral time I, and 08-03 differential time D.

Example

- When M0=On, the set PID reference target value input terminal selection is 0 (no PID function), the PID function proportional gain P is 0, the PID function integral time I is 1 (units: 0.01 sec.), and the PID function differential time D is 1 (units: 0.01 sec.).
- When M1=On, the set PID reference target value input terminal selection is 0 (no PID function), the PID function proportional gain P is 1 (units: 0.01), the PID function integral time I is 0, and the PID function differential time D is 0.
- When M2=On, the set PID reference target value input terminal selection is 1 (target frequency input is controlled from the digital keypad), the PID function proportional gain P is 1 (units: 0.01), the PID function integral time I is 0, and the PID function differential time D is 0.
- D1027: Frequency command after PID operation.



API		FREQ P	S1 S2 S3	Driver speed control mode
142				

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S1				*	*						*
S2				*	*						*
S3				*	*						*

Notes on operand usage: none

16-bit command (7 STEP)

FREQ	Continuous execution type	FREQP	Pulse execution type

32-bit command

–	–	–	–

Flag signal: M1015

Explanation

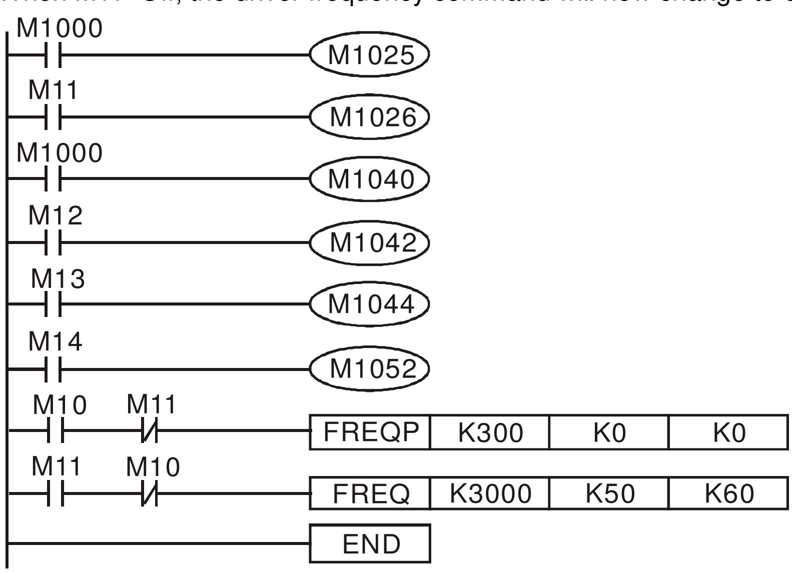
- S1: Frequency command. S2: Acceleration time. S3: Deceleration time
- S2,S3: In acceleration/deceleration time settings, the number of decimal places is determined by the definitions of Pr01-45.

Example
When 01-45=0: units of 0.01 sec.
The setting of 50 for S2 (acceleration time) in the ladder diagram below implies 0.5 sec, and the S3 (deceleration time) setting of 60 implies 0.6 sec

- The FREQ command can control driver frequency commands, and acceleration and deceleration time; it also uses special register control actions, such as:
  M1025: Control driver RUN(On)/STOP(Off) (RUN requires Servo On (M1040 On) to be effective)
  M1026: Control driver operating direction FWD(Off)/REV(On)
  M1040: Control Servo On/Servo Off.
  M1042: Trigger quick stop (ON)/does not trigger quick stop (Off).
  M1044: Pause (On)/release pause (Off)
  M1052: Lock frequency (On)/release lock frequency (Off)

Example

- M1025: Driver RUN(On)/STOP(Off), M1026: driver operating direction FWD(Off)/REV(On). M1015: frequency reached.
- When M10=On, sets the driver frequency command K300(3.00Hz), with an acceleration/deceleration time of 0.
  When M11=On, sets the driver frequency command K3000 (30.00Hz), with an acceleration time of 50 (0.5 sec.) and deceleration time of 60 (0.6 sec.). (When 01-45=0)
- When M11=Off, the driver frequency command will now change to 0

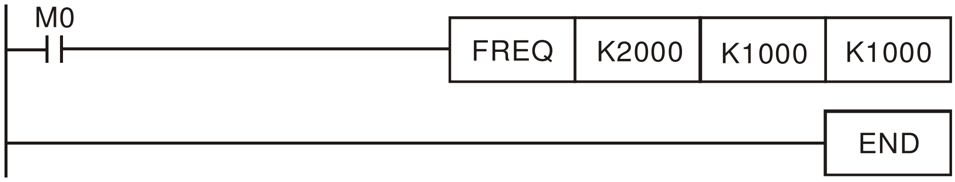


- Parameter 09-33 are defined on the basis of whether reference commands have been cleared before PLC operation
  Bit 0 : Prior to PLC scanning procedures, whether the target frequency has been cleared is 0. (This will be written to the FREQ command when the PLC is On)

Bit 1 : Prior to PLC scanning procedures, whether the target torque has been cleared is 0. (This will be written to the TORQ command when the PLC is On)

Bit 2 : Prior to PLC scanning procedures, whether speed limits in the torque mode have been cleared is 0. (This will be written to the TORQ command when the PLC is On)

Example: When using r to write a program,



if we force M0 to be 1, the frequency command will be 20.00 Hz; but when M0 is set as 0, there will be a different situation.

Case 1: When the 09-33 bit 0 is 0, and M0 is set as 0, the frequency command will remain at 20.00Hz.

Case 2: When the 09-33 bit 0 is 1, and M0 is set as 0, the frequency command will change to 0.00Hz

The reason for this is that when the 09-33 bit 0 is 1 prior to PLC scanning procedures, the frequency will first revert to 0.

When the 09-33 bit 0 is 0, the frequency will not revert to 0.

API 261	CANRX P	(S1) (S2) (S3) (D)	Read CANopen slave station data

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S1				*	*						
S2				*	*						
S3				*	*						
D									*	*	*

Notes on operand usage: none

16-bit command (9 STEP)

CANRX	Continuous execution type	CANRXP	Pulse execution type

32-bit command

–	–	–	–

Flag signal

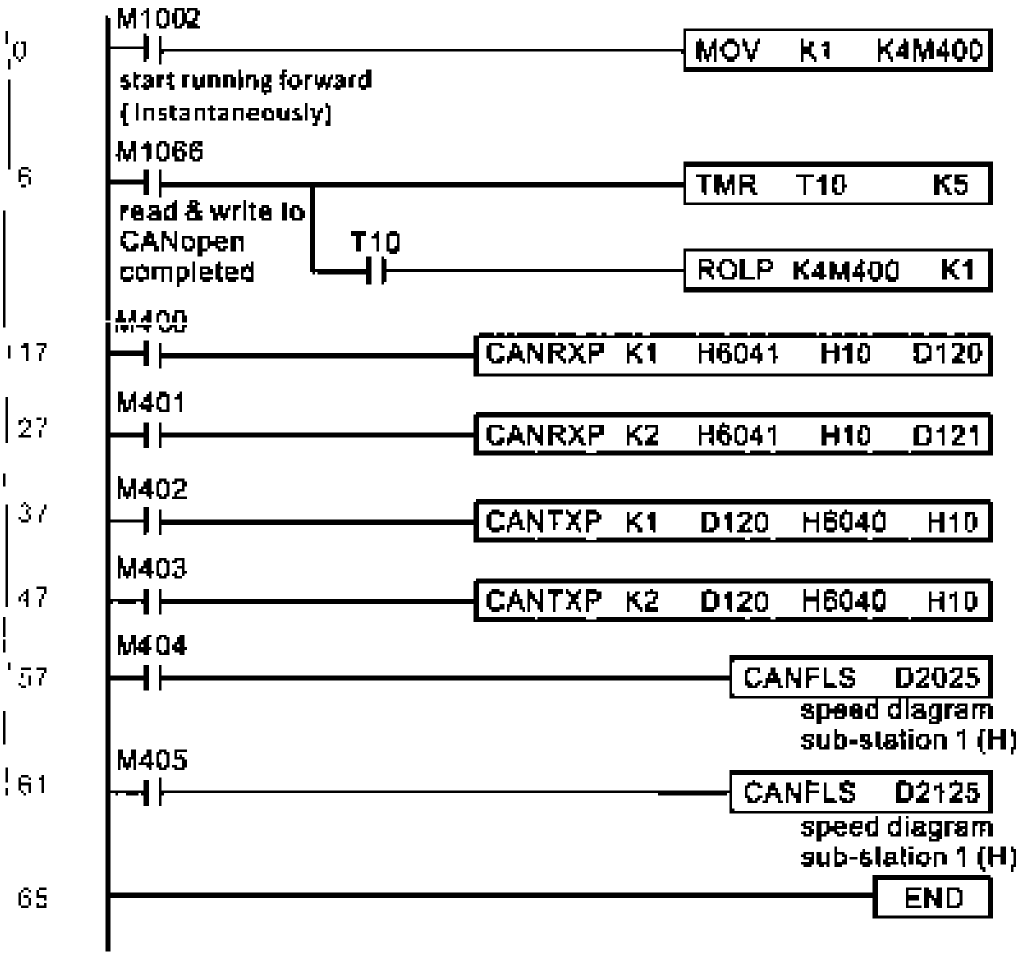
Explanation

- (S1): Slave station number. (S2): Main index.. (S3): Subindex+bit length. (D): Preset address.
- The CANRX command can read the index of the corresponding slave station. When it is executed, it will send the SDO message format to the slave station. M1066 and M1067 will both be 0 at that time, and M1066 will be set as 1 after reading. If the slave station gives the correct response, it will write the value to the preset register, and set M1067 as 1. If the slave station has a response error, M1067 will be set as 0, and an error message will be recorded to D1076 to D1079.

Example

M1002: When the PLC runs, the command will be triggered once and will set K4M400 = K1

Afterwards, each time M1066 is 1, it will switch to a different message.



API 264		CANTX	P	S1 S2 S3 S4	Write CANopen slave station data

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S1				*	*						
S2				*	*				*	*	*
S3				*	*						
S4				*	*						

Notes on operand usage: none

16-bit command (9 STEP)

CANTX	Continuous execution type	CANTXP	Pulse execution type

32-bit command

–	–	–	–

Flag signal

Explanation

- S1: Slave station number. S2: Address to be written. S3: Main index. S4: Subindex+bit length.
- The CANTX command can write a value to the index of the corresponding slave station. When it is executed, it will send the SDO message format to the slave station. M1066 and M1067 will both be 0 at that time, and M1066 will be set as 1 after reading. If the slave station gives the correct response, it will write the value to the preset register, and set M1067 as 1. If the slave station has a response error, M1067 will be set as 0, and an error message will be recorded to D1076 to D1079.

API 265		CANFLS	P	D	Refresh special D corresponding to CANopen

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
D				*	*						

Notes on operand usage: none

16-bit command (3 STEP)

CANFLS	Continuous execution type	CANFLSP	Pulse execution type

32-bit command

–	–	–	–

Flag signal

Explanation

- D: Special D to be refreshed.
- The CANFLS command can refresh special D commands. When is a read only attribute, executing this command will send a message equivalent to that of CANRX to the slave station, and the number of the slave station will be transmitted back and refreshed to this special D. When there is a read/write attribute, executing this command will send a message equivalent to that of CANTX to the slave station, and the value of this special D will be written to the corresponding slave station.
- When M1066 and M1067 are both 0, and M1066 is set as 1 after reading, if the slave station gives a correct response, the value will be written to the designated register, and M1067 will be set as 1. If the slave station's response contains an error, then M1067 will be set as 0, and an error message will be recorded to D1076-D1079.

API 320	D	ICOMR	P	S1 S2 S3 D	Internal communications read

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S1				*	*						*
S2				*	*						*
S3				*	*						*
D				*	*						*

Notes on operand usage: none

16-bit command (9 STEP)

ICOMR	Continuous execution type	ICOMRP	Pulse execution type

32-bit command (17 STEP)

DICOMR	Continuous execution type	DICOMRP	Pulse execution type

Flag signal: M1077 M1078 M1079

Explanation

S1: Selection of slave device. S2: Device selection (0: converter, 1: internal PLC). S3: Read address. D: Saving target.

- The ICOMR command can obtain the slave station's converter and the internal PLC's register value.

API				
321	D	ICOMW	P	(S1)(S2)(S3)(D) Internal communications write

	Bit device			Word device							
	X	Y	M	K	H	KnX	KnY	KnM	T	C	D
S1				*	*						*
S2				*	*						*
S3				*	*						*
D				*	*						*

Notes on operand usage: none

16-bit command (9 STEP)

ICOMW	Continuous execution type	ICOMWP	Pulse execution type

32-bit command (17 STEP)

DICOMW	Continuous execution type	DICOMWP	Pulse execution type

Flag signal: M1077 M1078 M1079

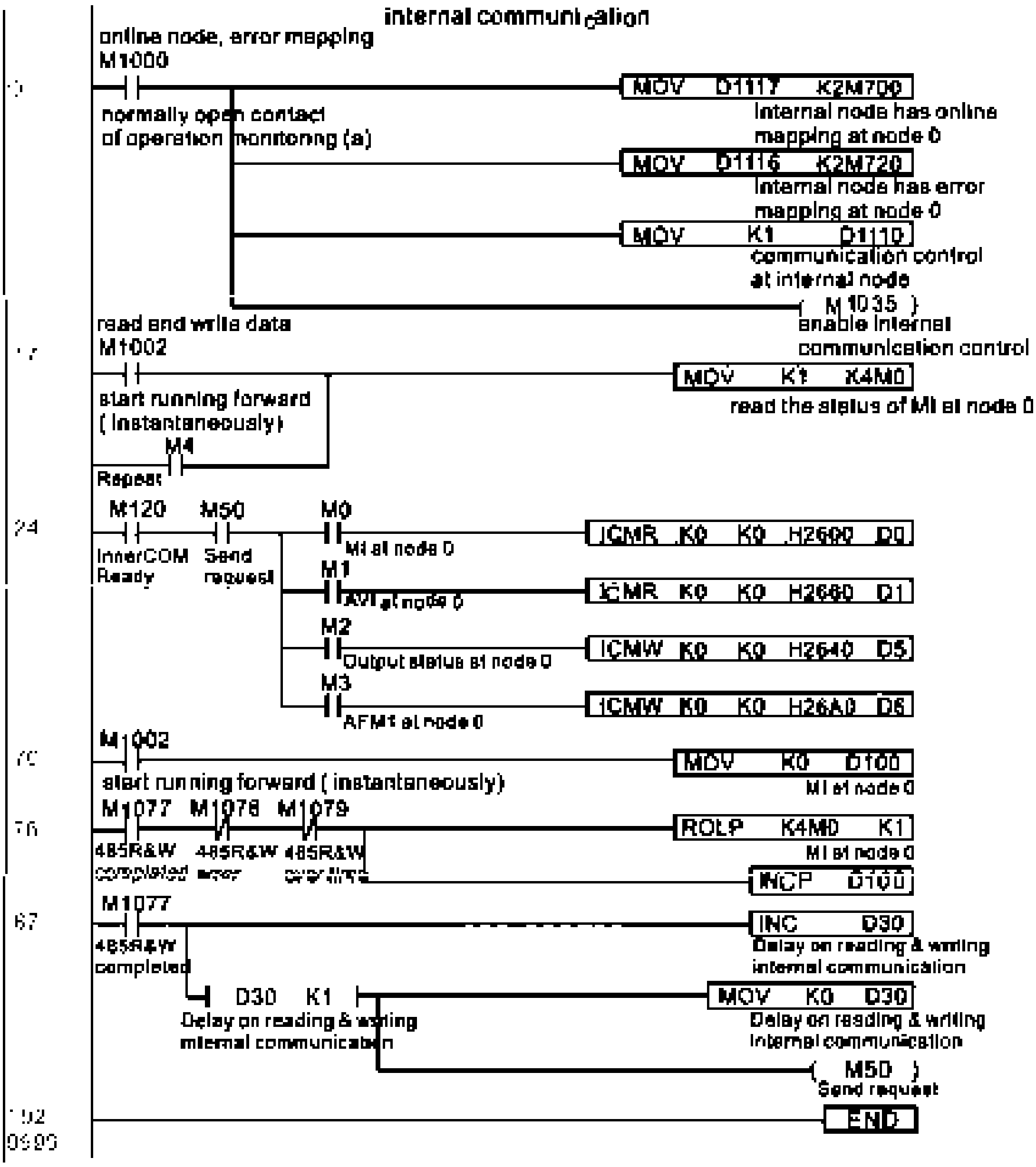
Explanation

(S1): Selection of slave device. (S2): Device selection (0: converter, 1: internal PLC). (S3): Read address. (D): Saving target.

- The ICOMW command write a value to the slave station's converter and the internal PLC's register.

Example

Please refer to the following example:



16-7 Error display and handling

Code	ID	Descript	Recommended handling approach
PLrA	47	RTC time check	Turn power on and off when resetting the keypad time
PLrt	49	(incorrect RTC mode)	Turn power on and off after making sure that the keypad is securely connected
PLod	50	Data writing memory error	Check whether the program has an error and download the program again
PLSv	51	Data write memory error during program execution	Restart power and download the program again
PLdA	52	Program transmission error	Try uploading again; if the error persists, sent to the manufacturer for service
PLFn	53	Command error while downloading program	Check whether the program has an error and download the program again
PLor	54	Program exceeds memory capacity or no program	Restart power and download the program again
PLFF	55	Command error during program execution	Check whether the program has an error and download the program again
PLSn	56	Check code error	Check whether the program has an error and download the program again
PLEd	57	Program has no END stop command	Check whether the program has an error and download the program again
PLCr	58	MC command has been used continuously more than nine times	Check whether the program has an error and download the program again
PLdF	59	Download program error	Check whether the program has an error and download again
PLSF	60	PLC scan time excessively long	Check whether the program code has a writing error and download again

16- 8 CANopen Master control applications

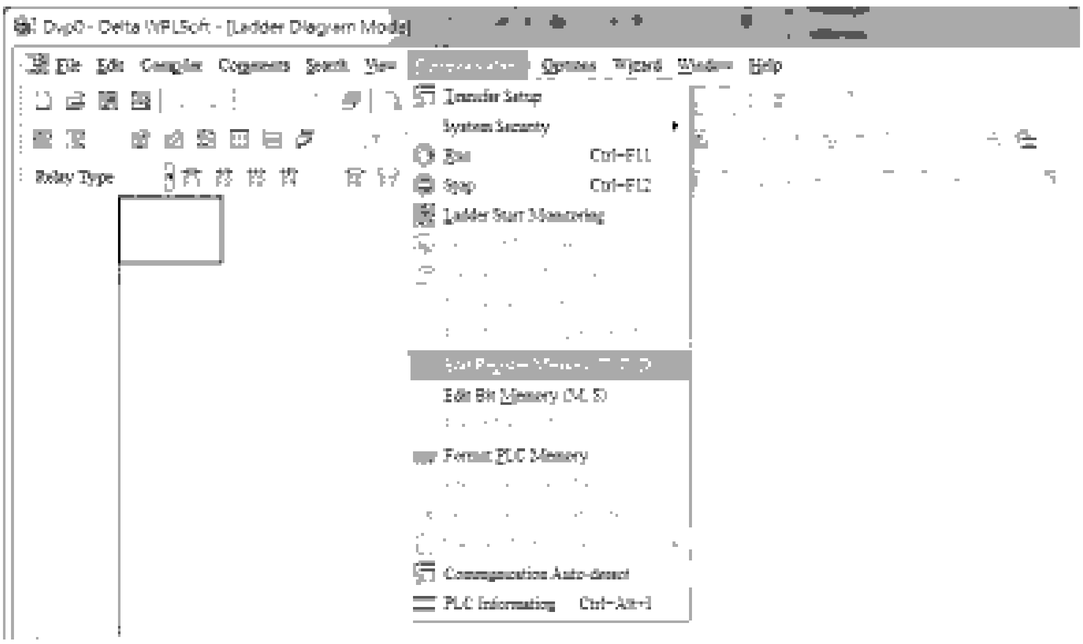
Control of a simple multi-axis application is required in certain situations. If the device supports the CANopen protocol, a CP2000 can serve as the master in implementing simple control (position, speed, homing, and torque control). The setting method comprises the following seven steps:

Step 1: Activating CANopen Master functions

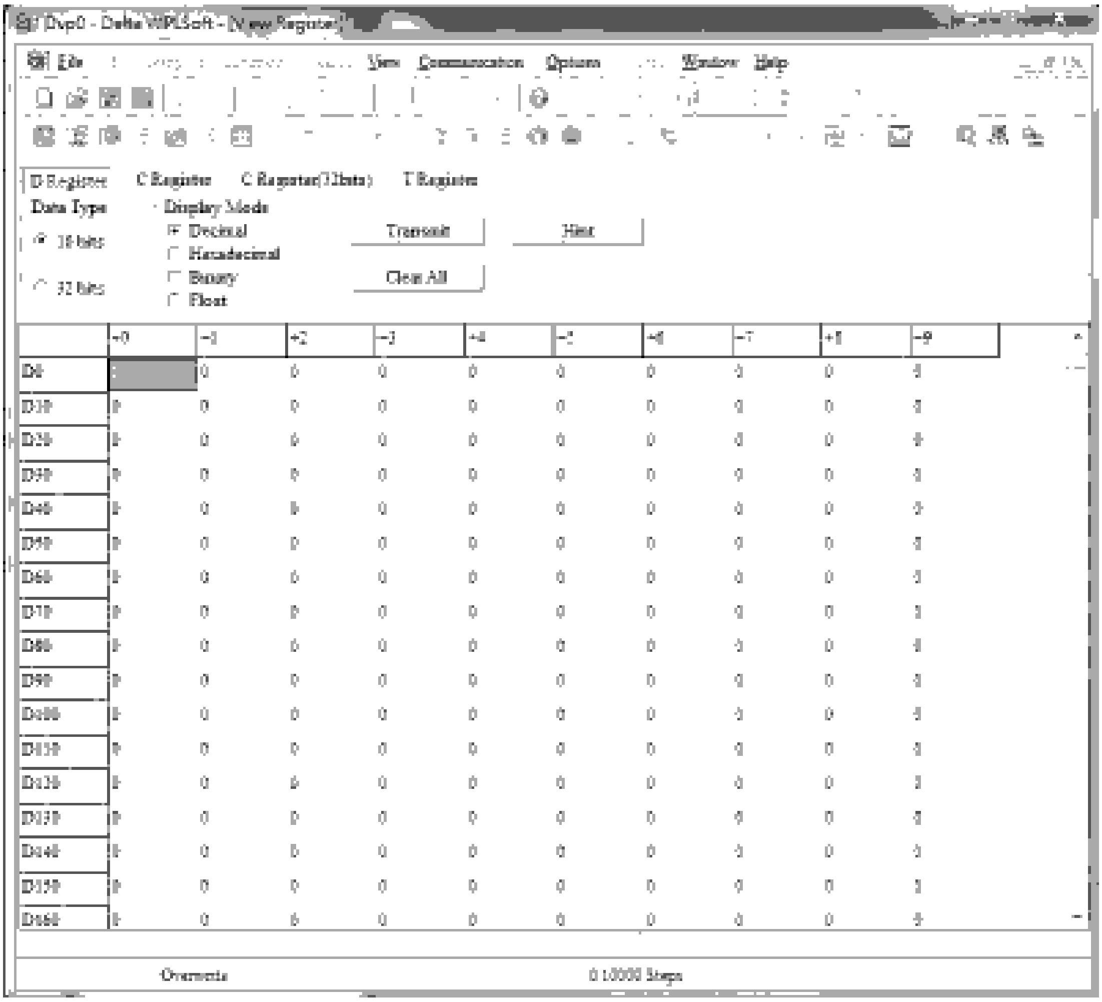
1. Parameter 09-45=1 (initiates Master functions); restart power after completing setting, the status bar on the KPC-CC01 digital keypad will display "CAN Master".
2. Parameter 00-02=6 reset PLC (please note that this action will reset the program and PLC registers to the default values)
3. Turn power off and on again.
4. Use the KPC-CC01 digital keypad to set the PLC control mode as **"PLC Stop"** (if the KPC-CE01 digital keypad is used, set as "PLC 2"; if a newly-introduced driver is used, the blank internal PLC program will cause a PLFF warning code to be issued).

Step 2: Master memory settings

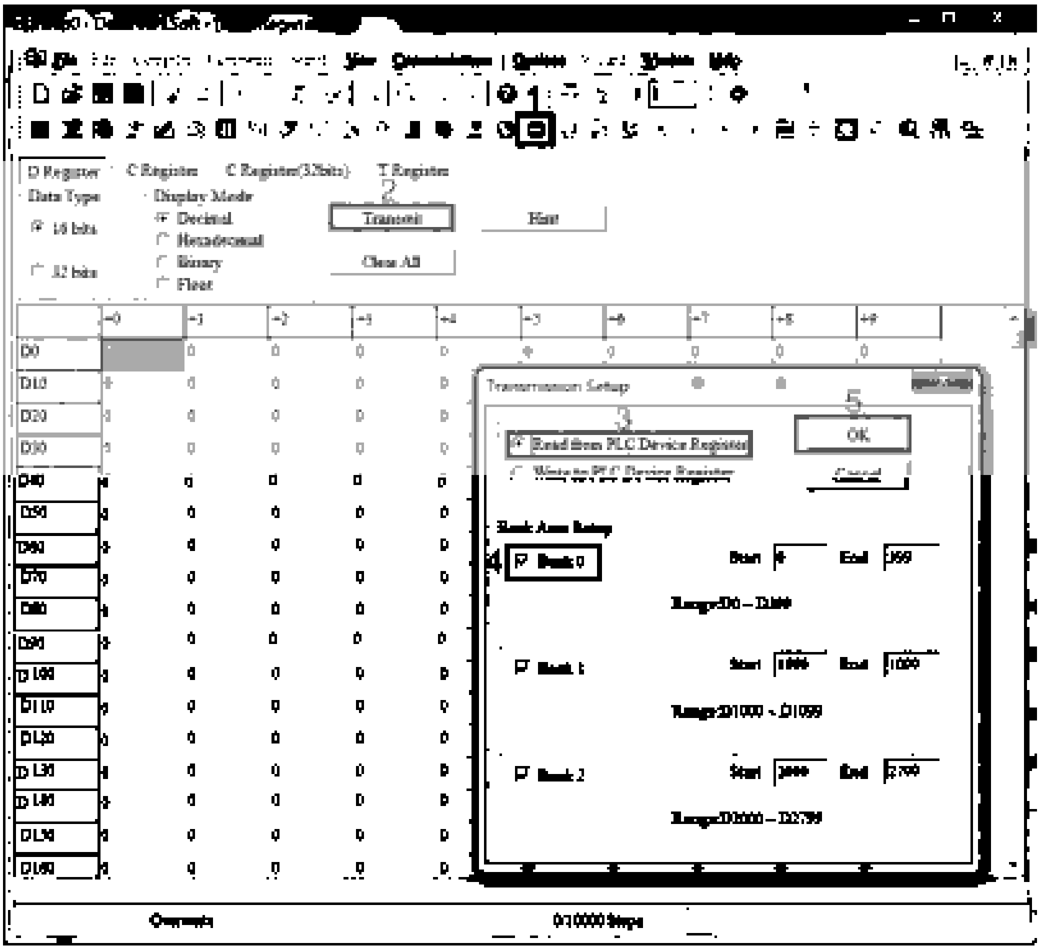
1. After connecting the 485 communications cable, use WPL Soft to set the PLC **status** as Stop (if the PLC mode has been switched to the **"PLC Stop"** mode, the PLC **status** should already be Stop)
2. Set the address and corresponding station number of the slave station to be controlled. For instance, if it is wished to control two slave stations (a maximum of 8 stations can be controlled simultaneously), and the station numbers are 21 and 22, it is only necessary to set D2000 and D2100 as 20 and 21, and then set D2200, D2300, D2400, D2500, D2600, and D2700 as 0. The setting method involves use of the PLC's WPL editing software WPL as follows:
   - Open WPL and implement **communications > register edit (T C D)** function



- After leaving the PLC register window, the register setting screen will appear, as shown below:



If there is a new PLC program and no settings have yet been made, you can read default data from the converter, and merely edit it to suit the current application. If settings have already been made, however, the special D in the CANopen area will display the saved status (the CANopen D area is located at D1090 to D1099 and D2000 to D2799). Assuming it is a new program, we will first read the default data from the converter; check the communications format if there is no communications link (the default PLC station number is 2, 9600, 7N2, ASCII). Perform the following steps: 1. Switch the PLC to Stop status; 2. Press the transmit button; 3. click on read memory after exiting the window; 4. Ignore D0-D399; and 5. click on the confirm button.)



After reading the data, it is necessary to perform some special D settings. Before proceeding, we will first introduce the special D implications and setting range. The CANopen Master's special D range is currently D1070 to D1099 and D2000 to D2799; this range is divided into 3 blocks:

The first block is used to display CANopen's current status, and has a range of D1070 to D1089; the second block is used for CANopen's basic settings, and has a range of D1090 to D1099;
the third block is the slave station mapping and control area, and has a range of D2000 to D2799;
These areas are therefore introduced as follows:

The first contains the current CANopen status display:

When the master initializes a slave station, we can from find out from D1070 whether configuration of the slave device has been completed; we can find out whether an error occurred in the configuration process from D1071 and whether the configuration is inappropriate from D1074.
After entering normal control, we can find out whether the slave device is offline from D1073. In addition, we can check the slave device's read/write information using the CANRX, CANTX, and CANFLS commands; error information can be obtained from D1076 to D1079 if there has been a read/write failure.

Special D	Description of Function	R/W
D1070	Channel opened by CANopen initialization (bit0=Machine code0 …….)	R
D1071	Error channel occurring in CANopen initialization process (bit0=Machine code0 …….)	R
D1072	Reserved	-
D1073	CANopen break channel (bit0=Machine code0 …….)	R

Special D	Description of Function	R/W
D1074	Error code of master error 0: No error 1: Slave station setting error 2: Synchronizing cycle setting error (too small)	R
D1075	Reserved	-
D1076	SDO error message (main index value)	R
D1077	SDO error message (secondary index value)	R
D1078	SDO error message (error code L)	R
D1079	SDO error message (error code H)	R

The second area is for basic CANopen settings: (the PLC must have **stopped** when this area is used to make settings)

We must set the information exchange time for the master and slave station,

Special D	Description of Function	Default:	R/W
D1090	Synchronizing cycle setting	4	RW

Use D1090 to perform settings; setting time relationships include:

$$\text{Sync time} \geq \frac{1M}{\text{Rate}} * \frac{N}{4}$$

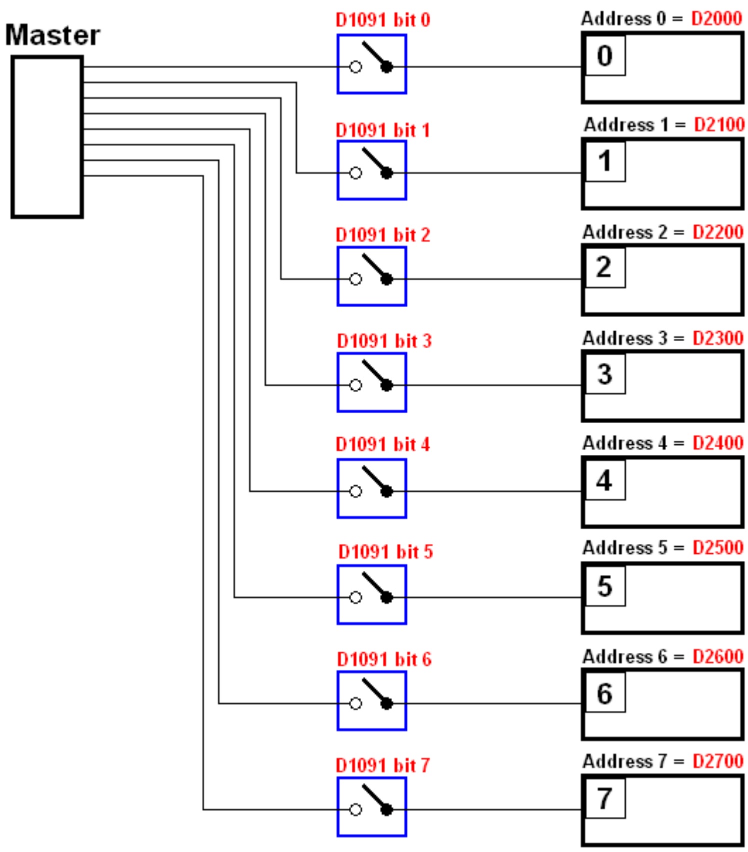
N: TXPDO + RXPDO

For instance, when communications speed is 500K, TXPDO + RXPDO have 8 sets, and synchronizing time will require more than 4 ms

We must also define how many slave stations will be open. D1091 is the channel for defining station opening, and D2000+100*n is the station number defining this channel. See the detailed explanation below.

Slave station number **n**=0-7

Special D	Description of Function	R/W
D1091	Sets slave station On or Off (bit 0-bit 7 correspond to slave stations number 0-7)	RW
D2000+100***n**	Slave station number	RW



If slave devices have a slow start-up, the master can delay for a short time before performing slave station configuration; this time delay can be set via D1092.

Special D	Description of Function	Default:	R/W
D1092	Delay before start of initialization	0	RW

With regard to slave device initialization, a delay time can be set to judge whether failure has occurred. If the communications speed is relatively slow, the delay time can be adjusted to judge whether initialization has been completed, which will ensure that there is time to perform slave device initialization.

Special D	Description of Function	Default:	R/W
D1099	Initialization completion delay time Setting range: 1 to 60000 sec	15 sec.	RW

After communication is successful, the system must detect whether there is a break in communications with the slave station. D1093 is used to set detection time, and D1094 sets the number of consecutive errors that will trigger a break error.

Special D	Description of Function	Default:	R/W
D1093	Break time detection	1000ms	RW
D1094	Break number detection	3	RW

The packet type transmitted by PDO is set before establishing normal communications and generally does not require adjustment.

Special D	Description of Function	Default:	R/W
D1097	Corresponding real-time transmission type (PDO) Setting range: 1~240	1	RW
D1098	Corresponding real-time receiving type (PDO) Setting range: 1~240	1	RW

The third block is the slave station mapping and control area.

CANopen provides a PDO method to perform mapping of the master and slave station memory, and enables the master to directly access read/write data in a certain memory area. The master will automatically perform data exchange with the corresponding slave device, and the read/write values can be seen directly from the special D area after real-time exchange (M1034 = 1 time) has been established. The CP2000 currently supports real-time mapping of four PDOs, and there are two types of PDO RXPDO (reads slave device information) and TXPDO (writes to slave device). In addition, in order to facilitate control, the CP2000 cannot perform mapping of commonly-used registers; the following is an overview of the current PDO mapping situation:

TX PDO							
PDO4 (Torque)		**PDO3 (Position)**		**PDO2 (Remote I/O)**		**PDO1 (Speed)**	
Description	Special D	Description	Special D	Description	Special D	Description	Special D
Controller word	D2008+100*n	Controller word	D2008+100*n	Slave device DO	D2027+100*n	Controller word	D2008+100*n
Target torque	D2017+100*n	Target position	D2020+100*n D2021+100*n	Slave device AO1	D2031+100*n	Target speed	D2012+100*n
Control mode	D2010+100*n	Control mode	D2010+100*n	Slave device AO2	D2032+100*n		
				Slave device AO3	D2033+100*n		

RXPDO							
PDO4 (Torque)		**PDO3 (Position)**		**PDO2 (Remote I/O)**		**PDO1 (Speed)**	
Description	Special D	Description	Special D	Description	Special D	Description	Special D
Mode word	D2009+100*n	Mode word	D2009+100*n	Slave device DI	D2026+100*n	Mode word	D2009+100*n
Actual torque	D2018+100*n	Actual position	D2022+100*n D2023+100*n	Slave device AI1	D2028+100*n	Actual frequency	D2013+100*n
Actual mode	D2011+100*n	Actual mode	D2011+100*n	Slave device AI2	D2029+100*n		
				Slave device AI3	D2030+100*n		

Because usage requires only simple to open the corresponding PDO, where TXPDO employs D2034+100*n settings and RXPDO employs D2067+100*n settings.

These two special D areas are defined as follows:

	PDO4		PDO3		PDO2		PDO1	
Default definition	Torque		Position		Remote I/O		Speed	
bit	15	14 ~ 12	11	10 ~ 8	7	6 ~ 4	3	2 ~ 0
Definition	En	Length:	En	Length:	En	Length:	En	Length:

En: indicates whether PDO is used

Length: indicates mapping of several variables

In a simple example, if we wish to control a CP2000 slave device and cause it to operate in speed mode, we only have to make the following settings:

D2034+100*n =000Ah

Length	TX PDO							
	PDO4		**PDO3**		**PDO2**		**PDO1**	
	Description	Special D	Description	Special D	Description	Special D	Description	Special D
1	Controller word	D2008+100*n	Controller word	D2008+100*n	Slave device DO	D2027+100*n	Controller word	D2008+100*n
2	Target torque	D2017+100*n	Target position	D2020+100*n D2021+100*n	Slave device AO1	D2031+100*n	Target speed	D2012+100*n
3	Control mode	D2010+100*n	Control mode	D2010+100*n	Slave device AO2	D2032+100*n		
4					Slave device AO3	D2033+100*n		

	PDO4		PDO3		PDO2		PDO1	
Definition	Torque		Position		Remote I/O		Speed	
bit	15	14 ~ 12	11	10 ~ 8	7	6 ~ 4	3	2 ~ 0
Definition	0	0	0	0	0	0	1	2

D2067+100*n =000Ah

Length	TX PDO							
	PDO4		**PDO3**		**PDO2**		**PDO1**	
	Description	Special D	Description	Special D	Description	Special D	Description	Special D
1	Controller word	D2009+100*n	Controller word	D2009+100*n	Slave device DI	D2026+100*n	Controller word	D2009+100*n
2	Actual torque	D2018+100*n	Actual position	D2022+100*n D2023+100*n	Slave device AI1	D2028+100*n	Actual frequency	D2013+100*n
3	Actual mode	D2011+100*n	Actual mode	D2011+100*n	Slave device AI2	D2029+100*n		
4					Slave device AI3	D2030+100*n		

	PDO4		PDO3		PDO2		PDO1	
Definition	Torque		Position		Remote I/O		Speed	
bit	15	14 ~ 12	11	10 ~ 8	7	6 ~ 4	3	2 ~ 0
Definition	0	0	0	0	0	0	1	2

Switch the PLC to Run after completing settings. Now wait for successful initialization of CANopen (M1059 = 1 and M1061 = 0), and then initiate CANopen memory mapping (M1034 = 1). The control word and frequency command will now automatically refresh to the corresponding slave device (D2008+n*100 and D2012+n*100), and the slave device's status word and currently frequency will also be automatically sent back to the master station (D2009+n*100 and D2013+n*100). This also illustrates how the master can handle these tasks through read/write operations in the special D area.

Furthermore, it should be noted that the remote I/O of PDO2 can obtain the slave device's current DI and AI status, and can also control the slave device's DO and AO status. Nevertheless, after introducing a fully automatic mapping special D, the CP2000 CANopen master also provides additional information refreshes. For instance, while in speed mode, acceleration/deceleration settings may have been refreshed. The special D therefore also stores some seldom-used real-time information, and these commands can be refreshed using the CANFLS command. The following is the CP2000's current CANopen master data conversion area, which has a range of D2001+100*n - D2033+100*n, as shown below:

1. The range of n is 0-7
2. ●Indicates PDOTX, ▲Indicates PDORX; unmarked special D can be refreshed using the CANFLS command

Special D	Description of Function	Default	PDO Default				R/W
			1	2	3	4	
D2000+100*n	Station number n of slave station Setting range: 0~127 0: No CANopen function	0					RW
D2002+100*n	Manufacturer code of slave station number n (L)	0					R
D2003+100*n	Manufacturer code of slave station number n (H)	0					R
D2004+100*n	Manufacturer's product code of slave station number n (L)	0					R
D2005+100*n	Manufacturer's product code of slave station number n (H)	0					R

Basic definitions

Special D	Description of Function	Default	PDO Default				R/W
			1	2	3	4	
D2006+100*n	Communications break handling method of slave station number n	0					RW
D2007+100*n	Error code of slave station number n error	0					R
D2008+100*n	Control word of slave station number n	0	●		●	●	RW
D2009+100*n	Status word of slave station number n	0	▲		▲	▲	R
D2010+100*n	Control mode of slave station number n	2					RW
D2011+100*n	Actual mode of slave station number n	2					R

Velocity Control

Special D	Description of Function	Default	PDO Default				R/W
			1	2	3	4	
D2001+100*n	Torque restriction on slave station number n	0					RW
D2012+100*n	Target speed of slave station number n (rpm)	0	●				RW
D2013+100*n	Actual speed of slave station number n (rpm)	0	▲				R
D2014+100*n	Error speed of slave station number n (rpm)	0					R
D2015+100*n	Acceleration time of slave station number n (ms)	1000					RW
D2016+100*n	Deceleration time of slave station number n (ms)	1000					RW

Torque control

Special D	Description of Function	Default	PDO Default				R/W
			1	2	3	4	
D2017+100*n	Target torque of slave station number n(-100.0%~+100.0%)	0				●	RW
D2018+100*n	Actual torque of slave station number n(XX.X%)	0				▲	R
D2019+100*n	Actual current of slave station number n(XX.XA)	0					R

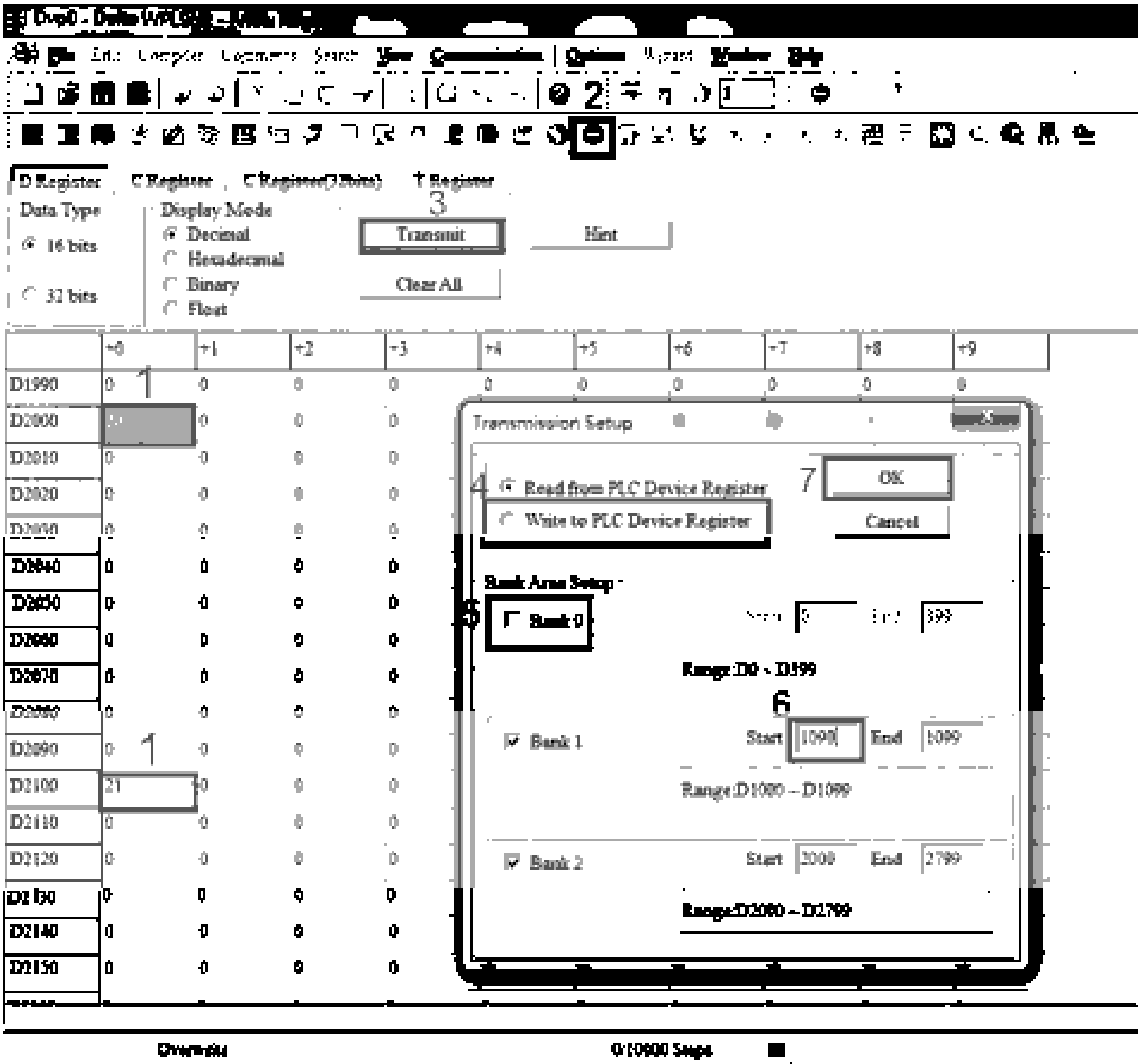
Position control

Special D	Description of Function	Default	PDO Default				R/W
			1	2	3	4	
D2020+100*n	Target of slave station number n (L)	0			●		RW
D2021+100*n	Target of slave station number n (H)	0					RW
D2022+100*n	Actual position of slave station number n (L)	0			▲		R
D2023+100*n	Actual position of slave station number n (H)	0					R
D2024+100*n	Speed chart of slave station number n (L)	10000					RW
D2025+100*n	Speed chart of slave station number n (H)	0					RW

Remote I/O

Special D	Description of Function	Default	PDO Default				R/W
			1	2	3	4	
D2026+100*n	MI status of slave station number n	0		▲			R
D2027+100*n	MO setting of slave station number n	0		●			RW
D2028+100*n	AI1 status of slave station number n	0		▲			R
D2029+100*n	AI2 status of slave station number n	0		▲			R
D2030+100*n	AI3 status of slave station number n	0		▲			R
D2031+100*n	AO1 setting of slave station number n	0		●			RW
D2032+100*n	AO2 setting of slave station number n	0		●			RW
D2033+100*n	AO3 setting of slave station number n	0		●			RW

After gaining an understanding of special D definitions, we return to setting steps. After entering the values corresponding to D1090 to D1099, D2000+100*n, D2034+100*n and D2067+100*n, we cannot begin to perform downloading, which is performed in accordance with the following steps: (1. D2000 and D2100 are set as 20 and 21, and D2200, D2300, D2400, D2500, D2600, and D2700 are set as 0; if a setting of 0 causes problems, D1091 can be set as 3, and slave stations 2 to 7 can be closed. 2. Switch PLC to Stop status. 3. Press the transmit button. 4. click on write memory after exiting the window. 5. Ignore D0-D399. 6. Change the second range to D1090-D1099. 7. Click on Confirm.)



- Another method can be used to set D1091: Determine which of slave stations 0 to 7 will not be needed, and set the corresponding bits to 0. For instance, if it is not necessary to control slave stations 2, 6 and 7, merely set D1091 = 003B, and the setting method is the same as described above: Use WPL to initiate **communications > use register edit (T C D)** function to perform settings.

Step 3: Set the master's communications station number and communications speed

☑ When setting the master's station number (parameter 09-46, default is set as 100), make sure not to use the same number as a slave station.

☑ Set the CANopen communications speed (parameter 09-37); regardless of whether the driver is defined as a master or slave station, the communications speed is set via this parameter.

Step 4: Write program code

Real-time access: Can directly read/write to or from the corresponding D area.

Non real-time access:

Read command: Use the CANRX command for reading. M1066 will be 1 when reading is complete; M1067 will be 1 if reading is successful, and M1067 will be 0 if an error has occurred.

Write command: Use the CANTX command for writing. M1066 will be 1 when writing is complete; M1067 will be 1 if writing is successful, and M1067 will be 0 if an error has occurred.

Refresh command: Use CANFLS command to refresh (if there are RW attributes, the master will write to the slave station; if there are RO attributes, the slave station will return the read values to the master); M1066 will be 1 if refresh has been completed; M1067 will be 1 if refresh is successful, and M1067 will be 0 if an error has occurred.

NOTE

When using CANRX, CANTX or CANFLS, internal implementation commands will wait until M1066 is completed before executing the next CANRX, CANTX or CANFLS.

Afterwards, download program to the driver (Please note that the PLC's default communications format is ASCII 7N2 9600, and the station number is 2. The WPL must therefore be modified, and the WPL setting pathway is **settings > communications settings**)

Step 5: Set the slave stations' station numbers, communications speed, control source, and command source

Delta's CP2000 and EC series devices currently support the CANopen communications interface driver, and the corresponding slave station numbers and communications speed parameters are as follows:

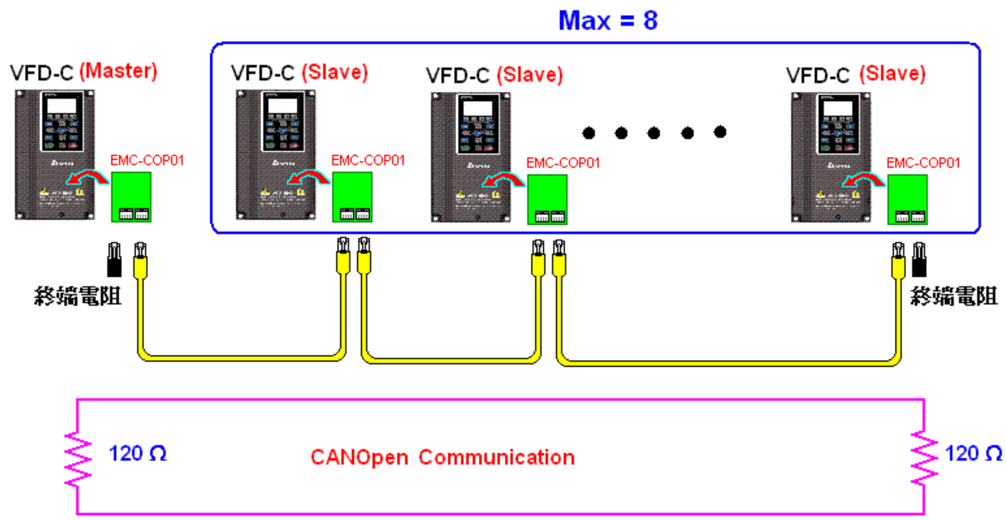
<table>
<tr><th rowspan="2"></th><th colspan="2">Corresponding device parameters</th><th rowspan="2">Value</th><th rowspan="2">Definition</th></tr>
<tr><th>CP2000</th><th>E-C</th></tr>
<tr><td rowspan="2">Slave station address</td><td rowspan="2">09-36</td><td rowspan="2">09-20</td><td>0</td><td>Disable CANopen hardware interface</td></tr>
<tr><td>1~127</td><td>CANopen Communication address</td></tr>
<tr><td rowspan="6">Communication speed</td><td rowspan="6">09-37</td><td rowspan="6">09-21</td><td>0</td><td>1M</td></tr>
<tr><td>1</td><td>500K</td></tr>
<tr><td>2</td><td>250K</td></tr>
<tr><td>3</td><td>125K</td></tr>
<tr><td>4</td><td>100K</td></tr>
<tr><td>5</td><td>50K</td></tr>
<tr><td rowspan="2">Control source</td><td>00-21</td><td>-</td><td>3</td><td></td></tr>
<tr><td>-</td><td>02-01</td><td>5</td><td></td></tr>
<tr><td rowspan="2">Frequency source</td><td>00-20</td><td>-</td><td>6</td><td></td></tr>
<tr><td>-</td><td>02-00</td><td>5</td><td></td></tr>
<tr><td rowspan="2">Torque source</td><td>11-33</td><td>-</td><td>3</td><td></td></tr>
<tr><td>-</td><td>-</td><td>-</td><td></td></tr>
<tr><td rowspan="2">Position source</td><td>11-40</td><td>-</td><td>3</td><td></td></tr>
<tr><td>-</td><td>-</td><td>-</td><td></td></tr>
</table>

Delta's A2 Servo currently supports the CANopen communications interface, and the corresponding slave station numbers and communications speed parameters are as follows:

	Corresponding device parameters A2	Value	Definition
Slave station address	03-00	1~127	CANopen Communication address
Communication speed	03-01 bit 8-11 XRXX	R= 0	125K
		R= 1	250K
		R= 2	500K
		R= 3	750K
		R= 4	1M
Control/command source	01-01	B	

Step 6: Connect hardware wiring

When performing wiring, note the head and tail terminal resistance; connection methods are as follows:



Step 7: Initiate control

After a program has been written and downloaded, switch the PLC mode to Run. Merely turn power to master and slave stations off and then on again.

Refer to CANMasterTest 1 vs. 2 driver.dvp

Example :

CP2000 driver one-to-two control

Step 1: Activating CANopen Master functions

- ☑ Parameter 09-45=1 (initiates Master functions); restart power after completing setting, the status bar on the KPC-CC01 digital keypad will display "CAN Master".
- ☑ Parameter 00-02=6 reset PLC (please note that this action will reset the program and PLC registers to the default values)
- ☑ Turn power off and on again.
- ☑ **Use the KPC-CC01 digital keypad to set the PLC control mode as "PLC Stop"** (if the KPC-CE01 digital keypad is used, set as "PLC 2"; if a newly-introduced driver is used, the blank internal PLC program will cause a PLFF warning code to be issued).

Step 2: Master memory correspondences

- ☑ Enable WPL
- ☑ Use keypad set PLC mode as Stop (PLC 2)
- ☑ WPL read D1070 to D1099 D2000 to D2799
- ☑ Set D2000=10 D2100=11
- ☑ Set D2100 2200 2300 2400 2500 2600 2700=0
- ☑ Download D2000 to D2799 settings

Step 3: Set the master's communications station number and communications speed

- ☑ When setting the master's station number (parameter 09-46, default is set as 100), make sure not to use the same number as a slave station.
- ☑ Set the CANopen communications speed as 1M (parameter 09-37=0); regardless of whether the driver is defined as a master or slave station, the communications speed is set via this parameter.

Step 4: Write program code

Real-time access: Can directly read/write to or from the corresponding D area.

Non real-time access:

Read command: Use the CANRX command for reading. M1066 will be 1 when reading is complete; M1067 will be 1 if reading is successful, and M1067 will be 0 if an error has occurred.

Write command: Use the CANTX command for writing. M1066 will be 1 when writing is complete; M1067 will be 1 if writing is successful, and M1067 will be 0 if an error has occurred.

Refresh command: Use CANFLS command to refresh (if there are RW attributes, the master will write to the slave station; if there are RO attributes, the slave station will return the read values to the master); M1066 will be 1 if refresh has been completed; M1067 will be 1 if refresh is successful, and M1067 will be 0 if an error has occurred.

NOTE

When using CANRX, CANTX or CANFLS, internal implementation commands will wait until M1066 is completed before executing the next CANRX, CANTX or CANFLS.

Afterwards, download program to the driver (Please note that the PLC's default communications format is ASCII 7N2 9600, and the station number is 2. The WPL must therefore be modified, and the WPL setting pathway is **settings > communications settings**)

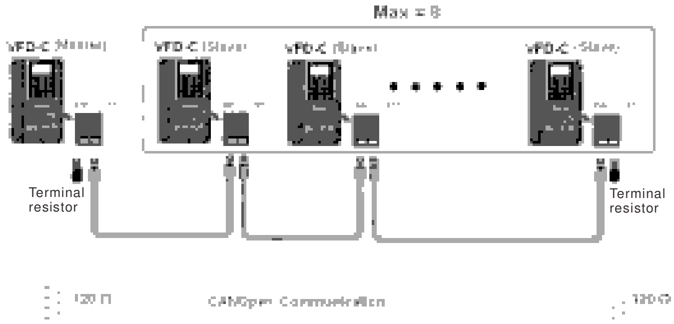
Step 5: Set the slave stations' station numbers and communications speed

Slave station no. 1: 09-37 = 0(Speed 1M)   09-36=10(Node ID 10)

Slave station no. 2: 09-37 = 0(Speed 1M)   09-36=10(Node ID 11)

Step 6: Connect hardware wiring

When performing wiring, note the head and tail terminal resistance; connection methods are as follows:



Step 7: Initiate control

After a program has been written and downloaded, switch the PLC mode to Run. Merely turn power to master and slave stations off and then on again.

Refer to CANMasterTest 1 vs. 2 driver.dvp

16-9 Explanation of various PLC speed mode controls

Speed mode supports SVC control. Under the speed mode of SVC control, control therefore cannot be performed successfully unless finish motor parameter auto tuning ahead of time.

Control methods and settings are explained as follows:

Speed control:

Register table for speed mode:

Control special M

Special M	Description of Function	Attributes
M1025	Driver frequency = set frequency (ON)/driver frequency =0 (OFF)	RW
M1026	Driver operating direction FWD(OFF)/REV(ON)	RW
M1040	Hardware power (Servo On)	RW
M1042	Quick stop	RW
M1044	Pause (Halt)	RW
M1052	Lock frequency (lock, frequency locked at the current operating frequency)	RW

Status special M

Special M	Description of Function	Attributes
M1015	Frequency attained (when used together with M1025)	RO
M1056	Servo On Ready	RO
M1058	On Quick Stopping	RO

Control special D

Special D	Description of Function	Attributes
D1060	Mode setting (speed mode is 0)	RW

Status special D

Special D	Description of Function	Attributes
D1037	Converter output frequency (0.00~600.00)	RO
D1050	Actual operating mode (speed mode is 0)	RO

Speed mode control commands:

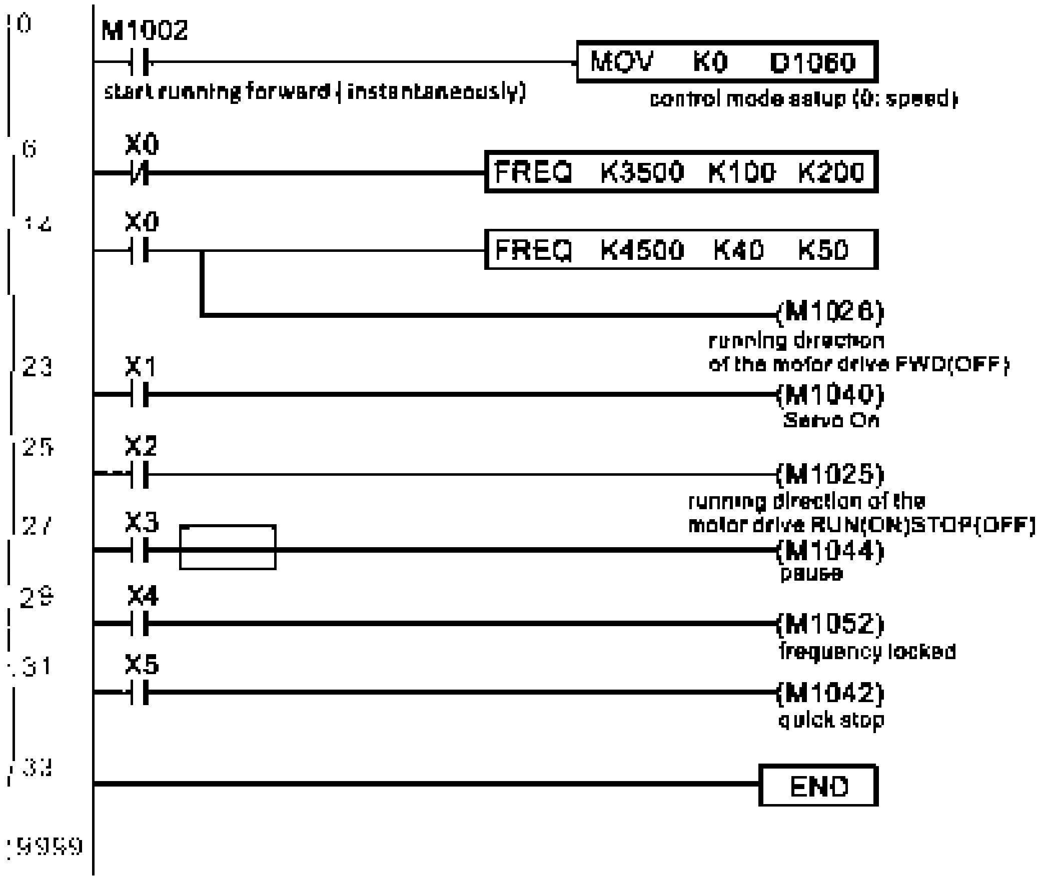
FREQ(P)	S1	S2	S3
	Target speed	The first acceleration time setting	The first deceleration time setting

Example of speed mode control:

Before performing speed control, if the SVC control method is used, setting of electromechanical parameters must first be completed.

1. Setting D1060 = 0 will shift the converter to the speed mode (default).
2. Use the FREQ command to control frequency, acceleration time, and deceleration time.
3. Set M1040 = 1, the driver will now be excited, but the frequency will be 0.

4. Set M1025 = 1, the driver frequency command will now jump to the frequency designated by FREQ, and acceleration/deceleration will be controlled on the basis of the acceleration time and deceleration time specified by FREQ.
5. M1052 can be used to lock the current operating frequency.
6. M1044 can be used to temporarily pause operation, and the deceleration method will comply with deceleration settings.
7. M1042 can be used to perform quick stop, and deceleration will be as quick as possible without giving rise to an error. (There may still be a jump error if the load is too large.)
8. Control user rights: M1040(Servo ON) > M1042(Quick Stop) >M1044(Halt) >M1052(LOCK)



16-10 Internal communications main node control

The protocol has been developed in order to facilitate the use of 485 instead of CANopen in certain application situations. The 485 protocol offers similar real-time characteristics as CANopen; this protocol can only be used on the CP2000 and CT2000 devices. The maximum number of slave devices is 8.

Internal communications have a master-slave structure. The initiation method is very simple:

Slave device:

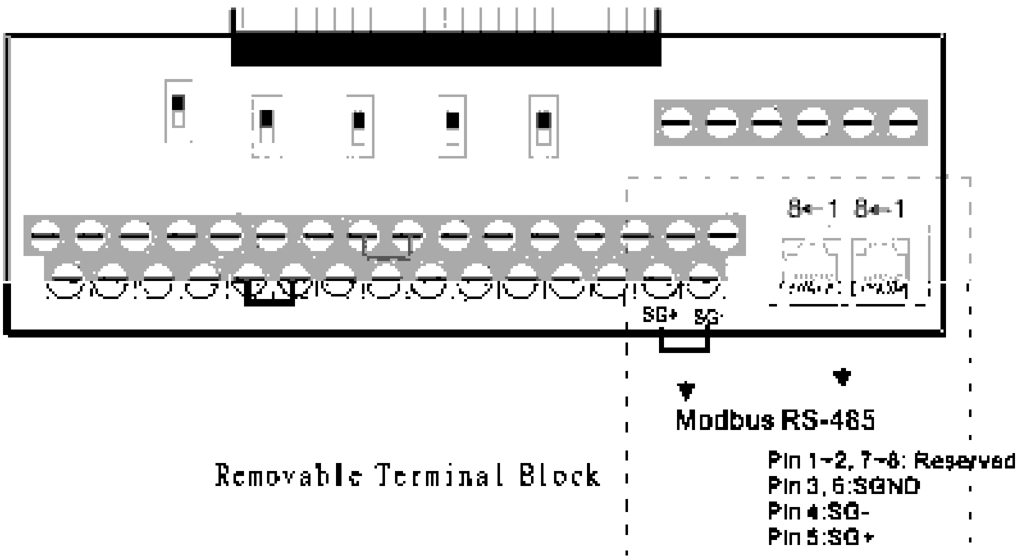
Set parameter 09-31 = -1 to -8 in order to access 8 nodes, and set parameter 00-20 = 1 to define the control source as 485 and access the reference sources that must be controlled, namely speed command (00-21 = 2), torque command (11-33 = 1), and position command (11-40=2). This will complete slave device settings. (PLC functions do not need to be activated)

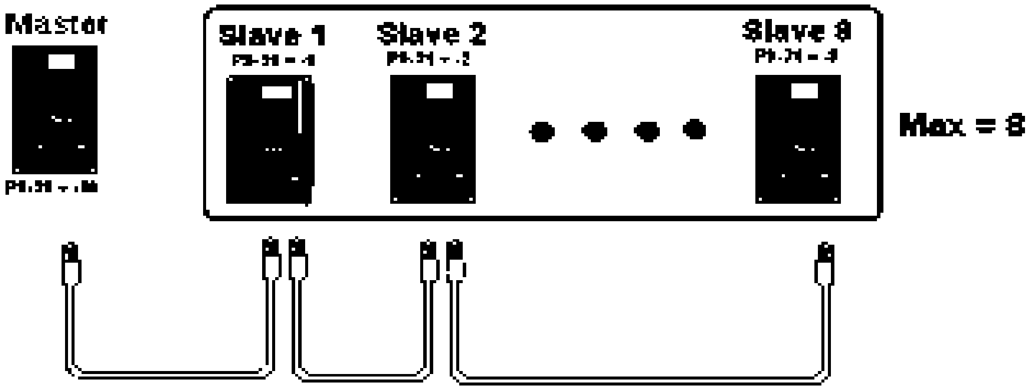
System

Setting the master is even simpler; it is only necessary to set parameter 09-31 = -10, and enable the PLC.

Hardware wiring:

The master and slave stations are connected via the 485 serial port. The CP2000 provide two types of 485 serial port interfaces, see the figure below: (please refer to 06 Control terminals concerning detailed terminal connections)





Master programming: In a program, D1110 can be used to define a slave station to be controlled (1-8, if set as 0, can jump between 8 stations). Afterwards, M1035 is set as 1, and the memory positions of the master and slave stations will correspond. At this time, it is only necessary to send commands to the correlation slave station address to control that station. The following is a register table connected with internal communications:

Control special M

Special M	Description of Function	Attributes
M1035	Initiates internal communications control	RW

Control special D

Special D	Description of Function	Attributes
D1110	Internal node communications number 1-8 (set the station number of the slave station to be controlled)	RW

<table>
<tr><th rowspan="2">Special D</th><th colspan="7">Description of Function</th><th rowspan="2">Attributes</th></tr>
<tr><th>Definition</th><th>bit</th><th>User rights</th><th>Speed mode</th><th>Location mode</th><th>Torque mode</th><th>Homing mode</th></tr>
<tr><td rowspan="14">D1120 + 10*N</td><td rowspan="14">Internal node N control command</td><td>0</td><td>4</td><td>Command functions</td><td>-</td><td>-</td><td>Homing Origin</td><td rowspan="14">RW</td></tr>
<tr><td>1</td><td>4</td><td>Reverse rotation requirements</td><td>Immediate change</td><td>-</td><td>-</td></tr>
<tr><td>2</td><td>4</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>3</td><td>3</td><td>Temporary pause</td><td>Temporary pause</td><td>-</td><td>-</td></tr>
<tr><td>4</td><td>4</td><td>Frequency locking</td><td>-</td><td>-</td><td>Temporary pause</td></tr>
<tr><td>5</td><td>4</td><td>JOG</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>6</td><td>2</td><td>Quick Stop</td><td>Quick Stop</td><td>Quick Stop</td><td>Quick Stop</td></tr>
<tr><td>7</td><td>1</td><td>Servo ON</td><td>Servo ON</td><td>Servo ON</td><td>Servo ON</td></tr>
<tr><td>11~8</td><td>4</td><td>Speed interval switching</td><td>Speed interval switching</td><td>-</td><td>-</td></tr>
<tr><td>13~12</td><td>4</td><td>Deceleration time change</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>14</td><td>4</td><td>Enable Bit 13 ~ 8</td><td>Enable Bit 13 ~ 8</td><td>-</td><td>-</td></tr>
<tr><td>15</td><td>4</td><td>Clear error code</td><td>Clear error code</td><td>Clear error code</td><td>Clear error code</td></tr>
<tr><td>D1121 + 10*N</td><td>Internal node N control mode</td><td></td><td></td><td>0</td><td>1</td><td>2</td><td>3</td><td>RW</td></tr>
<tr><td>D1122 + 10*N</td><td>Internal node N reference command L</td><td></td><td></td><td>Speed command (no number)</td><td>Position command (with numbers)</td><td>Torque command (with numbers)</td><td>-</td><td>RW</td></tr>
<tr><td>D1123 + 10*N</td><td>Internal node N reference command H</td><td></td><td></td><td>-</td><td></td><td>Speed limit</td><td>-</td><td>RW</td></tr>
</table>

※ N = 0 ~ 7

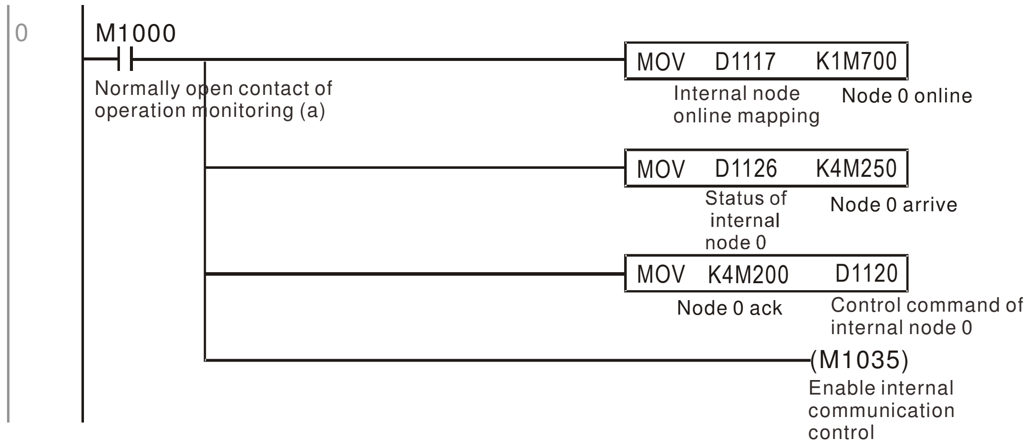
Status special D

Special D	Description of Function	Attributes
D1115	Internal node synchronizing cycle (ms)	RO
D1116	Internal node error (bit0 = slave device 1, bit1 = slave device 2,…bit7 = slave device 8)	RO
D1117	Internal node online correspondence (bit0 = slave device 1, bit1 = slave device 2,…bit7 = slave device 8)	RO

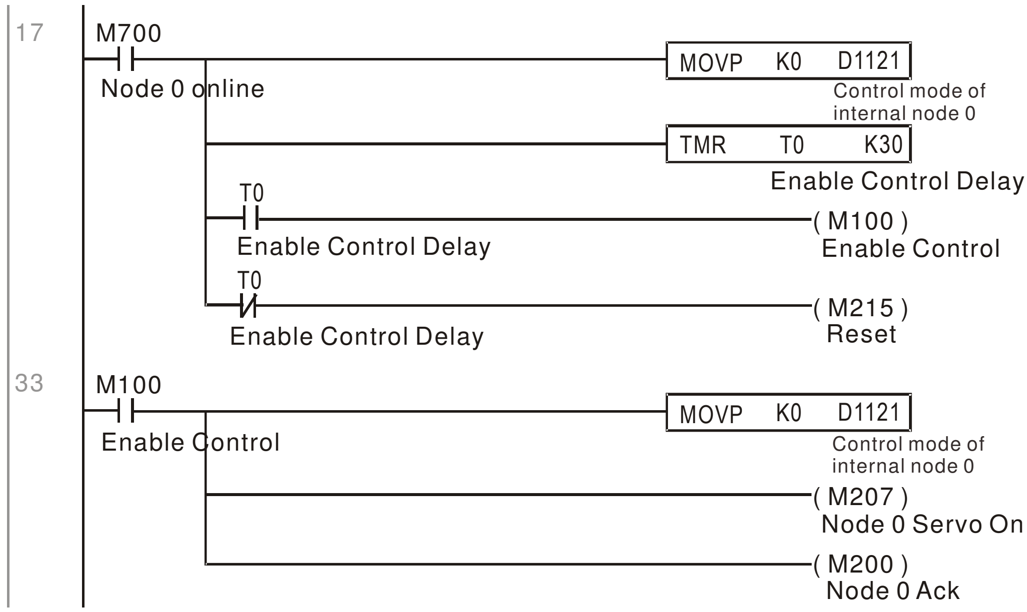
Special D	Description of Function					Attributes
	bit	Speed mode	Location mode	Torque mode	Homing mode	
D1126 + 10*N	0	Frequency command arrival	Position command attained	Torque command attained	Zero command completed	RO
	1	Clockwise	Clockwise	Clockwise	Clockwise	
		Counterclockwise:	Counterclockwise:	Counterclockwise:	Counterclockwise:	
	2	Warning	Warning	Warning	Warning	
	3	Error	Error	Error	Error	
	5	JOG				
	6	Quick Stop	Quick Stop	Quick Stop	Quick Stop	
	7	Servo ON	Servo ON	Servo ON	Servo ON	
D1127 + 10*N		Actual frequency	Actual position (with numbers)	Actual torque (with numbers)	-	RO
D1128 + 10*N		-		-	-	

※ N = 0 ~ 7

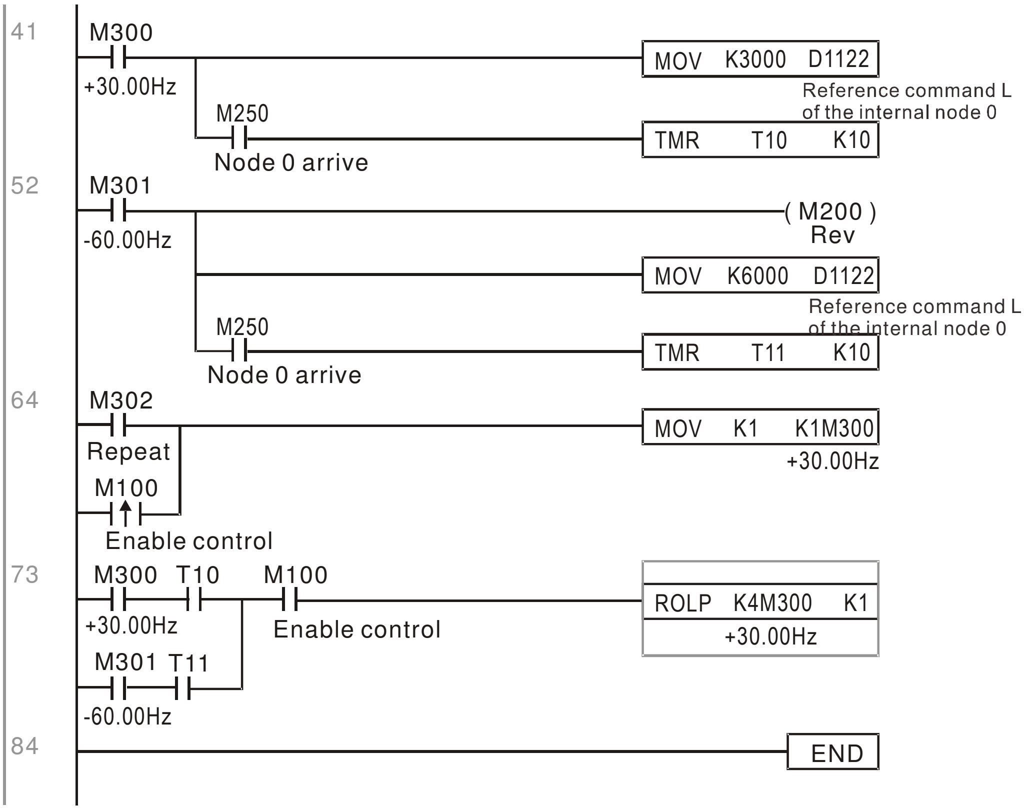
Example: Assume it is desired to control slave station 1 operation at frequencies of 30.00Hz and 60.00 Hz, status, and online node correspondences:



When it is judged that slave station 1 is online, delay 3 sec. and begin control



It is required slave station 1 maintain forward rotation at 30.00Hz for 1 sec., and maintain reverse rotation at 60.00 Hz for 1 sec., and repeat this cycle continuously.



16-11 Modbus remote IO control applications (use MODRW)

The CP2000's internal PLC supports 485 read/write functions, which can be realized using the MODRW command. However, the 485 serial port must be defined as available for the PLC's 485 use before writing a program, and the parameter 09-31 must be set as -12. After completing settings, the standard functions defined by 485 can be used to implement read/write commands at other stations. Communications speed is defined by parameter 09-01, the communications format is defined by parameter 09-04, and the PLC's current station number is defined by parameter 09-35. The CP2000 currently supports the functions read coil (0x01), read input (0x02), read register (0x03), write to single register (0x06), write to several coils (0x0F), and write to several registers (0x10). Explanations and the usage of these functions are provided as follows:

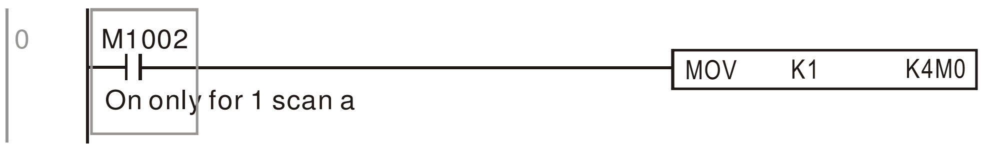
MODRW command					General meaning	Slave device is Delta's PLC meaning	Slave device is Delta's converter meaning
S1	S2	S3	S4	S5			
Node ID	Command	Address	Return: D area	Length:			
K3	H01	H500	D0	K18	Read coil (Bit)	Read 18 bits of data corresponding to slave station 3 PLC Y0 to Y21. This data is stored by bit 0 to 15 of the this station's D0 and bit 0 to bit 3 of D1.	Does not support this function
K3	H02	H400	D10	K10	Read input (Bit)	Read 10 bits of data corresponding to slave station 3 PLC X0 to X11. This data is stored by bit 0 to 9 of this station's D10.	Does not support this function
K3	H03	H600	D20	K3	Read register (word)	Read 3 words of data corresponding to slave station 3 PLC T0 to T2. This data is stored by D20 to D22.	Read 3 words of data corresponding to slave station 3 converter parameters 06-00 to 06-02. This data is stored by D20 to D22
K3	H06	H610	D30	XX	Write to single register (word)	Write slave station 3 PLC's T16 to this station's D30 value	Write slave station 3 converter 06 to 16 parameter to this station's D30 value
K3	H0F	H509	D40	K10	Write to multiple coils (Bit)	Write slave station 3 PLC's Y11 to Y22 to bit 0 to 9 of D40.	Does not support this function
K3	H10	H602	D50	K4	Write to multiple registers (word)	Write slave station 3 PLC's T2 to T5 to D50 to D53	Write slave station 3 converter 06-02 to 06-05 parameters to this station's D50 to D53

※ XX indicates doesn't matter

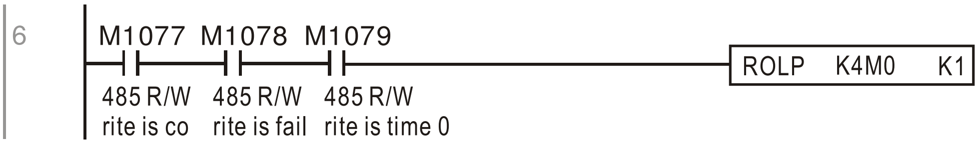
After implementing MODRW, the status will be displayed in M1077 (485 read/write complete), M1078 (485 read/write error), and M1079 (485 read/write time out). M1077 is defined so as to immediately revert to 0 after the MODRW command has been implemented. However, any of three situations—a report of no error, a data error report, or time out with no report—will cause the status of M1077 to change to On.

Example program: Testing of various functions

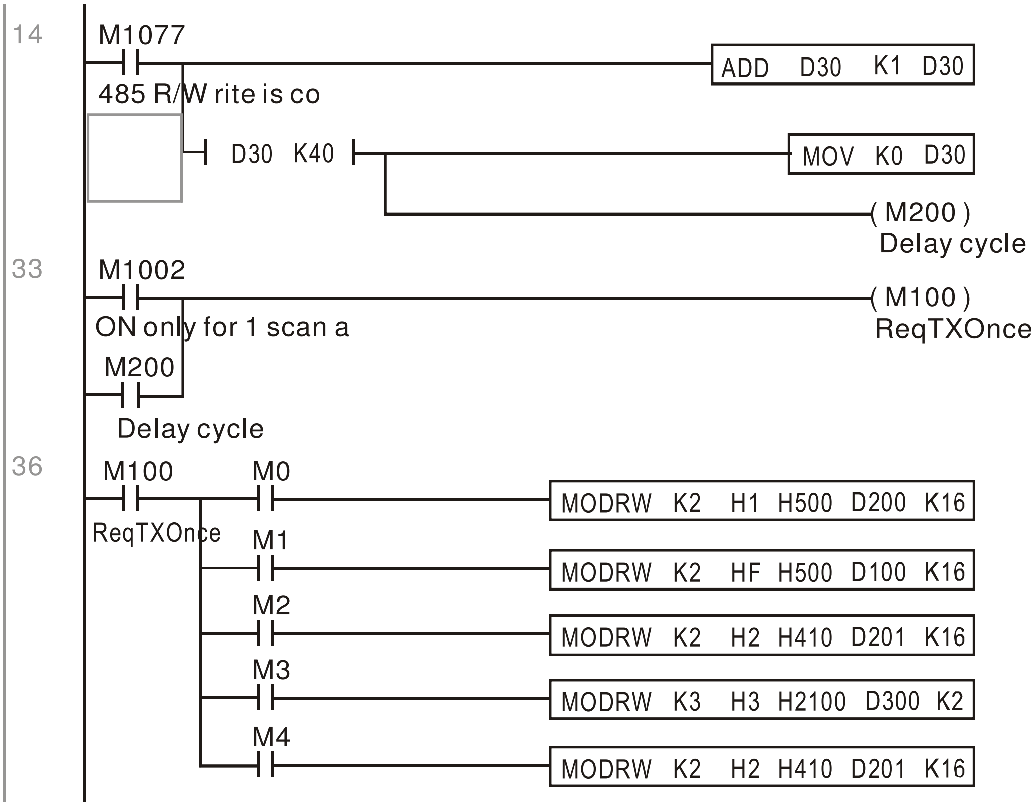
At the start, will cause the transmitted time sequence to switch to the first data unit.



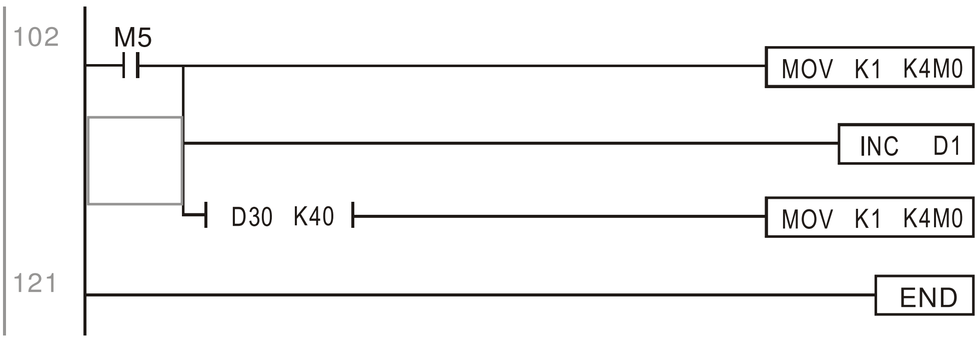
When the reported message indicates no error, it will switch to the next transmitted command



If time out occurs or an error is reported, the M1077 will change to On. At this time, after a delay of 30 scanning cycles, it will re-issue the original command once



It will repeat after sending all commands



Practical applications:

Actual use to control the RTU-485 module.

Step 1: Set the communications format. Assume that the communications format is 115200, 8,N,2, RTU

CP2000：The default PLC station number is set as 2 (09-35)

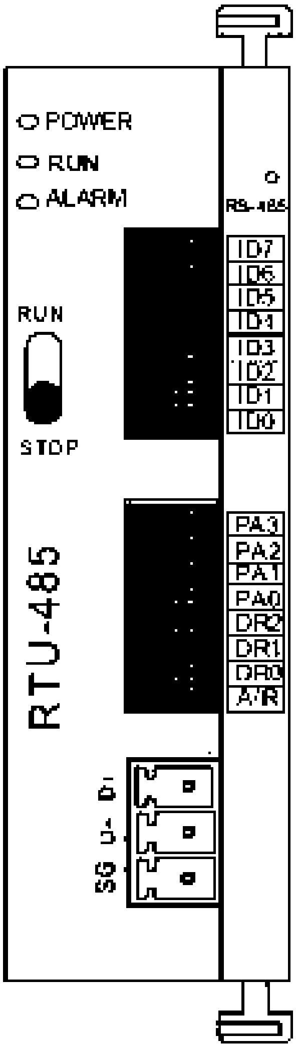
09-31=-12(COM1 is controlled by the PLC), 09-01=115.2(The communications speed is 115200)

09-04=13(The format is 8,N,2, RTU)

RTU485: The station number = 8 (give example)

ID7	ID6	ID5	ID4	ID3	ID2	ID1	ID0
0	0	0	0	1	0	0	0

PA3	PA2	PA1	PA0	DR2	DR1	DR0	A/R
1	0	0	0	1	1	1	0



Communication station #:
ID0~ ID7 are defined as 2^0, 2^1, 2^2...2^6, 2^7

Communication protocol

PA3	PA2	PA1	PA0	A/R	Communication Protocol
OFF	OFF	OFF	OFF	ON	7,E,1 · ASCII
OFF	OFF	OFF	ON	ON	7,O,1 ASCII
OFF	OFF	ON	OFF	ON	7,E,2 · ASCII
OFF	OFF	ON	ON	ON	7,O,2 ASCII
OFF	ON	OFF	OFF	ON	7,N,2 · ASCII
OFF	ON	OFF	ON	ON	8,E,1 · ASCII
OFF	ON	ON	OFF	ON	8,O,1 ASCII
OFF	ON	ON	ON	ON	8,N,1 · ASCII
ON	OFF	OFF	OFF	ON	8,N,2 · ASCII
OFF	ON	OFF	ON	OFF	8,E,1 RTU
OFF	ON	ON	OFF	OFF	8,O,1 · RTU
OFF	ON	ON	ON	OFF	8,N,1 · RTU
ON	OFF	OFF	OFF	OFF	8,N,2 · RTU

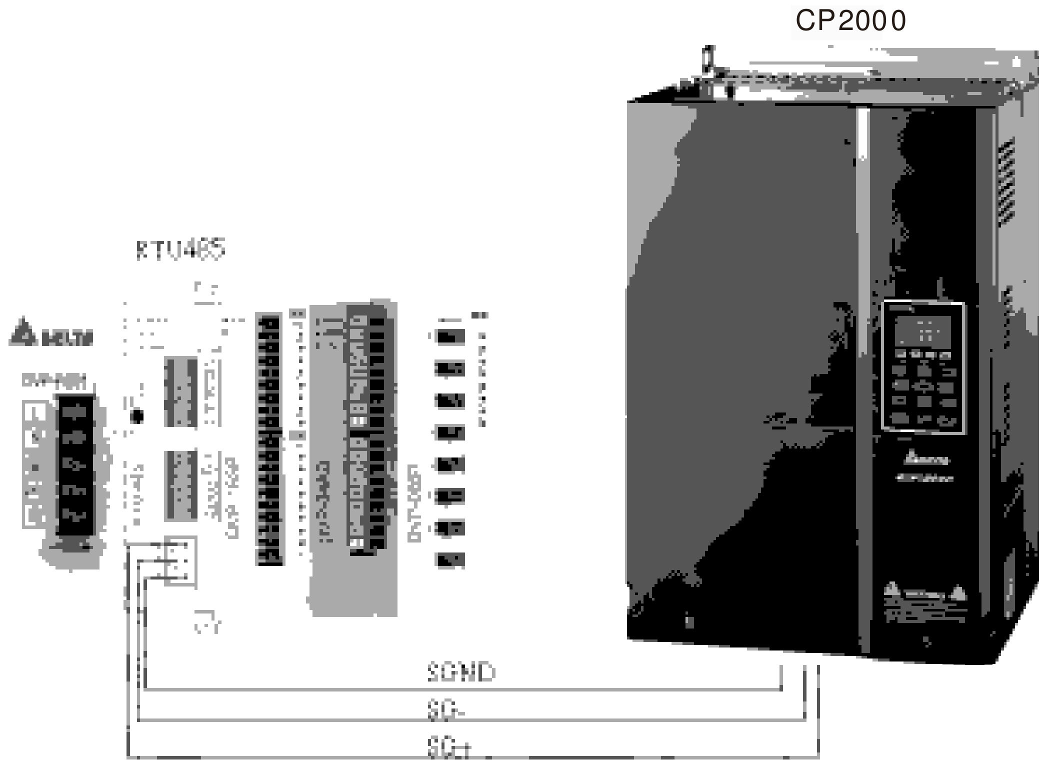
DR2	DR1	DR0	Communicaton Speed
OFF	OFF	OFF	1,200 bps
OFF	OFF	ON	2,400 bps
OFF	ON	OFF	4,800 bps
OFF	ON	ON	9,600 bps
ON	OFF	OFF	19,200 bps
ON	OFF	ON	38,400 bps
ON	ON	OFF	57,600 bps
ON	ON	ON	115,200 bps

Step 2: Install control equipment. We sequentially connect a DVP16-SP (8 IN 8 OUT), DVP-04AD (4 channels AD), DVP02DA (2 channels DA), and DVP-08ST (8 switches) to the RTU485.

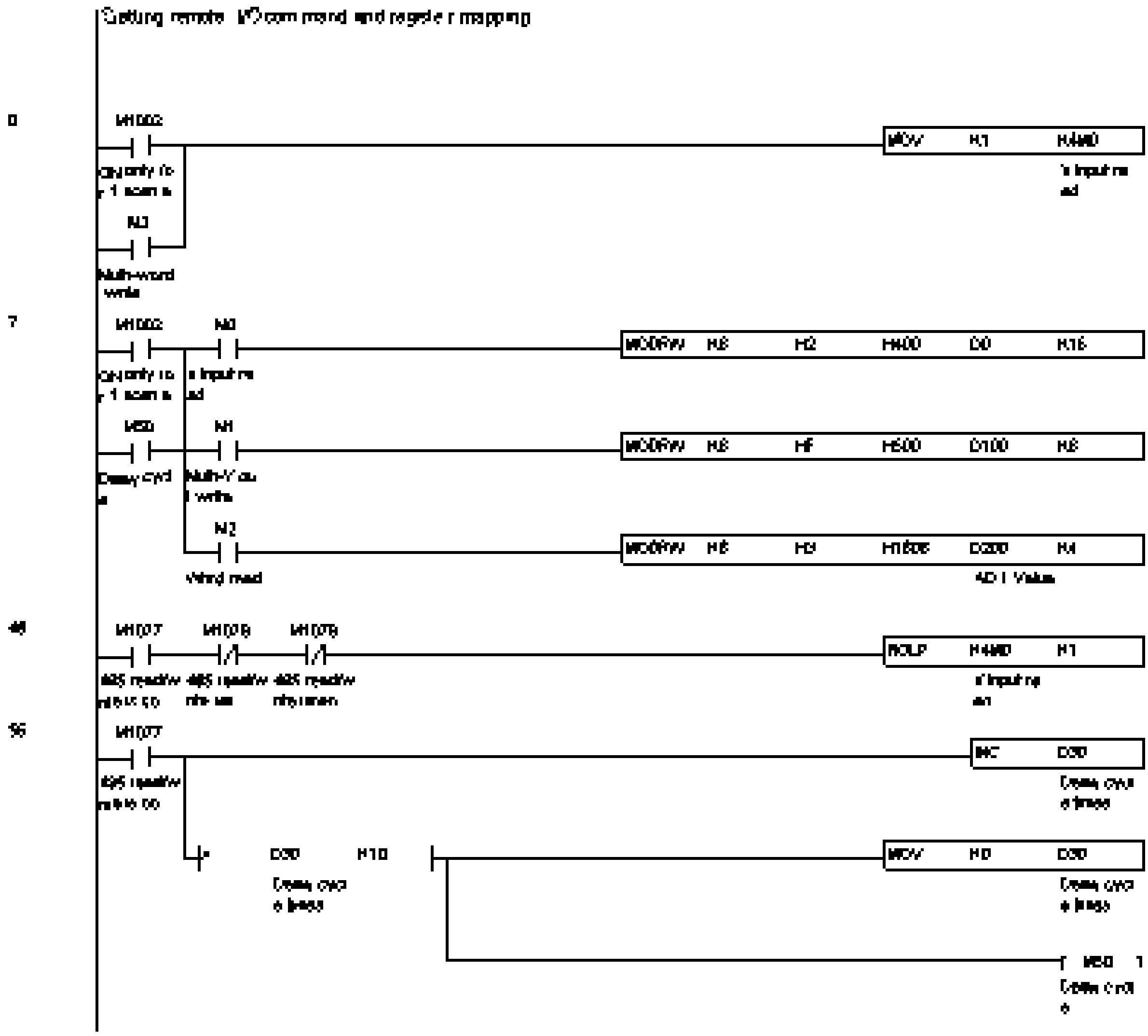
The following corresponding locations can be obtained from the RTU485's configuration definitions:

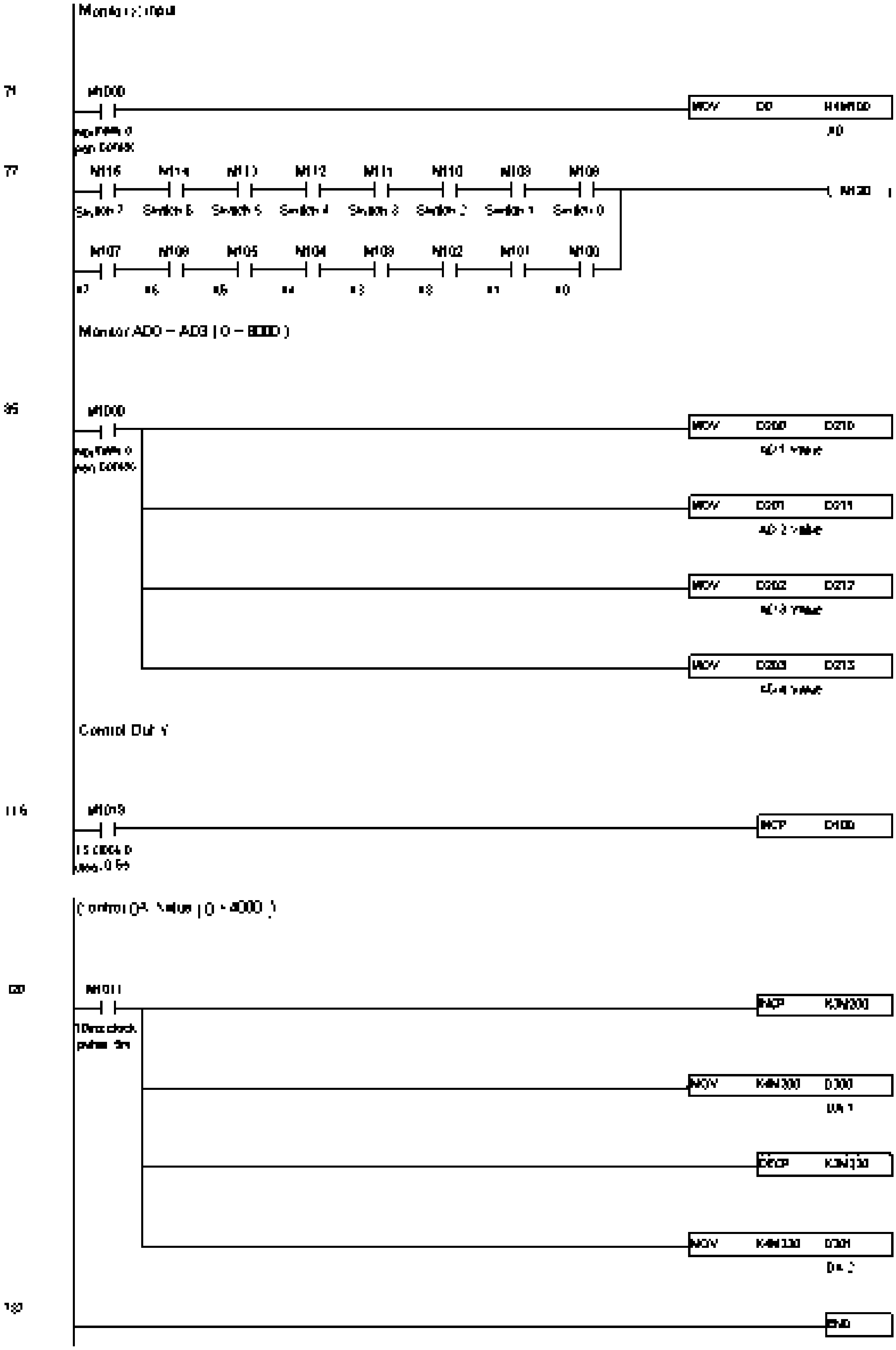
Module	Terminals	485 Address
DVP16-SP	X0 ~ X7	0400H ~ 0407H
	Y0 ~ Y7	0500H ~ 0507H
DVP-04AD	AD0 ~ AD3	1600H ~ 1603H
DVP02DA	DA0 ~ DA1	1640H ~ 1641H
DVP-08ST	Switch 0 ~ 7	0408H ~ 040FH

Step 3: Physical configuration



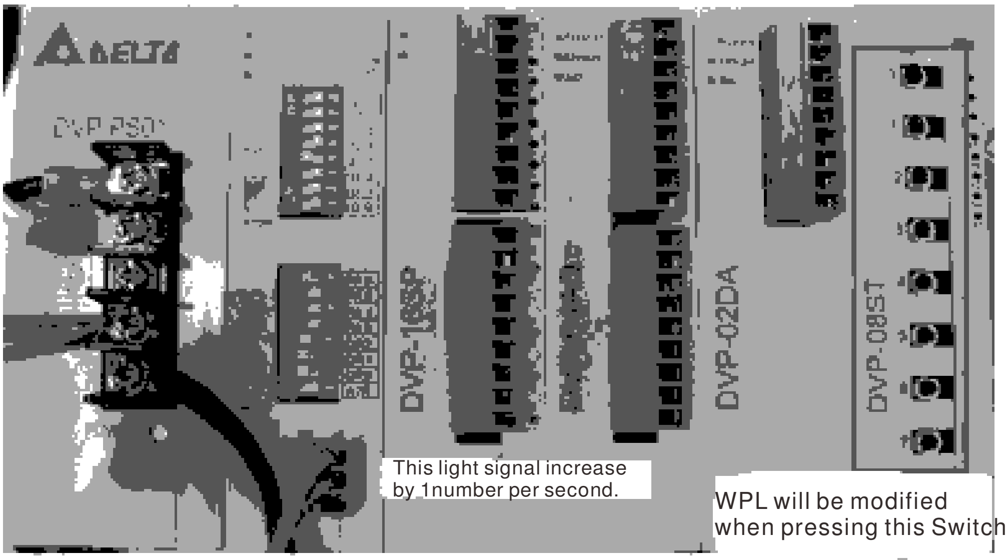
Step 4: Write to PLC program

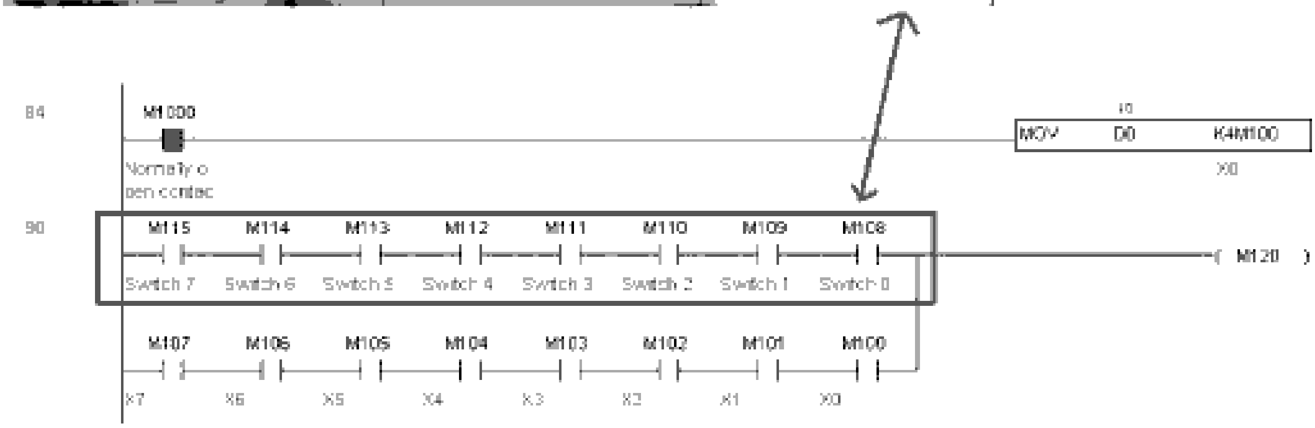



M1000
MOV
D0
K4M100
M116
M114
M113
M112
M111
M110
M109
M108
M107
M106
M105
M104
M103
M102
M101
M100
MOV
D200
D210
MOV
D201
D211
MOV
D202
D212
MOV
D203
D213
Control Out Y
INCP
D100
INCP
K3M200
MOV
K4M300
D300
DECP
MOV
END

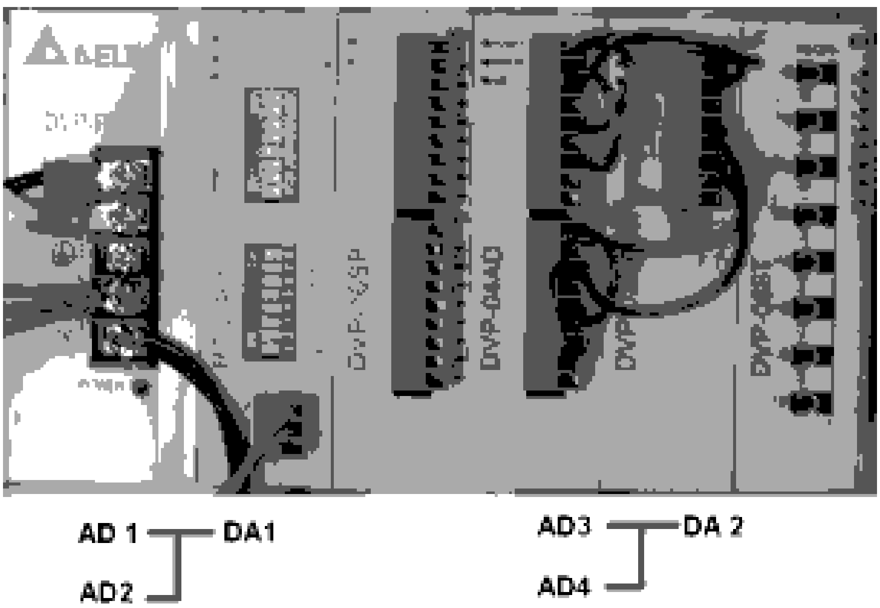
Step 5: Actual testing situation:

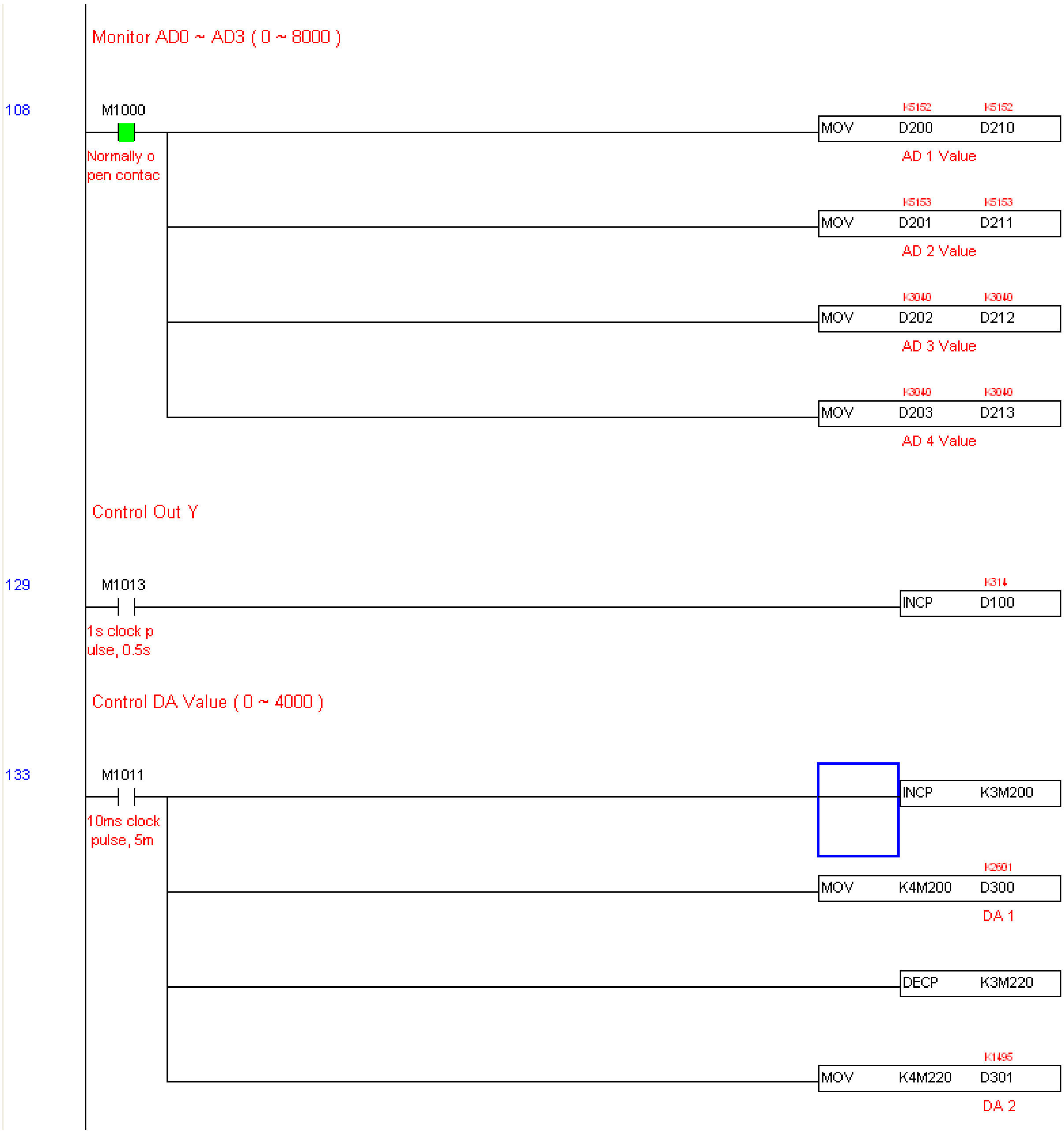
I/O testing: When the switch is activated, it can be discovered that the display corresponds to M115 - M108. Furthermore, it can be seen that one output point light is added every 1 sec. (the display uses a binary format)





AD DA testing: It can be discovered that D200 and D201 are roughly twice the D300, and continue to increase progressively. For their part, the D202 and D203 are roughly twice the D301, and continue to decrease progressively.




Monitor AD0 ~ AD3 (0 ~ 8000)
108
M1000
Normally o
pen contac
MOV D200 D210
AD 1 Value
MOV D201 D211
AD 2 Value
MOV D202 D212
AD 3 Value
MOV D203 D213
AD 4 Value
Control Out Y
129
M1013
1s clock p
ulse, 0.5s
INCP D100
Control DA Value (0 ~ 4000)
133
M1011
10ms clock
pulse, 5m
INCP K3M200
MOV K4M200 D300
DA 1
DECP K3M220
MOV K4M220 D301
DA 2

16-12 Calendar functions

(KPC-CC01) is connected, and otherwise cannot be used. Currently-support commands include TCMP (comparison of calendar data), TZCP (calendar data range comparison), TADD (calendar data addition), TSUB (calendar data subtraction), and TRD (calendar reading). Please refer to the explanation of relevant commands and functions for the usage of these commands.

In real applications, the internal PLC can judge whether calendar function have been activated; if they have been activated, calendar warning codes may be displayed in some situations. The basis for whether a calendar function has been activated is whether the program has written the calendar time (D1063 to D1069) in connection with the foregoing calendar commands or programs.

The calendar's time display is currently assigned to D1063 to D1069, and is defined as follows:

Special D	Item	Content	Attributes
D1063	Year (Western)	20xx (2000~2099)	RO
D1064	Weeks	1~7	RO
D1065	Month	1~12	RO
D1066	Day	1~31	RO
D1067	Hour	0~23	RO
D1068	Minute	0~59	RO
D1069	Second	0~59	RO

Calendar-related special M items are defined as follows:

Special D	Item	Attributes
M1068	Calendar time error	RO
M1076	Calendar time error or refresh time out	RO
M1036	Ignore calendar warning	RW

*When a program writes to the commands TCMP, TZCP, TADD, or TSUB, if it is discovered that a value exceeds the reasonable range, M1026 will be 1.

*When the keypad display is PLra (RTC correction warning) or PLrt (RTC time out warning), M1076 will be ON.

*When M1036 is 1, the PLC will ignore the calendar warning.

Calendar trigger warning code is defined as follows:

Warning	Description	Reset approach	Whether it affects PLC operation
PLra	Calendar time correction	Requires power restart	Will not have any effect
PLrt	Calendar time refresh time out	Requires power restart	Will not have any effect

*When the PLC's calendar functions are operating, if the keypad is replaced with another keypad, it will jump to PLra.

*When it is discovered at startup that the keypad has not been powered for more than 7 days, or the time is wrong, PLra will be triggered.

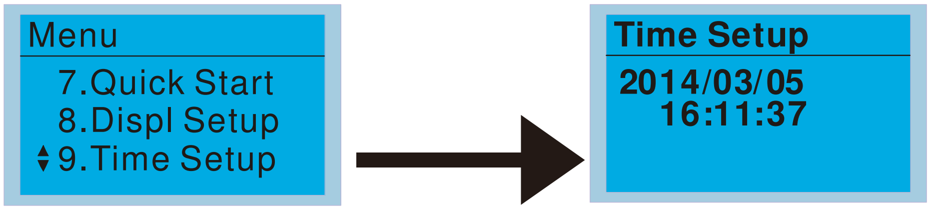
*When it is discovered that the CP2000 has no keypad 10 sec. after startup, PLrt will be triggered.

*If the keypad is suddenly pulled out while the calendar is operating normally, and is not reconnected for more than 1 minute, PLrt will be triggered.

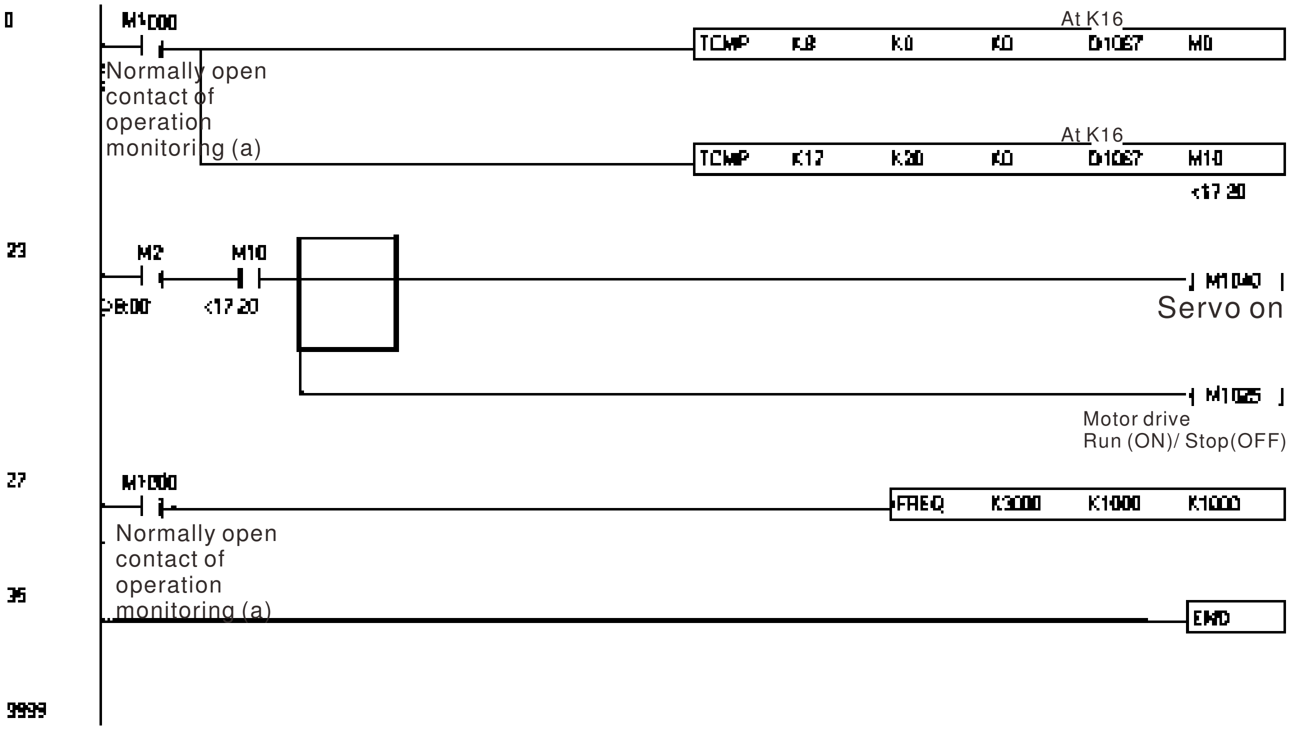
Practical applications:

We will perform a demo of simple applications.

We first correct the keypad time. After pressing Menu on the keypad, select the 9th time setting option. After selection, set the current time.



We set converter on during the period of 8:00-17:20, which allows us to write the following example



Chapter 17 Introduction to BACnet

1. About BACnet:

BACnet is an ASHRAE communication protocol for **b**uilding **a**utomation and **c**ontrol **net**works. (ASHRAE: **A**merican **S**ociety of **H**eating, **R**efrigerating and Air-Conditioning **E**ngineers, Inc.).
CP2000's BACnet is based on version 20004.

BACnet's regulations are related to several kinds of physical layers' interfaces. The physical layer built inside CP200 is achieved via MS/TP interface.

The BACnet of CP2000 supports a device type called B-ASC. B-ASC supports six types of services such as DS-RP-B, DS-RPM-B, DS-WP-B, DM-DDB-B, DM-DOB and DM-DCC-B.

2. CP2000 BACnet-Object and Property:

In CP2000, BACnet supports 3 object types: Device, AnalogValue (AV) and BinaryValue (BV). In each object type, we have to the following table to show the Properties list:

Property ID		Object Type		
		Device	Analog Value	Binary Value
#4	ACTIVE TEXT			V
#11	APDU_TIMEOUT	V		
#12	APPLICATION_SOFTWARE_VERSION	V		
#28	DESCRIPTION	V	V	V
#30	DEVICE ADDRESS BINDING	V	V	
#36	EVENT STATE		V	V
#44	FIRMWARE_REVISION	V		
#46	INACTIVE TEXT			V
#62	MAX_APDU_LENGTH_ACCEPTED	V		
#63	MAX_INFO_FRAMES	V		
#64	MAX_MASTER	V		
#70	MODEL_NAME	V		
#73	NUMBER_OF_APDU_RETRIES	V		
#75	OBJECT_IDENTIFIER	V *1	V	V
#76	OBJECT_LIST	V		
#77	OBJECT_NAME	V *1	V	V
#79	OBJECT_TYPE	V	V	V
#81	OUT OF SERVICE		V	V
#85	PRESENT VALUE		V *2	V *2
#87	PRIORITY ARRAY		V *3	V *3
#96	PROTOCOL_OBJECT_TYPES_SUPPORTED	V		

Property ID		Object Type		
		Device	Analog Value	Binary Value
#97	PROTOCOL_SERVICES_SUPPORTED	V		
#98	PROTOCOL_VERSION	V		
#104	RELINQUISH DEFAULT		V *3	V *3
#107	SEGMENTATION_SUPPORTED	V		
#111	STATUS FLAGS		V	V
#112	SYSTEM_STATUS	V		
#117	UNITS		V	
#120	VENDOR_IDENTIFIER	V		
#121	VENDOR_NAME	V		
#139	PROTOCOL_REVISION	V		
#155	DATABASE_REVISION	V		

*1. The Object_ID and Object_Name Properties of Device are writeable.

*2. The Present_Value Property of some AV and BV objects is commendable.

*3. Only Commendable objects support Priority_Array and Relinquish_Default.

The AV objects, we have commendable and readonly cases.

- Commendable case: We can use Write_Service to access the Present_Value property of commendable AV objects. Thus, the commandable AV objects are linking to the Control_Word and Pr_Word in CP2000.
- Readonly case: We can use Read_Service to access the Present_Value property of readonly AV objects. Thus, these readonly AV objects are linking to the Status_Word in CP2000.

The BV objects, we also have commandable and readonly cases.

- Commendable case: We can use Write_Service to access the Present_Value property of commendable BV objects. Thus, the commandable BV objects are linking to the Control_Bit in CP2000.
- Readonly case: We can use Read_Service to access the Present_Value property of readonly BV objects. Thus, these readonly BV objects are linking to the Status_Bit in CP2000.

2.1 Commendable Analog Value Object

In CP20000, we have AV_000~AV_026 supporting commendable Presnet_Value property. For these AV_Objects, we also can use (Multi)Read_Service to access Priority_Array and Relinquish_Default properties.

Object Number	R/W	Object Name	Object Description	Unit
AV 000	RW	Reserved	Reserved	UNITS_NO_UNITS
AV 001	RW	FreqRefValue	Frequency Reference Value	UNITS_HERTZ
AV 002	RW	Reserved	Reserved	UNITS_NO_UNITS
AV 003	RW	Reserved	Reserved	UNITS_NO_UNITS
AV 004	RW	Reserved	Reserved	UNITS_NO_UNITS
AV 005	RW	Reserved	Reserved	UNITS_NO_UNITS
AV 006	RW	Reserved	Reserved	UNITS_NO_UNITS
AV 007	RW	Reserved	Reserved	UNITS_NO_UNITS

Object Number	R/W	Object Name	Object Description	Unit
AV 008	RW	Reserved	Reserved	UNITS_NO_UNITS
AV 009	RW	Reserved	Reserved	UNITS_NO_UNITS
AV 010	RW	Reserved	Reserved	UNITS_NO_UNITS
AV 011	RW	(P9-11 map set)	AV11 will modify data which is P9-11 mapping to	Depends
AV 012	RW	(P9-12 map set)	AV12 will modify data which is P9-12 mapping to	Depends
AV 013	RW	(P9-13 map set)	AV13 will modify data which is P9-13 mapping to	Depends
AV 014	RW	(P9-14 map set)	AV14 will modify data which is P9-14 mapping to	Depends
AV 015	RW	(P9-15 map set)	AV15 will modify data which is P9-15 mapping to	Depends
AV 016	RW	(P9-16 map set)	AV16 will modify data which is P9-16 mapping to	Depends
AV 017	RW	(P9-17 map set)	AV17 will modify data which is P9-17 mapping to	Depends
AV 018	RW	(P9-18 map set)	AV18 will modify data which is P9-18 mapping to	Depends
AV 019	RW	(P9-19 map set)	AV19 will modify data which is P9-19 mapping to	Depends
AV 020	RW	(P9-20 map set)	AV20 will modify data which is P9-20 mapping to	Depends
AV 021	RW	(P9-21 map set)	AV21 will modify data which is P9-21 mapping to	Depends
AV 022	RW	(P9-22 map set)	AV22 will modify data which is P9-22 mapping to	Depends
AV 023	RW	(P9-23 map set)	AV23 will modify data which is P9-23 mapping to	Depends
AV 024	RW	(P9-24 map set)	AV24 will modify data which is P9-24 mapping to	Depends
AV 025	RW	(P9-25 map set)	AV25 will modify data which is P9-25 mapping to	Depends
AV 026	RW	(P9-26 map set)	AV26 will modify data which is P9-26 mapping to	Depends

2.2 Status (Readonly) Analog Value Object

In CP20000, we have AV_027~AV_068 with readonly Presnet_Value property. For these AV_Objects, we do NOT have Priority_Array and Relinquish_Default properties.

Object Number	R/W	Object Name	Object Description	Unit
AV 027	R	Reserved	Reserved	UNITS_NO_UNITS
AV 028	R	Reserved	Reserved	UNITS_NO_UNITS
AV 029	R	Reserved	Reserved	UNITS_NO_UNITS
AV 030	R	Reserved	Reserved	UNITS_NO_UNITS
AV 031	R	Output frequency	Display output frequency(Hz)	UNITS_HERTZ
AV 032	R	Reserved	Reserved	UNITS_NO_UNITS
AV 033	R	Reserved	Reserved	UNITS_NO_UNITS
AV 034	R	Reserved	Reserved	UNITS_NO_UNITS
AV 035	R	Output torque(%)	Display output torque(%)	UNITS_PERCENT
AV 036	R	Reserved	Reserved	UNITS_NO_UNITS
AV 037	R	Reserved	Reserved	UNITS_NO_UNITS
AV 038	R	Reserved	Reserved	UNITS_NO_UNITS
AV 039	R	Status word	Display status word,made from BV16~BV31	UNITS_NO_UNITS
AV 040	R	Reserved	Reserved	UNITS_NO_UNITS

Object Number	R/W	Object Name	Object Description	Unit
AV 041	R	Driver type code	Driver type code	UNITS_NO_UNITS
AV 042	R	Warn code	Warn code	UNITS_NO_UNITS
AV 043	R	Error code	Error code	UNITS_NO_UNITS
AV 044	R	Output current	Display output current(Amp)	UNITS_AMPERES
AV 045	R	DC-bus voltage	Display DC-BUS voltage(Volt)	UNITS_VOLTS
AV 046	R	Output Voltage	Display output voltage of U, V, W(Volt)	UNITS_VOLTS
AV 047	R	Count Value	Display counter value of TRG terminal	UNITS_NO_UNITS
AV 048	R	Power Angle	Display output power angle of U, V, W	UNITS_POWER_FACTOR
AV 049	R	Output Power	Display actual output power of U, V, W(kw)	UNITS_KILOWATTS
AV 050	R	IGBT temperature	Display the IGBT temperature	UNITS_DEGREES_CELSIUS
AV 051	R	Temperature of driver	Display the temperature of capacitance	UNITS_DEGREES_CELSIUS
AV 052	R	Real carry frequency	Display real carrier frequency of the drive(KHz)	UNITS_KILOHERTZ
AV 053	R	PID feedback value	Display PID feedback value(%)	UNITS_PERCENT
AV 054	R	Overload rate	Display overload condition(%)	UNITS_PERCENT
AV 055	R	Ground fail detect level	Display GND fail detect level(%)	UNITS_PERCENT
AV 056	R	DC bus ripple	Display DCbus voltage ripples(Volt)	UNITS_VOLTS
AV 057	R	Fan Speed	Fan speed of the drive(%)	UNITS_PERCENT
AV 058	R	Output speed(rpm)	Output speed(rpm)	UNITS_REVOLUTIONS_PER_MINUTE
AV 059	R	KW per Hour	KW per Hour	UNITS_KILOWATTS
AV 060	R	Multi-speed switch	Real multi-speed switch	UNITS_NO_UNITS
AV 061	R	AVI input value	0~10V corresponds to 0~100%	UNITS_PERCENT
AV 062	R	ACI input value	4~20mA/0~10V corresponds to 0~100%	UNITS_PERCENT
AV 063	R	AUI input value	-10V~10V corresponds to -100~100%	UNITS_PERCENT
AV 064	R	Digital input status	Refer to P2-12	UNITS_NO_UNITS
AV 065	R	Digital output status	Refer to P2-18	UNITS_NO_UNITS
AV 066	R	CPU pin status of DI	Corresponding CPU pin status of digital input	UNITS_NO_UNITS
AV 067	R	CPU pin status of DO	Corresponding CPU pin status of digital output	UNITS_NO_UNITS
AV 068	R	PLC D1043 value	PLC D1043 value	UNITS_NO_UNITS

2.3 Commandable Binary Value Object

In CP20000, we have BV_000~BV_015 supporting commendable Presnet_Value property. For these BV_Objects, we also can use (Multi)Read_Service to access Priority_Array and Relinquish_Default properties.

Object Number	R/W	Object Name	Object Description
BV 000	RW	ACTIVE CMD	(0)FreqCmd=0;(1)FreqCmd=FreqRefValue
BV 001	RW	FWD/REV CMD	(0)Forward; (1)Reverse
BV 002	RW	Reserved	Reserved
BV 003	RW	HALT CMD	(0)None;(1)RampDown to 0Hz.
BV 004	RW	LOCK CMD	(0)None;(1)OutputFreq stays at current freqency
BV 005	RW	Reserved	Reserved
BV 006	RW	QSTOP CMD	(0)None;(1)Force driver quick stop
BV 007	RW	ServoPower CMD	(0)PowerOff(free run to stop);(1)PowerOn
BV 008	RW	Reserved	Reserved
BV 009	RW	Reserved	Reserved
BV 010	RW	Reserved	Reserved
BV 011	RW	Reserved	Reserved
BV 012	RW	Reserved	Reserved
BV 013	RW	Reserved	Reserved
BV 014	RW	Reserved	Reserved
BV 015	RW	RESET	RESET:(0)Do nothing;(1)Reset fault

2.4 Status (Readonly) Binary Value Object

In CP20000, we have BV_016~BV_031 with readonly Presnet_Value property. For these BV_Objects, we do NOT have Priority_Array and Relinquish_Default properties.

Object Number	R/W	Object Name	Object Description
BV 016	R	ARRIVE STATE	(0)Not yet;(1)Arrive (OutputFreq=FreqCmd)
BV 017	R	FWD/REV STATE	(0)Forward;(1)Reverse
BV 018	R	WARN STATE	(0)No Warn;(1)Occur Warn
BV 019	R	ERROR STATE	(0)No Error;(1)Occur Error
BV 020	R	Reserved	Reserved
BV 021	R	Reserved	Reserved
BV 022	R	QSTOP STATE	(0)No QSTOP;(1)Occur QSTOP
BV 023	R	SerovPower STATE	(0)PowerOff(free run to stop);(1)PowerOn
BV 024	R	Reserved	Reserved
BV 025	R	Reserved	Reserved
BV 026	R	Reserved	Reserved
BV 027	R	Reserved	Reserved

Object Number	R/W	Object Name	Object Description
BV 028	R	Reserved	Reserved
BV 029	R	Reserved	Reserved
BV 030	R	Reserved	Reserved
BV 031	R	Reserved	Reserved

3. Steps to setup the Pr about BACnet in CP2000

Related to BACnet function in CP2000, We have to configure 2 parts of Pr.

Part1. Setup parameters related to Communication at Pr_Group9.

Part2. Setup parameters related to System_Parameter at Pr_Group0.

Part1. Pr_Group9, Communication.

1-1. Set Pr09-31 =1, BACnet is enabled, then the COM1_Port will be accessed by BACnet. When this is set, the COM1_Port communication format will be changed to RTU 8N1.

(Note: The HW Pins of COM1_Port are shared by RJ45 and RS485. When BACnet is enabled, BACnet will access the COM1_Port, that also means we can **NOT** have Modbus, PLC connections, VFDSoft and VFD Explorer by COM1_Port).

1-2. Set Pr09-50, Default = 10, BACnet's MS/TP station number 0~127

1-3. Set Pr09-51, Default = 38400, BACnet communication baud rate, 9600, 19200, 38400 or 76800bps.

1-4. Set Pr09-52 and Pr09-53, The default setting of Device Object_Identifier is 0x000A (Pr09-52=10, Pr09-53=00). Device Object_Identifier is the combination of Pr09-52 and Pr09-53, thus the setting range can be 0~4194303.

For example, Pr09-53=12(0Ch) and Pr09-52 =3456(0D80h), then the device Identifier's value =12*65536+3456 =789888(0C0D80h).

1-5. Set Pr09-55, Default =127, the highest allowable address for master nodes on the same MS/TP network. CP2000 base on this setting to know the Max search range.

1-6. Set Pr09-56, setup the BACnet password. If setup is successful, the keypad will display 8888.

Part2. Pr_Group0, System Parameter.

2-1. Set Pr00-20 =1, That means the source of the Frequency command is from RS485 Interface (accessed by BACnet).

2-2. Set Pr00-21 =2, That means the source of the Operation command is from RS485 Interface (accessed by BACnet).

Here is a simple example:

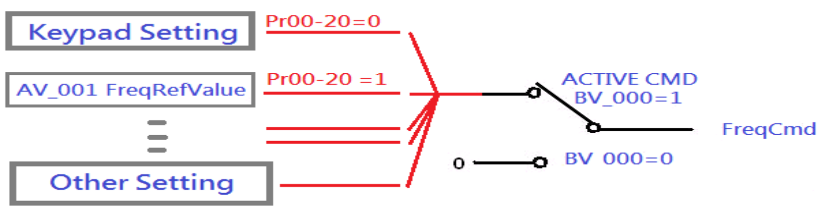
After setting up the 2 parts of Pr, we can enable the BACnet function in CP2000. Thus, we can access some BACnet objects to make the CP2000 driving motor Run or Stop.

Step1. Write_Service on AV_001, Present_Value =60.0 ➔ Setup Frequency Reference Value.

Step2. Write_Service on BV_007, Present_Value =Active. ➔ Setup Servo PowerOn.

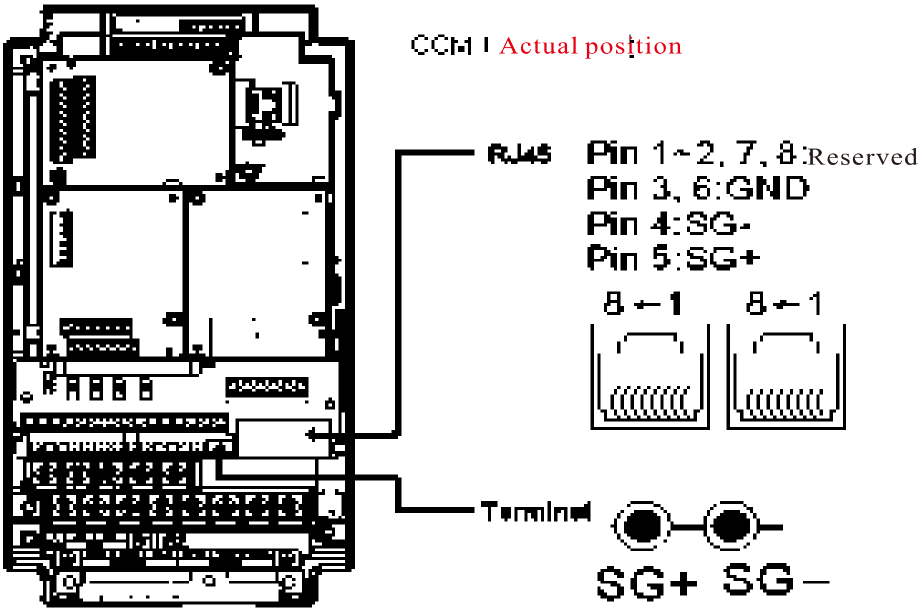
Step3. Write_Service on BV_000, Present_Value =Active. ➔ Setup Active CMD.

Step4. Read_Service on AV_031, Present_Value ➔ User can know the Output frequency.



PS. In CP2000, base on different Pr setting or IO setting, we can make FreqCmd with different source of Reference Value. PLS check the usage of Keypad, Pr and IO setting for more detail information.

- Then connection of the communication cable as shown in the below diagram.
  Please note that HW Pins of COM1_Port are shared by RJ45 and RS485. That means user can use RJ45_cable or RS485_lines to access the COM1_Port.
  When BACnet is enabled, COM1_Port will be dominated by BACnet function. Under this condition, user will not be able to have MODBUS or PLC function on COM1_Port.



BACnet Protocol Implementation Conformance Statement

Date： July 24, 2014

Vendor Name: Delta Electronics, Inc.

Product Name: CP2000

Product Model Number: VFD-CP2000

Applications Software Version: Ver 01.04- yyyymm **Firmware Revision:** Ver 01.04 **BACnet Protocol Revision:** 7

Product Description:

Delta VFD-CP2000 is a Variable Frequency AC motor Drive with BACnet embedded.

In VFD-CP2000, the BACnet connection is by MS/TP, RS485-based. VFD-CP2000 provides a BACnet communication function that permits it as a server and supports BIBBs defined by the BACnet B-ASC. VFD-CP2000 BACnet provides the capability to control and monitor the VFD-CP2000 machine.

BACnet Standardized Device Profile (Annex L):

☐ **BACnet Operator Workstation (B-OWS)_**

☐ **BACnet Building Controller (B-BC)**

☐ **BACnet Advanced Application Controller (B-AAC)_**

■ **BACnet Application Specific Controller (B-ASC)**

☐ **BACnet Smart Sensor (B-SS)**

☐ **BACnet Smart Actuator (B-SA)**

List all BACnet Interoperability Building Blocks Supported (Annex K):

Data Sharing BIBBs

Data Sharing-ReadProperty-B (DS-RP-B)

Data Sharing-WriteProperty-B (DS-WP-B)

Data Sharing-ReadPropertyMultiple-B (DS-RPM-B)

Device and Network Management BIBBs

Device Management-Dynamic Device Binding-B (DM-DDB-B)

Device Management-Dynamic Object Binding-B (DM-DOB-B)

Device Management-DeviceCommunicationControl-B (DM-DCC-B)

Segmentation Capability:

☐ Segmented requests supported Window Size ____________________

☐ Segmented responses supported Window Size ________________

Standard Object Types Supported:

Analog Value

Binary Value

Device

Object instantiation is static. Refer to table at end of this document for object details.

Data Link Layer Options:

☐ BACnet IP, (Annex J)

☐ BACnet IP, (Annex J), Foreign Device

☐ ISO 8802-3, Ethernet (Clause 7)

☐ ANSI/ATA 878.1, 2.5 Mb. ARCNET (Clause 8)

☐ ANSI/ATA 878.1, RS-485 ARCNET (Clause 8), baud rate(s) ____________

■ MS/TP master (Clause 9), baud rate(s): 9600, 19200, 38400, 76800

☐ MS/TP slave (Clause 9), baud rate(s): ________

☐ Point-To-Point, EIA 232 (Clause 10), baud rate(s):______

☐ Point-To-Point, modem, (Clause 10), baud rate(s): _____

☐ LonTalk, (Clause 11), medium: __________

☐ Other: _________

Device Address Binding:

Is static device binding supported? (This is currently necessary for two-way communication with MS/TP slaves and certain other devices.) ☐Yes ■No

Networking Options:

☐ Router, Clause 6 - List all routing configurations, e.g., ARCNET-Ethernet, Ethernet-MS/TP, etc.

☐ Annex H, BACnet Tunneling Router over IP

☐ BACnet/IP Broadcast Management Device (BBMD)

Does the BBMD support registrations by Foreign Devices? ☐ Yes ☐ No

Character Sets Supported:

Indicating support for multiple character sets does not imply that they can all be supported simultaneously.

■ ANSI X3.4	☐ IBM™/Microsoft™ DBCS	☐ ISO 8859-1
☐ ISO 10646 (UCS-2)	☐ ISO 10646 (UCS-4)	☐ JIS C 6226

If this product is a communication gateway, describe the types of non-BACnet equipment/networks(s) that the gateway supports:

____

____

____

____

The Properties of Objects

Property ID		Object Type		
		Device	Analog Value	Binary Value
#4	ACTIVE TEXT			V
#11	APDU_TIMEOUT	V		
#12	APPLICATION_SOFTWARE_VERSION	V		
#28	DESCRIPTION	V	V	V
#30	DEVICE ADDRESS BINDING	V	V	
#36	EVENT STATE		V	V
#44	FIRMWARE_REVISION	V		
#46	INACTIVE TEXT			V
#62	MAX_APDU_LENGTH_ACCEPTED	V		
#63	MAX_INFO_FRAMES	V		
#64	MAX_MASTER	V		
#70	MODEL_NAME	V		
#73	NUMBER_OF_APDU_RETRIES	V		
#75	OBJECT_IDENTIFIER	**V *1**	V	V
#76	OBJECT_LIST	V		
#77	OBJECT_NAME	**V *1**	V	V
#79	OBJECT_TYPE	V	V	V
#81	OUT OF SERVICE		V	V
#85	PRESENT VALUE		**V *2**	**V *2**
#87	PRIORITY ARRAY		V *3	V *3
#96	PROTOCOL_OBJECT_TYPES_SUPPORTED	V		
#97	PROTOCOL_SERVICES_SUPPORTED	V		
#98	PROTOCOL_VERSION	V		
#104	RELINQUISH DEFAULT		V *3	V *3
#107	SEGMENTATION_SUPPORTED	V		
#111	STATUS FLAGS		V	V
#112	SYSTEM_STATUS	V		
#117	UNITS		V	
#120	VENDOR_IDENTIFIER	V		
#121	VENDOR_NAME	V		
#139	PROTOCOL_REVISION	V		
#155	DATABASE_REVISION	V		

*1. The Object_ID and Object_Name Properties of Device are writeable.

*2. The Present_Value Property of some AV and BV objects are commandable.

*3. Only Commandable objects support Priority_Array and Relinquish_Default.

- **Commandable Analog Value Object**

In VFD-CP2000, we have AV_000~AV_026 supporting commandable Presnet_Value property. In these AV_Objects, we also can use (Multi)Read_Service to access Priority_Array and Relinquish_Default properties.

Object Number	R/W	Object Name	Object Description	Unit
AV 000	RW	AV_000_Reserved	Reserved	UNITS_NO_UNITS
AV 001	RW	AV_001_FreqRefValue	Frequency Reference Value	UNITS_HERTZ
AV 002	RW	AV_002_Reserved	Reserved	UNITS_NO_UNITS
AV 003	RW	AV_003_Reserved	Reserved	UNITS_NO_UNITS
AV 004	RW	AV_004_Reserved	Reserved	UNITS_NO_UNITS
AV 005	RW	AV_005_Reserved	Reserved	UNITS_NO_UNITS
AV 006	RW	AV_006_Reserved	Reserved	UNITS_NO_UNITS
AV 007	RW	AV_007_Reserved	Reserved	UNITS_NO_UNITS
AV 008	RW	AV_008_Reserved	Reserved	UNITS_NO_UNITS
AV 009	RW	AV_009_Reserved	Reserved	UNITS_NO_UNITS
AV 010	RW	AV_010_Reserved	Reserved	UNITS_NO_UNITS
AV 011	RW	AV_011_P9-11 map set= -----	AV11 will modify data which is P9-11 mapping to	Depends
AV 012	RW	AV_012_P9-12 map set= -----	AV12 will modify data which is P9-12 mapping to	Depends
AV 013	RW	AV_013_P9-13 map set= -----	AV13 will modify data which is P9-13 mapping to	Depends
AV 014	RW	AV_014_P9-14 map set= -----	AV14 will modify data which is P9-14 mapping to	Depends
AV 015	RW	AV_015_P9-15 map set= -----	AV15 will modify data which is P9-15 mapping to	Depends
AV 016	RW	AV_016_P9-16 map set= -----	AV16 will modify data which is P9-16 mapping to	Depends
AV 017	RW	AV_017_P9-17 map set= -----	AV17 will modify data which is P9-17 mapping to	Depends
AV 018	RW	AV_018_P9-18 map set= -----	AV18 will modify data which is P9-18 mapping to	Depends
AV 019	RW	AV_019_P9-19 map set= -----	AV19 will modify data which is P9-19 mapping to	Depends
AV 020	RW	AV_020_P9-20 map set= -----	AV20 will modify data which is P9-20 mapping to	Depends
AV 021	RW	AV_021_P9-21 map set= -----	AV21 will modify data which is P9-21 mapping to	Depends
AV 022	RW	AV_022_P9-22 map set= -----	AV22 will modify data which is P9-22 mapping to	Depends
AV 023	RW	AV_023_P9-23 map set= -----	AV23 will modify data which is P9-23 mapping to	Depends
AV 024	RW	AV_024_P9-24 map set= -----	AV24 will modify data which is P9-24 mapping to	Depends
AV 025	RW	AV_025_P9-25 map set= -----	AV25 will modify data which is P9-25 mapping to	Depends
AV 026	RW	AV_026_P9-26 map set= -----	AV26 will modify data which is P9-26 mapping to	Depends

- **Status (Readonly) Analog Value Object**

In VFD-CP2000, we have AV_027~AV_068 with readonly Presnet_Value property. In these AV_Objects, we do NOT have Priority_Array and Relinquish_Default properties.

Object Number	R/W	Object Name	Object Description	Unit
AV 027	R	AV_027_Reserved	Reserved	UNITS_NO_UNITS
AV 028	R	AV_028_Reserved	Reserved	UNITS_NO_UNITS
AV 029	R	AV_029_Reserved	Reserved	UNITS_NO_UNITS
AV 030	R	AV_030_Reserved	Reserved	UNITS_NO_UNITS
AV 031	R	AV_031_Output frequency	Display output frequency(Hz)	UNITS_HERTZ
AV 032	R	AV_032_Reserved	Reserved	UNITS_NO_UNITS
AV 033	R	AV_033_Reserved	Reserved	UNITS_NO_UNITS
AV 034	R	AV_034_Reserved	Reserved	UNITS_NO_UNITS
AV 035	R	AV_035_Output torque(%)	Display output torque(%)	UNITS_PERCENT
AV 036	R	AV_036_Reserved	Reserved	UNITS_NO_UNITS
AV 037	R	AV_037_Reserved	Reserved	UNITS_NO_UNITS
AV 038	R	AV_038_Reserved	Reserved	UNITS_NO_UNITS
AV 039	R	AV_039_Status word	Display status word,made from BV16~BV31	UNITS_NO_UNITS
AV 040	R	AV_040_Reserved	Reserved	UNITS_NO_UNITS
AV 041	R	AV_041_Driver type code	Driver type code	UNITS_NO_UNITS
AV 042	R	AV_042_Warn code	Warn code	UNITS_NO_UNITS
AV 043	R	AV_043_Error code	Error code	UNITS_NO_UNITS
AV 044	R	AV_044_Output current	Display output current(Amp)	UNITS_AMPERES
AV 045	R	AV_045_DC-bus voltage	Display DC-BUS voltage(Volt)	UNITS_VOLTS
AV 046	R	AV_046_Output Voltage	Display output voltage of U, V, W(Volt)	UNITS_VOLTS
AV 047	R	AV_047_Count Value	Display counter value of TRG terminal	UNITS_NO_UNITS
AV 048	R	AV_048_Power Angle	Display output power angle of U, V, W	UNITS_POWER_FACTOR
AV 049	R	AV_049_Output Power	Display actual output power of U, V, W(kw)	UNITS_KILOWATTS
AV 050	R	AV_050_IGBT temperature	Display the IGBT temperature	UNITS_DEGREES_CELSIUS
AV 051	R	AV_051_Temperature of driver	Display the temperature of capacitance	UNITS_DEGREES_CELSIUS
AV 052	R	AV_052_Real carry frequency	Display real carrier frequency of the drive(KHz)	UNITS_KILOHERTZ
AV 053	R	AV_053_PID feedback value	Display PID feedback value(%)	UNITS_PERCENT
AV 054	R	AV_054_Overload rate	Display overload condition(%)	UNITS_PERCENT
AV 055	R	AV_055_Ground fail detect level	Display GND fail detect level(%)	UNITS_PERCENT
AV 056	R	AV_056_DC bus ripple	Display DCbus voltage ripples(Volt)	UNITS_VOLTS
AV 057	R	AV_057_Fan Speed	Fan speed of the drive(%)	UNITS_PERCENT
AV 058	R	AV_058_Output speed(rpm)	Output speed(rpm)	UNITS_REVOLUTIONS_PER_MINUTE

Object Number	R/W	Object Name	Object Description	Unit
AV 059	R	AV_059_KW per Hour	KW per Hour	UNITS_KILOWATTS
AV 060	R	AV_060_Multi-speed switch	Real multi-speed switch	UNITS_NO_UNITS
AV 061	R	AV_061_AVI input value	0~10V corresponds to 0~100%	UNITS_PERCENT
AV 062	R	AV_062_ACI input value	4~20mA/0~10V corresponds to 0~100%	UNITS_PERCENT
AV 063	R	AV_063_AUI input value	-10V~10V corresponds to -100~100%	UNITS_PERCENT
AV 064	R	AV_064_Digital input status	Refer to P2-12	UNITS_NO_UNITS
AV 065	R	AV_065_Digital output status	Refer to P2-18	UNITS_NO_UNITS
AV 066	R	AV_066_CPU pin status of DI	Corresponding CPU pin status of digital input	UNITS_NO_UNITS
AV 067	R	AV_067_CPU pin status of DO	Corresponding CPU pin status of digital output	UNITS_NO_UNITS
AV 068	R	AV_068_PLC D1043 value	PLC D1043 value	UNITS_NO_UNITS

- **Commendable Binary Value Object**

  In VFD-CP2000, we have BV_000~BV_015 supporting commandable Presnet_Value property. In these BV_Objects, we also can use (Multi)Read_Service to access Priority_Array and Relinquish_Default properties.

Object Number	R/W	Object Name	Object Description
BV 000	RW	BV_000_ACTIVE CMD	(0)FreqCmd=0;(1)FreqCmd=FreqRefValue
BV 001	RW	BV_001_FWD/REV CMD	(0)Forward; (1)Reverse
BV 002	RW	BV_002_Reserved	Reserved
BV 003	RW	BV_003_HALT CMD	(0)None;(1)RampDown to 0Hz.
BV 004	RW	BV_004_LOCK CMD	(0)None;(1)OutputFreq stays at current freqency
BV 005	RW	BV_005_Reserved	Reserved
BV 006	RW	BV_006_QSTOP CMD	(0)None;(1)Force driver quick stop
BV 007	RW	BV_007_ServoPower CMD	(0)PowerOff(free run to stop);(1)PowerOn
BV 008	RW	BV_008_Reserved	Reserved
BV 009	RW	BV_009_Reserved	Reserved
BV 010	RW	BV_010_Reserved	Reserved
BV 011	RW	BV_011_Reserved	Reserved
BV 012	RW	BV_012_Reserved	Reserved
BV 013	RW	BV_013_Reserved	Reserved
BV 014	RW	BV_014_Reserved	Reserved
BV 015	RW	BV_015_RESET	RESET:(0)Do nothing;(1)Reset fault

- **Status (Readonly) Binary Value Object**

In VFD-CP2000, we have BV_016~BV_031 with readonly Presnet_Value property. In these BV_Objects, we do NOT have Priority_Array and Relinquish_Default properties.

Object Number	R/W	Object Name	Object Description
BV 016	R	BV_016_ARRIVE STATE	(0)Not yet;(1)Arrive (OutputFreq=FreqCmd)
BV 017	R	BV_017_FWD/REV STATE	(0)Forward;(1)Reverse
BV 018	R	BV_018_WARN STATE	(0)No Warn;(1)Occur Warn
BV 019	R	BV_019_ERROR STATE	(0)No Error;(1)Occur Error
BV 020	R	BV_020_Reserved	Reserved
BV 021	R	BV_021_Reserved	Reserved
BV 022	R	BV_022_QSTOP STATE	(0)No QSTOP;(1)Occur QSTOP
BV 023	R	BV_023_SerovPower STATE	(0)PowerOff(free run to stop);(1)PowerOn
BV 024	R	BV_024_Reserved	Reserved
BV 025	R	BV_025_Reserved	Reserved
BV 026	R	BV_026_Reserved	Reserved
BV 027	R	BV_027_Reserved	Reserved
BV 028	R	BV_028_Reserved	Reserved
BV 029	R	BV_029_Reserved	Reserved
BV 030	R	BV_030_Reserved	Reserved
BV 031	R	BV_031_Reserved	Reserved

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Chapter 18 Suggestions and Error Corrections for Standard AC Motor Drives

The AC motor drive has a comprehensive fault diagnostic system that includes several different alarms and fault messages. Once a fault is detected, the corresponding protective functions will be activated. The following faults are displayed as shown on the AC motor drive digital keypad display. The six most recent faults can be read from the digital keypad or communication.

The AC motor drive is made up by numerous components, such as electronic components, including IC, resistor, capacity, transistor, and cooling fan, relay, etc. These components can't be used permanently. They have limited-life even under normal operation. Preventive maintenance is required to operate this AC motor drive in its optimal condition, and to ensure a long life.

Check your AC motor drive regularly to ensure there are no abnormalities during operation and follows the precautions:

CAUTION

- ☑ Wait 5 seconds after a fault has been cleared before performing reset via keypad of input terminal.
- ☑ When the power is off after 5 minutes for ≦ 22kW models and 10 minutes for ≧ 30kW models, please confirm that the capacitors have fully discharged by measuring the voltage between + and -. The voltage between + and - should be less than 25VDC.
- ☑ Only qualified personnel can install, wire and maintain drives. Please take off any metal objects, such as watches and rings, before operation. And only insulated tools are allowed.
- ☑ Never reassemble internal components or wiring.
- ☑ Make sure that installation environment comply with regulations without abnormal noise, vibration and smell.

18-1 Maintenance and Inspections

Before the check-up, always turn off the AC input power and remove the cover. Wait at least 10 minutes after all display lamps have gone out, and then confirm that the capacitors have fully discharged by measuring the voltage between DC+ and DC-. The voltage between DC+ and DC-should be less than 25VDC.

Ambient environment

Check Items	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
Check the ambient temperature, humidity, vibration and see if there are any dust, gas, oil or water drops	Visual inspection and measurement with equipment with standard specification	○		
If there are any dangerous objects	Visual inspection	○		

Voltage

Check Items	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
Check if the voltage of main circuit and control circuit is correct	Measure with multimeter with standard specification	○		

Digital Keypad Display

Check Items	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
Is the display clear for reading	Visual inspection	○		
Any missing characters	Visual inspection	○		

Mechanical parts

Check Items	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
If there is any abnormal sound or vibration	Visual and aural inspection		○	
If there are any loose screws	Tighten the screws		○	
If any part is deformed or damaged	Visual inspection		○	
If there is any color change by overheating	Visual inspection		○	
If there is any dust or dirt	Visual inspection		○	

Main circuit

Check Items	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
If there are any loose or missing screws	Tighten or replace the screw	○		
If machine or insulator is deformed, cracked, damaged or with color change due to overheating or ageing	Visual inspection **NOTE: Please ignore the color change of copper plate**		○	
If there is any dust or dirt	Visual inspection		○	

Terminals and wiring of main circuit

Check Items	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
If the terminal or the plate is color change or deformation due to overheat	Visual inspection		○	
If the insulator of wiring is damaged or color change	Visual inspection		○	
If there is any damage	Visual inspection	○		

DC capacity of main circuit

Check Items	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
If there is any leak of liquid, color change, crack or deformation	Visual inspection	○		
If the safety valve is not removed? If valve is inflated?	Visual inspection	○		
Measure static capacity when required		○		

Resistor of main circuit

Check Items	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
If there is any peculiar smell or insulator cracks due to overheat	Visual inspection, smell	○		
If there is any disconnection	Visual inspection	○		
If connection is damaged?	Measure with multimeter with standard specification	○		

Transformer and reactor of main circuit

Check Items	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
If there is any abnormal vibration or peculiar smell	Visual, aural inspection and smell	○		

Magnetic contactor and relay of main circuit

Check Items	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
If there are any loose screws	Visual and aural inspection	○		
If the contact works correctly	Visual inspection	○		

Printed circuit board and connector of main circuit

Check Items	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
If there are any loose screws and connectors	Tighten the screws and press the connectors firmly in place.		○	
If there is any peculiar smell and color change	Visual and smell inspection		○	
If there is any crack, damage, deformation or corrosion	Visual inspection		○	
If there is any liquid is leaked or deformation in capacity	Visual inspection		○	

Cooling fan of cooling system

Check Items	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
If there is any abnormal sound or vibration	Visual, aural inspection and turn the fan with hand (turn off the power before operation) to see if it rotates smoothly		○	
If there is any loose screw	Tighten the screw		○	
If there is any color change due to overheat	Change fan		○	

Ventilation channel of cooling system

Check Items	Methods and Criterion	Maintenance Period		
		Daily	Half Year	One Year
If there is any obstruction in the heat sink, air intake or air outlet	Visual inspection		○	

NOTE

Please use the neutral cloth for clean and use dust cleaner to remove dust when necessary.

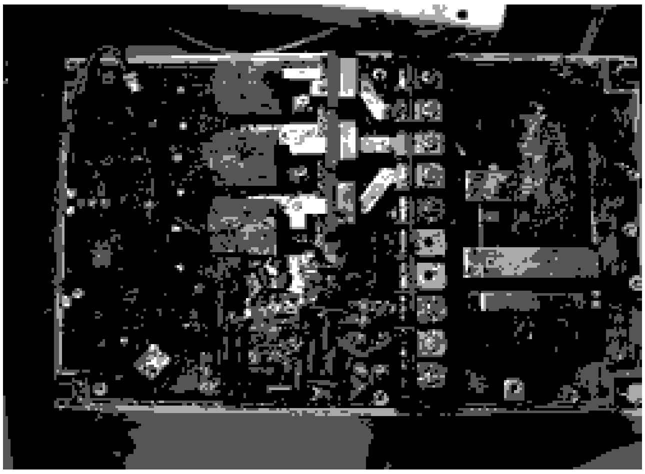
18-2 Greasy Dirt Problem

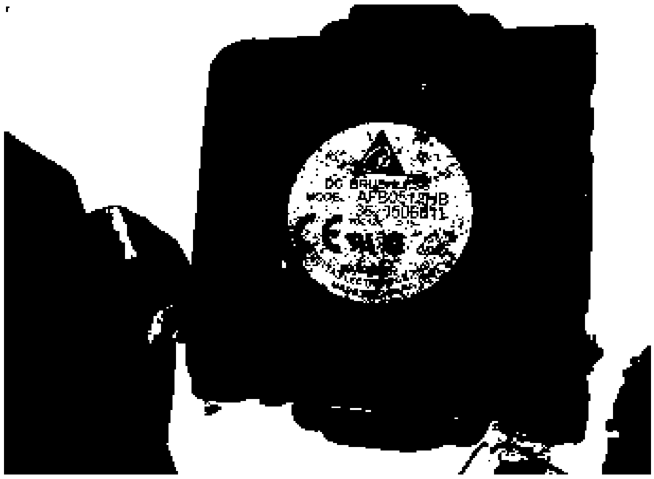
Serious greasy dirt problems generally occur in processing industries such as machine tools, punching machines and so on. Please be aware of the possible damages that greasy oil may cause to your drive:

1. Electronic components that silt up with greasy oil may cause the drive to burn out or even explode.
2. Most greasy dirt contains corrosive substances that may damage the drive.

Solution:

Install the AC motor drive in a standard cabinet to keep it away from dirt. Clean and remove greasy dirt regularly to prevent damage of the drive.





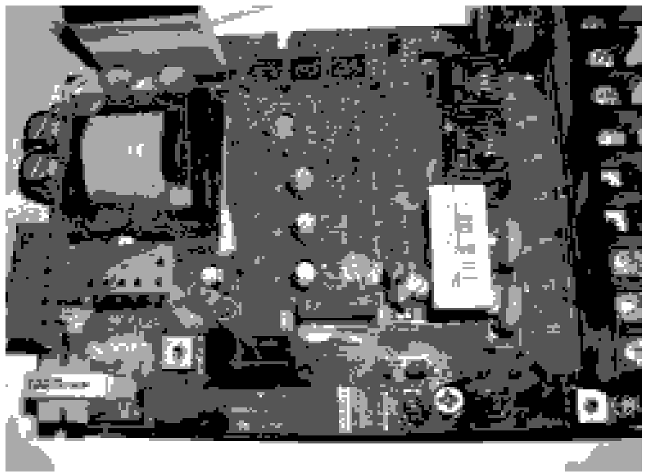
18-3 Fiber Dust Problem

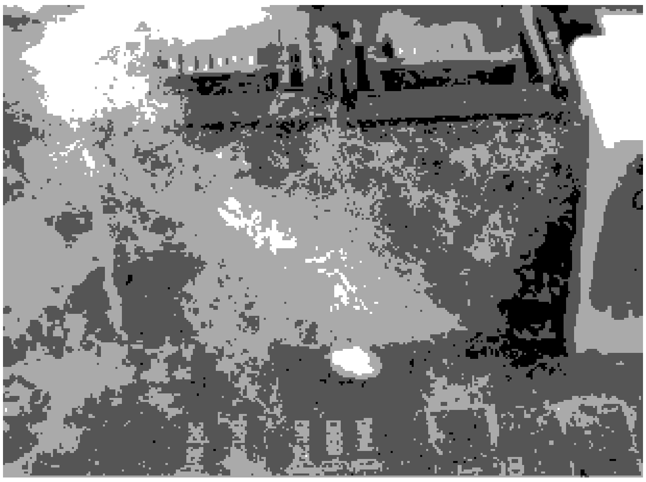
Serious fiber dust problems generally occur in the textile industry. Please be aware of the possible damages that fiber may cause to your drives:

1. Fiber that accumulates or adheres to the fans will lead to poor ventilation and cause overheating problems.
2. Plant environments in the textile industry have higher degrees of humidity that may cause the drive to burn out, become damaged or explode due to wet fiber dust adhering to the devices.

Solution:

Install the AC motor drive in a standard cabinet to keep it away from fiber dust. Clean and remove fiber dust regularly to prevent damage to the drive.





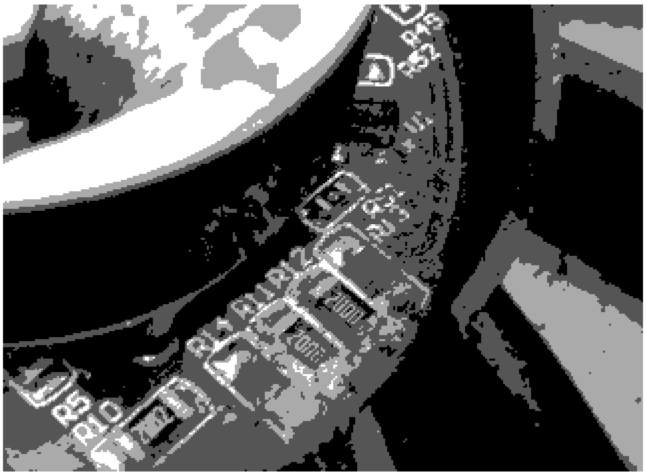
18-4 Erosion Problem

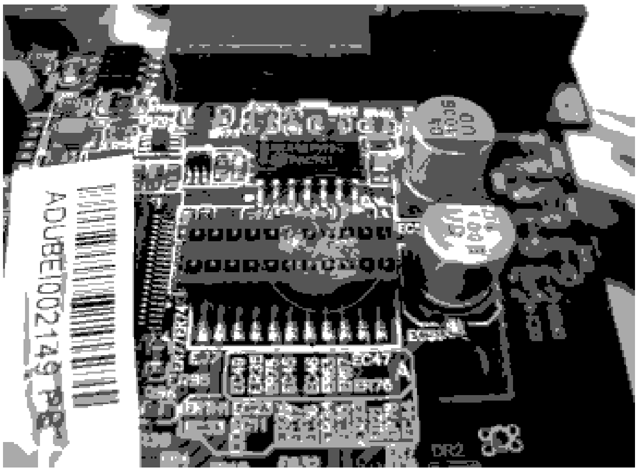
Erosion problems may occur if any fluids flow into the drives. Please be aware of the damages that erosion may cause to your drive.

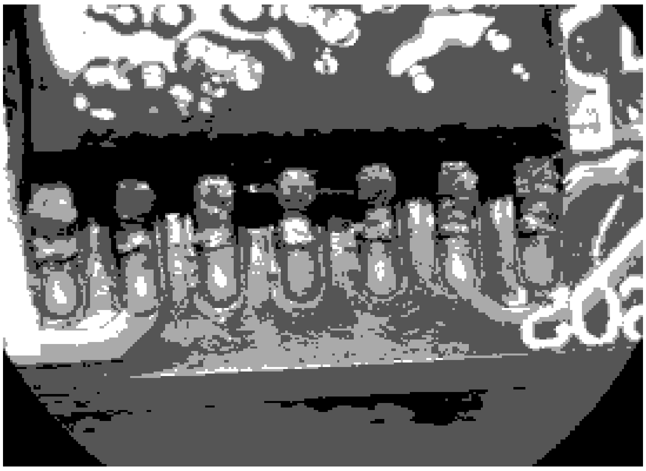
1. Erosion of internal components may cause the drive to malfunction and possibility to explode.

Solution:

Install the AC motor drive in a standard cabinet to keep it away from fluids. Clean the drive regularly to prevent erosion.







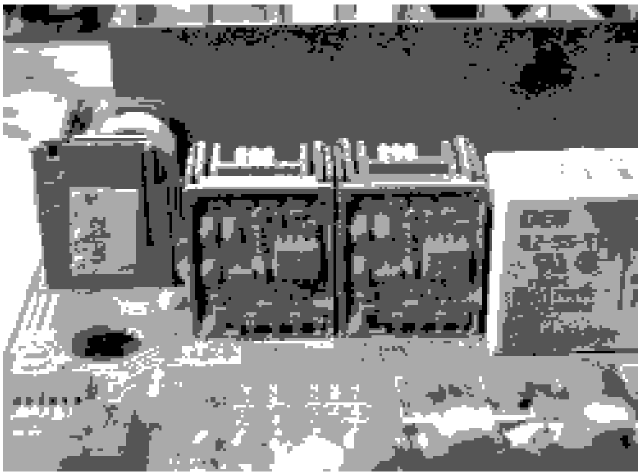
18-5 Industrial Dust Problem

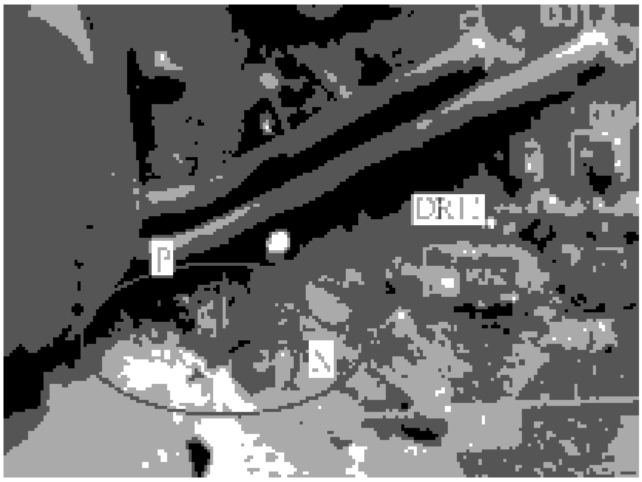
Serious industrial dust pollution frequently occurs in stone processing plants, flour mills, cement plants, and so on. Please be aware of the possible damage that industrial dust may cause to your drives:

1. Dust accumulating on electronic components may cause overheating problem and shorten the service life of the drive.
2. Conductive dust may damage the circuit board and may even cause the drive to explode.

Solution:

Install the AC motor drive in a standard cabinet and cover the drive with a dust cover. Clean the cabinet and ventilation hole regularly for good ventilation.





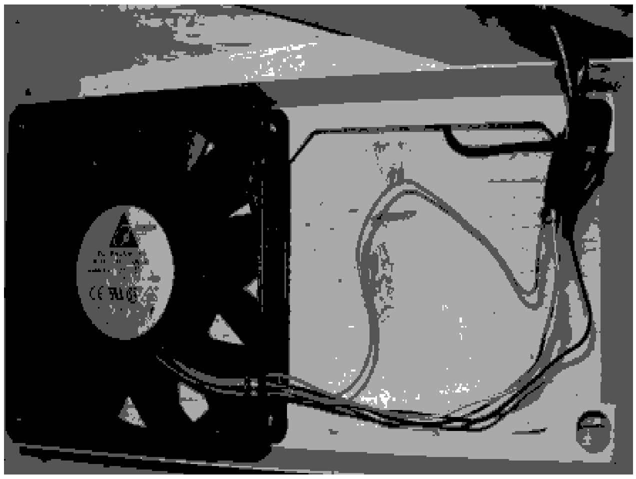
18-6 Wiring and Installation Problem

When wiring the drive, the most common problem is wrong wire installation or poor wiring. Please be aware of the possible damages that poor wiring may cause to your drives:

1. Screws are not fully fastened. Occurrence of sparks as impedance increases.
2. If a customer has opened the drive and modified the internal circuit board, the internal components may have been damaged.

Solution:

Ensure all screws are fastened when installing the AC motor drive. If the AC motor drive functions abnormally, send it back to the repair station. DO NOT try to reassemble the internal components or wire.



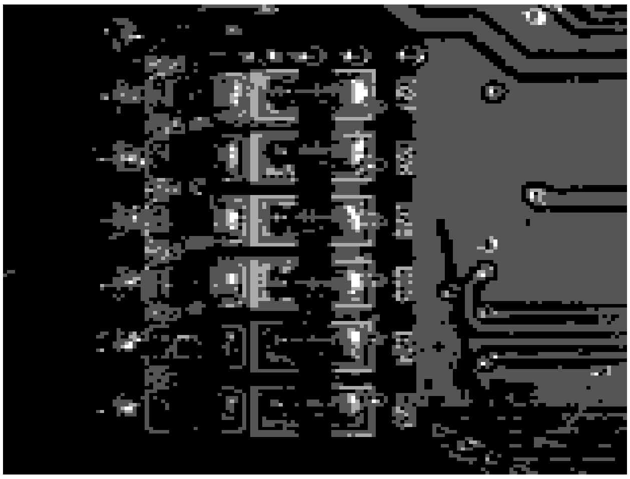
18-7 Multi-function Input/Output Terminals Problem

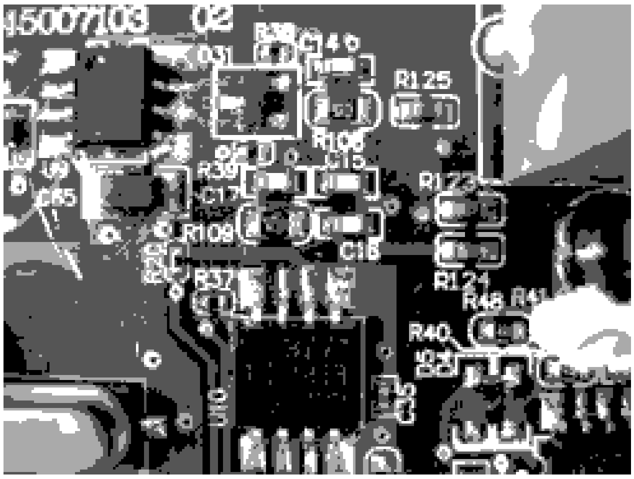
Multi-function input/output terminal errors are generally caused by over usage of terminals and not following specifications. Please be aware of the possible damages that errors on multi-function input/output terminals may cause to your drives:

1. Input/output circuit may burns out when the terminal usage exceeds its limit.

Solution:

Refer to the user manual for multi-function input output terminals usage and follow the specified voltage and current. DO NOT exceed the specification limits.





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Chapter 19 EMC Standard Installation Guide

Preface

When an AC motor drive is installed in a noisy environment, radiated and/or conducted noise via signal and power cables can interfere with the correct functioning, cause errors or even damage to the drive. To prevent this, some AC motor drives have an enhanced noise resistance but the results are limited and it is not economical. Therefore, an effective method would be finding the cause of the noise and use the right solution to achieve “no emission, no transmission and no reception of noise”. All three solutions should be applied.

Finding the Noise

- Ascertain whether the error is caused by noise.
- Find the source of the noise and its transmission path.
- Confirm the signal and the source of noise

Solutions

- Grounding
- Shielding
- Filtering

19-1 Introduction

19-1.1 What is EMC?

Electromagnetic Compatibility (EMC) is the ability of an electrical device to function properly in electromagnetic environments. It does not emit electromagnetic noise to surrounding equipment and is immune to interference from surrounding equipment. The goal is to achieve high immunity and low emission; these two properties define the quality of EMC. In general, electrical devices react to high and low frequency phenomena. High frequency phenomena are electrostatic discharge (ESD); pulse interference; radiated electromagnetic field; and conducted high frequency electrical surge. Low frequency phenomena refer to mains power harmonics and imbalance.

The standard emission and immunity levels for compliance depend on the installation location of the drive. A Power Drive System (PDS) is installed in an industrial or domestic environment. A PDS in a domestic environment must have lower emission levels and is allowed to have lower immunity levels. A PDS in an industrial environment is allowed to have higher emission levels but must have more severe immunity levels.

19-1.2 EMC for AC Motor Drive

When an AC motor drive is put into operation, harmonic signal will occur at the AC drive's power input and output side. It creates a certain level of electromagnetic interference to the surrounding electrical devices and the mains power network. An AC motor dive is usually applied in industrial environments with a strong electromagnetic interference. Under such conditions, an AC drive could disturb or be disturbed.

Delta's AC motor drives are designed for EMC and comply with EMC standard EN61800-3 2004. Installing the AC motor drive accurately will decrease EMI influences and ensure long term stability of the electricity system. It is strongly suggested to follow Delta's user manual for wiring and grounding. If any difficulties or problems arise, please follow the instructions and measures as indicated in this EMC Standard Installation Guide.

19-2 How to prevent EMI

19-2.1 Types of EMI: Common-mode and differential-mode noise

The electromagnetic noise of an AC motor drive can be distinguished into common-mode and differential-mode noise. Differential-mode noise is caused by the stray capacitance between the conducting wires and common-mode noise is caused by the common-mode coupling current path created by the stray capacitance between the conducting wires and ground.

Basically, differential-mode noise has a greater impact to the AC motor drive and common-mode noise has a greater impact to high-sensitivity electronic devices. An excessive amount of differential-mode noise may trigger the circuit protection system of the AC motor drive. Common-mode noise affects peripheral electronic devices via the common ground connection.

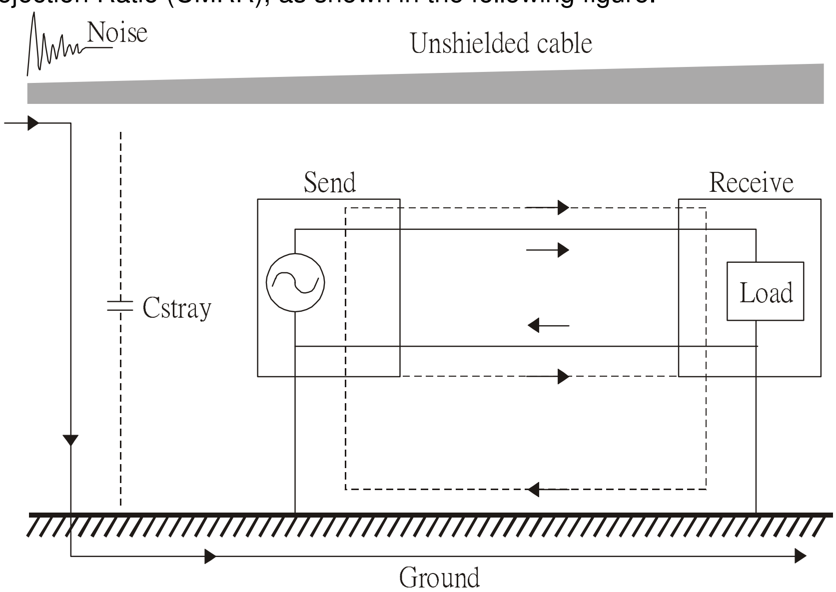
EMC problems can be more serious when the following conditions apply:

- When a large horsepower AC motor drive is connected to a large horsepower motor.
- The AC motor drive's operation voltage increases.
- Fast switching of the IGBTs.
- When a long cable is used to connect the motor to the AC motor drive.

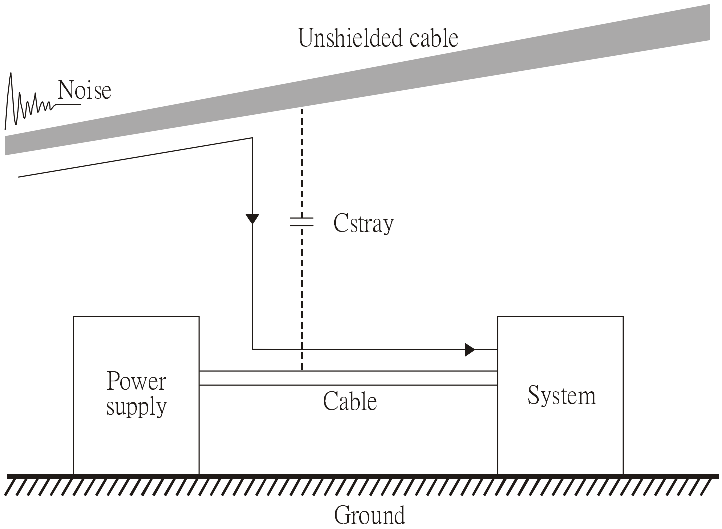
19-2.2 How does EMI transmit? (Noise transmission path)

Noise disturbs peripheral high-sensitivity electrical devices/systems via conduction and radiation, their transmission paths are shown hereafter:

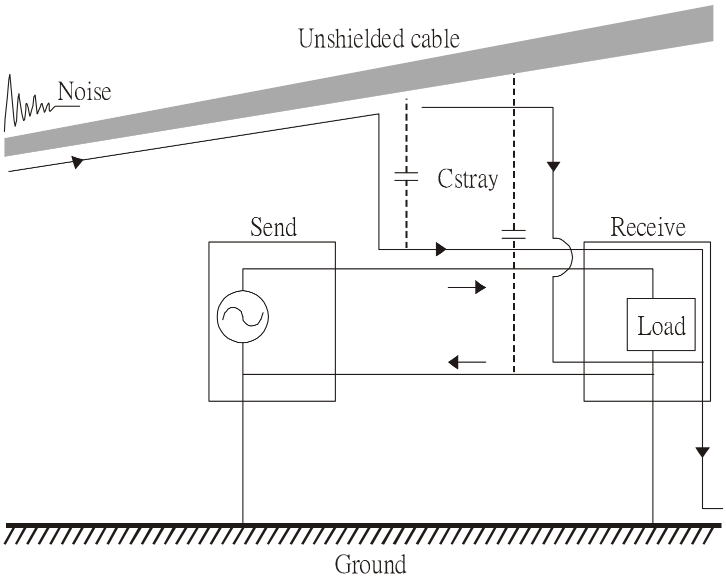
1. Noise current in the unshielded power cable is conducted to ground via stray capacitances into a common-mode voltage. Whether or not other modules are capable to resist this common-mode noise depends on their Common-Mode Rejection Ratio (CMRR), as shown in the following figure.



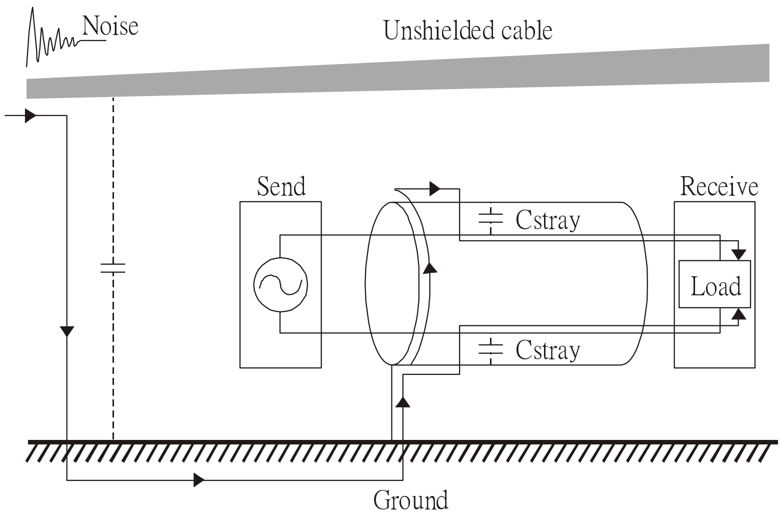
2. Common-mode noise in the power cable is transmitted through the stray capacitance and coupled into the adjacent signal cable, as shown in Figure 2. Several methods can be applied to reduce the effect of this common-mode noise; for example, shield the power cable and/or the signal cables, separate the power and signal cables, take the input and output side of the signal cable and twist them together to balance out the stray capacitance, let power cables and signal cables cross at 90°, etc.



3. Common-mode noise is coupled via the power cable to other power systems then the cable of such a power system is coupled to the transmission system, as shown in Figure 3.



4. The common-mode noise of an unshielded power cable is transmitted to the ground via the stray capacitance. Since both shielded wire and unshielded wire are connected to a common ground, other systems can be interfered with by the common-mode noise that is transmitted from the ground back to the system via the shield. See Figure 4.



5. When excessive pulse modulated currents pass through an un-grounded AC drive cable, it acts as an antenna and creates radiated interference.

19-3 Solution to EMI: Grounding

The leakage current of an electronic equipment is conducted to ground via the grounding wire and the ground electrode. According to Ohm's law, potential differences may arise when the electrode's ground and the ground's ground resistance are different.

According to Ohm's law, the earth resistance for electrode and the ground are different, in this case potential differences may arise.

19-3.1 Protective Grounding & Functional Grounding

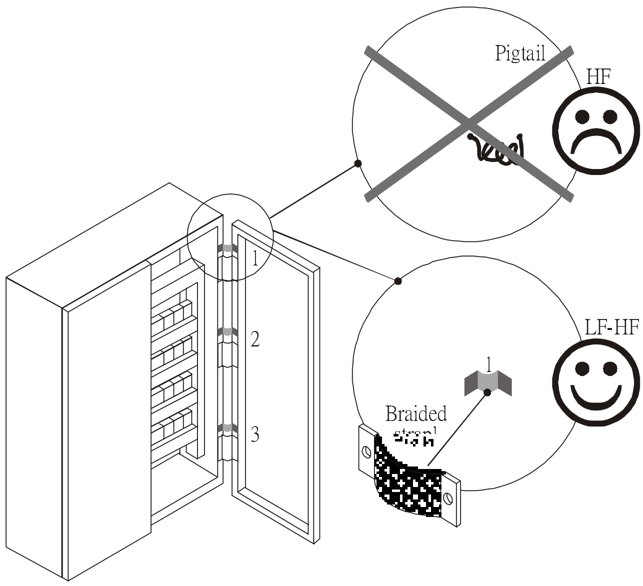
Please carefully read the following instruction if two types of grounding are applied at the same time.

Protective grounding is applied outside buildings and must have low resistance. On the other hand, functional grounding can be applied inside buildings and must have low impedance.

The goal of EMC is to avoid any interference effects. Grounding for EMC can be distinguished by frequency. For frequencies lower than 10kHz, a *single-point ground* system should be used and for frequencies higher than 10 kHz, a *multiple point ground* system should be used.

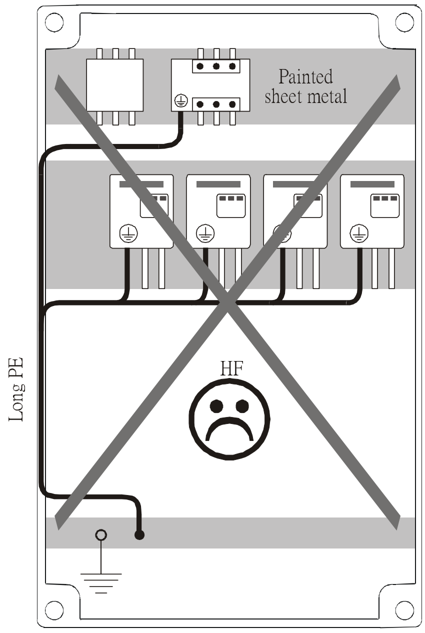
- *Single Point Grounding*: all signal grounds of all IT equipment are connected in series to form a single reference point. This point can be grounded directly to earth; to the designated grounding point or to the safety point that is already grounded.
- *Multiple Point Grounding:* all signals of all IT equipment are grounded independently.
- *Hybrid Grounding:* this type of grounding behaves differently for low and high frequencies. When two pieces of IT equipment (A and B) are connected via a shielded cable, one end is connected directly to ground while the other end is connected to ground via a capacitor. This type of grounding system fulfils the criteria for high and low frequency grounding.
- *Floating grounding:* the signals of all IT equipment are isolated from each other and are not grounded.

DC current flows evenly throughout the conductor section. But AC current flows towards the conductor's surface as frequency increases; this is called the "skin effect". It causes the effective cross-section area to be reduced with increasing frequency. Therefore it is suggested to increase the effective ground cross-section area for high frequencies by replacing pigtail grounding by braided conductors or strip conductors. Refer to the following figure.



This is why a thick short ground wire must be implemented for connecting to the common grounding path or the ground busbar. Especially when a controller (e.g. PLC) is connected to an AC motor drive, it must be grounded by a short and thick conducting wire. It is suggested to use a flat braided conductor (ex: metal mesh) with a lower impedance at high frequencies.

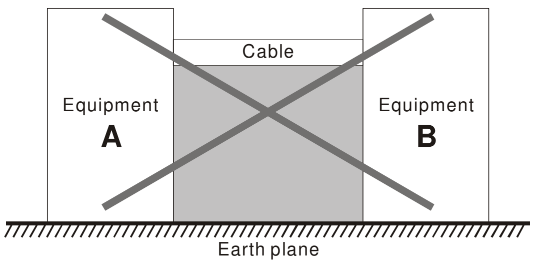
If the grounding wire is too long, its inductance may interfere structure of the building or the control cabinet and form mutual inductance and stray capacitance. As shown in the following figure, a long grounding wire could become a vertical antenna and turn into a source of noise.

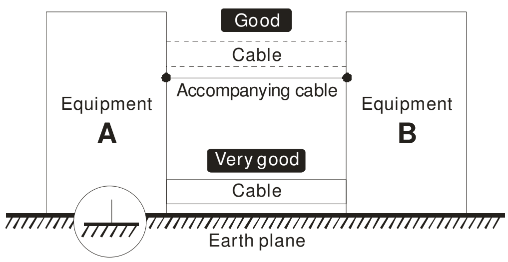


19-3.2 Ground Loops

A *ground loop* occurs when the pieces of equipment are connected to more than one grounding path. In this case, the ground current may return to the grounding electrode via more than one path. There are three methods to prevent ground loops

1. Use a common power circuit
2. Single point grounding
3. Isolate signals, e.g. by photocouplers





In order to avoid "Common Mode Noise", please use parallel wires or twisted pair wiring. Follow this rule and also avoid long wires, it is suggested to place the two wires as close to each other as possible.

19-3.3 Earthing Systems

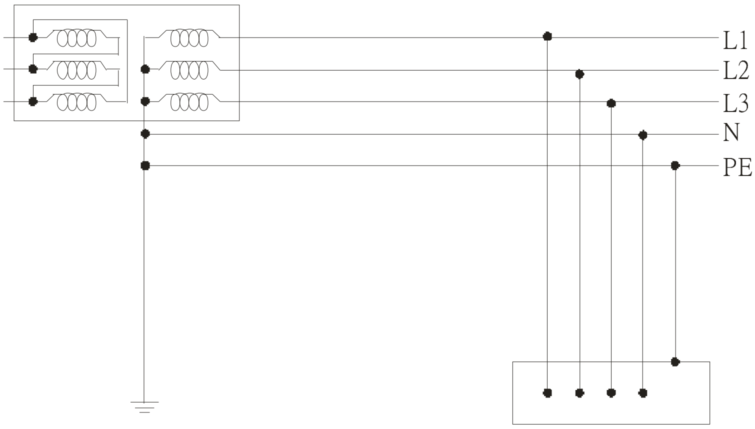
The international standard IEC60364 distinguishes three different earthing system categories, using the two-letter codes TN, TT, IT.

- The ***first letter*** indicates the type of earthing for the power supply equipment (generator or transformer).
  T: One or more points of the power supply equipment are connected directly to the same earthing point.
  I: Either no point is connected to earth (isolated) or it is connected to earth via a high impedance.
- The ***second letter*** indicates the connection between earth and the power supply equipment.
  T: Connected directly to earth (This earthing point is separate from other earthing points in the power supply system.)
  N: Connected to earth via the conductor that is provided by the power supply system
- The ***third and forth letter*** indicate the location of the earth conductor.
  S: Neutral and earth conductors are separate
  C: Neutral and earth are combined into a single conductor

TN system

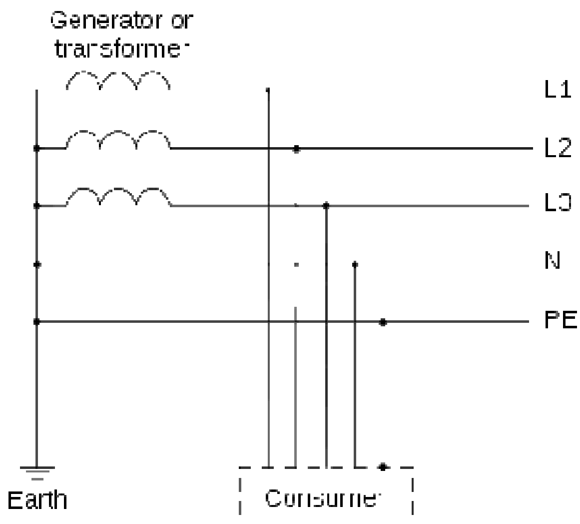
TN*:* The neutral point of the low voltage transformer or generator is earthed, usually the star point in a three-phase system. The body of the electrical device is connected to earth via this earth connection at the transformer.

protective earth (*PE*): The conductor that connects the exposed metallic parts of the consumer.
neutral (*N*): The conductor that connects to the start point in a 3-phase system or that carries the return current in a single phase system.



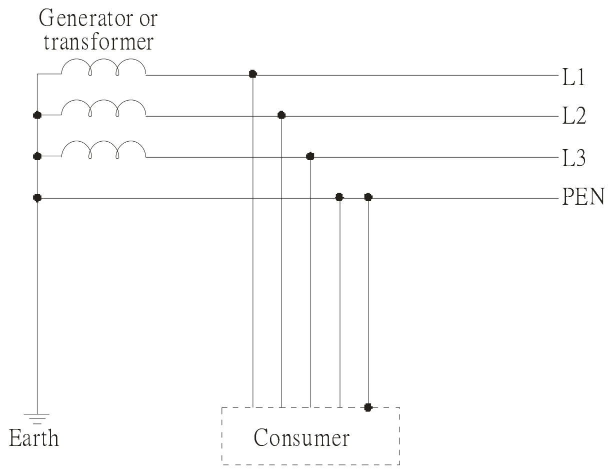
TN-S system

TN-S: PE and N are two separate conductors that are combined together only near the power source (transformer or generator). It is the same as a three-phase 5-wire system.



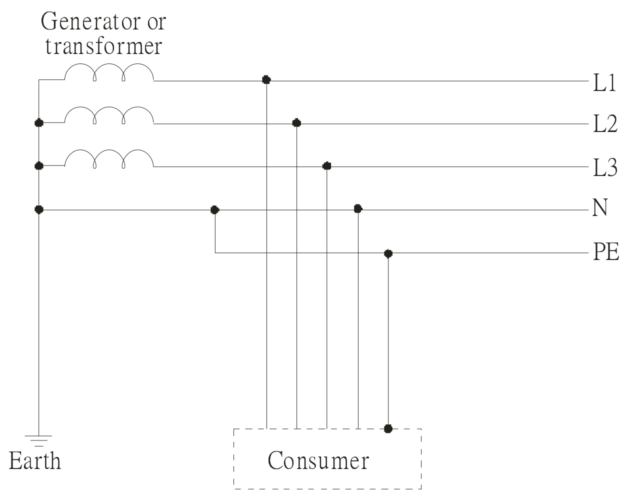
TN-C system

TN-C: PE and N are two separate conductors in an electrical installation similar to a three-phase 5wire system, but near the power side, PE and N are combined into a PEN conductor similar to a three-phase 4 wire system.



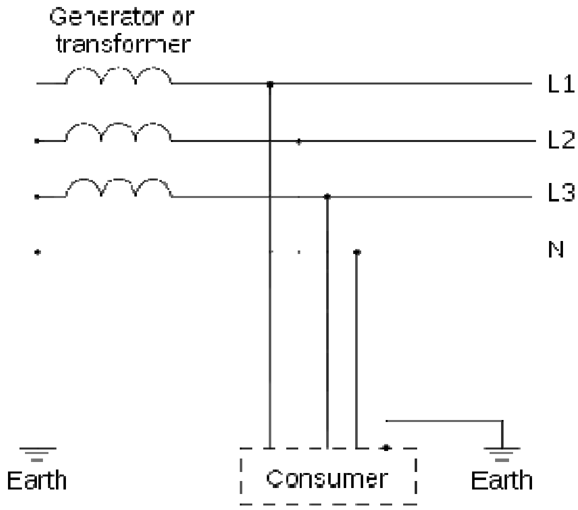
TN-C-S system

TN-C-S: A combined earth and neutral system (PEN conductor) is used in certain systems but eventually split up into two separate conductors PE and N. A typical application of combined PEN conductor is from the substation to the building but within the building PEN is separated into the PE and N conductors. Direct connection of PE and N conductors to many earthing points at different locations in the field will reduce the risk of broken neutrals. Therefore this application is also known as *protective multiple earthing (PME)* in the UK or as *multiple earthed neutral (MEN)*in Australia



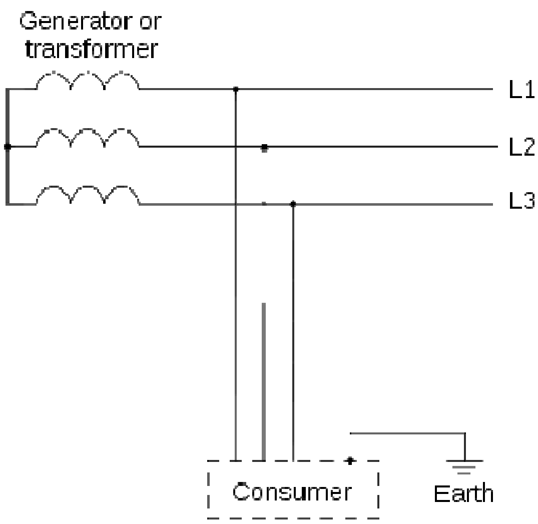
TT system

TT: The neutral point (N) of the low voltage transformer and the equipment frames (PE) are connected to a separate earthing point. The Neutral (N) of the transformer and electrical equipment are connected.



IT system

IT: The neutral point of the transformer and electrical equipment are not earthed, only the equipment frames PE are earthed.
In the IT network, the power distribution system Neutral is either not connected to earth or is earthed via a high impedance. In such a system, an insulated monitoring device is used for impedance monitoring.
A built-in filter should be disconnected by the RFI-jumper and an external filter should not be installed when the AC



motor drive or the AC servo motor drive is connected to an IT system.

Criteria for earthing system and EMC

	TN-S	TN-C	TT	IT
Safety of Personnel	Good Continuity of the PE conductor must be ensured throughout the installation	Good Continuity of the PE conductor must be ensured throughout the installation	Good RCD is mandatory	Good Continuity of the PE conductor must be ensured throughout the installation
Safety of property	Poor High fault current (around 1kA)	Poor High fault current (around 1kA)	Good Medium fault current (< a few dozen amperes)	Good Low current at the first fault (< a few dozen mA) but high current at the second fault
Availability of energy	Good	Good	Good	Excellent
EMC behavior	Excellent Few equipotential Problems: - Need to handle the high leaking currents problem of the device - High fault current (transient disturbances)	Poor (prohibited) - Neutral and PE are the same - Circulation of disturbance currents in exposed conductive parts (high magnetic-field radiation) - High fault currents (transient disturbances)	Good - Over-voltage risk - Equipotential Problems: - Need to handle the high leaking currents problem of the device - RCD (Residual-current device)	Poor (should be avoided) - Over-voltage risk - Common–mode filters and surge arrestors must handle the phase to phase voltage. - RCDs subject to nuisance tripping when common-mode capacitors are present - Equivalent to TN system for second fault

19-4 Solution to EMI: Shielding

19-4.1 What is Shielding?

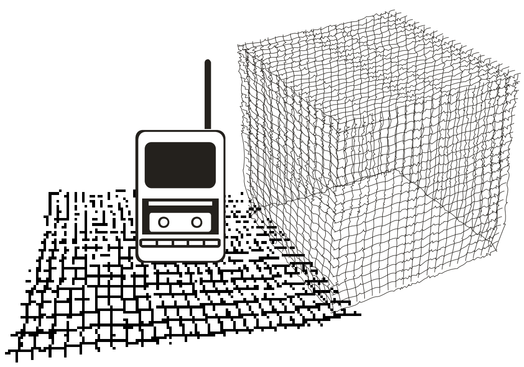
Electrostatic shielding is used to isolate equipment so that it will not create electromagnetic field interference or be influenced by an external electromagnetic field. A conductive material is used for electrostatic shielding to achieve this isolation.

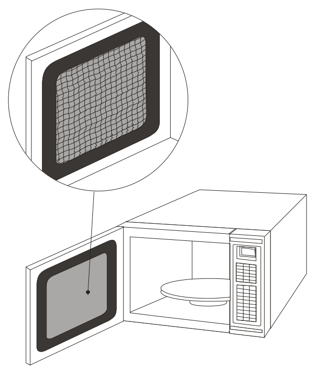
A *Faraday cage* can be made from a mesh of metal or a conductive material.
One characteristic of metal is that it is highly conductive and not electrostatic,, which offers shielding and prevents interference by external electrical fields. Metal with its high conductivity protects the internal devices from high voltages—no voltage will enter the cage even when the cage is experiencing a high current. In addition, electromagnetic fields can also pass through the Faraday cage without causing any disturbance.

Electromagnetic shielding is applied to some electrical devices and measurement equipment for the purpose of blocking interference. Examples of shielding include:

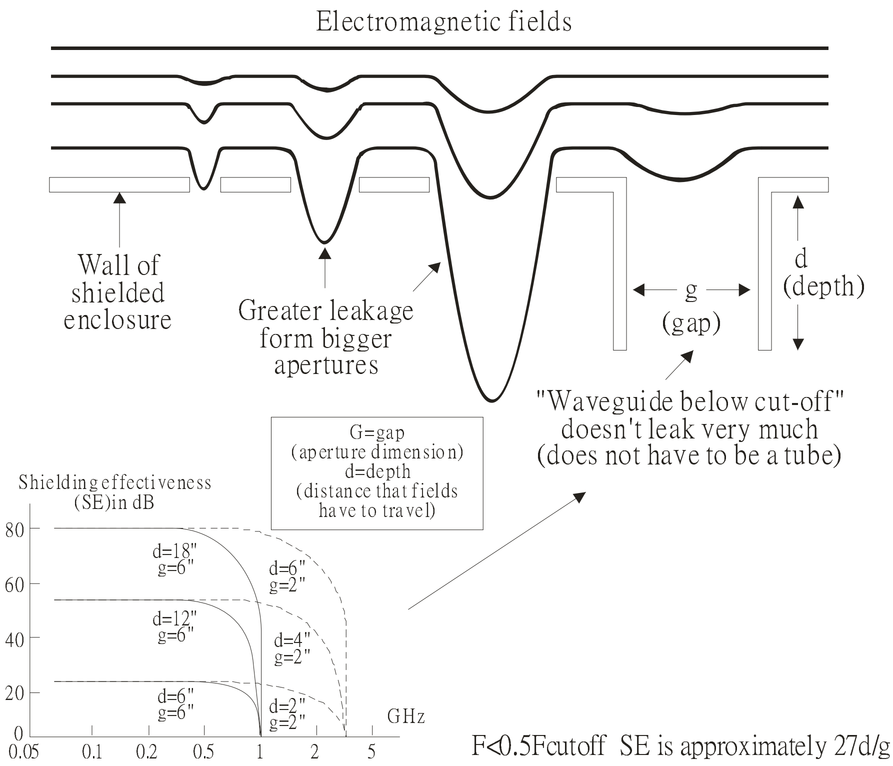
- earth high-voltage indoor equipment using a metal frame or a high-density metal mesh
- shielding a power transformer is achieved by wrapping a metal sheet between the primary and secondary windings or by adding an enamel wire to the winding wire which is then earthed.
- a shielding coating, which is made of metal mesh or conductive fibres to provide effective protection for the workers who work in a high-voltage environment.

In the picture below, the radio appears to be not fully covered by metal but if the conductivity of the metal is high, radio waves are completely blocked and the radio will not receive any signal.





Mobile phone connections are also established through the transmission of radio waves. This is why the mobile phone reception is often cut off when we walk into an elevator. The metal walls of the elevator create the same shielding effect just as if we had entered a metal cage. Another example is a microwave oven. The microwave door may seem transparent in visible light, but the density of the metal mesh in the microwave door blocks the electromagnetic waves. A higher density of the metal mesh offers better shielding.



19-4.2 How to reduce EMI by Shielding?

Iron and other metals are high conductivity materials that provide effective shielding at extremely low frequencies. But conductivity will decrease as:

1. High frequency signals are applied to the conductor.
2. Equipment is located in a strong magnetic field
3. The shielding frame is forced into a specific form by machines.

It is difficult to select a suitable high-conductivity material for shielding without the help from a shielding material supplier or a related EMI institution.

Metallic Shielding Effectiveness

Shielding Effectiveness (SE) is used to assess the applicability of the shielding shell. The formula is:

SEdB=A+R+B (Measures in dB) where A= Absorption loss (dB)
R= Reflection loss (dB)
B= Correction factor (dB) (for multiple reflections in thin shields)

The absorption loss refers to the amount of energy loss as the electromagnetic wave travels through the shield. The formula is:

$\mathrm{AdB}=1.314(f\sigma\mu)1/2t$ where f= frequency (MHz)
μ= permeability relative to copper
σ= conductivity relative to copper
t= thickness of the shield in centimetres

The reflection loss depends on the source of the electromagnetic wave and the distance from that source. For a rod or straight wire antenna, the wave impedance increases as it moves closer to the source and decreases as it moves away from the source until it reaches the plane wave impedance (377) and shows no change. If the wave source is a small wire loop, the magnetic field is dominant and the wave impedance decreases as it moves closer to the source and increases as it moves away from the source; but it levels out at 377 when the distance exceeds one-sixth of the wavelength.

Electrical Cabinet Design

In a high frequency electric field, shielding can be achieved by painting a thin layer of conductive metal on the enclosure or on the internal lining material. However, the coating must be thorough and all parts should be properly covered without any seams or gaps (just like a Faraday cage). That is only the ideal. Making a seamless shielding shell is practically impossible since the cage is composed of metal parts. In some conditions, it is necessary to drill holes in the shielding enclosure for installation of accessories (like optional cards and other devices).

1. If the metallic components are properly welded using sophisticated welding technology to form an electrical cabinet, deformation during usage is unlikely to occur. But if the electrical cabinet is assembled with screws, the protective insulating layer under the screw must be properly removed before assembly to achieve the greatest conductivity and best shielding.
2. Drilling holes for the installation of wires in the electrical cabinet lowers the shielding effectiveness and increases the chance of electric waves leaking through the openings and emitting interference. We recommend that the drilled holes are as narrow as possible. When the wiring holes are not used, properly cover the holes with metal plates or metal covers. The paint or the coating of the metal plate and metal cover should be thoroughly removed to ensure a metal-to-metal contact or a conductive gasket should be installed.
3. Install industrial conductive gaskets to completely seal the electrical cabinet and the cabinet door without gaps. If conductive gaskets are too costly, please screw the cabinet door to the electrical cabinet with a short distance between the screws.
4. Reserve a grounding terminal on the electrical cabinet door. This grounding terminal shall not be painted. If the paint already exists, please remove the paint before grounding.

Electrical wires and cables

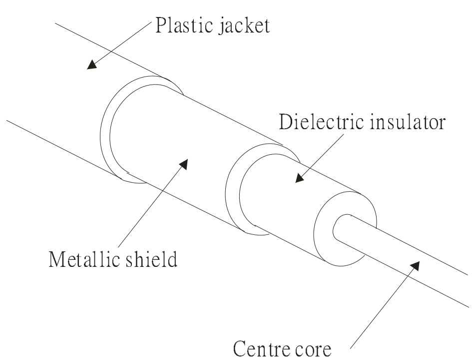
Shielded Twisted Pair (STP) is a type of cable where two insulated copper wires are twisted together with a metal mesh surrounding the twisted pair that forms the electromagnetic shielding and can also be used for grounding.

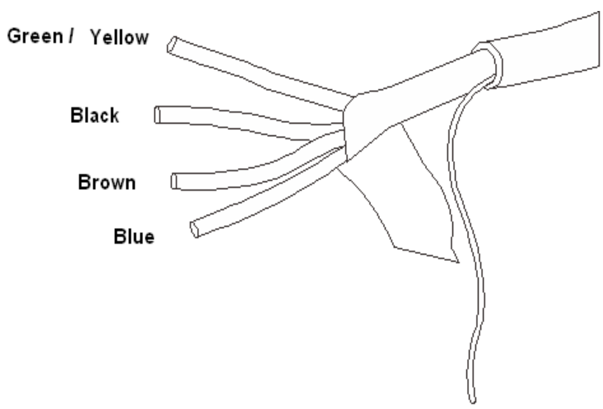
The individual electrical wires and complete cable are surrounded by (synthetic) rubber, that provides insulation and also protects against damage.

There are two types of electrical cables: high voltage and low voltage. The high voltage cable differs from the low voltage cable in that it has an additional insulation layer called the dielectric insulator within the plastic sleeve. The dielectric insulator is the most important component in insulation. The low voltage cable is usually only filled with a soft polymer material for keeping the internal copper wire in place.

The shield has two functions.

1. To shield the electrical wire and cable.
   A. Electric currents increase as power flows through the power cable and generate an electrical field. Such interference can be suppressed inside the cable by shielding the power cables or the electrical wires.
   B. To form a protective earthing. When the cable core is damaged, the leakage current will flow via the shield to ground
2. To protect the cable. A power cable used for the computer control purpose generates only relatively low amount of current inside the cable. Such power cable will not become the source of interferences but has great possibility to be interfered by the surrounding electrical devices.





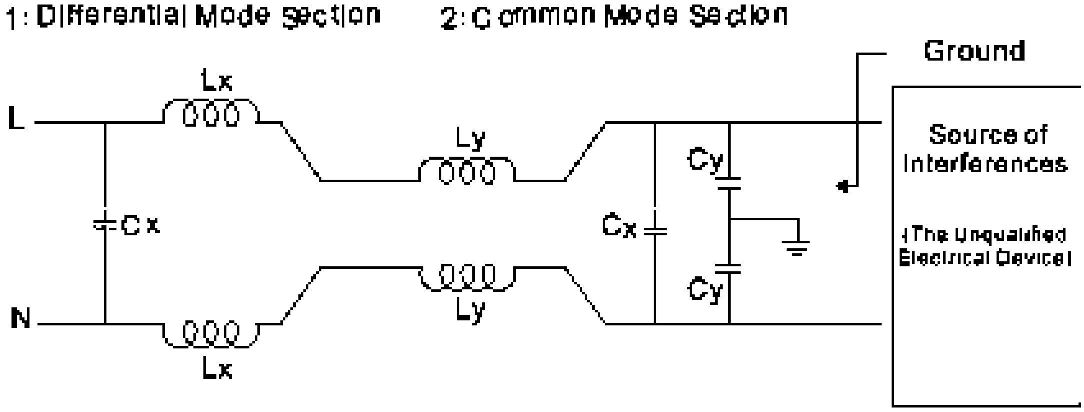
19-5 Solution to EMI: Filter

19-5.1 Filter

Electromagnetic interference is transmitted in two ways, by radiation and by conduction. The most effective and economical method of reducing radiated interference is to use shielding and of reducing conducted interference is to use an electromagnetic filter.

Noise interference can be divided into two categories: high frequency (150kHz~300MHz) and low frequency (100Hz~3000Hz). High-frequency noise fades more over distance and has a shorter wave-length, while low-frequency noise fades less over distance and has a longer wave-length.. Both types of interference are transmitted through power cables and power leads, affecting the power supply side.

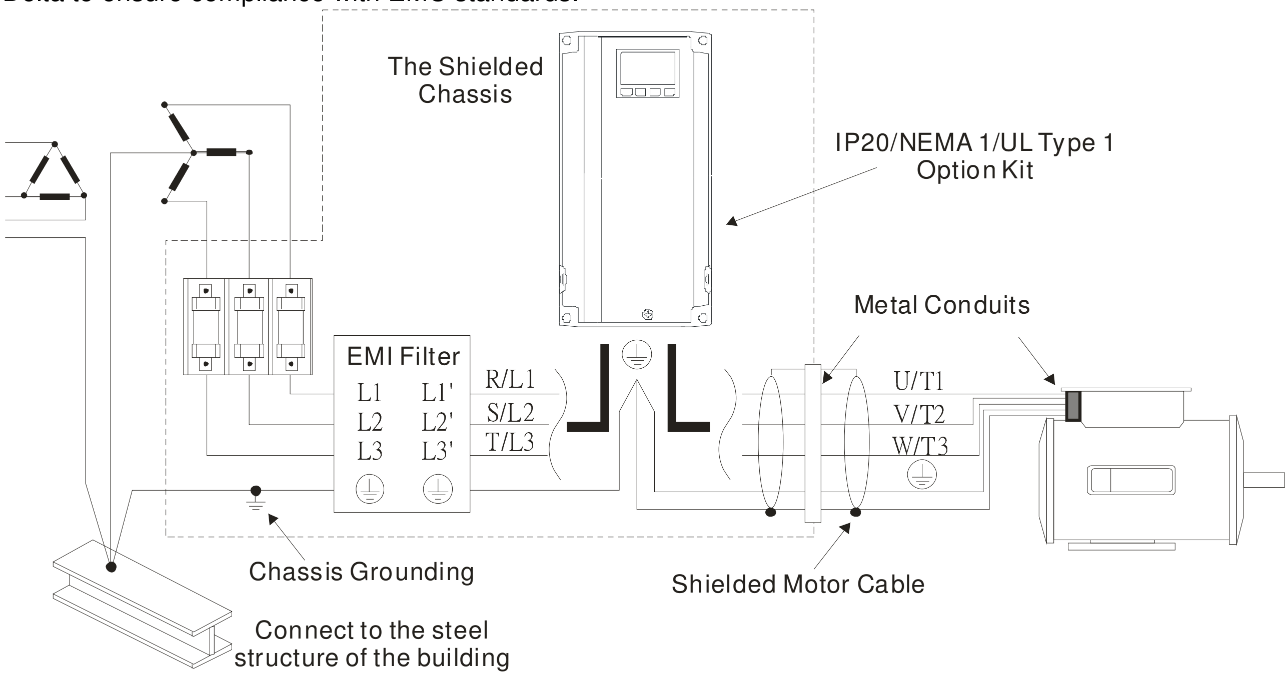
High-frequency interference at the power side can be eliminated or attenuated by mounting a filter. The filter consists of coils and capacitors. Some drives do not have a built-in filter, in which case the installation of an external option filter is required. The drawing below shows a standard filter diagram:



A filter is composed of a Differential Mode section (to eliminate noise below 150kHz) and a Common Mode section (to eliminate noise above 150kHz). For high-frequency noise , the inductor acts as a high impedance to form an open circuit and the capacitor acts as a low impedance to form a short circuit. Proper design and dimensioning of inductors and capacitors give a resonant circuit to absorb harmonic currents. Capacitor Cy is earthed to lead the harmonic currents to the ground.

External Filter

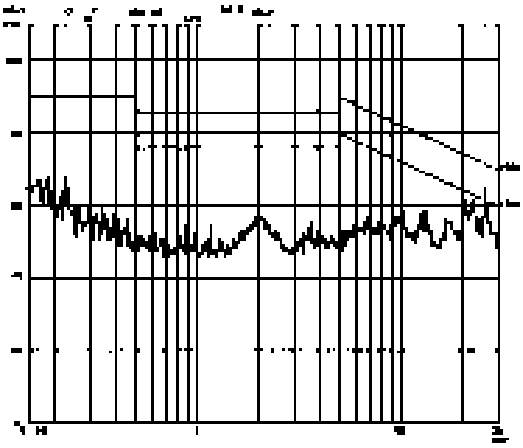
The filter and the AC drive should be installed in the control cabinet or on the mounting plate that is earthed to ground. The motor cable must be shielded and as short as possible. Please use the filters recommended by Delta to ensure compliance with EMC standards.



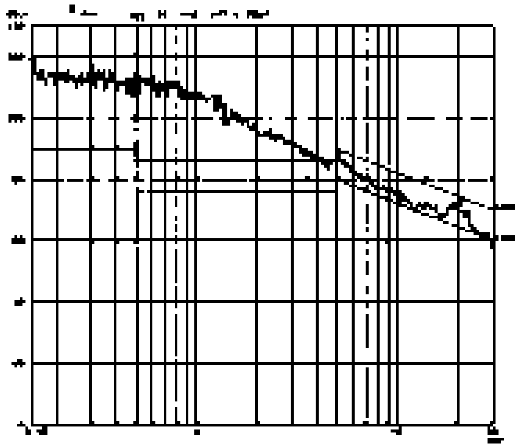
AC Motor Drives with Built-in Filter

1. Since interferences are suppressed by installing an earthed capacitor in the filter, the amount of current to ground (leakage current) could result in electric shocks to personnel or the power system. Please be aware of this problem.
2. Since the leakage current to ground can be high, it is crucial to implement protective earthing to prevent electrical shocks.

Filter Installation (With and Without)



<15m@60Hz with EMI Filter>



<15m@60Hz without EMI Filter>

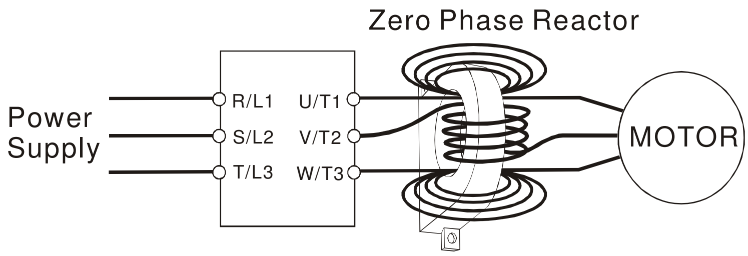
Zero Phase Reactor (Choke)

Interferences can also be suppressed by installing a zero phase reactor at the power supply side and/or the AC Motor Drive's output, depending on where the interference is. Since currents are large at the power input and the AC Motor Drive's output, please carefully select the magnetic core with suitable current handling capability. An ideal magnetic material for large currents is compound magnetic powder. It has a higher current handling capability and higher impedance compared to pure metallic magnetic cores. It is therefore suitable to implement in a high frequency environment. The impedance can also be enhanced by increasing the turn ratio.

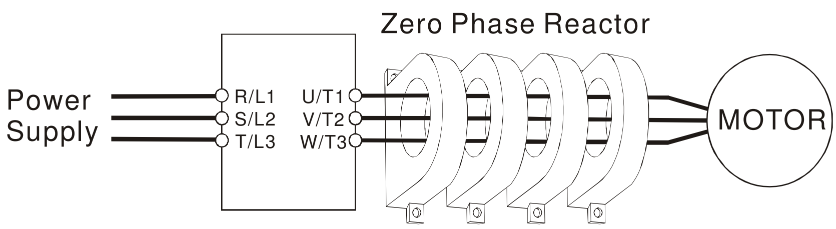
Zero Phase Reactor Installation

There are two installation methods, depending on the size of the zero phase reactor and the motor cable length.

1. Wind the motor cable through the middle of a zero-phase reactor 4 times. Place the reactor and the AC Motor Drive as close to each other as possible.



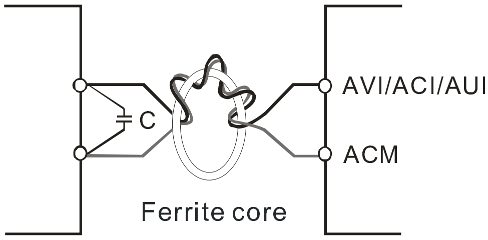
2. Place all wires through the middle of four zero-phase reactors without winding.



Analog Input Signals

If the analog input signals are affected by noise from the AC motor drive, please connect a capacitor and a ferrite core as indicated in the following diagram.

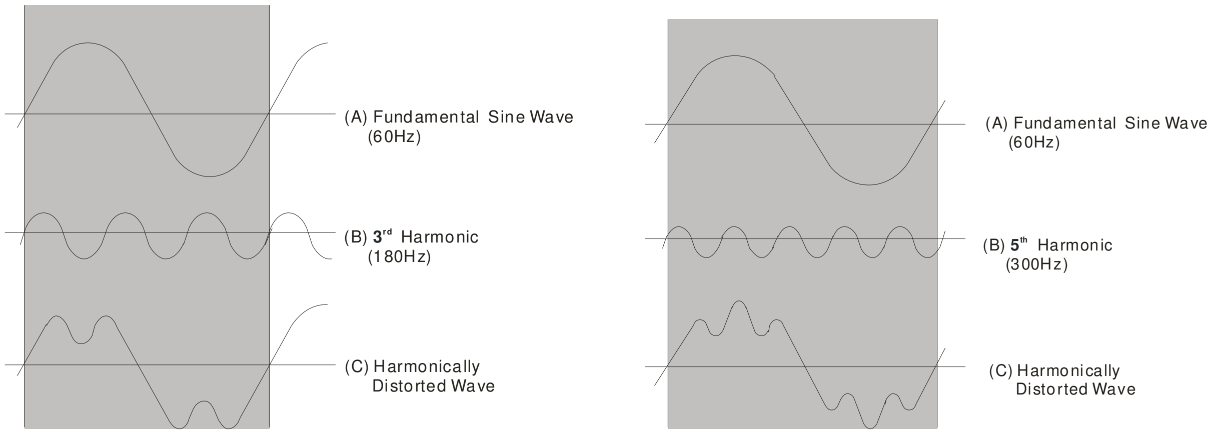
Wind the wires around the core in same direction for 3 times or more.



19-5.2 Harmonic Interference

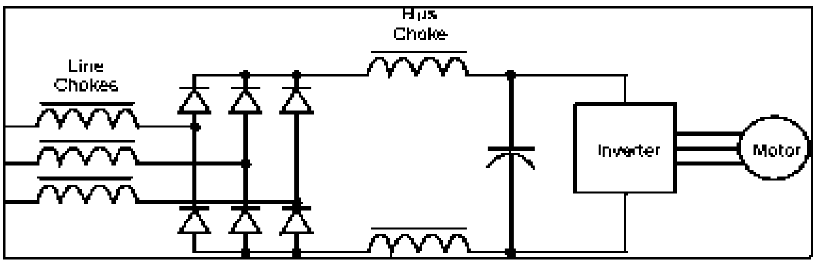
The AC motor drive's input current is non-linear, the input rectifier generates harmonics. Harmonics must be limited to within a certain range to avoid impact the mains power and to avoid current distortion to ensure surrounding devices are not influenced. An AC Motor Drive with built-in DC reactor suppresses harmonic currents (Total Harmonic Current Distortion THID) effectively and therefore reduces the harmonic voltage peaks (Total Harmonic Voltage Distortion).

Harmonic Current at the Power Supply Side



Suppression of Harmonic Currents

When a large portion of lower order harmonic currents (5th, 7th, 11th, etc) occur at the power input, surrounding devices will be disturbed and the power factor will be low as a result of reactive power. Installing a reactor at the AC Motor Drive's input effectively suppresses lower order harmonic currents.



AC Reactor

Installed in series with the power supply and is effective in reducing low order current harmonics.
Features of an AC reactor include:

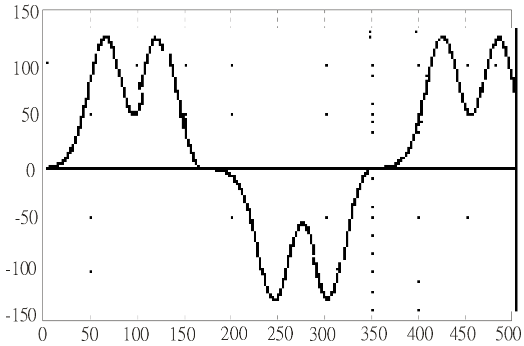
1. Reduces the harmonic currents to the AC Motor Drive and increases the impedance of the power supply.
2. Absorbs interferences generated by surrounding devices (such as surge voltages, currents, and mains surge voltages) and reduce their effect on the AC Motor Drive.
3. Increases the power factor.

DC Reactor

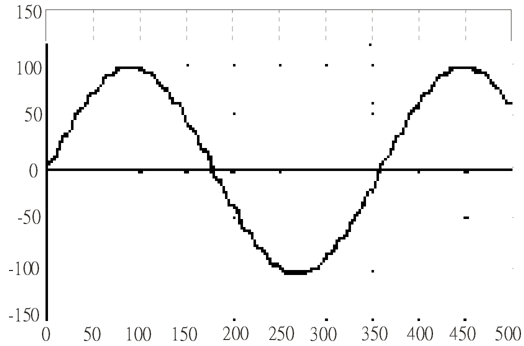
A DC-Reactor is installed between the rectifier and the DC-bus capacitor to suppress harmonic currents and to achieve a higher power factor.

Current Wave Diagrams

Without Reactor



With Reactor



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Chapter 20 Safety Torque Off Function

20-1 The drive safety function failure rate

Item	Definition	Standard	Performance
SFF	Safe Torque Off	IEC61508	Channel 1: 80.08% Channel 2: 68.91%
HFT (Type A subsystem)	Hardware Fault Tolerance	IEC61508	1
SIL	Safety Integrity Level	IEC61508	SIL 2
		IEC62061	SILCL 2
PFH	Average frequency of dangerous failure [h-1]	IEC61508	9.56×10^{-10}
PFD_{av}	Probability of Dangerous Failure on Demand	IEC61508	4.18×10^{-6}
Category	Category	ISO13849-1	Category 3
PL	Performance level	ISO13849-1	d
$MTTF_d$	Mean time to dangerous failure	ISO13849-1	High
DC	Diagnostic coverage	ISO13849-1	Low

20-2 Safety Torque Off terminal function description

The safety Torque Off function is to cut off the power supply to motor through the hardware, thereby the motor couldn't produce torque.

The safety Torque Off function is respectively by two independent hardware to control the motor current drive signal, and thus cut off the inverter power module output in order to achieve the status of safety stop.

Operation principle Description as below table 1:

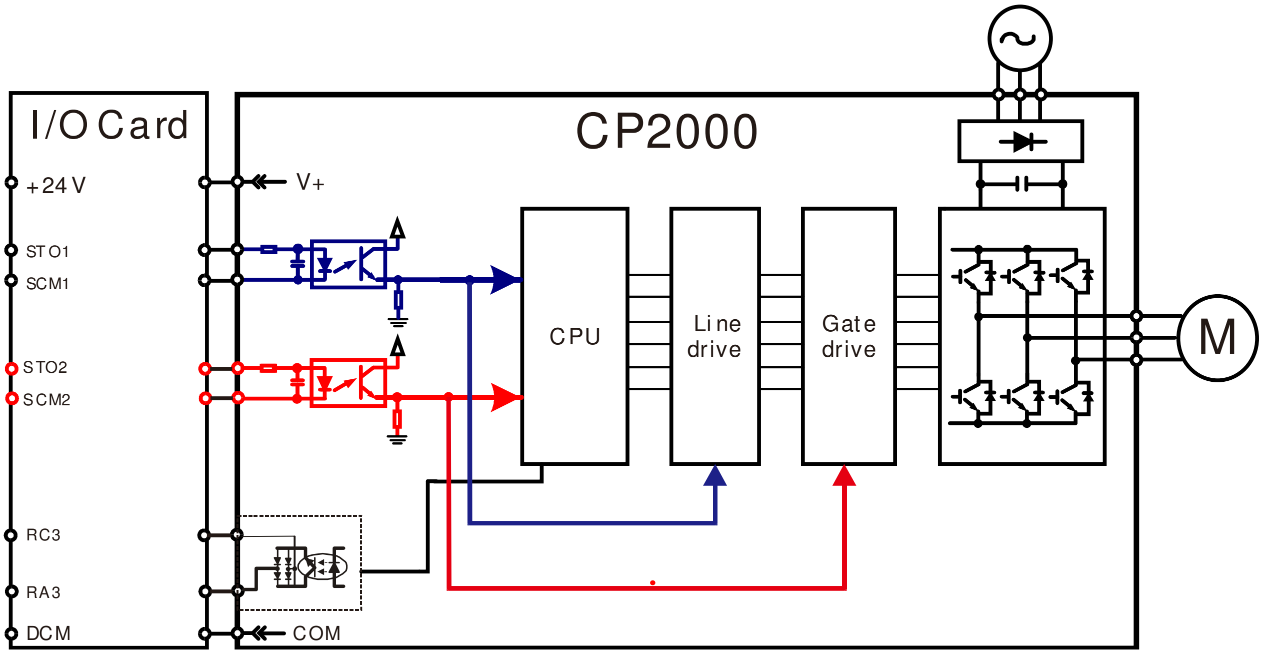
Table 1: Terminal operation description

Signal	**Channel**	Photo-coupler status			
STO signal	STO1~SCM1	ON (High)	ON (High)	OFF (Low)	OFF (Low)
	STO2~SCM2	ON (High)	OFF (Low)	ON (High)	OFF (Low)
Driver Output status		Ready	STL2 mode (Torque output off)	STL1 mode (torque output off)	STO mode (Torque output off)

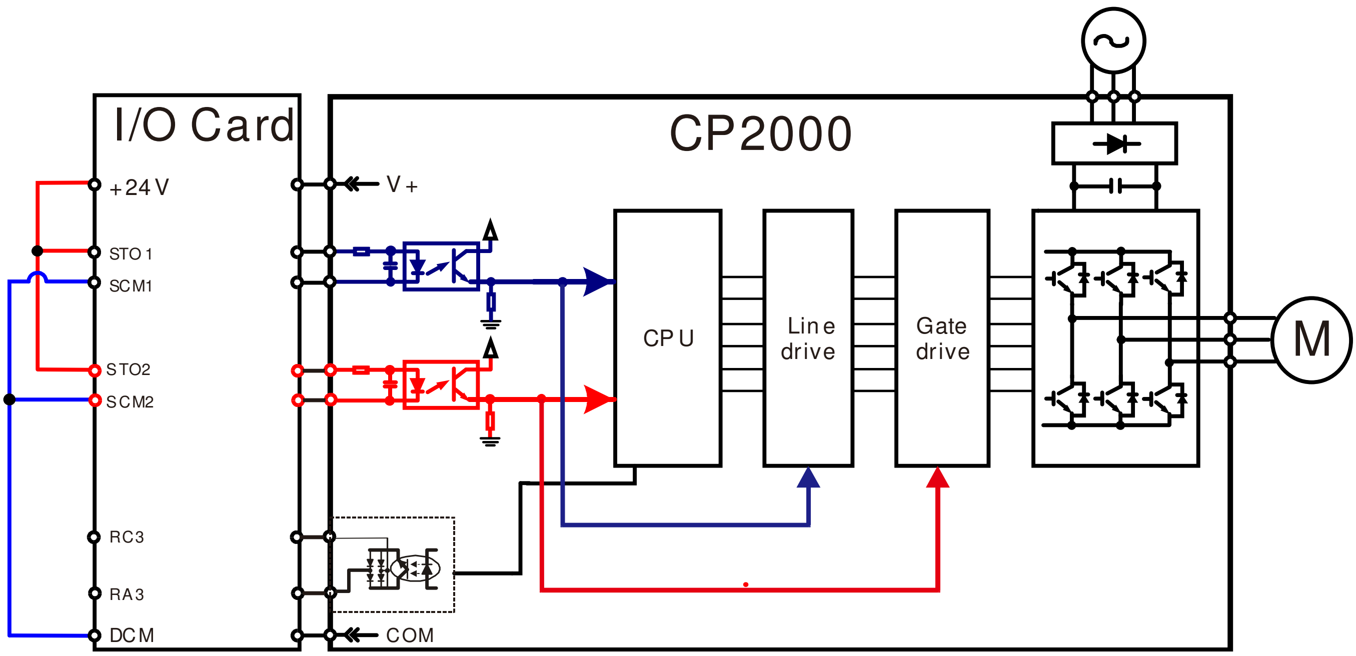
- STO means Safe Torque Off
- STL1~STL3 means Safety Torque Off hardware abnormal.
- STL3 means STO1~SCM1 and STO2~SCM2 internal circuit detected abnormal.
- STO1~SCM1 ON(High): means STO1~SCM1has connect to a +24VDC power supply.
- STO2~SCM2 ON(High): means STO2~SCM2 has connect to a +24V power supply.
- STO1~SCM1 OFF(Low): means STO1~SCM1hasn't connect to a +24VDC power supply.
- STO2~SCM2 OFF(Low): means STO2~SCM2hasn't connect to a +24VDC power supply.

20-3 Wiring diagram

20-3-1 Internal STO circuit as below:

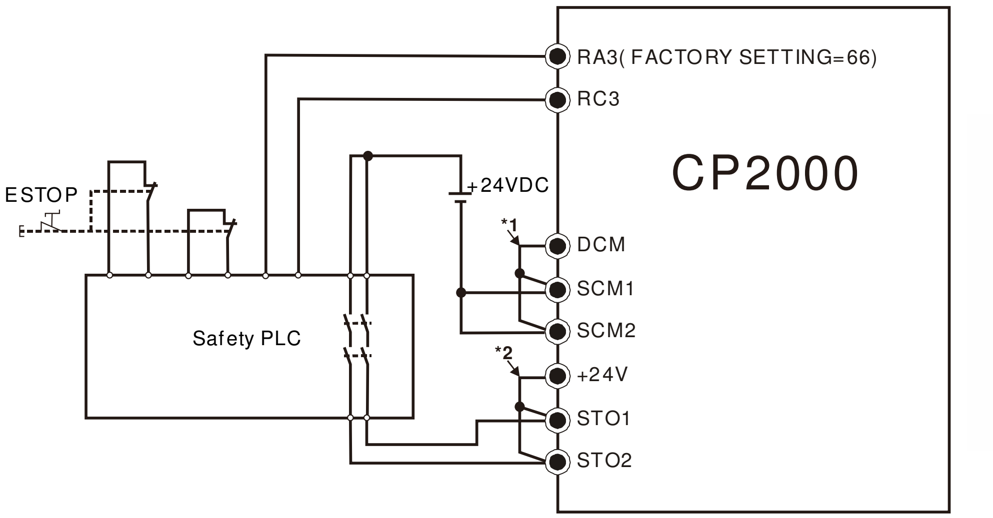


20-3-2 In the figure below, the factory setting for +24V-STO1-STO2 and SCM1-SCM2-DCM is short circuit:



20-3-3 The control loop wiring diagram:

1. Remove the shot-circuit of +24V-STO1-STO2 and DCM-SCM1-SCM2.
2. The wiring as below diagram. The ESTOP switch must at Close status in normal situation and drive will be able to Run.
3. STO mode, switch ESTOP open. Drive output stop and keypad display STO.



NOTE

*1: factory short circuit of DCM-SCM1-SCM2. To use the Safety function, please remove this short circuit
*2: factory short circuit of +24V-STO1-STO2. to use the Safety function, please remove this short circuit.

20-4 Parameter

06-44 STO Alarm Latch

Factory setting: 0

Settings 0 : STO Alarm Latch
1 : STO Alarm no Latch

- Pr06-44=0 STO Alarm Latch: after the reason of STO Alarm is cleared, a Reset command is need to clear STO Alarm.
- Pr06-44=1 STO Alarm no Latch: after the reason of STO Alarm is cleared, the STO Alarm will be cleared automatically.
- All of STL1~STL3 error are "Alarm latch" mode (in STL1~STL3 mode, the Pr06-44 function is no effective).

02-13 Multi-function Output 1 (Relay1)

Factory Setting:11

02-14 Multi-function Output 2 (Relay2)

Factory Setting:1

02-15 Multi-function Output 3 (Relay3)

Factory Setting:66

Settings
66: SO N.O. output
68: SO N.C. output

Settings	Functions	Descriptions
66	SO Logic A output	Safety Output Normal Open
68	SO Logic B output	Safety Output Normal Close

- CP2000 factory setting Pr02-17(MO2)=66(N.O.) and Multi-function Output setting item has add 2 new function: 66 and 68.

Drive status	Safety Output status	
	N.O. (MO=66)	N.C. (MO=68)
Normal run	Open	Close
STO	Close	Open
STL1~STL3	Close	Open

00-04 Content of Multi-function Display

Factory setting: 3

Settings 45: Hardware version

00-04=45	Hardware version

20-5 Operating sequence description

20-5-1Normal operation status

As shown in Figure 3: When the STO1~SCM1 and STO2~SCM2=ON (no STO function is need),

the drive will execute “Operating” or “Output Stop” according to RUN/STOP command.

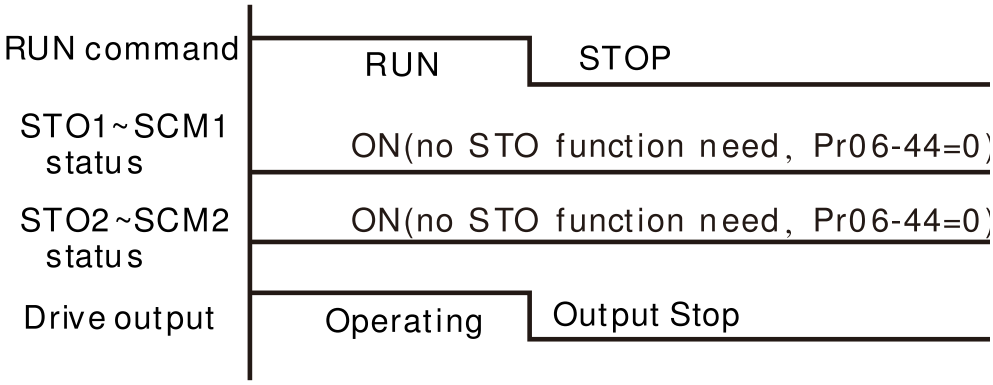


Figure 3

20-5-2-1 STO，Pr06-44=0，Pr02-35=0

As shown in Figure 4: When both of STO1~SCM1 and STO2~SCM2 channel has turn off during

operating, the STO function enabling and the drive will stop output regardless of Run command is

ON or OFF status.

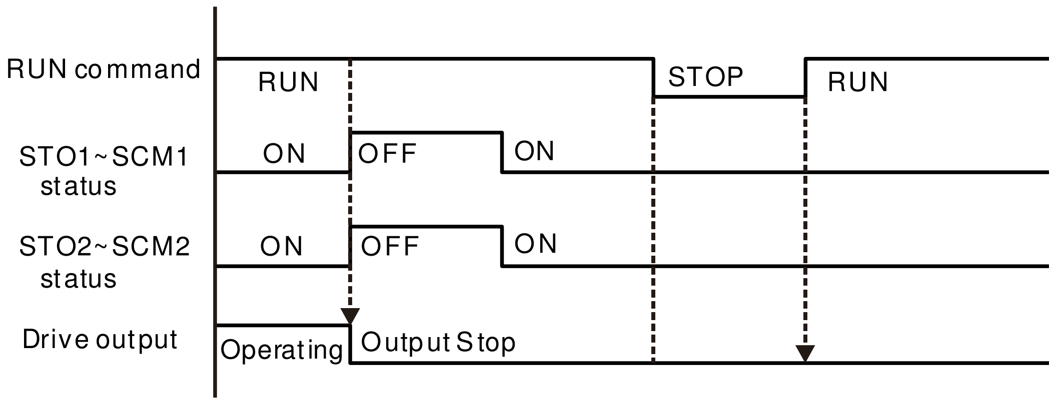


Figure 4

20-5-2-2 STO，Pr06-44=0，Pr02-35=1

As shown in Figure 5: As same as the figure 4. But, because the Pr02-35=1, therefore, after the

Reset command, if the operating command still exists, then the drive will immediately execute the run command again.

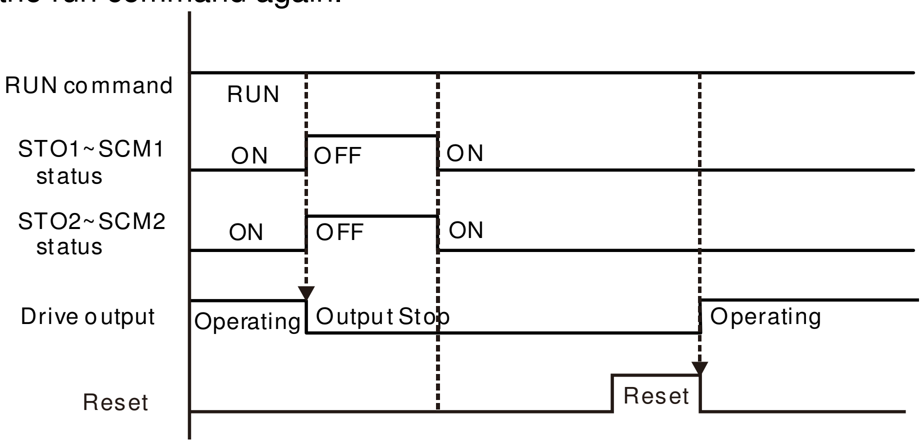


Figure 5

20-5-3 STO，Pr06-44=1

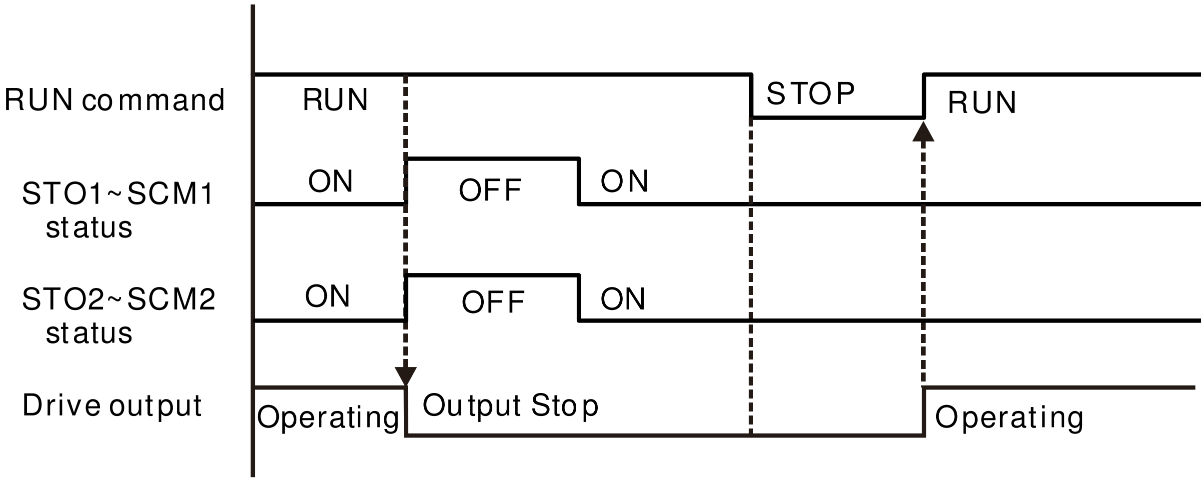


Figure 6

20-5-4 STL1

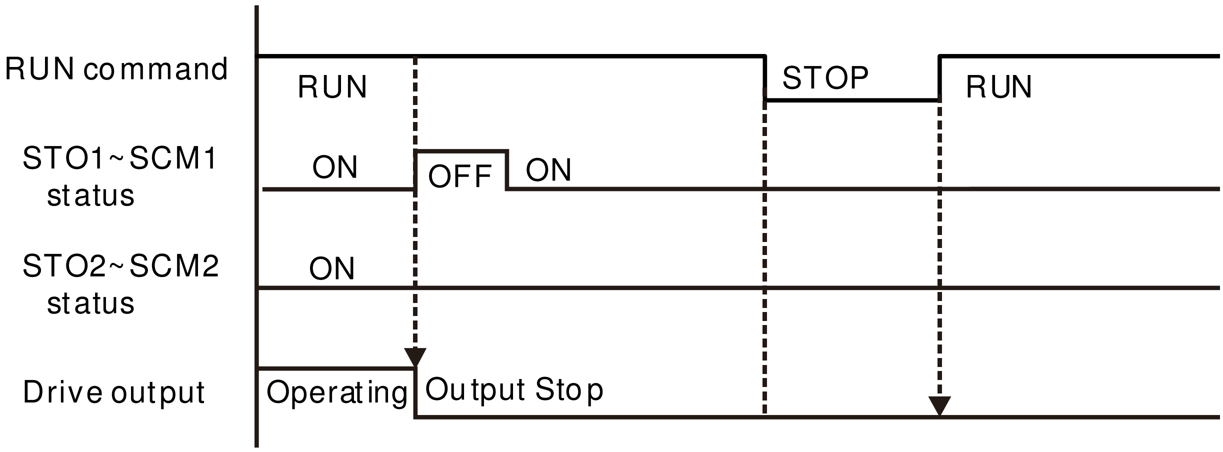


Figure 7

20-5-4 STL2

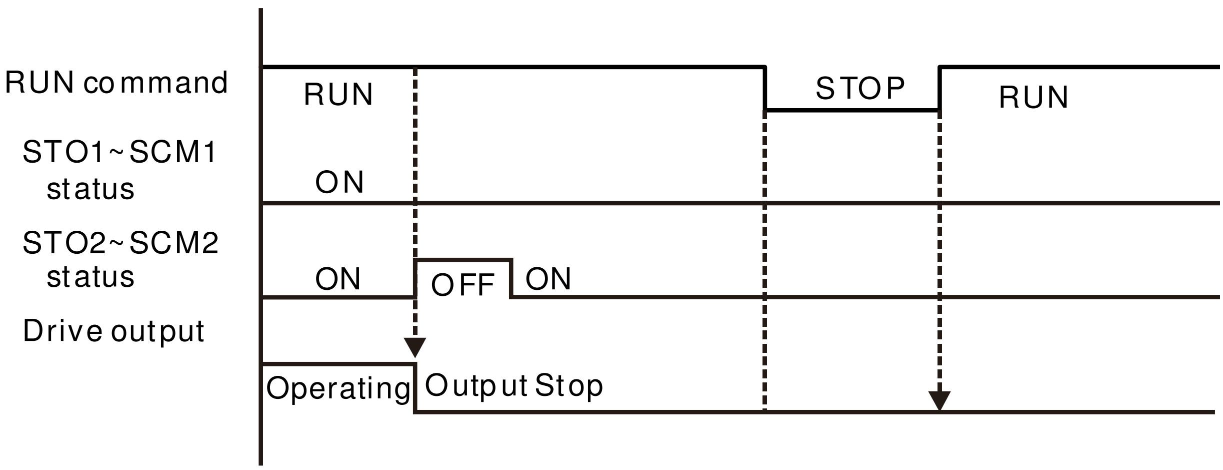


Figure 8

20-6 New Error code for STO function

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
72：Channel 1(STO1~SCM1)internal hardware error
76：STO(Safety Torque Off
77：Channel 2(STO2~SCM2)internal hardware error
78：Channel 1 and Channel 2 internal hardware error

Error code	Name	Description
76	STO	Safety Torque Off function active
72	STL1 (STO1~SCM1)	STO1~SCM1 internal hardware detect error
77	STL2 (STO2~SCM2)	STO2~SCM2 internal hardware detect error
78	STL3	STO1~SCM1 and STO2~SCM2 internal hardware detect error

The Old/New control board and Old/New I/O card:

CP2000	v1.20 firmware	v1.21 firmware
v1.20 control board + old I/O card (no STO function)	OK	OK
v1.20 control board + new I/O card (with STO function)	Error	Error
v1.21 control board + old I/O card (no STO function)	Error	Error
v1.21 control board + new I/O card (with STO function)	Error	OK

Appendix A. Publication History

V1.21→V1.22	
Explanations	**Coverage**
Add	
V/F curve selection	Group 01 Parameters (01-43)
AC/DC reactors and specification of shielding calbles for motors	Chapter 7 – Optional Accessories
Specification of shielding cable for EMI filters	Chapter 7 – Optional Accessories
Revise	
Constant speed. The Accel./Decel. Speed of the UP/DOWN key.--- setting and factory setting value	Group 02 Parameters (02-10)
Over-torque Detection Time (OT1, OT2) ---setting	Group 06 Parameters (06-08, 06-11)
Torque value of main circuit terminals	Chapter 5 — Main Circuit Terminals
Torque value of control terminals	Chapter 6 — Control Terminals
The times that the rated current of the breaker to the maximum rated input current of AC motor drive	Chapter 7 — Optional Accessories
The protection level of panel mounting keypad	Chapter 7 — Optional Accessories
Torque limit of normal duty	Chapter 9 — Specifications