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Sensorless Vector Control Drives
$\qquad$ For HVAC Drive Applications CD2000 User Manual


5012604601
August 2011

## PLEASE READ PRIOR TO INSTALLATION FOR SAFETY.

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## NOTE

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Application Control BD V1.01
Keypad V1.011

## Publication History

Please include the Issue Edition and the Firmware Version, both shown below, when communicating with Technical Support regarding this publication.

Issue Edition: 01
Firmware Version: 1.01
Keypad Version: 1.011
Issue date : August 2011

| Date | Description of Changes |
| :--- | :--- |
| 2011/08 | Add parameters from Pr03-50 AI calculated selection to Pr03-68 AUI point 3 in <br> percentage. <br> Modify the factory setting of Pr06-03 and Pr06-04. It is now Normal duty 120\%; Light <br> duty: 120\%. <br> Modify Pr08-10. It is now 0.00~600.00Hz or 0~200.00\%. <br> Modify Pr08-11. new setting 0.00~600.00Hz or 0~200.00\% <br> Add Pr08-18: Setting of Sleep Mode Function. <br> Add Pr08-19 is: Integral Limit during Wake-Up. <br>  <br>  <br>  <br>  <br>  <br>  <br> Add Pr02-57: Mix active by Internal or External Selection <br> Add Pr05-07: Rotor Resistance (Rr) of Motor 1 1 <br> Add Pr05-08: Magnetizing Inductance (Lm) of Induction Motor 11 Active Value <br> Add Pr05-09: Stator Inductance (Lx) of Induction Motor 1 <br> Add Pr05-19: Rotor Resistance (Rr) of Induction Motor 2 <br> Add Pr05-20: Magnetizing Inductance (Lm) of Induction Motor 2 new chapters 16, 17, 18 and 19. <br> Add Pr 05-21: Stator Inductance (Lx) of Induction Motor 2 <br> Modify the setting of Pr09-50. it is now 0~127 <br> Remove Pr09-54 BACnet Enable Master |

## 01 Introduction

## Receiving and Inspection

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

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

## Nameplate Information:



## Model Name:



## Serial Number:



Production sequence: number 3
Production week: week 22
Production year: year 2011
Production factory:
T:Taoyuan, W: Wujian, S: Shanghai
3 phases, 230V, $0.75 \mathrm{kw}, 1 \mathrm{hp}$
Abbreviation of the model name

## Dimensions:

Frame A, Corresponding models:
VFD007CP23A-21;VFD015CP23A-21,VFD022CP23A-21,VFD037CP23A-21,VFD055CP23A-21, VFD007CP43A-21, VFD015CP43A-21,VFD022CP43A-21,VFD037CP43A-21, VFD040CP43A-21,VFD055CP43A-21,VFD075CP43A-21,VFD007CP4EA-21,VFD015CP4EA-21, VFD022CP4EA-21,VFD037CP4EA-21; VFD040CP4EA-21,VFD055CP4EA-21,VFD075CP4EA-21


See Detail B 3



Detail B (Mounting Hole)

| Unit : mm [inch] |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Frame | W | H | D | W1 | H1 | D1* | S1 | 11 | 12 | $\Phi 3$ |
| A1 | 130.0 | 250.0 | 170.0 | 116.0 | 236.0 | 45.8 | 6.2 | 22.2 | 34.0 | 28.0 |
|  | $[5.12]$ | $[9.84]$ | $[6.69]$ | $[4.57]$ | $[9.29]$ | $[1.80]$ | $[0.24]$ | $[0.87]$ | $[1.34]$ | $[1.10]$ |

## Frame B

Corresponding models:
VFD075CP23A-21,VFD110CP23A-21,VFD150CP23A-21,VFD110CP43A-21, VFD150CP43A-21,VFD185CP43A-21,VFD110CP4EA-21,VFD150CP4EA-21, VFD185CP4EA-21


## See Detail B



| Frame | W | H | D | W1 | H1 | D1* | S1 | $\Phi 1$ | $\Phi 2$ | $\Phi 3$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| B | 190.0 | 320.0 | 190.0 | 173.0 | 303.0 | 77.9 | 8.5 | 22.2 | 34.0 | 43.8 |
|  | $[7.48]$ | $[12.60]$ | $[7.48]$ | $[6.81]$ | $[11.93]$ | $[3.07]$ | $[0.33]$ | $[0.87]$ | $[1.34]$ | $[1.72]$ |

## Frame C

Corresponding models:
VFD185CP23A-21,VFD220CP23A-21,VFD300CP23A-21,VFD220CP43A-21,
VFD300CP43A-21,VFD370CP43A-21,VFD220CP4EA-21,VFD300CP4EA-21, VFD370CP4EA-21


See Detail B


Detail A (Mounting Hole)


Detail B (Mounting Hole)

| Frame | W | H | D | W1 | H1 | D1* | S1 | $\Phi 1$ | $\Phi 2$ | $\Phi 3$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| C | 250.0 | 400.0 | 210.0 | 231.0 | 381.0 | 92.9 | 8.5 | 22.2 | 34.0 | 50.0 |
|  | $[9.84]$ | $[15.75]$ | $[8.27]$ | $[9.09]$ | $[15.00]$ | $[3.66]$ | $[0.33]$ | $[0.87]$ | $[1.34]$ | $[1.97]$ |

## Frame D

Corresponding models:
Frame D1:
VFD370CP23A-00, VFD450CP23A-00, VFD450CP43A-00, VFD550CP43A-00, VFD750CP43A-00, VFD900CP43A-00,

Frame D2:
VFD370CP23A-21, VFD450CP23A-21, VFD450CP43A-21, VFD550CP43A-21, VFD750CP43A-21, VFD900CP43A-21

FRAME_D1


FRAME_D2



DETAILA
(MOUNTING HOLE) (MOUNTING HOLE)

Unit : mm[inch]

| Frame | W | H | D | W 1 | H 1 | H 2 | H 3 | $\mathrm{D} 1 *$ | D 2 | S 1 | S 2 | Ф1 | Ф2 | Ф3 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| D 1 | 330.0 |  | 275.0 | 285.0 | 550.0 | 525.0 | 492.0 | 107.2 | 16.0 | 11.0 | 18.0 |  |  |  |
|  | $[12.99]$ | - | $[10.83]$ | $[11.22]$ | $[21.65]$ | $[20.67]$ | $[19.37]$ | $[4.22]$ | $[0.63]$ | $[0.43]$ | $[0.71]$ | - | - | - |
| D 2 | 330.0 | 688.3 | 275.0 | 285.0 | 550.0 | 525.0 | 492.0 | 107.2 | 16.0 | 11.0 | 18.0 | 76.2 | 34.0 | 22.0 |
|  | $[12.99]$ | $[27.10]$ | $[10.83]$ | $[11.22]$ | $[21.65]$ | $[20.67]$ | $[19.37]$ | $[4.22]$ | $[0.63]$ | $[0.43]$ | $[0.71]$ | $[3.00]$ | $[1.34]$ | $[0.87]$ |

[^1]
## Frame E

Corresponding models:
Frame E1:
VFD550CP23A-00, VFD750CP23A-00,VFD900CP23A-00,VFD1100CP43A-00, VFD1320CP43A-00

Frame E2:
VFD550CP23A-21,VFD750CP23A-21,VFD900CP23A-21, VFD1100CP43A-21,VFD1320CP43A-21
FRAME_E1


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

FRAME_E2



Detail A (Mounting Hole)


Detail B (Mounting Hole)

Unit: mm [inch]

| Frame | W | H | D | W 1 | H 1 | H 2 | H 3 | $\mathrm{D} \boldsymbol{*}^{*}$ | D 2 | $\mathrm{~S} 1, \mathrm{~S} 2$ | S 3 | Ф1 | Ф2 | Ф3 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| E 1 | 370.0 | - | 300.0 | 335.0 | 589 | 560.0 | 528.0 | 143.0 | 18.0 | 13.0 | 18.0 | - | - | - |
|  | $[14.57]$ | - | $[11.81]$ | $[13.19$ | $[23.19]$ | $[22.05]$ | $[20.80]$ | $[5.63]$ | $[0.71]$ | $[0.51]$ | $[0.71]$ |  |  |  |
| E2 | 370.0 | 715.8 | 300.0 | 335.0 | 589 | 560.0 | 528.0 | 143.0 | 18.0 | 13.0 | 18.0 | 22.0 | 34.0 | 92.0 |
|  | $[14.57]$ | $[28.18]$ | $[11.81]$ | $[13.19$ | $[23.19]$ | $[22.05]$ | $[20.80]$ | $[5.63]$ | $[0.71]$ | $[0.51]$ | $[0.71]$ | $[0.87]$ | $[1.34]$ | $[3.62]$ |

[^2]
## Frame F

Correpsonding models:
Frame F1: VFD1600CP43A-00,VFD1850CP43A-00,

Frame F2: VFD1600CP43A-21,VFD1850CP43A-21

## FRAME_F1



Detail A (Mounting Hole)


## FRAME_F2



Detail A (Mounting Hole)


Detail B (Mounting Hole)

| Unit : mm [inch] |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Frame | W | H | D | W1 | H1 | H2 | H3 | D1* | D2 | S1 | S2 | S3 |
| F1 | $\begin{gathered} 420.0 \\ {[16.54]} \end{gathered}$ | - | $\begin{gathered} \hline 300.0 \\ {[11.81]} \end{gathered}$ | $\begin{gathered} \hline 380.0 \\ {[14.96]} \end{gathered}$ | $\begin{gathered} \hline 800.0 \\ {[31.50]} \end{gathered}$ | $\begin{gathered} \hline 770.0 \\ {[30.32]} \end{gathered}$ | $\begin{gathered} \hline 717.0 \\ {[28.23]} \end{gathered}$ | $\begin{aligned} & 124.0 \\ & {[4.88]} \end{aligned}$ | $\begin{gathered} 18.0 \\ {[0.71]} \end{gathered}$ | $\begin{gathered} 13.0 \\ {[0.51]} \end{gathered}$ | $\begin{gathered} 25.0 \\ {[0.98]} \end{gathered}$ | $\begin{gathered} 18.0 \\ {[0.71]} \end{gathered}$ |
| F2 | $\begin{gathered} 420.0 \\ {[16.54]} \end{gathered}$ | $\begin{gathered} 940.0 \\ {[37.00]} \end{gathered}$ | $\begin{gathered} 300.0 \\ {[11.81]} \\ \hline \end{gathered}$ | $\begin{gathered} 380.0 \\ {[14.96]} \\ \hline \end{gathered}$ | $\begin{gathered} 800.0 \\ {[31.50]} \\ \hline \end{gathered}$ | $\begin{gathered} 770.0 \\ {[30.32]} \\ \hline \end{gathered}$ | $\begin{gathered} 717.0 \\ {[28.23]} \\ \hline \end{gathered}$ | $\begin{aligned} & 124.0 \\ & {[4.88]} \end{aligned}$ | $\begin{gathered} 18.0 \\ {[0.71]} \\ \hline \end{gathered}$ | $\begin{gathered} 13.0 \\ {[0.51]} \\ \hline \end{gathered}$ | $\begin{gathered} 25.0 \\ {[0.98]} \\ \hline \end{gathered}$ | $\begin{gathered} 18.0 \\ {[0.71]} \\ \hline \end{gathered}$ |
| Frame | Ф1 | Ф2 | Ф3 |  |  |  |  |  |  |  |  |  |
| F1 | - | - | - |  |  |  |  |  |  |  |  |  |
| F2 | $\begin{gathered} 92.0 \\ {[3.62]} \\ \hline \end{gathered}$ | $\begin{gathered} 35.0 \\ {[1.38]} \\ \hline \end{gathered}$ | $\begin{gathered} 22.0 \\ {[0.87]} \\ \hline \end{gathered}$ |  |  |  |  |  |  |  |  |  |

## Frame G

Corresponding models:
Frame G1: VFD2200CP43A-00,VFD2800CP43A-00
Frame G2: VFD2200CP43A-21,VFD2800CP43A-21

FRAME_G1



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

FRAME_G2



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

| Frame | W | H | D | W1 | H1 | H2 | H3 | S1 | S2 | S3 | Ф1 | Ф2 | Ф3 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| G1 | $\begin{array}{\|c\|} \hline 500.0 \\ {[19.69]} \end{array}$ | - | $\begin{gathered} \hline 397.0 \\ {[15.63]} \end{gathered}$ | $\left[\begin{array}{c} 440.0 \\ {[217.32]} \end{array}\right]$ | $\begin{gathered} \hline 1000.0 \\ {[39.37]} \end{gathered}$ | $\begin{gathered} 963.0 \\ {[37.91]} \end{gathered}$ | $\begin{array}{\|c\|} \hline 913.6 \\ {[35.97]} \end{array}$ | $\begin{gathered} 13.0 \\ {[0.51]} \end{gathered}$ | $\begin{gathered} 26.5 \\ {[1.04]} \end{gathered}$ | $\begin{gathered} 27.0 \\ {[1.06]} \end{gathered}$ | - | - | - |
| G2 | $\begin{gathered} \hline 500.0 \\ {[19.69]} \end{gathered}$ | $\begin{aligned} & 1240.2 \\ & {[48.83]} \end{aligned}$ | $\begin{gathered} \hline 397.0 \\ {[15.63]} \end{gathered}$ | $\begin{gathered} 440.0 \\ {[217.32]} \end{gathered}$ | $\begin{aligned} & 1000.0 \\ & {[39.37]} \end{aligned}$ | $\begin{gathered} \hline 963.0 \\ {[37.91]} \end{gathered}$ | $\begin{array}{\|c\|} \hline 913.6 \\ {[35.97]} \end{array}$ | $\begin{gathered} 13.0 \\ {[0.51]} \end{gathered}$ | $\begin{gathered} 26.5 \\ {[1.04]} \end{gathered}$ | $\begin{gathered} 27.0 \\ {[1.06]} \end{gathered}$ | $\begin{gathered} 22.0 \\ {[0.87]} \end{gathered}$ | $\begin{gathered} 34.0 \\ {[1.34]} \end{gathered}$ | $\begin{gathered} 117.5 \\ {[4.63]} \end{gathered}$ |

## Frame H

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

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

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

FRAME_H1



See Detail A(Mounting Hole)


See Detail B(Mounting Hole)

FRAME_H2


Side FIxing Baffle Plate


FRAME_H3


Unit: mm [inch]

| Frame | W | H | D | W1 | W2 | W3 | W4 | W5 | W6 | H1 | H2 | H3 | H4 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| H1 | $\begin{gathered} 700.0 \\ {[27.56]} \end{gathered}$ | $\begin{aligned} & 1435.0 \\ & {[56.5]} \end{aligned}$ | $\begin{gathered} 398.0 \\ {[15.67]} \end{gathered}$ | $\begin{gathered} 630.0 \\ {[24.8]} \end{gathered}$ | $\begin{array}{\|c\|} \hline 290.0 \\ {[11.42]} \end{array}$ | - | - | - | - | $\begin{aligned} & \hline 1403.0 \\ & {[55.24]} \end{aligned}$ | $\begin{aligned} & 1346.6 \\ & {[53.02]} \end{aligned}$ | - | - |
| H2 | $\begin{gathered} 700.0 \\ {[27.56]} \end{gathered}$ | $\begin{aligned} & 1745.0 \\ & {[68.70]} \end{aligned}$ | $\begin{gathered} 404.0 \\ {[15.90]} \end{gathered}$ | $\begin{gathered} 630.0 \\ {[24.8]} \end{gathered}$ | $\begin{array}{\|c\|} \hline 500.0 \\ {[19.69]} \end{array}$ | $\begin{array}{\|c\|} \hline 630.0 \\ {[24.80]} \end{array}$ | $\begin{gathered} \hline 760.0 \\ {[29.92]} \end{gathered}$ | $\begin{aligned} & \hline 800.0 \\ & {[31.5]} \end{aligned}$ | - | $\begin{array}{\|l\|} \hline 1729.0 \\ {[68.07]} \end{array}$ | $\begin{aligned} & 1701.6 \\ & {[66.99]} \end{aligned}$ | - | - |
| H3 | $\begin{aligned} & 700.0 \\ & {[27.56]} \end{aligned}$ | $\begin{aligned} & 1745.0 \\ & {[68.70]} \end{aligned}$ | $\begin{gathered} 404.0 \\ {[15.91]} \end{gathered}$ | $\begin{gathered} 630.0 \\ {[24.80]} \end{gathered}$ | $\left[\begin{array}{c} 500.0 \\ {[19.69]} \end{array}\right.$ | $\begin{gathered} 630.0 \\ {[24.80]} \end{gathered}$ | $\begin{gathered} 760.0 \\ {[29.92]} \end{gathered}$ | $\begin{aligned} & 800.0 \\ & {[31.5]} \end{aligned}$ | - | $\begin{aligned} & 1729.0 \\ & {[68.07]} \end{aligned}$ | $\begin{aligned} & 1701.6 \\ & {[66.99]} \end{aligned}$ | - | - |
| Frame | H5 | D1 | D2 | D3 | D4 | D5 | D6 | S1 | S2 | S3 | Ф1 | Ф2 | Ф3 |
| H1 |  | $\begin{gathered} \hline 45.0 \\ {[1.77]} \end{gathered}$ | - | - | - | - | - | $\begin{gathered} 13.0 \\ {[0.51]} \end{gathered}$ | $\begin{gathered} \hline 26.5 \\ {[1.04]} \end{gathered}$ | $\begin{gathered} \hline 25.0 \\ {[0.98]} \end{gathered}$ | - | - | - |
| H2 |  | $\begin{array}{\|c} \hline 51.0 \\ {[2.00]} \\ \hline \end{array}$ | $\begin{gathered} 38.0 \\ {[1.50]} \end{gathered}$ | $\begin{gathered} 65.0 \\ {[2.56]} \\ \hline \end{gathered}$ | $\begin{aligned} & 204.0 \\ & {[8.03]} \end{aligned}$ | $\begin{array}{\|c\|} \hline 68.0 \\ {[2.68]} \\ \hline \end{array}$ | $\begin{aligned} & 137.0 \\ & {[5.40]} \end{aligned}$ | $\begin{gathered} 13.0 \\ {[0.51]} \end{gathered}$ | $\begin{gathered} 26.5 \\ {[1.04]} \end{gathered}$ | $\begin{array}{\|c\|} \hline 25.0 \\ {[0.98]} \\ \hline \end{array}$ | - | - | - |
| H3 |  | $\begin{gathered} 51.0 \\ {[2.00]} \end{gathered}$ | $\begin{gathered} 38.0 \\ {[1.50]} \end{gathered}$ | $\begin{gathered} 65.0 \\ {[2.56]} \end{gathered}$ | $\begin{aligned} & 204.0 \\ & {[8.03]} \end{aligned}$ | $\begin{gathered} 68.0 \\ {[2.68]} \end{gathered}$ | $\begin{aligned} & 137.0 \\ & {[5.40]} \end{aligned}$ | $\begin{gathered} 13.0 \\ {[0.51]} \end{gathered}$ | $\begin{gathered} 26.5 \\ {[1.04]} \end{gathered}$ | $\begin{gathered} 25.0 \\ {[0.98]} \end{gathered}$ | $\begin{gathered} 22.0 \\ {[0.87]} \end{gathered}$ | $\begin{gathered} \hline 34.0 \\ {[1.34]} \end{gathered}$ | $\begin{aligned} & 117.5 \\ & {[4.63]} \end{aligned}$ |

## Digital Keypad

KPC-CC01


## 02 Installation

The appearances shown in the following figures are for reference only.
Airflow direction: $\downarrow$ (Blue arrow) inflow $\longleftarrow$ (Red arrow) outflow


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


Multiple drives side-by-side installation in rows (Frame A,B,C )
Ta: Frame A~G Ta*: Frame H
For installation in rows, it is recommended installing a barrier between the drives. Adjust the size/depth of the barrier till the temperature measured at the fan's inflow side is lower than the operation temperature. Operation temperature is the defined as the temperature measured 50 mm away from the fan's inflow side. (As shown in the figure below)


Minimum mounting clearance

| Frame | $\mathrm{A}(\mathrm{mm})$ | $\mathrm{B}(\mathrm{mm})$ | $\mathrm{C}(\mathrm{mm})$ | $\mathrm{D}(\mathrm{mm})$ |
| :---: | :---: | :---: | :---: | :---: |
| $\mathrm{A} \sim \mathrm{C}$ | 60 | 30 | 10 | 0 |
| $\mathrm{D} \sim \mathrm{F}$ | 100 | 50 | - | 0 |
| G | 200 | 100 | - | 0 |
| H | 350 | 0 | 0 | $200\left(100, \mathrm{Ta}=40^{\circ} \mathrm{C}\right)$ |

Frame A VFD007CP23A-21; VFD007CP43A/4EA-21; VFD015CP23A-21; VFD015CP43A/4EA-21; VFD022CP23A-21;VFD022CP43A/4EA-21; VFD037CP23A-21; VFD037CP43A/4EA-21; VFD040C43A/4EA-21; VFD055CP23A-21; VFD055CP43A/4EA-21; VFD075CP43A/4EA-21
Frame B VFD075CP23A-21; VFD110CP23A-21; VFD110CP43A/4EA -21; VFD150CP23A-21; VFD150CP43A/4EA -21; VFD185CP43A/4EA -21
Frame C VFD185CP23A-21; VFD220CP23A-21; VFD220CP43A/4EA -21; VFD300CP23A-21; VFD300CP43A/4EA -21; VFD370CP43A/4EA -21
Frame D VFD370CP23A-00/23A-21; VFD450CP23A-00/23A-21; VFD450CP43A-00/43A-21; VFD550CP43A-00/43A-21; VFD750CP43A-00/43A-21; VFD900CP43A-00/43A-21
Frame E VFD550CP23A-00/23A-21; VFD750CP23A-00/23A-21; VFD900CP23A-00/23A-21; VFD1100CP43A-00/43A-21; VFD1320CP43A-00/43A-21;
Frame F VFD1600CP43A-00/43A-21; VFD1850CP43A-00/43A-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.


| Air flow rate for cooling |  |  |  |  |  |  | Power Dissipation |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Flow Rate (cfm) |  |  | Flow Rate ( $\mathrm{m}^{3} / \mathrm{hr}$ ) |  |  | Power Dissipation (watt) |  |  |
| Model No. | 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 |
| VFD015CP43A/4EA-21 | - | - | - | - | - | - | 44 | 31 | 75 |
| VFD022CP43A/4EA-21 | - | - | - | - | - | - | 58 | 43 | 101 |
| VFD037CP43A/4EA-21 | 14 | - | 14 | 24 | - | 24 | 92 | 60 | 152 |
| VFD040CP43A/4EA-21 | 10 | - | 10 | 17 | - | 17 | 124 | 81 | 205 |


| Air flow rate for cooling |  |  |  |  |  |  | Power Dissipation |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| VFD055CP43A/4EA-21 | 10 | - | 10 | 17 | - | 17 | 135 | ) | 23 |
| VFD075CP43A/4EA-21 | 10 | - | 10 | 17 | - | 17 | 165 | 98 | 26 |
| VFD110CP43A/4EA-21 | 40 | 14 | 54 | 68 | 24 | 92 | 275 | 164 | 439 |
| VFD150CP43A/4EA-21 | 66 | 14 | 80 | 112 | 24 | 136 | 370 | 194 | 564 |
| VFD185CP43A/4EA-21 | 58 | 14 | 73 | 99 | 24 | 124 | 459 | 192 | 651 |
| VFD220CP43A/4EA-21 | 99 | 21 | 120 | 168 | 36 | 204 | 455 | 358 | 813 |
| VFD300CP43A/4EA-21 | 99 | 21 | 120 | 168 | 36 | 204 | 609 | 363 | 972 |
| VFD370CP43A/4EA-21 | 126 | 21 | 147 | 214 | 36 | 250 | 845 | 405 | 1250 |
| VFD450CP43A-00/43A-21 | 179 | 30 | 209 | 304 | 51 | 355 | 1056 | 459 | 1515 |
| VFD550CP43A-00/43A-21 | 179 | 30 | 209 | 304 | 51 | 355 | 1163 | 669 | 1832 |
| VFD750CP43A-00/43A-21 | 179 | 30 | 209 | 304 | 51 | 355 | 1639 | 657 | 2296 |
| 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 |
| VFD1320CP43A-00/43A-21 | 223 | 73 | 296 | 379 | 124 | 503 | 2417 | 1157 | 3574 |
| VFD1600CP43A-00/43A-21 | 224 | 112 | 336 | 381 | 190 | 571 | 3269 | 1235 | 4504 |
| VFD1850CP43A-00/43A-21 | 289 | 112 | 401 | 491 | 190 | 681 | 3632 |  | 4983 |
| VFD2200CP43A-00/43A |  |  | 454 |  |  | 771 |  |  | 6358 |
| VFD2800CP43A-00/43A |  |  | 4 |  |  | 7 |  |  | 7325 |
| VFD3150CP43A-00/43C-00/4 |  |  | 769 |  |  | 1307 |  |  | 8513 |
| VFD3550CP43A-00/43C-00/43C-21 |  |  | 76 |  |  | 1307 |  |  | 9440 |
| VFD4000CP43A-00/43C-00/43C-21 |  |  | 769 |  |  | 1307 |  |  | 10642 |
| * The required airflow shown in chart is for installing single drive in a confined space. <br> ※ When installing the multiple drives, the required air volume should be the required air volume for single drive $X$ the number of the drives. <br> ※ The heat dissipation shown in the chart is for installing single drive in a confined space. <br> ※ When installing the multiple drives, volume of heat dissipation should be the heat dissipated for single drive $X$ the number of the drives. <br> Heat dissipation for each model is calculated by rated voltage, current and default carrier. |  |  |  |  |  |  |  |  |  |

## 03 Unpacking

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

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

Crate 01 (VFDXXXCPXXA-00)

Loosen the 12 cover screws to open the crate.


Crate 02 (VFDXXXCPXXA-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)


Remove the crate cover, EPEs, rubber and manual.


Loosen the 8 screws that fastened on the pallet, remove the wooden plate.


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


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


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


## Frame E

Crate 01 (VFDXXXXCPXXA-00)
Loosen the 4 screws on the iron plates. There are 4 iron plates and in total of 16 screws.


Crate 02 (VFDXXXXCPXXA-21)
Loosen the 4 screws on the iron plates. There are 4 iron plates and in total of 16 screws.



Frame F

Crate 01 (VFDXXXXCPXXA-00)
Remove the 6 clips on the side of the crate with a flat-head screwdriver. (As shown in figure below.)


Loosen the 5 screws on the pallet as shown in the following figure.


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, rubbers and manual.


Loosen the 9 screws on the pallet and remove the wooden plate.


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


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


## Frame G




Lift the drive by hooking the lifting hole. It is now readyLift 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

flathead screwdriver. (As shown in figure below.) | Crate 02 (VFDXXXXCPXXC-00) |
| :--- |
| Remove the 8 clips on the side of the crate with a |
| flathead screwdriver. (As shown in figure below.) |

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


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


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


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


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


## Frame H

Crate 03 (VFDXXXXCPXXC-21)
Use flathead screwdriver to remove the clips on the side of the crate, 8 clips in total.


Remove the crate cover, EPEs, rubber and manual.


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


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


## Secure the drive from the internal.

Loosen 18 of the M6 screws and remove the top cover as shown in figure 2. Mount the cover (figure 1) back to the drive by fasten the M6 screws to the two sides of the drive, as shown in figure 2.
Torque: 35~45kg-cm (30.38~39.061b-in.)


Figure 1
Top cover (Use M12 screws)

## Secure the drive from the external.

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

Torque: $150 \sim 180 \mathrm{~kg}-\mathrm{cm}$ (130.20~156.24lb-in.)



Figure 2

Fasten 6 of the M6 screws that were removed from last step back to the AC motor drive. As shown in figure below:


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


Frame H: Secure the drive
(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 D~H).


Figure 1


Figure 2


Figure 5

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

(Applicable to Frame H)

lifting device is within the specification, as shown in the following diagram.

(Applicable to Frame H)


Weight
VFDXXXCPXXA-00
D
$37.6 \mathrm{~kg}(82.9 \mathrm{lbs}$.
VFDXXXCPXXA-21
D $40 \mathrm{~kg}(88.2 \mathrm{lbs}$.

vFDXXXXCPXXA.00 $\mathrm{E}_{63.6 \mathrm{~kg}(140.2 \mathrm{lgs} .)}$


VFDXXXXCPXXA-00 ■ $85 \mathrm{~kg}(187.2$ Ibs.)


VFDXXXXCPXXA-00 $\quad 130 \mathrm{~kg}(286.5 \mathrm{lbs}$.$) \quad VFDXXXXCPXXA-21$


H1: VFD3150CP43A-00; VFD3550CP43A-00; VFD4000CP43A-00; 235kg (518.1lbs)


H2: VFD3150CP43C-00; VFD3550CP43C-00; VFD4000CP43C-00; 257kg (566.6lbs)


H3: VFD3150CP43C-21; VFD3550CP43C-21; VFD4000CP43C-21; 263kg (579.8lbs)


## 04 Wiring



## Wiring Diagram for Frame D



## Wiring diagram for frame $E$ and above



Figure 1

Input power terminals for frame $G$ and $H$ Provides 3-phase power

Fuse or NFB (non-fuse breaker)


It provides 12-pulse power


Figure 2
SINK (NPN) ISOURCE (PNP) Mode


Figure 3
Frame $\mathrm{E} \sim \mathrm{H}$, remove terminal $r$ and terminal s before using DC-Link. (As circled in dotted line, uninstall the gray section and properly store cable $r$ and cable $s$. Cable $r$ and cable $s$ are not available in optional accessories, do not dispose them.)


## 05 Main Circuit Terminal

Figure 01: Main Circuit Terminal of Frame A ~ C


Figure 02: Main Circuit Terminal of Frame $D$
Wiring Diagram for Frame D
3 -phase power is provided


Figure 03: Main Circuit Terminal of Frame $E$ and above

## Wiring diagram for frame $E$ and above

3-phase power is provided


| 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 <br> 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) <br> (for 230 V models: $\leqq 22 \mathrm{~kW}$, built-in brake unit) <br> (for 460 V models: $\leqq 30 \mathrm{~kW}$, built-in brake unit) <br> Common DC Bus <br> When connecting DC+ and DC-, please follow the required wired gauge in CP2000 user manual. But when connecting DC+ and DC- to brake modules, please follow VFDB Instrutcion Sheet. <br> Download VFDB Instruction Sheet Brake Modules, English version |
| B1, B2 | Connections for brake resistor (optional) |
| $\dagger$ | Earth connection, please comply with local regulations. |
|  | Main power terminals <br> च Do not connect 3-phase model to one-phase power. It is unnecessary to consider phase-sequence for these terminals R/L1, S/L2 and T/L3. <br> च It is recommended to add a magnetic contactor (MC) in the power input wiring to cut off power quickly and reduce malfunction when activating the protection function of the AC motor drive. Both ends of the MC should have an R-C surge absorber. <br> $\square \quad$ 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. <br> $\square \quad$ Please use voltage and current within the specification. <br> $\square \quad$ When using a general GFCI (Ground Fault Circuit Interrupter), select a current sensor with sensitivity of 200 mA or above and not less than 0.1 -second operation time to avoid nuisance tripping. <br> च Please use the shield wire or tube for the power wiring and ground the two ends of the shield wire or tube. <br> ■ 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 |
|  | च 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.
$\square$ DO NOT connect phase-compensation capacitors or surge absorbers at the output terminals of AC motor drives.
$\boxtimes \quad$ Use well-insulated motor, suitable for inverter operation.
Terminals for connecting DC reactor, external brake resistor, external brake resistor and DC circuit
$\boxtimes \quad$ 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.


च 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.

$\boxtimes \quad$ The external brake resistor should connect to the terminals (B1, B2) of AC motor drives.

V 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.
V 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.

## Specifications of the Main Circuit Terminals

Frame A


Frame B


Main Circuit Terminals: :
R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, © ${ }^{(1)}$ B1, B2, +1, +2,-

| Model | Max. Wire Gauge | Min. Wire Gauge | Torque( $\pm 10 \%$ ) |
| :---: | :---: | :---: | :---: |
| VFD007CP23A-21 | $\begin{aligned} & \text { 8 AWG } \\ & \left(8.4 \mathrm{~mm}^{2}\right) \end{aligned}$ | 14 AWG (2.1mm ${ }^{2}$ ) | $\begin{gathered} \mathrm{M} 4 \\ 20 \mathrm{~kg}-\mathrm{cm} \\ (17.4 \mathrm{lb}-\mathrm{in} .) \\ (1.96 \mathrm{Nm}) \end{gathered}$ |
| VFD015CP23A-21 |  | 14 AWG (2.1mm ${ }^{2}$ ) |  |
| VFD022CP23A-21 |  | 12 AWG (2.1mm ${ }^{2}$ ) |  |
| VFD037CP23A-21 |  | 10 AWG (5.3mm ${ }^{2}$ ) |  |
| VFD055CP23A-21 |  | 10 AWG (5.3mm ${ }^{2}$ ) |  |
| VFD007CP43A-21 |  | 14 AWG (2.1mm ${ }^{2}$ ) |  |
| VFD015CP43A-21 |  | 14 AWG (2.1mm ${ }^{2}$ ) |  |
| VFD022CP43A-21 |  | 14 AWG (2.1 $\mathrm{mm}^{2}$ ) |  |
| VFD037CP43A-21 |  | 14 AWG (2.1 $\mathrm{mm}^{2}$ ) |  |
| VFD040CP43A-21 |  | 12 AWG (3.3mm ${ }^{2}$ ) |  |
| VFD055CP43A-21 |  | 10 AWG (2.1 $\mathrm{mm}^{2}$ ) |  |
| VFD075CP43A-21 |  | 10 AWG (2.1mm ${ }^{2}$ ) |  |
| VFD007CP4EA-21 |  | 14 AWG (2.1mm ${ }^{2}$ ) |  |
| VFD015CP4EA-21 |  | 14 AWG (2.1mm ${ }^{2}$ ) |  |
| VFD022CP4EA-21 |  | 14 AWG (2.1 $\mathrm{mm}^{2}$ ) |  |
| VFD037CP4EA-21 |  | 14 AWG (2.1mm ${ }^{2}$ ) |  |
| VFD040CP4EA-21 |  | 12 AWG (3.3mm ${ }^{2}$ ) |  |
| VFD055CP4EA-21 |  | 10 AWG (2.1mm ${ }^{2}$ ) |  |
| VFD075CP4EA-21 |  | 10 AWG (2.1mm ${ }^{2}$ ) |  |
| UL installations must use $600 \mathrm{~V}, 75^{\circ} \mathrm{C}$ or $90^{\circ} \mathrm{C}$ wire. Use copper wire only. |  |  |  |

Main Circuit Terminals:
R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, © , B1, B2, +1, +2,-

| Model | Max. Wire <br> Gauge | Min. Wire Gauge | Torque $\pm 10 \%$ ) |
| :---: | :---: | :---: | :---: |
| VFD075CP23A-21 | $\begin{gathered} 4 \mathrm{AWG} \\ \left(21.2 \mathrm{~mm}^{2}\right) \end{gathered}$ | 8 AWG (8.4mm ${ }^{2}$ ) | $\begin{gathered} \text { M5 } \\ 35 \mathrm{~kg}-\mathrm{cm} \\ (30.4 \mathrm{lb}-\mathrm{in} .) \\ (3.434 \mathrm{Nm}) \end{gathered}$ |
| VFD110CP23A-21 |  | 6 AWG (13.3mm ${ }^{2}$ ) |  |
| VFD150CP23A-21 |  | 4 AWG (21.2mm ${ }^{2}$ ) |  |
| VFD110CP43A-21 |  | 8 AWG (8.4mm ${ }^{2}$ ) |  |
| VFD150CP43A-21 |  | 8 AWG (8.4mm ${ }^{2}$ ) |  |
| VFD185CP43A-21 |  | 6 AWG (13.3 $\mathrm{mm}^{2}$ ) |  |
| VFD110CP4EA-21 |  | 8 AWG (8.4mm ${ }^{2}$ ) |  |
| VFD150CP4EA-21 |  | 8 AWG (8.4mm ${ }^{2}$ ) |  |
| VFD185CP4EA-21 |  | 6 AWG (13.3mm ${ }^{2}$ ) |  |

UL installations must use $600 \mathrm{~V}, 75^{\circ} \mathrm{C}$ or $90^{\circ} \mathrm{C}$ wire. Use copper wire only.

## D, NOTE

Terminal D+ [+2 \& +1]: Torque: $45 \mathrm{~kg}-\mathrm{cm}[39.0 \mathrm{lb}-\mathrm{in}$.$] (4.415Nm) ( \pm 10 \%$ )
VFD150CP23A-21 must use $600 \mathrm{~V}, 90^{\circ} \mathrm{C}$ wire when surrounding temperature exceeds $45^{\circ} \mathrm{C}$.

Frame C


Frame D


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

| Model | Max. Wire <br> Gauge | Min. Wire Gauge | Torque( $\pm 10 \%$ ) |
| :---: | :---: | :---: | :---: |
| VFD185CP23A -21 | 1/0 AWG <br> ( $53.5 \mathrm{~mm}^{2}$ ) | 1 AWG (42.4mm ${ }^{2}$ ) | $\begin{gathered} \text { M8 } \\ 80 \mathrm{~kg}-\mathrm{cm} \\ (69.4 \mathrm{lb}-\mathrm{in} .) \\ (7.85 \mathrm{Nm}) \end{gathered}$ |
| VFD220CP23A-21 |  | 1/0 AWG ( $53.5 \mathrm{~mm}^{2}$ ) |  |
| VFD300CP23A-21 |  | 1/0 AWG ( $53.5 \mathrm{~mm}^{2}$ ) |  |
| VFD220CP43A-21 |  | 4 AWG ( $21.2 \mathrm{~mm}^{2}$ ) |  |
| VFD300CP43A-21 |  | 3 AWG ( $26.7 \mathrm{~mm}^{2}$ ) |  |
| VFD370CP43A-21 |  | 2 AWG ( $33.6 \mathrm{~mm}^{2}$ ) |  |
| VFD220CP4EA-21 |  | 4 AWG ( $21.2 \mathrm{~mm}^{2}$ ) |  |
| VFD300CP4EA-21 |  | 3 AWG (26.7mm ${ }^{\text {2 }}$ ) |  |
| VFD370CP4EA-21 |  | 2 AWG (33.6mm ${ }^{\text {) }}$ |  |

UL installations must use $600 \mathrm{~V}, 75^{\circ} \mathrm{C}$ or $90^{\circ} \mathrm{C}$ wire. Use copper wire only.

## NOTE

Terminal D+ [+2 \& +1]: Torque: 90 kg-cm [78.2lb-in.] (8.83Nm) ( $\pm 10 \%$ )
VFD300CP23A-21 must use $600 \mathrm{~V}, 90^{\circ} \mathrm{C}$ wire when surrounding temperature exceeds
$45^{\circ} \mathrm{C}$
Main Circuit Terminals:
R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, ${ }^{-( },+1 / D C+,-/ D C-$

| Model | Max. Wire Gauge | Min. Wire Gauge | Torque $( \pm 10 \%)$ |
| :---: | :---: | :---: | :---: |
| VFD370CP23A-00 | $\begin{gathered} 300 \mathrm{MCM} \\ \left(152 \mathrm{~mm}^{2}\right) \end{gathered}$ | 4/0 AWG (107mm ${ }^{2}$ ) | $\begin{gathered} \text { M8 } \\ 80 \mathrm{~kg}-\mathrm{cm} \\ (173 \mathrm{lb}-\mathrm{in} .) \\ (19.62 \mathrm{Nm}) \end{gathered}$ |
| VFD450CP23A-00 |  | 300MCM ( $152 \mathrm{~mm}^{2}$ ) |  |
| VFD450CP43A-00 |  | 1/0 AWG ( $53.5 \mathrm{~mm}^{2}$ ) |  |
| VFD550CP43A-00 |  | 2/0 AWG ( $67.4 \mathrm{~mm}^{2}$ ) |  |
| VFD750CP43A-00 |  | 3/0AWG (85mm ${ }^{\text {2 }}$ ) |  |
| VFD900CP43A-00 |  | $300 \mathrm{MCM}\left(152 \mathrm{~mm}^{2}\right)$ |  |
| VFD370CP23A-21 |  | 4/0AWG(107mm ${ }^{\text {2 }}$ ) |  |
| VFD450CP23A-21 |  | 4/0 AWG (107mm ${ }^{2}$ ) |  |
| VFD450CP43A-21 | 4/0 AWG | 1/0 AWG ( $53.5 \mathrm{~mm}^{2}$ ) |  |
| VFD550CP43A-21 | (107mm ${ }^{\text {2 }}$ ) | 2/0 AWG (67.4mm ${ }^{2}$ ) |  |
| VFD750CP43A-21 |  | 3/0 AWG ( $85 \mathrm{~mm}^{2}$ ) |  |
| VFD900CP43A-21 |  | 4/0 AWG ( $107 \mathrm{~mm}^{2}$ ) |  |

1. UL installations must use $600 \mathrm{~V}, 75^{\circ} \mathrm{C}$ or $90^{\circ} \mathrm{C}$ wires. Use copper wire only. VFD450CP23A-21 and VFD900CP43A-21 must use $90^{\circ} \mathrm{C}$ wire
2. Figure 1 shows the terminal specification.
3. Figure 2 shows the specifications of insulated heat shrink tubing that comply with UL (600C, YDPU2).
4. Specification of grounding wire $\Theta$ : It needs to be at least as the same size as the Min. Wire Gauge listed above.

Figure 1


Figure 2
Ring lug


Heat Shrink Tube

WIRE

Frame E


Main Circuit Terminals:
R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, $\left.{ }^{( }\right),+1 / D C+,-/ D C-$

| Model | Max. Wire Gauge | Min. Wire Gauge | Torque( $\pm 10 \%$ ) |
| :---: | :---: | :---: | :---: |
| VFD550CP23A-00 | $\begin{gathered} 300 \mathrm{MCM}^{2} * 2 \\ \left(152 \mathrm{~mm}^{2} 2\right) \end{gathered}$ | $\begin{gathered} \text { 2/0AWG*2 } \\ \left(67.4 \mathrm{~mm}^{2} * 2\right) \end{gathered}$ | $\begin{gathered} \text { M8 } \\ 200 \mathrm{~kg}-\mathrm{cm} \\ (173 \mathrm{lb}-\mathrm{in} .) \\ (19.62 \mathrm{Nm}) \end{gathered}$ |
| VFD750CP23A-00 |  | $\begin{aligned} & 3 / 0 A W G * 2 \\ & \left(85 \mathrm{~mm}^{2} * 2\right) \end{aligned}$ |  |
| VFD900CP23A-00 |  | $\begin{gathered} 4 / 0 \mathrm{AWG} * 2 \\ \left(107 \mathrm{~mm}^{2} * 2\right) \end{gathered}$ |  |
| VFD1100CP43A-00 |  | $\begin{gathered} 2 / 0 \mathrm{AWG}^{* 2} \\ \left(67.4 \mathrm{~mm}^{2} * 2\right) \end{gathered}$ |  |
| VFD1320CP43A-00 |  | $\begin{gathered} \text { 2/0AWG*2 } \\ \left(67.4 \mathrm{~mm}^{2} * 2\right) \end{gathered}$ |  |
| VFD550CP23A-21 | $\begin{gathered} 4 / 0 \mathrm{AWG} * 2 \\ \left(107 \mathrm{~mm}^{2} * 2\right) \end{gathered}$ | $\begin{gathered} 2 / 0 \mathrm{AWG} * 2 \\ \left(67.4 \mathrm{~mm}^{2} * 2\right) \end{gathered}$ |  |
| VFD750CP23A-21 |  | $\begin{aligned} & 3 / 0 A W G * 2 \\ & \left(85 \mathrm{~mm}^{2 *} 2\right) \end{aligned}$ |  |
| VFD900CP23A-21 |  | $\begin{aligned} & \text { 4/0 AWG*2 } \\ & \left(107 \mathrm{~mm}^{2 *} 2\right) \end{aligned}$ |  |
| VFD1100CP43A-21 |  | $\begin{gathered} 2 / 0 \mathrm{AWG}^{*} 2 \\ \left(67.4 \mathrm{~mm}^{2} * 2\right) \end{gathered}$ |  |
| VFD1320CP43A-21 |  | $\begin{gathered} 2 / 0 \mathrm{AWG}^{*} 2 \\ \left(67.4 \mathrm{~mm}^{2} * 2\right) \end{gathered}$ |  |

1. UL installations must use $600 \mathrm{~V}, 75^{\circ} \mathrm{C}$ or $90^{\circ} \mathrm{C}$ wires. Use copper wire only.
2. Figure 01 shows the specification for ring lug.
3. Specification of grounding wire $\ddagger$ : It needs to be at least as the same size as the Min. Wire Gauge listed above. Torque: M8 200kg-cm ( 173 lb -in.) ( 19.62 Nm ) ( $\pm 10 \%$ ), as shown in Figure 02.
4. Figure 03 shows the specifications of insulated heat shrink tubing that comply with UL (600C, YDPU2).

Figure01


Figure02


Figure03


## Frame F



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

| Model | Max. Wire <br> Gauge | Min. Wire Gauge | Torque( $\pm 10 \%$ ) |
| :---: | :---: | :---: | :---: |
| VFD1600CP43A-00 | $\begin{aligned} & 300 \mathrm{MCM}^{2} * 2 \\ & \left(152 \mathrm{~mm}^{2} 2\right) \end{aligned}$ | $\begin{gathered} 4 / 0 \mathrm{AWG}^{*} 2 \\ \left(107 \mathrm{~mm}^{2} \times 2\right) \end{gathered}$ | $\begin{gathered} \text { M8 } \\ 200 \mathrm{~kg}-\mathrm{cm} \\ (173 \mathrm{lb}-\mathrm{in} .) \\ (19.62 \mathrm{Nm}) \end{gathered}$ |
| VFD1850CP43A-00 |  | $300 \mathrm{MCM} * 2\left(152 \mathrm{~mm}^{2}\right)$ |  |
| VFD1600CP43A-21 |  | 4/OAWG*2 (107mm ${ }^{2}$ 2) |  |
| VFD1850CP43A-21 | $\begin{aligned} & 4 / 0 \mathrm{AWG} * 2 \\ & \left(107 \mathrm{~mm}^{2} \star 2\right) \end{aligned}$ | 4/OAWG*2 (107 $\left.\mathrm{mm}^{2} * 4\right)$ |  |

1. VFD1850CP43A-21 installations must use $90^{\circ} \mathrm{C}$ wire.
2. For other model, UL installations must use $600 \mathrm{~V}, 75^{\circ} \mathrm{C}$ or $90^{\circ} \mathrm{C}$ wire. Use copper wire only.
3. Specification of grounding wire $\stackrel{\xi}{\xi}$ : It needs to be at least as the same size as the Min. Wire Gauge listed above.
Torque: M8 200kg-cm (173 lb-in.) (19.62Nm) ( $\pm 10 \%$ )
4 Figure 1 shows the specification for ring lug.
5 Figure 2 shows the specifications of insulated heat shrink tubing that comply with UL (600C, YDPU2).

Figure01


Figure02


## Frame G



Main Circuit Terminals:
R/L11, R/L12, S/L2, S/L22, T/L31, T/L32

| Model | Max. Wire Gauge | Min. Wire Gauge | Torque( $\pm 10 \%$ ) |
| :---: | :---: | :---: | :---: |
| VFD2200CP43A-00 | $\begin{gathered} \hline 300 \mathrm{MCM}^{*} 4 \\ \left(152 \mathrm{~mm}^{2} * 4\right) \end{gathered}$ | $\begin{gathered} \hline \text { 2/0AWG*4 } \\ \left(67.4 \mathrm{~mm}^{2} * 4\right) \end{gathered}$ | M8$200 \mathrm{~kg}-\mathrm{cm}$$(173 \mathrm{lb}-\mathrm{in}$.$(19.62 \mathrm{Nm})$ |
| VFD2800CP43A-00 |  | $\begin{aligned} & 3 / 0 \mathrm{AWG} * 4 \\ & \left(85 \mathrm{~mm}^{2 *} 4\right) \end{aligned}$ |  |
| VFD2200CP43A-21 | $\begin{gathered} \hline 300 \mathrm{MCM}{ }^{\star 4} \\ \left(152 \mathrm{~mm}^{2} * 4\right) \end{gathered}$ | $\begin{gathered} \text { 2/0AWG*4 } \\ \left(67.4 \mathrm{~mm}^{2 *} \times 4\right) \\ \hline \end{gathered}$ |  |
| VFD2800CP43A-21 |  | $\begin{aligned} & 3 / 0 \mathrm{AWG} * 4 \\ & \left(85 \mathrm{~mm}^{2 *} 4\right) \end{aligned}$ |  |

Main Circuit Terminals:
U/T1, V/T2, W/T3, +1/DC+, -/DC-

| Model | Max. Wire Gauge | Min. Wire Gauge | Torque( $\pm 10 \%$ ) |
| :---: | :---: | :---: | :---: |
| VFD2200CP43A-00 | $\begin{aligned} & \hline 500 \mathrm{MCM} * 2 \\ & \left(253 \mathrm{~mm}^{2} * 2\right) \end{aligned}$ | $\begin{aligned} & 400 \mathrm{M} \mathrm{CM} * 2 \\ & \left(203 \mathrm{~mm}^{2} * 2\right) \end{aligned}$ | $\begin{gathered} \mathrm{M} 12 \\ 408 \mathrm{~kg}-\mathrm{cm} \\ (354 \mathrm{lb}-\mathrm{in} .) \\ (40 \mathrm{Nm}) \end{gathered}$ |
| VFD2800CP43A-00 |  | $\begin{aligned} & 500 \mathrm{MCM} * 2 \\ & \left(253 \mathrm{~mm}^{2} * 2\right) \end{aligned}$ |  |
| VFD2200CP43A-21 | $\begin{aligned} & \hline 500 \mathrm{MCM} * 2 \\ & \left(253 \mathrm{~mm}^{2} * 2\right) \end{aligned}$ | $\begin{aligned} & 400 \mathrm{MCM} * 2 \\ & \left(203 \mathrm{~mm}^{2} * 2\right) \\ & \hline \end{aligned}$ |  |
| VFD2800CP43A-21 |  | $\begin{gathered} 500 \mathrm{MCM} * 2 \\ \left(253 \mathrm{~mm}^{2 *} \times 2\right) \end{gathered}$ |  |

1. UL installations must use $600 \mathrm{~V}, 75^{\circ} \mathrm{C}$ or $90^{\circ} \mathrm{C}$ wire. Use copper wire only.
2. Figure 1 and Figure 2 show the specification for using ring lug.
3. Specification for grounding wire $\fallingdotseq$ : It needs to be at least as the same size as the Min. Wire Gauge listed above. Torque: M8 $200 \mathrm{~kg}-\mathrm{cm}(173 \mathrm{lb}-\mathrm{in}).(19.62 \mathrm{Nm})( \pm 10 \%)$, 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).

Figure01
Figure02
R/L11, R/L12, S/L2, S/L22, T/L31, U/T1, V/T2, W/T3, +1/DC+, -/DCT/L32,



Figure03


Figure04


Frame H


Main circuit terminals:

| Model | Max. Wire Gauge | Min. Wire Gauge | Torque( $\pm 10 \%$ ) |
| :---: | :---: | :---: | :---: |
| VFD3150CP43A-00 | $\begin{aligned} & 300 \mathrm{MCM} * 4 \\ & \left(152 \mathrm{~mm}^{2} * 4\right) \end{aligned}$ | $\begin{gathered} 4 / 0 \mathrm{AWG} * 4 \\ \left(107 \mathrm{~mm}^{2 *} * 4\right) \end{gathered}$ | $\begin{gathered} \text { M8 } \\ 200 \mathrm{~kg}-\mathrm{cm} \\ (173 \mathrm{lb}-\mathrm{in} .) \\ (19.62 \mathrm{Nm}) \end{gathered}$ |
| VFD3550CP43A-00 |  | $\begin{aligned} & 250 \mathrm{MCM} * 4 \\ & \left(127 \mathrm{~mm}^{2} * 4\right) \end{aligned}$ |  |
| VFD4000CP43A-00 |  | $\begin{aligned} & 300 \mathrm{MCM} * 4 \\ & \left(152 \mathrm{~mm}^{2 *} * 4\right) \end{aligned}$ |  |
| VFD4000CP43C-00 |  | $\begin{aligned} & 300 \mathrm{MCM} * 4 \\ & \left(152 \mathrm{~mm}^{2} * 4\right) \end{aligned}$ |  |
| VFD3150CP43C-00 |  | $\begin{gathered} 4 / 0 \mathrm{AWG} * 4 \\ \left(107 \mathrm{~mm}^{2 *} \times 4\right) \end{gathered}$ |  |
| VFD3550CP43C-00 |  | $\begin{gathered} 250 \mathrm{MCM} * 4 \\ \left(127 \mathrm{~mm}^{2} * 4\right) \\ \hline \end{gathered}$ |  |
| VFD3150CP43C-21 | $\begin{aligned} & \hline 300 \mathrm{MCM} * 4 \\ & \left(152 \mathrm{~mm}^{2} * 4\right. \end{aligned}$ | 4/0 AWG*4 (107mm ${ }^{2 * 4 \text { ) }}$ |  |
| VFD3550CP43C-21 |  | $250 \mathrm{MCM} * 4\left(127 \mathrm{~mm}^{2 * 4}\right)$ |  |
| VFD4000CP43C-21 |  | $300 \mathrm{MCM} * 4\left(152 \mathrm{~mm}^{2 *} 4\right)$ |  |

1. UL installations must use $600 \mathrm{~V}, 75^{\circ} \mathrm{C}$ or $90^{\circ} \mathrm{C}$ wire. Use copper wire only.
2. Figure 1 shows the specification for using the ring lug.
3. Specification of grounding wire $\Theta: 300 M C M^{*} 4$ [152 $\left.\mathrm{mm}^{2 *} 4\right]$, Torque: M8 $180 \mathrm{~kg}-\mathrm{cm}$ ( $156 \mathrm{lb}-\mathrm{in}$. ) ( 17.64 Nm ) ( $\pm 10 \%$ ), as shown in figure 1.
4. Figure 2 shows the specifications of heat shrink tubing that comply with UL (600C, YDPU2).

Figure01


Figure02


## 06 Control Circuit Terminal

For multi-function input and output terminal, remove the top cover before wiring
The figures shown in the diagram below are for reference only.
Remove the cover for wiring. Frame A~H

## Frame A\&B

Loosen the screws and press the tabs on both sides to remove the cover.
Screw torque: $12 \sim 15 \mathrm{Kg}-\mathrm{cm}$ [10.4~13lb-in.]


## Frame C\&D

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


## Frame E

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


## Frame F

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


## Frame G

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


## Frame H

Screw torque: $14 \sim 16 \mathrm{Kg}-\mathrm{cm}$ [12.15~13.89lb-in.] Slightly lift the cover then pull outward for removal.



## Removable Terminal Block

## Control Terminal Specifications

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

## Wiring precautions:

- Reserves 5 mm 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 3.5 mm , tip thickness 0.6 mm
- In the figure above, the factory setting for S1-SCM is short circuit. The factory setting for $+24 \mathrm{~V}-\mathrm{COM}$ 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 $\pm 5 \% 200 \mathrm{~mA}$ |
| COM | Digital control signal common <br> (Sink) | Common for multi-function input terminals |
| FWD | Forward-Stop command | FWD-DCM: <br> $\mathrm{ON} \rightarrow$ forward running <br> $\mathrm{OFF} \rightarrow$ deceleration to stop |
| REV | Reverse-Stop command | REV-DCM: <br> $\mathrm{ON} \rightarrow$ reverse running <br> $\mathrm{OFF} \rightarrow$ deceleration to stop |
| $\begin{aligned} & \text { MI1 } \\ & \underset{\sim}{\text { MI8 }} \end{aligned}$ | Multi-function input 1~8 | Refer to parameters 02-01~02-08 to program the multi-function inputs MI1~MI8. <br> ON : the activation current is $6.5 \mathrm{~mA} \geqq 11 \mathrm{Vdc}$ OFF: leakage current tolerance is $10 \mu \mathrm{~A} \leqq 11 \mathrm{Vdc}$ |
| DCM | Digital frequency signal common |  |
| RA1 | Multi-function relay output 1 (N.O.) a | Resistive Load: <br> 5A(N.O.)/3A(N.C.) 250VAC |
| RB1 | Multi-function relay output 1 (N.C.) b |  |

\begin{tabular}{|c|c|c|}
\hline RC1 \& Multi-function relay common (Relay) \& \begin{tabular}{l}
Inductive Load (COS 0.4): \\
2.0A(N.O.)/1.2A(N.C.) 250VAC
\end{tabular} \\
\hline RA2 \& Multi-function relay output 2 (N.O.) a \& 2.0A(N.O.)/1.2A(N.C.) 30VDC \\
\hline RC2 \& Multi-function relay common (Relay) \& \multirow[t]{3}{*}{It is used to output each monitor signal, such as drive is in operation, frequency attained or overload indication.} \\
\hline RA3 \& Multi-function relay output 3 (N.O.) a \& \\
\hline RC3 \& Multi-function relay common (Relay) \& \\
\hline \(+10 \mathrm{~V}\) \& Potentiometer power supply \& Analog frequency setting: +10Vdc 20mA \\
\hline \[
\begin{aligned}
\& \text { AVI1 } \\
\& (\mathrm{AVI})
\end{aligned}
\] \& Analog voltage input \& \begin{tabular}{l}
Impedance: \(20 \mathrm{k} \Omega\) \\
Range: \(0 \sim 20 \mathrm{~mA} / 0 \sim 10 \mathrm{~V}=0 \sim\) Max. Output Frequency (Pr.01-00) \\
AVI switch, factory setting is \(0 \sim 10 \mathrm{~V}\)
\end{tabular} \\
\hline ACI \& Analog current input \& \begin{tabular}{l}
Impedance: \(250 \Omega\) \\
Range: \(0 \sim 20 \mathrm{~mA} / 0 \sim 10 \mathrm{~V}=0 \sim\) Max. Output Frequency (Pr.01-00) \\
ACI Switch, factory setting is \(0 \sim 20 \mathrm{~mA}\)
\end{tabular} \\
\hline \[
\begin{aligned}
\& \text { AVI2 } \\
\& \text { (AUI) }
\end{aligned}
\] \& \begin{tabular}{l}
Auxiliary analog voltage input \\
internal circuit
\end{tabular} \& \begin{tabular}{l}
Impedance: \(20 \mathrm{k} \Omega\) \\
Range: \(0 \sim+10 V D C=0 \sim\) Max. Output Frequency
(Pr.01-00)
\end{tabular} \\
\hline AFM1

AFM2 \&  \& | Impedance: $100 \Omega$ (current output) |
| :--- |
| Output current: 20mA max |
| Resolution: 0~10V corresponds to Max. operation frequency |
| Range: $0 \sim 10 \mathrm{~V} \rightarrow 0 \sim 20 \mathrm{~mA}$ |
| AFM Switch: factory setting is $0 \sim 10 \mathrm{~V}$ | <br>

\hline ACM \& Analog Signal Common \& Common for analog terminals <br>

\hline S1 \& \multicolumn{2}{|l|}{\multirow[t]{2}{*}{| Factory setting: short-circuit |
| :--- |
| Power removal safety function for emergency stop. |}} <br>

\hline SCM \& \& <br>
\hline SG+ \& \multicolumn{2}{|l|}{Modbus RS-485} <br>

\hline SG- \& PIN 1,2,7,8 : Reserved PIN 4: SG- \& $$
\begin{aligned}
& \text { 6: GND } \\
& \text { SG+ }
\end{aligned}
$$ <br>

\hline
\end{tabular}

[^3]
## Analog input terminals (AVI 1, ACI, AVI 2, ACM)

$\boxtimes \quad$ Analog input signals are easily affected by external noise. Use shielded wiring and keep it as short as possible ( less than 20 meters ( 65.6168 feet) ) with proper grounding. If the noise is inductive, connecting the shield to terminal ACM can bring improvement.
$\square$ This way of using contacts in a circuit should be able to process weak signals at the bifurcated contacts. Besides, don't use contacts to control the terminal ACM.
$\checkmark \quad$ 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.


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

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

## 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 $6 \sim 8 \mathrm{~cm}$ (as 1 in the figure) then lift the control board upward (as 2 in the figure).


## 07 Optional Components

The components listed in this chapter are optional (not built-in) and available upon request. Installing additional components to your drive would substantially improve its performance. Please select applicable components according to your need or contact the local distributor for suggestions.

List of Optional Components:
> All Brake Resistors and Brake Units Used in AC Motor Drives
> Non-fuse Circuit Breaker

- Fuse (Specification Chart)
> AC Reactor (Choke)
. Zero Phase Reactor (Choke)
> DC Reactor (Choke)
- EMI filter
> Digital Keypad
> Panel Mounting Kit
> Conduit Box Kit
> Fan Kit
> Flange Mounting Kit
> IFD6530: USB/RS-485 Communication Interface


## All Brake Resistors and Brake Units Used in AC Motor Drives

230V

| $\begin{array}{r} \mathrm{Appl} \\ \mathrm{M} \end{array}$ | cable <br> to | $*^{1} 125 \%$ Braking Torque $10 \% \mathrm{ED}$ |  |  |  |  |  | *2 Max. Braking Torque |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| HP | kW | Braking Torque (kg-m) | Brake Unit <br> ${ }^{4} \mathrm{VFDB}$ | *3Braking Resist for each Brak | or series <br> Unit | Resistor value spec. for each AC motor Drive | Total Braking Current (A)) | Min. <br> Resistor <br> Value ( $\Omega$ | Max. Total Braking Current (A) | Peak <br> Power <br> (kW) |
| 1 | 0.7 | 0.5 | - | BR080W200 |  | 80W200ת | 1.9 | 63.3 | 6 | 2.3 |
| 2 | 1.5 | 1.0 | - | BR200W091 |  |  | 4.2 | 47.5 | 8 | 3.0 |
| 3 | 2.2 | 1.5 | - | BR300W070 |  | 300W70 | 5.4 | 38.0 | 10 | 3.8 |
| 5 | 3.7 | 2.5 | - | BR400W040 |  | 400W40 ${ }^{\text {a }}$ | 9.5 | 19.0 | 20 | 7.6 |
| 7.5 | 5.5 | 3.7 | - | BR1K0W020 |  | 1000W20 | 19 | 14.6 | 26 | 9.9 |
| 10 | 7.5 | 5.1 | - | BR1K0W020 |  | $1000 \mathrm{~W} 20 \Omega$ | 19 | 14.6 | 26 | 9.9 |
| 15 | 11 | 7.5 | - | BR1K5W013 |  | 1500W138 | 29 | 13.6 | 28 | 10.6 |
| 20 | 15 | 10.2 | - | BR1K0W4P3*2 | 2 series | 2000W8.6s | 44 | 8.3 | 46 | 17.5 |
| 25 | 18 | 12.2 | - | BR1K0W4P3*2 | 2 series | 2000W8.6 | 44 | 8.3 | 46 | 17.5 |
| 30 | 22 | 14.9 | - | BR1K5W3P3*2 | 2 series | 3000W6.6 | 58 | 5.8 | 66 | 25.1 |
| 40 | 30 | 20.3 | 2015*2 | BR1K0W5P1*2 | 2 series | 4000W5.1 $\Omega$ | 75 | 4.8 | 80 | 30.4 |
| 50 | 37 | 25.1 | 2022*2 | BR1K2W3P9*2 | 2 series | 4800W3.9 | 97 | 3.2 | 120 | 45.6 |
| 60 | 45 | 30.5 | 2022*2 | BR1K5W3P3*2 | 2 series | 6000W3.38 | 118 | 3.2 | 120 | 45.6 |
| 75 | 55 | 37.2 | 2022*3 | BR1K2W3P9*2 | 2 series | 7200W2.6 | 145 | 2.1 | 180 | 68.4 |
| 100 | 75 | 50.8 | 2022*4 | BR1K2W3P9*2 | 2 series | $9600 \mathrm{~W} 2 \Omega$ | 190 | 1.6 | 240 | 91.2 |
| 125 | 90 | 60.9 | 2022*4 | BR1K5W3P3*2 | 2 series | 12000W1.65 | 230 | 1.6 | 240 | 91.2 |

460 V

| $\begin{array}{r} \text { Appl } \\ \text { Mo } \end{array}$ | cable ors | *1 ${ }^{1} 125 \%$ Braking Torque $10 \%$ ED |  |  |  |  |  | *2 Max. Braking Torque |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| HP | kW | Braking Torque (kg-m) | Brake <br> Unit <br> VFDB $*^{4}$ | ${ }^{* 3}$ Braking Resistor series for each Brake Unit |  | Resistor value spec. for each AC motor Drive | Total Braking Current (A) | Min. <br> Resistor <br> Value ( $\Omega$ ) | Max. Total Braking Current (A) | Peak Power (kW) |
| 1 | 0.7 | 0.5 | - | BR080W | ** | 80W750 2 | , | 190.0 | 4 | 3.0 |
| 2 | 1.5 | 1.0 | - | BR200W | ** | 200W360 | 2.1 | 126.7 | 6 | 4.6 |
| 3 | 2.2 | 1.5 | - | BR300W | * 1 | 300W250』 | 3 | 108.6 | 7 | 5.3 |
| 5 | 3.7 | 2.5 | - | BR400W | 0*1 | $400 \mathrm{~W} 150 \Omega$ | 5.1 | 84.4 | 9 | 6.8 |
| 5 7.5 | 4.0 <br> 5.5 | 2.7 3.7 | - | BR1K0W | 5*1 | 1000W75 | 10.2 | 54.3 | 14 | 10.6 |
| 10 | 7.5 | 5.1 | - | BR1K0W | 5*1 | 1000W75 | 10.2 | 47.5 | 16 | 12.2 |
| 15 | 11 | 7.5 | - | BR1K5W | 3*1 | $1500 \mathrm{~W} 43 \Omega$ | 17.6 | 42.2 | 18 | 13.7 |
| 20 | 15 | 10.2 | - | BR1K0W016*2 | 2 series | 2000W32 2 | 24 | 26.2 | 29 | 22.0 |
| 25 | 18 | 12.2 | - | BR1K0W016*2 | 2 series | 2000W32 $\Omega$ | 24 | 23.0 | 33 | 25.1 |
| 30 | 22 | 14.9 | - | BR1K5W013*2 | 2 series | 3000W26 | 29 | 23.0 | 33 | 25.1 |
| 40 | 30 | 20.3 | - | BR1K0W016*4 | 2 parallel, | 4000W16 ${ }^{\text {a }}$ | 47.5 | 14.1 | 54 | 41.0 |
| 50 | 40 | 25.1 | 4045*1 | BR1K2W015*4 | 2 parallel, 2 series | 4800W15 ${ }^{\text {a }}$ | 50 | 12.7 | 60 | 45.6 |
| 60 | 45 | 30.5 | 4045*1 | BR1K5W013*4 | 2 parallel, 2 series | 6000W13 | 59 | 12.7 | 60 | 45.6 |
| 75 | 55 | 37.2 | 4030*2 | BR1K2W015*4 | 4 parallel | 7200W10 | 76 | 9.5 | 80 | 60.8 |
| 100 | 75 | 50.8 | 4045*2 | BR1K2W015*8 | 2 parallel, 2 series | 9600W7.5 | 100 | 6.3 | 120 | 91.2 |
| 125 | 90 | 60.9 | 4045*2 | BR1K5W013*8 | 2 parallel, 2 series | 12000W6.5 ${ }^{\text {a }}$ | 117 | 6.3 | 120 | 91.2 |
| 150 | 110 | 74.5 | 4110*1 | BR1K2W015*10 | 5 parallel, 2 series | 12000W6 ${ }^{\text {a }}$ | 126 | 6.0 | 126 | 95.8 |
| 175 | 132 | 89.4 | 4160*1 | BR1K5W012*12 | $\begin{aligned} & 6 \text { parallel, } \\ & 2 \text { series } \end{aligned}$ | $18000 \mathrm{~W} 4 \Omega$ | 190 | 4.0 | 190 | 144.4 |
|  |  |  |  |  |  |  |  |  |  |  |


| 460 V |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ApplicableMotors |  | ${ }^{1} 125 \%$ Braking Torque $10 \% \mathrm{ED}$ |  |  |  |  |  | *2 Max. Braking Torque |  |  |
| HP | kW | Braking Torque (kg-m) | Brake Unit | ${ }^{*}{ }^{3}$ Braking Resis each Brak | or series for Unit | Resistor value spec. for each AC motor Drive | Total Braking Current (A) | $\begin{array}{\|c\|} \hline \text { Min. } \\ \text { Resistor } \\ \text { Value } \\ (\Omega) \\ \hline \end{array}$ | Max. Total Braking Current (A) | Peak Power (kW) |
| 215 | 160 | 108.3 | 4160*1 | BR1K5W012*12 | 6 parallel, 2 series | $18000 \mathrm{~W} 4 \Omega$ | 190 | 4.0 | 190 | 144.4 |
| 250 | 185 | 125.3 | 4185*1 | BR1K5W012*14 | 7 parallel, 2 series | 21000W3.4 | 225 | 3.4 | 225 | 172.1 |
| 300 | 220 | 148.9 | 4110*2 | BR1K2W015*10 | 5 parallel, 2 series | 24000W3 3 | 252 | 3.0 | 252 | 190.5 |
| 375 | 280 | 189.6 | 4160*2 | BR1K5W012*12 | $\begin{aligned} & 6 \text { parallel, } \\ & 2 \text { series } \end{aligned}$ | 36000W2 2 | 380 | 2.0 | 380 | 288.8 |
| 425 | 315 | 213.3 | 4160*2 | BR1K5W012*12 | 6 parallel, 2 series | 36000W2 2 | 380 | 2.0 | 380 | 288.8 |
| 475 | 355 | 240.3 | 4185*2 | BR1K5W012*14 | 7 parallel, 2 series | 42000W1.7 ${ }^{\text {a }}$ | 450 | 1.7 | 450 | 344.2 |

$*^{1} \quad$ Calculation for $125 \%$ braking torque: $(\mathrm{kw})^{*} 125 \% * 0.8$; where 0.8 is motor efficiency.
Because there is a resistor limit of power consumption, the longest operation time for $10 \% \mathrm{ED}$ is 10 sec (on: $10 \mathrm{sec} / \mathrm{off}$ : 90 sec ).
*2 $^{2}$ Please refer to the Brake Performance Curve for "Operation Duration \& ED" vs. "Braking Current".
$*^{3}$ For heat dissipation, a resistor of 400 W or lower should be fixed to the frame and maintain the surface temperature below $50^{\circ} \mathrm{C}$; a resistor of 1000 W and above should maintain the surface temperature below $350^{\circ} \mathrm{C}$.

* $^{4} \quad$ Please refer to VFDB series Braking Module Instruction for more detail on braking resistor.


## $\square$ 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 together with the magnetic contactor (MC) prior to the drive to protect the drive from abnormal functions. The purpose of installing the thermal overload relay is to protect the brake resistor from damages due to frequent brakes, or caused by brake unit's continuous conductions resulted from unusual high input voltage. Under such circumstance, just turn off the power to prevent damaging the brake resistor.


Note1: When using the AC drive with DC reactor, please refer to wiring diagram in the AC drive user manual for the wiring of terminal $+(P)$ of Braking unit.
Note2: Do NOT wire terminal -(N) to the neutral point of power system.
2. If damage to the drive or other equipment is due to the fact that the brake resistors and brake modules in use are not provided by Delta, the warranty will be void.
3. Please 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 will be applied for frequent braking, it is recommended to enlarge 2~3 times of the Watts.
6. Thermal Relay:

Thermal relay selection is based on its overload capability. A standard braking capacity for CP2000 is 10\%ED (Tripping time $=10 \mathrm{~s}$ ). The figure below is an example of $460 \mathrm{~V}, 110 \mathrm{kw}$ AC motor drive. It requires the thermal relay to take $260 \%$ overload capacity in 10 s (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 read carefully specification provided by the manufacturer.


## Non-fuse Circuit Breaker

To comply with UL standard: Per UL 508, paragraph 45.8.4, part a:
The rated current of the breaker shall be $2 \sim 4$ times of the maximum rated input current of AC motor drive.

| 3-phase 230V |  |
| :---: | :---: |
| Model | Recommended <br> non-fuse breaker <br> $(\mathrm{A})$ |
| 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 | 5 |
| VFD015CP43A-21/4EA-21 | 10 |
| VFD022CP43A-21/4EA-21 | 15 |
| VFD040CP43A-21/4EA-21 | 20 |
| VFD037CP43A-21/4EA-21 | 20 |
| VFD055CP43A-21/4EA-21 | 30 |
| VFD075CP43A-21/4EA-21 | 40 |
| VFD110CP43A-21/4EA-21 | 50 |
| VFD150CP43A-21/4EA-21 | 60 |
| VFD185CP43A-21/4EA-21 | 75 |
| VFD220CP43A-21/4EA-21 | 100 |
| VFD300CP43A-21/4EA-21 | 125 |
| VFD370CP43A-21/4EA-21 | 150 |
| VFD450CP43A-00/43A-21 | 175 |
| VFD550CP43A-00/43A-21 | 250 |
| VFD750CP43A-00/43A-21 | 300 |
| VFD900CP43A-00/43A-21 | 300 |
| VFD1100CP43A-00/43A-21 | 400 |
| VFD1320CP43A-00/43A-21 | 500 |
| VFD1600CP43A-00/43A-21 | 600 |
| VFD1850CP43A-00/43A-21 | 600 |
| VFD2200CP43A-00/43A-21 | 800 |
| VFD2800CP43A-00/43A-21 | 1000 |
| VFD3150CP43A-00/43C-00/43C-21 | 1200 |
| VFD3550CP43A-00/43C-00/43C-21 | 1350 |
| VFD4000CP43A-00/43C-00/43C-21 | 1500 |

## Fuse (Specification Chart)

Fuses with specification smaller than the data in the following table are allowed.

| Model 230V | 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 |


| Model 460V | Input current (A) |  | Line Fuse |  |
| :---: | :---: | :---: | :---: | :---: |
|  | Light duty | Normal duty | I (A) | Bussmann P/N |
| VFD007CP43A-21/4EA-21 | 4.3 | 3.5 | 10 | JJS-10 |
| VFD015CP43A-21/4EA-21 | 5.4 | 4.3 | 10 | JJS-10 |
| VFD022CP43A-21/4EA-21 | 7.4 | 5.9 | 15 | JJS-15 |
| VFD037CP43A-21/4EA-21 | 11 | 8.7 | 20 | JJS-20 |
| VFD040CP43A-21/4EA-21 | 16 | 14 | 30 | JJS-20 |
| VFD055CP43A-21/4EA-21 | 18 | 15.5 | 30 | JJS-30 |
| VFD075CP43A-21/4EA-21 | 20 | 17 | 40 | JJS-40 |
| VFD110CP43A-21/4EA-21 | 25 | 20 | 50 | JJS-50 |
| VFD150CP43A-21/4EA-21 | 33 | 26 | 60 | JJS-60 |
| VFD185CP43A-21/4EA-21 | 39 | 35 | 75 | JJS-75 |
| VFD220CP43A-21/4EA-21 | 47 | 40 | 100 | JJS-100 |
| VFD300CP43A-21/4EA-21 | 58 | 47 | 125 | JJS-125 |
| VFD370CP43A-21/4EA-21 | 76 | 63 | 150 | JJS-150 |
| VFD450CP43A-00/43A-21 | 91 | 74 | 175 | JJS-175 |
| VFD550CP43A-00/43A-21 | 110 | 101 | 250 | JJS-250 |
| VFD750CP43A-00/43A-21 | 144 | 114 | 300 | JJS-300 |
| VFD900CP43A-00/43A-21 | 180 | 157 | 300 | JJS-300 |
| VFD1100CP43A-00/43A-21 | 220 | 167 | 400 | JJS-400 |
| VFD1320CP43A-00/43A-21 | 246 | 207 | 500 | JJS-500 |
| VFD1600CP43A-00/43A-21 | 310 | 240 | 600 | JJS-600 |
| VFD1850CP43A-00/43A-21 | 343 | 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 | 770 | 655 | 1350 |
| VFD4000CP43A-00/43C-00/43C-21 |  |  | KTU-1350 |  |
|  |  |  |  | KTU-1500 |

## AC Reactor (Choke)

$230 \mathrm{~V}, 50 / 60 \mathrm{~Hz}, 3$-phase

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

$460 \mathrm{~V}, 50 / 60 \mathrm{~Hz}, 3$-phase

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

## Zero Phase Reactor (Choke)

## RF220X00A



| Cable <br> type <br> (Note) | Recommended |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | AWG | $\mathrm{mm}^{2}$ | Nominal <br> $\left(\mathrm{mm}^{2}\right)$ | Qty. | Wiring <br> Method |
| Single- <br> core | $\leq 10$ | $\leq 5.3$ | $\leq 5.5$ | 1 | Diagram <br> A |
|  | $\leq 2$ | $\leq 33.6$ | $\leq 38$ | 4 | Diagram <br> B |
| Three- <br> core | $\leq 12$ | $\leq 3.3$ | $\leq 3.5$ | 1 | Diagram <br> A |
|  | $\leq 1$ | $\leq 42.4$ | $\leq 50$ | 4 | Diagram <br> B |

## NOTE

600 V insulated cable wire

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

UNIT: mm(inch)


## Diagram A

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


Diagram B
Please put wires through 4 cores in series without winding.


## DC Reactor (Choke)

230V DC Reactor (Choke)

| Input Voltage | kW | HP | DC Amps | Inductance (mh ) |
| :---: | :---: | :---: | :---: | :---: |
|  | 0.75 | 1 | 9.4 | 3.43 |
|  | 1.5 | 2 | 18 | 1.83 |
|  | 2.2 | 3 | 24 | 1.37 |
|  | 3.7 | 5 | 30 | 1.1 |
|  | 5.5 | 7.5 | 42 | 0.78 |
| $3-\mathrm{Phase}$ | 7.5 | 10 | 53 | 0.61 |
|  | 11 | 15 | 76 | 0.42 |
|  | 15 | 20 | 106 | 0.31 |
|  | 18.5 | 25 | 122 | 0.26 |
|  | 22 | 30 | 145 | 0.22 |

460V DC Choke

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

## EMI Filter

| Model | Corresponding EMI filter | Web site for your reference (PDF files to download) |
| :---: | :---: | :---: |
| VFD007CP23A-21; VFD015CP23A-21; VFD022CP23A-21; VFD037CP23A-21; | KMF325A | http://www.dem-uk.com/roxburgh/Data/Product Downloads/KMF325A.pdf KMF325A Three Phase Industrial Mains Filters - High Performance 25 Amps |
| VFD055C23A-21; | KMF336A | http://www.dem-uk.com/roxburgh/Data/Product Downloads/KMF336A.pdf KMF370A Three Phase Industrial Mains Filters - High Performance 70 Amps |
| VFD075CP23A-21; <br> VFD110CP23A-21; <br> VFD150CP23A-21; | KMF3100A | http://www.dem-uk.com/roxburgh/Data/Product_Downloads/KMF3100A.pdf KMF3100A Three Phase Industrial Mains Filters - High Performance 100 Amps |
| VFD185CP23A-21; <br> VFD220CP23A-21; <br> VFD300CP23A-21; | KMF3150A+Qty2 TOR221 | http://www.dem-uk.com/roxburgh/Data/Product_Downloads/KMF3150Aiss3.pdf KMF3150A Three Phase Industrial Mains Filters - High Performance 150 Amps MIF3150 Three Phase Industrial Multi Stage Drive Filters - Very High Performance 150 Amps |
| VFD370CP23A-00/ 23A-21; <br> VFD450CP23A-00/ 23A-21; | MIF3180 | http://www.dem-uk.com/roxburgh/Data/Product Downloads/KMF3180Aiss4.pdf MIF3400 Three Phase Industrial Drive Filters - Very High Performance 340 Amps |
| VFD550CP23A-00/23A-21; VFD750CP23A-00/23A-21; VFD900CP23A-00/23A-21 | MIF3400B | http://www.dem-uk.com/roxburgh/Data/Product_Downloads/MIF3400B.pdf KMF318 Three Phase Industrial Mains Filters - General Purpose 18 Amps |
| VFD007CP43A-21/4EA-21; VFD015CP43A-21/4EA-21; VFD022CP43A-21/4EA-21; <br> VFD037CP43A-21/4EA-21; | KMF318A | http://www.dem-uk.com/roxburgh/Data/Product_Downloads/KMF318A.pdf KMF350 Three Phase Industrial Mains Filters - General Purpose 50 Amps |
| VFD040CP43A-21/4EA-21; <br> VFD055CP43A-21/4EA-21; <br> VFD075CP43A-21/4EA-21; | KMF325A | http://www.dem-uk.com/roxburgh/Data/Product_Downloads/KMF325A.pdf KMF370 Three Phase Industrial Mains Filters - General Purpose 70 Amps |
| VFD110CP43A-21/4EA-21; <br> VFD150CP43A-21/4EA-21; <br> VFD185CP43A-21/4EA-21; | KMF350A | http://www.dem-uk.com/roxburgh/Data/Product_Downloads/KMF350A.pdf MIF3150 Three Phase Industrial Multi Stage Drive Filters - Very High Performance 150 Amps |
| VFD220CP43A-21/4EA-21; <br> VFD300CP43A-21/4EA-21; <br> VFD370CP43A-21/4EA-21; | KMF370A | http://www.dem-uk.com/roxburgh/Data/Product_Downloads/KMF370A.pdf MIF3400B Three Phase Industrial Multi Stage Drive Filters - Very High Performance 400 Amps |
| VFD450CP43A-00/43A-21; <br> VFD550CP43A-00/43A-21; <br> VFD750CP43A-00/43A-21; <br> VFD900CP43A-00/43A-21; | MIF3180 | http://www.dem-uk.com/roxburgh/Data/Product_Downloads/KMF3180Aiss4.pdf |
| VFD1100CP43A-00/43A-21; <br> VFD1320CP43A-00/43A-21 | MIF3400B | http://www.dem-uk.com/roxburgh/Data/Product_Downloads/MIF3400B.pdf |
| VFD1600CP43A-00/43A-21; <br> VFD1850CP43A-00/43A-21; | MIF3400B | http://www.dem-uk.com/roxburgh/Data/Product_Downloads/MIF3400B.pdf |
| VFD2200CP43A-00/43A-21; <br> VFD2800CP43A-00/43A-21; | $\begin{gathered} \text { MIF3800+Qty3 } \\ \text { TOR254 } \end{gathered}$ | http://www.dem-uk.com/roxburgh/Data/Product_Downloads/MIF3800curves.pdf |
| VFD3150CP43A-00/43C-00/43c-21; <br> VFD3550CP43A-00/43C-00/43c-21; <br> VFD4000CP43A-00/43C-00/43c-21; | MIF3800+Qty2 TOR254 | http://www.dem-uk.com/roxburgh/Data/Product_Downloads/MIF3800curves.pdf |

## EMI Filter Installation

## Preface

All electrical equipment, including AC motor drives, generates high-frequency/low-frequency noise and interferes with peripheral equipment by radiation or conduction when in normal 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:

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

## General precaution

To ensure an EMI Filter can maximize its performance on eliminating noise generated by an AC motor drive, it is not only necessary to follow instruction on installation and wiring in a user manual, but the following points need to be kept in mind. .
『 EMI filter and AC motor drive should be installed on the same metal plate
$\square$ Install AC motor drive on the footprint of the EMI filter or install EMI filter as close as possible to the AC motor drive.
$\square \quad$ Wiring should be as short as possible.
『 Metal plate should be grounded.
$\nabla$ The cover of the AC motor drive or grounding should be fixed on the metal plate and their contact area should be as large as possible.

## Choose suitable motor \& precautions

Improper installation and choice of motor cable will affect the performance of EMI filter. Be sure to follow exactly precautions listed below when selecting motor cable.
ஏ Use a cable with shielding (double shielding is the best).
$\square$ The shielding on both ends of the motor's cable should be grounded with the minimum length and maximum contact area.
$\square$ Remove any paint on the metal saddle for better ground contact with the metal plate and shielding (See diagram 1).
$\square$ The shielding of motor's cable should be connected properly to a metal plate. The shielding on both end of the motor's cable should be fixed on a metal plate by a metal saddle. (See diagram 2)

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


Diagram 1


Diagram 2

## The Length of a motor's cable

When motor is driven by an AC motor drive of PWM type, the motor terminals will easily experience surge voltages due to components conversion of AC motor drive and cable capacitance. When the motor cable is very long (especially for the 460 V series), surge voltages may reduce insulation quality. To prevent this situation to happen, 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 the AC motor drive and the motor should be as short as possible ( 10 m ( 32.81 feet) to 20 m ( 65.62 feet) or less)
- For models $7.5 \mathrm{hp} / 5.5 \mathrm{~kW}$ and above:

| Insulation level of motor | 1000 V | 1300 V | 1600 V |
| :---: | :---: | :---: | :---: |
| 460 VAC input voltage | $66 \mathrm{ft}(20 \mathrm{~m})$ | $328 \mathrm{ft}(100 \mathrm{~m})$ | $1312 \mathrm{ft}(400 \mathrm{~m})$ |
| 230 VAC input voltage | $1312 \mathrm{ft}(400 \mathrm{~m})$ | $1312 \mathrm{ft}(400 \mathrm{~m})$ | $1312 \mathrm{ft}(400 \mathrm{~m})$ |

- For models $5 \mathrm{hp} / 3.7 \mathrm{~kW}$ and less:

| Insulation level of motor | 1000 V | 1300 V | 1600 V |
| :---: | :---: | :---: | :---: |
| 460VAC input voltage | $66 \mathrm{ft}(20 \mathrm{~m})$ | $165 \mathrm{ft}(100 \mathrm{~m})$ | $165 \mathrm{ft}(400 \mathrm{~m})$ |
| 230VAC input voltage | $328 \mathrm{ft}(400 \mathrm{~m})$ | $328 \mathrm{ft}(400 \mathrm{~m})$ | $328 \mathrm{ft}(400 \mathrm{~m})$ |

If motor is driven by an AC motor drive of PWM type, the motor terminals will easily experience surge voltages due to components conversion of AC motor drive and cable capacitance. Especially when the motor's cable is very long, surge voltages may reduce insulation quality. To prevent this situation to happen, please consider the following measures:

If the wiring is too long, the amount of stray capacitance between the electrical wires will increase and probably cause leakage of current.
$\boxtimes \quad$ Then the display of the current will not be accurate If so, the AC motor drive will activate the over current protection. The worst case caused by leakage of current will be the break down of the AC motor drive.
च If an AC motor drive is connected to more than one motor, the length of the wiring should be the total length of wiring from the AC motor drive to each motor.
$\checkmark$ When a thermal O/L relay protected by motor is used between AC motor drive and motor, it may malfunction (especially for 460 V series), even if the length of motor cable is only $165 \mathrm{ft}(50 \mathrm{~m})$ or less. To prevent it, please use AC reactor and/or lower the carrier frequency (Pr. 00-17 PWM carrier frequency).

## NOTE

- When a thermal $\mathrm{O} / \mathrm{L}$ relay protected by motor is used between AC motor drive and motor, it may malfunction (especially for 460 V series), even if the length of motor cable is only $165 \mathrm{ft}(50 \mathrm{~m})$ or less. To prevent it, please use AC reactor and/or lower the carrier frequency (Pr. 00-17 PWM carrier frequency).
- Never connect phase lead capacitors or surge absorbers to the output terminals of the AC motor drive.


## Digital Keypad

KPC-CE01 digital keypad


## A: LED Display

Display frequency, current, voltage and error etc.
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 <br> When ESC key is pressed, it will return to the previous menu. It is also functioned as a return key in the sub-menu. |
| MENU | Menu Key <br> It can return to the main menu after pressing MENU key. <br> Menu content: <br> 1. Parameter Detail <br> 2. Copy Parameter |
| ENTER | ENTER Key <br> 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 <br> 1. This key is executed by the parameter settings of the source of Hand frequency and hand operation. The factory <br> settings of both source of Hand frequency and hand operation are the digital keypad. |
| AUTO | 2. If pressed at stop status, it will switch to Hand setting of frequency source and operation source. If HAND ON key is <br> pressed during operation, it will stop the AC motor drive first then switch to Hand setting. <br> 3. Hand mode display: H/A LED is ON. |
| Auto Operation Key |  |
| 1. This key is executed by the parameter settings of the source of AUTO frequency and AUTO operation. The factory |  |
| setting is the external terminal (source of operation is 4-20mA). |  |

Dimensions: mm [inch]


## Panel Mounting Kit (MKC-KPPK)

For MKC-KPPK model, user can choose wall mounting or embedded mounting, protection level is IP56.
Applicable to the digital keypads (KPC-CC01 \& KPC-CE01).



## Conduit Box Kit

- outer appearance of conduit box



## - Installation of conduit box

## Frame D

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

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

3. Install the conduit box by fasten the 5 screws shown in the following figure.

Screw torque: $24 \sim 26 \mathrm{~kg}-\mathrm{cm}$ (20.8~22.6Ib-in).

4. Fasten the $\mathbf{2}$ screws shown in the following figure. Screw torque: $10 \sim 12 \mathrm{~kg}-\mathrm{cm}(8.66 \sim 10.39 \mathrm{Ib}-\mathrm{in})$.


## Frame E

1. Loosen the 4 cover screws and lift the cover; Screw torque: $12 \sim 15 \mathrm{~kg}-\mathrm{cm}$ (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: $25 \sim 30 \mathrm{~kg}-\mathrm{cm}$ (20.8~30Ib-in)

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


## Frame F

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

2. Install the conduit box by fastens the 4 screws, as shown in the following figure.

Screw torque: 24~26kg-cm (20.8~22.6Ib-in).

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


## Frame G

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

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

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

Screw torque: 25~30kg-cm (20.8~30Ib-in); Screw torque: 12~15kg-cm (10.4~13Ib-in)

4. Fasten all the screws. Screw torque: $25 \sim 30 \mathrm{~kg}-\mathrm{cm}(20.8 \sim 30 \mathrm{Ib}-\mathrm{in})$.

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


## Fan Kit

- outer appearance of fans


| Frame C | Model 『MKC－CFKB2』 |
| :---: | :---: |
| $\begin{aligned} & \text { VFD220CP43A-21 } \\ & \text { VFD220CP4EA-21 } \\ & \text { VFD300CP43A-21 } \\ & \text { VFD300CP4EA-21 } \\ & \text { VFD370CP43A-21 } \\ & \text { VFD370CP4EA-21 } \end{aligned}$ |  |
| Frame D VFD370CP23A－00；VFD370CP23A－21； VFD450CP23A－00；VFD450CP23A－21； VFD450CP43A－00；VFD450CP43A－21； VFD550CP43A－00；VFD550CP43A－21； VFD750CP43A－00；VFD750CP43A－21； VFD900CP43A－00；VFD900CP43A－21； |  |
| Frame E <br> VFD550CP23A－00 <br> VFD750CP23A－21 <br> VFD750CP23A－00 <br> VFD750CP23A－21 |  |
| Frame E <br> Corresponding models： <br> VFD900CP23A－00；VFD900CP23A－21； <br> VFD1100CP43A－00；VFD1100CP43A－21； <br> VFD1320CP43A－00；VFD1320CP43A－21； |  |
| Frame E <br> VFD550CP23A－00 <br> VFD750CP23A－21 <br> VFD750CP23A－00 <br> VFD750CP23A－21； <br> VFD900CP23A－00；VFD900CP23A－21； <br> VFD1100CP43A－00；VFD1100CP43A－21； <br> VFD1320CP43A－00；VFD1320CP43A－21； | Model 『MKC-EFKB 』 |


| Frame F | Model 『MKC－FFKM』 |
| :---: | :---: |
| VFD1600CP43A－00；VFD1600CP43A－21 <br> VFD1850CP43A－00；VFD1850CP43A－21 |  |
| Frame F | Model 『MKC－FFKB』 |
| $\begin{aligned} & \text { VFD1600CP43A-00; VFD1600CP43A-21; } \\ & \text { VFD1850CP43A-00; VFD1850CP43A-21 } \end{aligned}$ |  |
| Frame G | Model 『MKC－GFKM ${ }_{\text {』 }}$ |
| $\begin{aligned} & \text { VFD2200CP43A-00; VFD2200CP43A-21; } \\ & \text { VFD2800CP43A-00; VFD2800CP43A-21; } \end{aligned}$ |  |
| Frame H | Model 『MKC－HFKM ${ }_{\text {』 }}$ |
| VFD3150CP43A－00； VFD3550CP43A－00； VFD4000CP43A－00； VFD3150CP43C－21 VFD3550CP43C－21； VFD4000CP43C－21 VFD3150CP43C－00 VFD3550CP43C－00 VFD4000CP43C－00 |  |

- Fan Removal

Frame A
Corresponding models:
VFD022CP23A-21; VFD037CP23A-21; VFD055CP23A-21; VFD037CP43A/4EA-21;
VFD040CP43A/4EA-21; VFD055CP43A/4EA-21; VFD075CP43A/4EA-21

1. As shown by the arrow sign, press the tabs on both side of 2 . As shown by the partially enlarged image below, the fan to remove the fan. disconnect the fan's power before removing the fan.


Frame B
Corresponding models:
VFD075CP23A-21; VFD110CP23A-21; VFD110CP43A-21;
VFD110CP4EA-21; VFD150CP23A-21; VFD150CP43A-21;
VFD150CP4EA-21; VFD185CP43A-21; VFD185CP4EA-21;

1. As shown by the arrow sign, press the tabs on both side of the fan to remove the fan.

2. As shown by the partially enlarged image below, disconnect the fan' power before removing the fan.


## Frame B\&C

Corresponding models:
Frame B:
VFD075CP23A-21; VFD110CP23A-21; VFD110CP43A-21; VFD110CP4EA-21; VFD150CP23A-21; VFD150CP43A-21; VFD150CP4EA-21; VFD185CP43A-21; VFD185CP4EA-21;

Frame C:
VFD185CP23A-21; VFD220CP23A-21; VFD300CP23A-21; VFD220CP43A-21;VFD220CP4EA-21; VFD300CP43A-21; VFD300CP4EA-21; VFD370CP43A-21;VFD370CP4EA-21

As shown by the partially enlarged image, disconnect the fan's power,
then use a screwdriver to unclinch and to remove the fan.


## Frame D

Corresponding models:
VFD370CP23A-00; VFD370CP23A-21; VFD450CP23A-00;
VFD450CP23A-21; VFD450CP43A-00; VFD450CP43A-21;
VFD550CP43A-00; VFD550CP43A-21; VFD750CP43A-00;
VFD750CP43A-21; VFD900CP43A-00; VFD900CP43A-21;

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


Figure 1
3. (Figure 3) Loosen screw 5 and disconnect the fan's power. Screw torque: $10 \sim 12 \mathrm{~kg}-\mathrm{cm}$ ( $8.6 \sim 10.4 \mathrm{in}-\mathrm{lbf}$ ).


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


Figure 2
4. (Figure 4) Loosen the screws 1~4. Screw torque: $24 \sim 26 \mathrm{~kg}-\mathrm{cm}$ (20.8~22.6in-lbf).
5. Disconnect fan's power (as shown in the partially enlarged picture) and pull out the fan (as shown in the larger picture).


Fuigure4

## Frame E

Corresponding models：
VFD550CP23A－00；VFD750CP23A－21；VFD750CP23A－00；
VFD750CP23A－21；VFD900CP23A－00；VFD900CP23A－21；
VFD1100CP43A－00；VFD1100CP43A－21；VFD1320CP43A－00；
VFD1320CP43A－21；
For fan model 『MKC－EFKM1
For fan model 『 MKC－EFKM2 』
Loosen screw 1～4（as shown in the figure below），and disconnect the fan＇s power then remove the fan．
Screw torque： $24 \sim 26 \mathrm{~kg}-\mathrm{cm}$（20．8～22．6in－lbf）．


Loosen screw 1～4（as shown in the figure below），and disconnect the fan＇s power then remove the fan．
Screw torque：24～26kg－cm（20．8～22．6in－lbf）．


Loosen screw 1 and screw 2 （as shown in the figure below），and disconnect fan＇s power before removing the fan． Screw torque：24～26kg－cm（20．8～22．6in－lbf）．


Frame F Corresponding models：
VFD1600CP43A－00；VFD1600CP43A－21；VFD1850CP43A－00；VFD1850CP43A－21；
VFD1600CP43A－00；VFD1600CP43A－21；VFD1850CP43A－00；VFD1850CP43A－21
For fan model 『MKC－FFKM As shown in the partially enlarged picture，disconnect the fan＇s power before you remove it．
Loosen the screws $1 \sim 4$ and remove the fan（as shown in figure below）．Screw torque：24～26kg－cm（20．8～22．6Ib－in 』


For fan model 『MKC－FFKB 』
（1）Loosen the screws $1 \sim 4$（as shown in figure below）and remove the cover．Screw torque： $14 \sim 16 \mathrm{~kg}-\mathrm{cm}(12.2 \sim 13.9 \mathrm{Ib}-\mathrm{in})$ ．

（2）Loosen the screws 5～8（as shown in figure below）and remove the cover．Screw torque： $24 \sim 26 \mathrm{~kg}-\mathrm{cm}$（20．8～22．6Ib－in）．

（3）As shown in the partially enlarged image，disconnect the fan＇s power．
（4）Loosen the screws 9～11（figure 3）and remove the fan（figure 4）．Screw torque：24～26kg－cm（20．8～22．6Ib－in）


Figure3


Figure 4

## Frame G

Corresponding models：
VFD2200CP43A－00；VFD2200CP43A－21；
VFD2800CP43A－00；VFD2800CP43A－21；

For fan model 『MKC－GFKM ${ }_{』}$
（1）Loosen the screws1～4（as shown in figure below）and remove the cover．Screw torque： $24 \sim 26 \mathrm{~kg}-\mathrm{cm}$
（20．8～22．6Ib－in）．

（3）Loosen screws 1～3 and remove snap bushing 4～5（as shown in the figure below）Screw torque： $15 \sim 20 \mathrm{~kg}-\mathrm{cm}$ （12．2～13．9Ib－in）』

（2）Loosen the screws $1 \sim 8$（as shown in the figure below）． Screw torque： $35 \sim 40 \mathrm{~kg}-\mathrm{cm}(30.4 \sim 34.7 \mathrm{Ib}-\mathrm{in})$ 』

Then loosen screws 9～10（as shown in the figure below）．Then remove the cover．Screw torque： $24 \sim 26 \mathrm{~kg}-\mathrm{cm}$（20．8～22．6Ib－in）

（4）Hook your index fingers to the two snap bushing holes 1～2（as shown in the figure below），then lift to remove the fan．


Frame H
Corresponding models:
VFD3150CP43A-00; VFD3550CP43A-00; VFD4000CP43A-00;
VFD3150CP43C-00; VFD3550CP43C-00; VFD4000CP43C-00
VFD3150CP43C-21; VFD3550CP43C-21; VFD4000CP43C-21

Model 『 MKC-HFKM ${ }_{\text {』 }}$
(1) Loosen the screws $1 \sim 4$ and remove the top cover. Screw torque: $14 \sim 16 \mathrm{~kg}-\mathrm{cm}(12.2 \sim 13.9 \mathrm{Ib}-\mathrm{in})$

(2) Loosen the screws $5 \sim 12$ and remove the top cover.

Screw torque: $24 \sim 26 \mathrm{~kg}-\mathrm{cm}(20.83 \sim 22.57 \mathrm{Ib}-\mathrm{in})$

(4) Loosen the screws $13 \sim 18$ and remove the fan. Make sure fan's is properly disconnected before removal. Screw torque: $24 \sim 26 \mathrm{~kg}-\mathrm{cm}$ (20.8~22.6Ib-in).


Before removing the fan, make sure that you have disconnect the fan's power.

## Flange Mounting Kit

Corresponding frames：Frames A～F

## Frame A

## 『MKC－AFM1』

Corresponding models：VFD022CP23A－21；VFD037CP23A－21；VFD037CP43A－21


Accessories 1＊1 piece


Accessories 2＊2 pieces


Screw 1 ＊4 pieces M3＊P 0．5；L＝6mm

Screws 2＊8 pieces M6＊P 1．0；$\quad \mathrm{L}=16 \mathrm{~mm}$

## 『MKC－AFM』

Corresponding models：VFD007CP23A－21；VFD015CP23A－21；VFD055CP23A－21；
VFD007CP43A／4EA－21；VFD015CP43A／4EA－21；VFD022CP43A／4EA－21；
VFD040CP43A／4EA－21；VFD055CP43A／4EA－21；VFD075CP43A／4EA－21


Accessories 1＊2 pieces

Screw 1＊8 pieces M6＊P 1．0；$\quad \mathrm{L}=16 \mathrm{~mm}$

Accessories 2＊2 pieces


Installation of 『MKC－AFM1』
Step1．Install accessory 1 by fastening 4 of the screw 1（M3）．Screw torque： $6 \sim 8 \mathrm{~kg}-\mathrm{cm}(5.21 \sim 6.95 \mathrm{Ib}-\mathrm{in})$ ．


Step2．Install accessory $2 \& 3$ by fastening 2 of the screw 2（M6）．Screw torque：25～30kg－cm（21．7～26．Ib－in）』


Step3．Install accessory $2 \& 3$ by fastening 2 of the screw 2（M6）．Screw torque：25～30kg－cm（21．7～26 Ib－in）』


Step4．Plate installation，place 4 of the screw 2 （M6）through accessory $2 \& 3$ and the plate then fasten the screws． Screw torque： $25 \sim 30 \mathrm{~kg}-\mathrm{cm}(5.21 \sim 6.94 \mathrm{Ib}-\mathrm{in}) .25 \sim 30 \mathrm{~kg}-\mathrm{cm}(21.7 \sim 26 \mathrm{Ib}-\mathrm{in}) 』$


## Installation of 『MKC－AFM』

1．Install accessory $1 \& 2$ by fastening 2 of the screw 1 （M3）．Screw torque：25～30kg－cm（21．7～26Ib－in）』（As shown in the figures below）


2．Install accessory $1 \& 2$ by fastening 2 of the screw $1(\mathrm{M} 3) .25 \sim 30 \mathrm{~kg}-\mathrm{cm}(21.7 \sim 26 \mathrm{Ib}-\mathrm{in}) 』$（As shown in the figures below）


3．Plate installation，place 4 of the screw 2 （M6）through accessory $1 \& 2$ and the plate then fasten the screws． Screw torque： $25 \sim 30 \mathrm{~kg}-\mathrm{cm}$（21．7～26 Ib－in）（As shown in the figures below）


## Frame B

## 『MKC-BFM』

Corresponding models: All Frame B models


Panel cutout diagram
Unit : mm [inch]


## Installation of 『MKC-BFM』

1. Install accessory $1 \& 2$ by fastening 4 of the screw 1 (M8). Screw torque: $40 \sim 45 \mathrm{~kg}-\mathrm{cm}$ ( $34.7 \sim 39.0 \mathrm{lb}-\mathrm{in}$ ). (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: $25 \sim 30 \mathrm{~kg}-\mathrm{cm}$ (21.7~26lb-in). (As shown in the following figure)


## Frame C

## ${ }^{\text {『 }}$ MKC-CFM』

Corresponding models: All Frame C models.


Screw 1*4pce ~ M8*P 1.25;
Screw 2*8 pieces $\sim$ M6*P 1.0;

Panel cutout diagram
Unit: :mm [inch]


## Installation of 『MKC-CFM』

1. Install accessory $1 \& 2$ by fastening 4 of the screw 1(M8). Screw torque: $50 \sim 55 \mathrm{~kg}-\mathrm{cm}$ ( $43.4 \sim 47.7 \mathrm{lb}-\mathrm{in})$. (As shown in the figures below)

2. Plate installation, place 8 of the screw 2 (M6) through accessories $1 \& 2$ and the plate then fasten the screws. Screw torque: 25~30kg-cm (21.7~26.0lb-in). (As shown in the figures below)


## Frame D

Panel Cutout Diagrams
Unit: mm [inch]


## Frame E

Panel Cutout Diagrams
Unit :mm [inch]


Installation for Frame D\&E

Step1. Loosen 8 screws and remove Fixture 2 (as shown in the following figure) 。


Step2. Loosen 10 screws and remove Fixture 1 (as shown in the figure below.)


Step3. Fasten 4 screws (as shown in the figure below). Screw torque: 30~32kg-cm (26.0~27.8lb-in).


Step5. Fasten 4 screws (as shown in the following figure). Screw torque: $24 \sim 26 \mathrm{~kg}-\mathrm{cm}$ (20.8~22.6 lb-in)


Step6. Fasten 5 screws (as shown in the figure below). Screw torque: $24 \sim 26 \mathrm{~kg}-\mathrm{cm}$ (20.8~22.6Ib-in).


Step7. Place 4 screws (M10) through Fixture 1\&2 and the plate then fasten the screws. (as shown in the following figure) Screw torque: 200~240kg-cm (173.6~208.3lb-in).


Step4. Fasten 5 screws (as shown in the figure below). Screw torque: 30~32kg-cm (26.0~27.8lb-in).


Frame F
Panel Cutout Diagram

$\|\| \mathbb{N} \mid$ TTrmmanlinnelhil

Installation for Frame
Step1. Loosen 12 screws and remove Fixture 2.
Step4. Install Fixture 1 by fasten screw 13~26 Screw torque: $24 \sim 26 \mathrm{~kg}-\mathrm{cm}$ (20.8~22.6Ib-in).


Step5. Place 4 of the M12 screws through Fixture 1\&2 and plate then fasten the screws. Screw torque: 300~400kg-cm (260~347lb-in).


Step3. Loosen screw 13~26 and remove Fixture 1.


## IFD6530: USB/RS-485 Communication Interface

## © Warning

$\checkmark$ Please read throughly this instruction sheet before installation and putting it into use.
$\checkmark$ 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 115.2 kbps 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. Specification

| Power supply | No external power is needed |
| :--- | :--- |
| Power consumption | 1.5 W |
| Isolated voltage | $2,500 \mathrm{VDC}$ |
| Baud rate | $75,150,300,600,1,200,2,400,4,800,9,600,19,200,38,400,57,600,115,200 \mathrm{bps}$ |
| 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 | +9 V |

## 3. Preparation before installing the driver

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

Note : Do NOT connect the IFD6530 to a computer before extracting the driver file.

## STEP 1



## STEP 2



STEP 4


## STEP 5

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

## 4. Driver Installation

Now connect the IFD6530 to a USB port on your computer. Then follow the steps below to install the driver of IFD6530.

STEP 1


STEP 2




## 5. LED Display

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

## 08 Installation of the Option Cards (all opional)

Select applicable option cards for your drive or contact local distributor for professional advice. To prevent drive damage during installation, please remove the digital keypad and the cover before wiring. Refer to the instructions below.

Remove cover \& keypad
Frame A, B and C: Screw Torque: 8~10Kg-cm [6.9~8.7lb-in.]


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


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


Frame F: Screw Torque: 12~15Kg-cm [10.4~13lb-in.] As shown below, lift the cover then pull to remove it.


Frame G: Screw Torque: 12~15Kg-cm [10.4~13lb-in.] As shown below, lift the cover then pull to remove it.


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




EMC-D42A

| I/O Expansion Card | Terminals | Descriptions |
| :---: | :---: | :---: |
|  | COM | Common for Multi-function input terminals Select SINK (NPN) /SOURCE (PNP) in J1 jumper / external power supply |
|  | MI10~ MI13 | Refer to parameters 02-27~02-30 in Chapter 11 to program the multi-function inputs MI10~MI13. <br> Internal power is applied from terminal E24: $+24 \mathrm{Vdc} \pm 5 \% 200 \mathrm{~mA}, 5 \mathrm{~W}$ External power +24VDC: max. voltage 30VDC, min. voltage 19VDC, 30W <br> ON: the activation current is 6.5 mA <br> OFF: leakage current tolerance is $10 \mu \mathrm{~A}$ |
|  | MO10~MO11 | Multi-function output terminals (photocoupler) <br> Duty-cycle: 50\% <br> Max. output frequency: 100 Hz <br> Max. current: 50 mA <br> Max. voltage: 48Vdc |
|  | MXM | Common for multi-function output terminals MO10, MO11(photocoupler) <br> Max 48VDC 50mA |

EMC-D611A


## EMC-R6AA

|  | Terminals | Descriptions |
| :---: | :---: | :---: |
| Relay Expansion Card | MO3 ~ MO13 | Refer to Pr. 02.36~ Pr. 02.46 in Chapter 11 for multi-function output selection <br> Resistive load: $\begin{aligned} & \text { 5A(N.O.)/3A(N.C.) 250VAC } \\ & \text { 5A(N.O.)/3A(N.C.) 30VDC } \end{aligned}$ <br> Inductive load (COS 0.4) <br> 2.0A(N.O.)/1.2A(N.C.) 250VAC <br> 2.0A(N.O.)/1.2A(N.C.) 30VDC <br> It is used to output each monitor signal, such as drive is in operation, frequency attained or overload indication. |

Screw Specifications for Option Cards' Terminals:

| EMC-D42A | Wire Gauge | $24 \sim 12 \mathrm{AWG}\left(0.205 \sim 3.31 \mathrm{~mm}^{2}\right)$ |
| :---: | :---: | :--- |
|  | Torque | $4 \mathrm{Kg}-\mathrm{cm}[3.47 \mathrm{Ib}-\mathrm{in}]$ |
| EMC-R6AA | Wire Gauge | $24 \sim 16 \mathrm{AWG}\left(0.205 \sim 1.31 \mathrm{~mm}^{2}\right)$ |
|  | Torque | $6 \mathrm{Kg}-\mathrm{cm}[5.21 \mathrm{Ib}-\mathrm{in}]$ |

## CMC-MOD01

- Features

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

- Product Introduction


| (1) | I/O CARD \& Relay Card |
| :--- | :--- |
| $(2)$ | No function |
| $(3)$ | Comm. Card |
| (4) | RJ-45 connection port |
| (5) | Removable control circuit <br> 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, SMTP, MODBUS OVER TCP/IP, Delta Configuration |

## Electrical specifications

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

## Environment Specifications

| Noise Immunity | ESD(IEC 61800-5-1,IEC 6100-4-2) |
| :--- | :--- |
|  | EFT(IEC 61800-5-1,IEC 6100-4-4) |
|  | Surge Teat(IEC 61800-5-1,IEC 6100-4-5) |
|  | Conducted Susceptibility Test(IEC 61800-5-1,IEC 6100-4-6) |


| Operation / Storage | Operation : $-10^{\circ} \mathrm{C} \sim 50^{\circ} \mathrm{C}$ (Temperature) , 90\% (Humidity) <br> Storage : $-25^{\circ} \mathrm{C} \sim 70^{\circ} \mathrm{C}$ (Temperature) , 95\% (Humidity ) |
| :--- | :--- |
| Shock/Vibration resistance | International Standard: IEC 61800-5-1,IEC 60068-2-6 / IEC 61800-5-1,IEC 60068-2-27 |

- Install CMC-MOD01 on 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 (see Figure 4).
4. Screw up at torque $6 \sim 8 \mathrm{~kg}-\mathrm{cm}(5.21 \sim 6.94$ in-lbs) after the PCB is clipped with the holes (see Figure 5).


## - Communication parameter for VFD-CP2000 to connect to an Ethernet

Before VFD-CP2000 is linked to an Ethernet, set up the communication parameters shown in the table below. Then Ethernet master will be able to read/write the frequency characters and control characters from/into VFD-CP2000 after communication parameters are set.

| CP2000 | Functions | Factory setting | Explanation |
| :---: | :---: | :---: | :--- |
| $00-20$ | Set up source of frequency | 0 | Frequency command from keypad |
| $00-21$ | Set up source of operation <br> command | 5 | Operation command from communication card. |
| $09-30$ | Communication decoding <br> method | 0 | The decoding method for Delta AC Motor Drive <br> (Delta AMD). |
| $09-75$ | IP configuration | 0 | Static IP(0) / Dynamic IP (DHCP) (1) |
| $09-76$ | IP address-1 | 192 | IP address 192.168.1.5 |
| $09-77$ | IP address-2 | 168 | IP address 192.168.1.5 |
| $09-78$ | IP address-3 | 1 | IP address 192.168.1.5 |
| $09-79$ | IP address-4 | 5 | IP address 192.168.1.5 |
| $09-80$ | Net mask-1 | 255 | Net mask 255.255.255.0 |
| $09-81$ | Net mask-2 | 255 | Net mask 255.255.255.0 |
| $09-82$ | Net mask-3 | 255 | Net mask 255.255.255.0 |
| $09-83$ | Net mask-4 | 0 | Net mask 255.255.255.0 |
| $09-84$ | Default gateway-1 | 192 | Default gateway 192.168.1.1 |
| $09-85$ | Default gateway-2 | 168 | Default gateway 192.168.1.1 |
| $09-86$ | Default gateway-3 | 1 | Default gateway 192.168.1.1 |
| $09-87$ | Default gateway-4 | 1 | Default gateway 192.168.1.1 |

## - Remove CMC- MOD01 from VFD-CP2000

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

[Figure 7]
[Figure 6]

[Figure 8]

- Basic Registers

| BR <br> number | Property | Content |  |
| :---: | :---: | :--- | :--- |
| $\# 0$ | 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 <br> firmware version V1.00. |
| $\# 2$ | R | Release date of <br> the version | Displaying the data in decimal form. 10,000s digit and 1,000s digit are for <br> "month"; 100s digit and 10s digit are for "day". <br> For 1 digit: $0=$ morning; $1=$ afternoon. |
| $\# 11$ | R/W | Modbus Timeout | Preset :500 (ms) |
| $\# 13$ | R/W | Keep Alive Time | Preset :30 (s) |

## LED Indicators \& Troubleshooting

LED Indicators

| LED | Status |  | Indication | Action |
| :--- | :---: | :---: | :--- | :--- |
|  | Green | On | Power supply in normal <br> status | No action required |
|  |  | Off | No power supply | Check if the power supply is <br> plugged. |
| LINK |  | Flashes | Network connection in <br> normal status | No action required |
|  |  | Off | Network not connected | Check if the network cable is <br> connected |

Troubleshooting

| Abnormality | Cause | Action |
| :---: | :---: | :---: |
| 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. |

Chapter 08 Installation of the Option Cards

| Abnormality | Cause | Action |
| :--- | :--- | :--- |
| Able to open <br> CMC-MOD01 setup <br> page but fail to <br> utilize webpage <br> monitoring | Incorrect network setting in <br> CMC-MOD01 | Check if the network setting for CMC-MOD01 is <br> correct. For the Intranet setting in your company, please <br> consult your IT staff. For the Internet setting in your <br> home, please refer to the network setting instruction <br> provided by your ISP. |
| Fail to send e-mail | Incorrect network setting in <br> CMC-MOD01 | Check if the network setting for CMC-MOD01 is <br> correct. |
|  | Incorrect mail server setting | Please confirm the IP address for SMTP-Server. |

## CMC-PD01

- Features

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

- Product Introduction



## - Specifications

PROFIBUS DP Communication Connector

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

## Communication

| Message type | Data exchange periodically |
| :--- | :--- |
| Module name | CMC-PD01 |
| GSD document | DELTA08DB.GSD |
| Company ID | 08DB(HEX) |
| Serial transmission <br> speed supported <br> (auto-detection) | Support 9.6kbps; 19.2kbps; 93.75kbps; 187.5kbps; $500 \mathrm{kbps} ; 1.5 \mathrm{Mbps} ; 3 \mathrm{Mbps} ; 6 \mathrm{Mbps} ; 12 \mathrm{Mbps}$ <br> (bits per second ) |

## Electrical Specification

| Power supply | 5 VDC (provided by AC Motor Drive) |
| :--- | :--- |
| Insulation | 500 VDC |
| Power | 1 W |
| Weight | 28 g |

## Environment Specification

| Noise immunity | ESD(IEC 61800-5-1,IEC 6100-4-2) <br> EFT(IEC 61800-5-1,IEC 6100-4-4) <br> Surge Teat(IEC 61800-5-1,IEC 6100-4-5) <br> Conducted Susceptibility Test(IEC 61800-5-1,IEC 6100-4-6) |
| :---: | :---: |
| Operation /storage | Operation: $-10^{\circ} \mathrm{C} \sim 50^{\circ} \mathrm{C}$ (Temperature), $90 \%$ (Humidity) <br> Storage: $-25^{\circ} \mathrm{C} \sim 70^{\circ} \mathrm{C}$ (Temperature) , $95 \%$ (Humidity) |
| Shock / vibration resistance | International standardIEC61131-2, IEC68-2-6 (TEST Fc) / IEC61131-2 \& IEC 68-2-27(TEST Ea) |

- Installation

PROFIBUS DP Communication Connector: Definition of pins

| 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 and 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 | Action |
| :--- | :--- | :--- |
| Green light on | Power supply in normal status. | No action required |
| Off | No power | Check if CMC-PD01 and AC motor drive are properly <br> connected. |

## NET LED

| LED status | Indication | Action |
| :--- | :--- | :--- |
| Green light on | Normal status | No action required |
| Red light on | CMC-PD01 is not connected <br> to PROFIBUS DP bus. | Connect CMC-PD01 to PROFIBUS DP bus. |
| Red light flashes | Invalid PROFIBUS <br> communication address | Set the PROFIBUS address of CMC-PD01 between 1 ~ 125 <br> (decimal) |
| Orange light flashes | CMC-PD01 fails to <br> communication with AC <br> motor drive. | Switch off the power and check whether CMC-PD01 is <br> correctly and normally connected to AC motor drive. |

## CMC-DN01

- Features

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: $125 \mathrm{kbps}, 250 \mathrm{kbps}$, 500 kbps 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 introduction


| 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 method | CAN |
| Transmission cable | Shielded twisted pair cable (with 2 power cables) |
| Transmission speed | 125kbps, 250kbps, 500kbps and extendable serial transmission speed mode |
| 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 <br> 2. Transmitting power supply from AC motor drive |
| Communication <br> protocol | Delta HSSP protocol |

## Electrical Specifications

| Power supply | 5 VDC (provided by AC motor drive) |
| :--- | :--- |
| Insulation | 500 VDC |
| Communication | 0.85 W |
| Power | 1 W |
| Weight | 23 g |

## Environmental Specifications

|  | ESD (IEC 61800-5-1,IEC 6100-4-2) <br> EFT (IEC 61800-5-1,IEC 6100-4-4) <br> Surge Teat(IEC 61800-5-1,IEC 6100-4-5) <br> Conducted Susceptibility Test (IEC 61800-5-1,IEC 6100-4-6) |
| :--- | :--- |
| Operation <br> /storage | Operation: $-10^{\circ} \mathrm{C} \sim 50^{\circ} \mathrm{C}$ (temperature), 90\% (humidity), pollution degree 2 <br> Storage: $-25^{\circ} \mathrm{C} \sim 70^{\circ} \mathrm{C}$ (temperature), 95\% (humidity, non-condensing) |
| Shock / vibration <br> resistance | International standards: IEC61131-2, IEC68-2-6 (TEST Fc)/IEC61131-2 \& IEC <br> $68-2-27 ~(T E S T ~ E a) ~$ |

DeviceNet Connector: Definition of Pins

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



## - 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 | Action |
| :--- | :--- | :--- |
| On | Power supply in abnormal status. | Check the power supply of CMC-DN01. |
| Off | Power supply in normal status | No action required |

## NS LED

| LED status | Indication | Action |
| :--- | :--- | :--- |
| Off | No power supply or CMC-DN01 has not <br> completed MAC ID test yet. | 1. Check the power of CMC-DN01 and see if the <br> connection is normal. <br> 2. Make sure at least one or more nodes are on the bus. <br> 3. Check if the serial transmission speed of <br> CMC-DN01 is the same as that of other nodes. |
| Green light <br> flashes | CMC-DN01 is on-line but has not <br> established connection to the master. | 1. Configure CMC-DN01 to the scan list of the master. <br> 2. Re-download the configured data to the master. |
| Green light on | CMC-DN01 is on-line and is normally <br> connected to the master | No action required |

\(\left.\left.$$
\begin{array}{|l|l|l|}\hline \begin{array}{l}\text { Red light } \\
\text { flashes }\end{array} & \begin{array}{l}\text { CMC-DN01 is on-line, but I/O } \\
\text { connection is timed-out. }\end{array} & \begin{array}{l}\text { 1. Check if the network connection is normal. } \\
\text { 2. Check if the master operates normally. }\end{array} \\
\hline \text { Red light on } & \begin{array}{l}\text { 1. The communication is down. } \\
\text { 2. MAC ID test failure. } \\
\text { 3. No network power supply. } \\
\text { 4. CMC-DN01 is off-line. }\end{array} & \begin{array}{l}\text { 1. Make sure all the MAC IDs on the network are not } \\
\text { repeated. }\end{array} \\
\text { 2. Check if the network installation is normal. }\end{array}
$$\right\} \begin{array}{l}3. Check if the baud rate of CMC-DN01 is consistent <br>

with that of other nodes.\end{array}\right\}\)| 4. Check if the node address of CMC-DN01 is illegal. |
| :--- |
| 5. Check if the network power supply is normal. |

MS LED

| LED status | Indication | How to correct |
| :--- | :--- | :--- |
| Off | No power supply or being off-line | Check the power supply of CMC-DN01 and see of the <br> connection is normal. |
| Green light <br> flashes | Waiting for I/O data | Switch the master PLC to RUN status |
| Green light on | I/O data are normal | -- |
| Red light <br> flashes | Mapping error | 1. Reconfigure CMC-DN01 <br> 2. Re-power AC motor drive |
| Red light on | Hardware error | 1. See the error code displayed on AC motor drive. <br> 2. Send back to the factory for repair if necessary. |
| Orange light <br> flashes | CMC-DN01 is establishing connection <br> with AC motor drive. | If the flashing lasts for a long time, check if <br> CMC-DN01 and AC motor drive are correctly installed <br> and normally connected to each other. |

## CMC-EIP01

- Features

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

## - Product Introduction


[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 | 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 <br> Configuration |

## Electrical Specifications

| Weight | 25 g |
| :--- | :--- |
| Insulation Voltage | 500 VDC |
| Power Consumption | 0.8 W |
| Power Supply Voltage | 5 VDC |

Environment Specifications

| Noise immunity | ESD (IEC 61800-5-1,IEC 61000-4-2) <br> EFT (IEC 61800-5-1,IEC 61000-4-4) <br> Surge Test (IEC 61800-5-1,IEC 61000-4-5) <br> Conducted Susceptibility Test (IEC 61800-5-1,IEC 61000-4-6) |
| :--- | :--- |
| Operation/storage | Operation: $-10^{\circ} \mathrm{C} \sim 50^{\circ} \mathrm{C}$ (temperature), 90\% (humidity), pollution degree 2 <br> Storage: $-25^{\circ} \mathrm{C} \sim 70^{\circ} \mathrm{C}$ (temperature), 95\% (humidity), non-condensing |
| Vibration/shock <br> immunity | International standard: IEC 61800-5-1, IEC 60068-2-6/IEC 61800-5-1, IEC 60068-2-27 |

- Installation


## Connecting CMC-EIP01 to a 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 connector: Definition of Pins

| PIN | Signal | Definition |
| :---: | :---: | :---: |
| 1 | $\mathrm{Tx}^{+}$ | Positive pole for |
| 2 | $\mathrm{Tx}-$ | Negative pole for |
| 3 | $\mathrm{Rx}^{+}$ | Positive pole for |
| 4 | -- | N/C |


| PIN | Signal | Definition |
| :---: | :---: | :---: |
| 5 | -- | N/C |
| 6 | Rx- | Negative pole for |
| 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 $6 \sim 8 \mathrm{~kg}-\mathrm{cm}(5.21 \sim 6.94 \mathrm{in}-\mathrm{lbs})$ after the PCB is clipped with the holes (see Figure 5).

[Figure 3]

[Figure 4]

［Figure 5］

## －Communication parameter for VFD－CP2000 to connect to an Ethernet

Before VFD－CP2000 is linked to an Ethernet，set up the communication parameters shown in the table below．
Then Ethernet master will be able to read／write the frequency characters and control characters from／into VFD－CP2000 after communication parameters are set．

| CP2000 Parameters | Functions | Factory setting <br> （Dec） | Explanation |
| :---: | :---: | :---: | :--- |
| $00-20$ | Set up source of <br> frequency command | 0 | Frequency command from keypad |
| $00-21$ | Set up source of <br> operation command | 5 | Operation command from communication <br> card． |
| $09-30$ | Communication <br> decoding method | 0 | The decoding method for Delta AC Motor <br> Drive（Delta AMD）． |
| $09-75$ | IP configuration | 0 | Static IP（0）／Dynamic IP |
| $09-76$ | IP address－1 | 192 | IP 地址 192．168．1．5 |
| $09-77$ | IP address－2 | 168 | IP 地址 192．168．1．5 |
| $09-78$ | IP address－3 | 1 | IP 地址 192．168．1．5 |
| $09-79$ | IP address－4 | 5 | IP 地址 192．168．1．5 |
| $09-80$ | Net mask－1 | 255 | Net mask 255．255．255．0 |
| $09-81$ | Net mask－2 | 255 | Net mask 255．255．255．0 |
| $09-82$ | Net mask－3 | 255 | Net mask 255．255．255．0 |
| $09-83$ | Net mask－4 | 0 | Net mask 255．255．255．0 |
| $09-84$ | Default gateway－1 | 192 | Default gateway 192．168．1．1 |
| $09-85$ | Default gateway－2 | 168 | Default gateway 192．168．1．1 |
| $09-86$ | Default gateway－3 | 1 | Default gateway 192．168．1．1 |
| $09-87$ | Default gateway－4 | 1 | Default gateway 192．168．1．1 |
|  |  |  |  |

## ■ Remove 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 8]

LED Indicators \& 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 | Action |
| :---: | :---: | :---: | :--- | :--- |
| POWER | Green | On | Power supply in normal status | No action required |
|  |  | Off | No power supply | Check the power supply. |
| LINK | On | Network connection in normal status | No action required |  |
|  | Green | Flashes | Network in operation | No action required |
|  | Off | Network not connected | Check if the network cable is <br> connected. |  |

Troubleshooting

| Abnormality | Cause | Action |
| :--- | :--- | :--- |
| POWER LED <br> off | AC motor drive not powered | Check if AC motor drive is powered, and if the power <br> supply is normal. |
|  | CMC-EIP01 not connected to AC <br> motor drive | Make sure CMC-EIP01 is connected to AC motor drive. |


| Abnormality | Cause | Action |
| :---: | :---: | :---: |
| LINK LED off | CMC-EIP01 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 communication card found | CMC-EIP01 not connected to network | Make sure CMC-EIP01 is connected to network. |
|  | PC and CMC-EIP01 in different networks and blocked by network firewall. | Search by IP or set up relevant settings by AC motor drive keypad. |
| Fail to open CMC-EIP01 setup page | CMC-EIP01 not connected to network | Make sure CMC-EIP01 is connected to the network. |
|  | Incorrect communication setting in DCISoft | Make sure the communication setting in DCISoft is set to Ethernet. |
|  | PC and CMC-EIP01 in different networks and blocked by network firewall. | Conduct the setup by AC motor drive keypad. |
| Able to open CMC-EIP01 setup page but fail to utilize webpage monitoring | Incorrect network setting in CMC-EIP01 | Check if the network setting for CMC-EIP01 is correct. For the Intranet setting in your company, please consult your IT staff. For the Internet setting in your home, please refer to the network setting instruction provided by your ISP. |
| Fail to send e-mail | Incorrect network setting in CMC-EIP01 | Check if the network setting for CMC-EIP01 is correct. |
|  | Incorrect mail server setting | Please confirm the IP address for SMTP-Server. |

EMC-COP01

- RJ-45: Definition of Pins

Male

Female

| 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- |
| 6 | CAN_GND | Ground/0V/V- |
|  |  |  |

- Specifications

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

- CANopen Communication Cable

Model : TAP-CB03, TAP-CB04


| Title | Part No. | L |  |
| :---: | :---: | :---: | :---: |
|  |  | mm | inch |
| 1 | TAP-CB03 | $500 \pm 10$ | $19 \pm 0.4$ |
| 2 | TAP-CB04 | $1000 \pm 10$ | $39 \pm 0.4$ |

- CANOpen Breakout Box

Model : TAP-CN03


## NOTE

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

## 09 CP2000 Specifications

## 230 V series

| Frame size | A |  |  |  |  | B |  |  | C |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Model ：VFD＿＿＿＿CP23A－ | 007 | 015 | 022 | 037 | 055 | 075 | 110 | 150 | 185 | 220 | 300 |
| Rated Output Capacity（kVA） | 2.0 | 3.0 | 4.0 | 6.0 | 8.4 | 12 | 18 | 24 | 30 | 36 | 42 |
| Rated Output Current（A） | 5 | 7.5 | 10 | 15 | 21 | 31 | 46 | 61 | 75 | 90 | 105 |
| Applicable Motor Output（kW） | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 |
| Light Applicable Motor Output（HP） | 1 | 2 | 3 | 5 | 7.5 | 10 | 15 | 20 | 25 | 30 | 40 |
| Duty Overload tolerance | 120\％of rated current for 1 minute |  |  |  |  |  |  |  |  |  |  |
| 気 Max．output frequency $(\mathrm{Hz})$ | $600.00 \mathrm{~Hz}(55 \mathrm{KW} \sim: 400.00 \mathrm{~Hz})$ |  |  |  |  |  |  |  |  |  |  |
| Carrier Frequency（kHz） | 2～15kHz（8KHz） |  |  |  |  |  |  |  | 2～10kHz（ 6 kHz ） |  |  |
| \％Rated Output Capacity（kVA） | 1.8 | 2.0 | 3.2 | 4.4 | 6.8 | 10 | 13 | 20 | 26 | 30 | 36 |
| －Rated Output Current（A） | 4.6 | 5 | 8 | 11 | 17 | 25 | 33 | 49 | 65 | 75 | 90 |
| Normal Applicable Motor Output（kW） | 0.4 | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 |
| Normal Applicable Motor Output（HP） | 0.5 | 1 | 2 | 3 | 5 | 7.5 | 10 | 15 | 20 | 25 | 30 |
| Duty Overload tolerance | 120\％of rated current for 1 minute，160\％of rated current for 3 seconds |  |  |  |  |  |  |  |  |  |  |
| Max．output frequency（Hz） | $600.00 \mathrm{~Hz}(55 \mathrm{KW} \sim: 400.00 \mathrm{~Hz})$ |  |  |  |  |  |  |  |  |  |  |
| Carrier Frequency（kHz） | 2～15kHz（8KHz） |  |  |  |  |  |  |  | 2～10kHz（6kHz）｀ |  |  |
| Input Current（A）Light Duty | 6.4 | 9.6 | 15 | 22 | 25 | 35 | 50 | 65 | 83 | 100 | 116 |
| \＃afinput Current（A）Normal Duty | 3.9 | 6.4 | 12 | 16 | 20 | 28 | 36 | 52 | 72 | 83 | 99 |
| 首：Rated Voltage／Frequency | 3－phase AC 200V～240V（－15\％～＋10\％），50／60Hz |  |  |  |  |  |  |  |  |  |  |
| Operating Voltage Range | 170～265Vac |  |  |  |  |  |  |  |  |  |  |
| Frequency Tolerance | $47 \sim 63 \mathrm{~Hz}$ |  |  |  |  |  |  |  |  |  |  |
| Cooling method | Natural Cooling | Fan Cooling |  |  |  |  |  |  |  |  |  |
| Braking Chopper | Frame A，B，C：Built－in |  |  |  |  |  |  |  |  |  |  |
| DC choke | Frame A，B，C：Optional |  |  |  |  |  |  |  |  |  |  |
| EMI Filter | Optional |  |  |  |  |  |  |  |  |  |  |

## 230V series

| Frame size | D |  | E |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Model：VFD＿＿＿＿CP23A－ | 370 | 450 | 550 | 750 | 900 |
| Rated Output Capacity（kVA） | 58 | 72 | 86 | 110 | 128 |
| Rated Output Current（A） | 146 | 180 | 215 | 276 | 322 |
| Applicable Motor Output（kW） | 37 | 45 | 55 | 75 | 90 |
| Applicable Motor Output（HP） | 50 | 60 | 75 | 100 | 125 |
| Light Duty Overload tolerance | 120\％of rated current for 1 minute |  |  |  |  |
| 杨 Max．output frequency（Hz） | $600.00 \mathrm{~Hz}(55 \mathrm{KW} \sim: 400.00 \mathrm{~Hz})$ |  |  |  |  |
| $\stackrel{\text { Carrier Frequency }}{ \pm} \mathrm{kHz}$ ） | 2～10kHz（6KHz） |  | 2～9kHz（4KHz） |  |  |
| 旁 Rated Output Capacity（kVA） | 48 | 58 | 72 | 86 | 102 |
| －Rated Output Current（A） | 120 | 146 | 180 | 215 | 255 |
| Applicable Motor Output（kW） | 30 | 37 | 45 | 55 | 75 |
| Normal Applicable Motor Output（HP） | 40 | 50 | 60 | 75 | 100 |
| Duty Overload tolerance | 120\％of rated current for 1 minute；160\％of rated current for 3 seconds |  |  |  |  |
| Max．output frequency（Hz） | $600.00 \mathrm{~Hz}(55 \mathrm{KW} \sim: 400.00 \mathrm{~Hz})$ |  |  |  |  |
| Carrier Frequency（kHz） | 2～10kHz（6kHz） |  | $2 \sim 9 \mathrm{kHz}(4 \mathrm{kHz})$ |  |  |
| Input Current（A）Light Duty | 146 | 180 | 215 | 276 | 322 |
| \＃on Input Current（A）Normal Duty | 124 | 143 | 171 | 206 | 245 |
| 을 Rated Voltage／Frequency | 3－phase AC 200V～240V（－15\％～＋10\％）， $50 / 60 \mathrm{~Hz}$ |  |  |  |  |
| $\simeq$ Operating Voltage Range | 170～265Vac |  |  |  |  |
| Frequency Tolerance | $47 \sim 63 \mathrm{~Hz}$ |  |  |  |  |
| Cooling method | Fan Cooling |  |  |  |  |
| Braking Chopper | Frame D and above：Optional |  |  |  |  |
| DC choke | Frame D and above：3\％built－in |  |  |  |  |
| EMI Filter | Optional |  |  |  |  |

## 460V series

| Frame | A |  |  |  |  |  |  | B |  |  | C |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Models <br> VFD____CP43A-_ _; | 007 | 015 | 022 | 037 | 040 | 055 | 075 | 110 | 150 | 185 | 220 | 300 | 370 |
| VFD____CP4EA-__; |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Rated Output Capacity (kVA) | 2.4 | 2.9 | 4.0 | 6.0 | 8.4 | 9.6 | 11.2 | 18 | 24 | 29 | 36 | 45 | 57 |
| Rated Output Current (A) | 3 | 3.7 | 5 | 7.5 | 10.5 | 12 | 14 | 22.5 | 30 | 36 | 45 | 56 | 72 |
| Applicable Motor Output(kW) | 0.75 | 1.5 | 2.2 | 3.7 | 4.0 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | 37 |
| Light Applicable Motor Output(HP) | 1 | 2 | 3 | 5 | 5 | 7.5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 |
| Duty Overload tolerance | 120\% of rated current for 1 minute |  |  |  |  |  |  |  |  |  |  |  |  |
| En Max. output frequency(Hz) | $600.00 \mathrm{~Hz}(90 \mathrm{KW} \sim: 400.00 \mathrm{~Hz})$ |  |  |  |  |  |  |  |  |  |  |  |  |
| \# Carrier Frequency(kHz) | 2~15kHz(8KHz) |  |  |  |  |  |  |  |  |  | 2~10kHz (6kHz) |  |  |
| \# Rated Output Capacity (kVA) | 2.2 | 2.4 | 3.2 | 4.8 | 7.2 | 8.4 | 10 | 14 | 19 | 25 | 30 | 36 | 48 |
| $\bigcirc \quad$ Rated Output Current (A) | 2.8 | 3.0 | 4.0 | 6.0 | 9.0 | 10.5 | 12 | 18 | 24 | 32 | 38 | 45 | 60 |
| Normal Applicable Motor Output(kW) | 0.4 | 0.75 | 1.5 | 2.2 | 3.7 | 4.0 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 |
| Duty ${ }^{\text {Nata }}$ Applicable Motor Output(HP) | 0.5 | 1 | 2 | 3 | 5 | 5 | 7.5 | 10 | 15 | 20 | 25 | 30 | 40 |
| Duty Overload tolerance | 120\% of rated current for 1 minute; $160 \%$ of rated current for 3 seconds |  |  |  |  |  |  |  |  |  |  |  |  |
| Max. output frequency(Hz) | $600.00 \mathrm{~Hz}(90 \mathrm{KW} \sim: 400.00 \mathrm{~Hz})$ |  |  |  |  |  |  |  |  |  |  |  |  |
| Carrier Frequency (kHz) | $2 \sim 15 \mathrm{kHz}(8 \mathrm{KHz})$ |  |  |  |  |  |  |  |  |  | 2~10kHz (6kHz) |  |  |
| Input Current (A) Light Duty | 4.3 | 5.4 | 7.4 | 11 | 16 | 18 | 20 | 25 | 33 | 39 | 47 | 58 | 76 |
| \# Input Current (A) Normal Duty | 3.5 | 4.3 | 5.9 | 8.7 | 14 | 15.5 | 17 | 20 | 26 | 35 | 40 | 47 | 63 |
| E- Rated Voltage/Frequency | 3-phase AC 380V~480V ( $-15 \% \sim+10 \%$ ), $50 / 60 \mathrm{~Hz}$ |  |  |  |  |  |  |  |  |  |  |  |  |
| Operating Voltage Range | 323~528Vac |  |  |  |  |  |  |  |  |  |  |  |  |
| Frequency Tolerance | $47 \sim 63 \mathrm{~Hz}$ |  |  |  |  |  |  |  |  |  |  |  |  |
| Cooling method | Natural Cooling Fan Cooling |  |  |  |  |  |  |  |  |  |  |  |  |
| Braking Chopper | Frame A,B,C: Built-in |  |  |  |  |  |  |  |  |  |  |  |  |
| DC choke | Frame A, B,C: Optional |  |  |  |  |  |  |  |  |  |  |  |  |
| EMI Filter | Frame A, B, C of VFD____CP4EA-_ _ , EMI filter built-in;Frame A, B, C of VFD_____CP43A___ EMI filter NOT built-in. ; |  |  |  |  |  |  |  |  |  |  |  |  |

## 460 V series



General Specifications:

|  | Control Method | 1: V/F(V/F control), 2: SVC(Sensorless Vector Control), |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Starting Torque | Reach up to $150 \%$ or above at 0.5 Hz . |  |  |  |  |
|  | V/F Curve | 4 point adjustable V/F curve and square curve |  |  |  |  |
|  | Speed Response Ability | 5 Hz |  |  |  |  |
|  | Torque Limit | Normal Duty: Max. 170\% torque current |  |  |  |  |
|  | Torque Accuracy | $\pm 5 \%$ |  |  |  |  |
|  | Max. Output Frequency (Hz) | 230V series: 600.00 Hz (55kw and above: 400.00 Hz ); 460 V series: 600.00 Hz ( 90 KW and above: 400.00 Hz ) |  |  |  |  |
|  | Frequency Output Accuracy | Digital command: $\pm 0.01 \%,-10^{\circ} \mathrm{C} \sim+40^{\circ} \mathrm{C}$, Analog command: $\pm 0.1 \%, 25 \pm 10^{\circ} \mathrm{C}$ |  |  |  |  |
|  | Output Frequency Resolution | Digital command: 0.01 Hz , Analog command: max. output frequency x $0.03 / 60 \mathrm{~Hz}$ ( $\pm 11 \mathrm{bit}$ ) |  |  |  |  |
|  | Overload Tolerance | Light duty: 120\% of rated current for 1 minute; <br> Normal duty: 120\% of rated current for 1 minute; $160 \%$ of rated current for 3 seconds |  |  |  |  |
|  | Frequency Setting Signal | 0~+10V, 4~20mA, 0~20mA, pulse input |  |  |  |  |
|  | Accel. /Decel. Time | 0.00~600.00/0.0~6000.0 seconds |  |  |  |  |
|  | Main control function | Fault restart | Parameter copy | Dwell | BACnet <br> Communication | Momentary power loss ride thru |
|  |  | Speed search | Over-torque detection | Torque limit | $\begin{aligned} & \text { 16-step speed } \\ & \text { (max) } \end{aligned}$ | Accel/Decel. time switch |
|  |  | S-curve accel/decel | 3-wire sequence | Auto-Tuning <br> (rotational, <br> stationary) | Frequency upper/lower <br> limit settings | Cooling fan on/off switch |
|  |  | Slip compensation | Torque compensation | JOG frequency | MODOBUS communication (RS-485 RJ45, max. 115.2 kbps) | DC injection braking at start/stop |
|  |  | Smart Stall | PID control (with sleep function) | Energy saving control |  |  |
|  | Fan Control | ```230V series Models higher than VFD150CP23A-21 (included) are PWM control ; Models lower than VFD150CP23A-21 (not included) are on/off switch control. 460 V series Models higher than VFD150CP43A-21/4EA-21 (included) are PWM control ; Models lower than VFD150CP43A-21/4EA-21(not included) are on/off switch control.``` |  |  |  |  |
|  | Motor Protection | Electronic thermal relay protection |  |  |  |  |
|  | Over-current Protection | Normal Duty: Over-current protection for $240 \%$ rated current Current clamp 『 Normal duty: 170~175\% 』 |  |  |  |  |
|  | Over-voltage Protection | 230: drive will stop when DC-BUS voltage exceeds 410 V 460: drive will stop when DC-BUS voltage exceeds 820 V |  |  |  |  |
|  | 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 |  |  |  |  |
| International Certifications |  | ( 4 (UL)us GB/T12668-2 |  |  |  |  |

## Environment for Operation, Storage and Transportation:

DO NOT expose the AC motor drive in harsh environments, such as dust, direct sunlight, corrosive/inflammable gasses, humidity, liquid and vibration environment. The salt in the air must be less than $0.01 \mathrm{mg} / \mathrm{cm}^{2}$ every year.

| Environment | Installation location | IEC60364-1/IEC60664-1 Pollution degree 2, Indoor use only |  |
| :---: | :---: | :---: | :---: |
|  | Surrounding Temperature | Storage $\quad-25^{\circ} \mathrm{C} \sim+70^{\circ} \mathrm{C}$ |  |
|  |  | Transportation $-25^{\circ} \mathrm{C} \sim+70^{\circ} \mathrm{C}$ |  |
|  |  | Non-condensation, non-frozen |  |
|  | Rated Humidity | Operation ${ }^{\text {Max. }}$ 90\% |  |
|  |  | Storage/ <br> Transportation Max. 95\% |  |
|  |  | No condense water |  |
|  | Air Pressure | Operation/ Storage 86 to 106 kPa |  |
|  |  | Transportation 70 to 106 kPa |  |
|  | Pollution Level | IEC721-3-3 |  |
|  |  | Class 3C2; Class 3S2 |  |
|  |  | Class 2C2; Class 2S2 |  |
|  |  | Class 1C2; Class 1S2 |  |
|  |  | No concentrate |  |
|  | Altitude | If AC motor drive is installed at altitude $0 \sim 1000 \mathrm{~m}$, follow normal operation restriction. If it is install at altitude $1000 \sim 3000 \mathrm{~m}$, decrease $2 \%$ of rated current or lower $0.5^{\circ} \mathrm{C}$ of temperature for every 100 m increase in altitude. Maximum altitude for Corner Grounded is 2000 m . |  |
| Package Drop | Storage | ISTA procedure 1A(according to weight) IEC60068-2-31 |  |
|  | Transportation |  |  |
| Vibration | 1.0 mm , peak to peak value range from 2 Hz to $13.2 \mathrm{~Hz} ; 0.7 \mathrm{G} \sim 1.0 \mathrm{G}$ range from 13.2 Hz to $55 \mathrm{~Hz} ; 1.0 \mathrm{G}$ range from 55 Hz to 512 Hz . Comply with IEC 60068-2-6 |  |  |
| Impact | IEC/EN 60068-2-27 |  |  |
| Operation <br> Position | Max. allowed offset angle $\pm 10^{\circ}$ (under normal installation position) |  |  |

## Specification for Operation Temperature and Protection Level

| Model | Frame | Top cover | Conduit Box | Protection Level | Operation Temperature |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\begin{aligned} & \text { Frame A~C } \\ & 230 \mathrm{~V}: 0.75 \sim 30 \mathrm{~kW} \end{aligned}$ | Remove top cover | Standard conduit | IP20/UL Open Type | $\begin{aligned} & \text { ND:- } 10 \sim 50^{\circ} \mathrm{C} \\ & \text { LD: }-10 \sim 40^{\circ} \mathrm{C} \end{aligned}$ |
| $\begin{aligned} & \text { VFDxxxxCP23A-21 } \\ & \text { VFDxxxxCP43A-21 } \end{aligned}$ | 460V: 0.75~37kW | Standard with top cover | plate | IP20/UL Type1/NEMA1 | $\begin{aligned} & \text { ND: }-10 \sim 40^{\circ} \mathrm{C} \\ & \text { LD: }-10 \sim 40^{\circ} \mathrm{C} \end{aligned}$ |
| $\begin{aligned} & \text { VFDxxxxCP4EA-21, } \\ & \text { VFDxxxxCP43C-21 } \end{aligned}$ | Frame $\mathrm{D} \mathrm{\sim H}$ $230 \mathrm{~V}:$ above 37 kW 460 V : above 45 kW | N/A | With conduit box | IP20/UL Type1/NEMA1 | $\begin{aligned} & \text { ND: }-10 \sim 40^{\circ} \mathrm{C} \\ & \text { LD: }-10 \sim 40^{\circ} \mathrm{C} \end{aligned}$ |
| VFDxxxxCP23A-00 <br> VFDxxxxCP43A-00 <br> VFDxxxxCP43C-00, | $\begin{aligned} & \text { Frame } \mathrm{D} \sim \mathrm{H} \\ & 230 \mathrm{~V}: \text { above } 37 \mathrm{~kW} \\ & 460 \mathrm{~V} \text { : above } 45 \mathrm{~kW} \end{aligned}$ | N/A | Without conduit box | IP00 <br> IP20/UL Open Type <br> Only the circled area is IPOO, other parts are IP20. | ND: $-10 \sim 50^{\circ} \mathrm{C}$ <br> LD: $-10 \sim 40^{\circ} \mathrm{C}$ (ND =Normal <br> Duty; LD = Light <br> Duty) |

## 10 Digital Keypad

KPC-CC01


KPC-CE01(Option)


- Communication Interface

RJ-45 (socket), RS-485 interface;

- Installation Method

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

- Charge the digital keypad for 6 minutes before you use it to program Delta's AC Motor Drive.
- What's new at KPC-CC01 keypad?
-It supports calendar function of PLC ( See Chapeter 17 for more infomation about PLC.)
-The available editing pages reach the maximum
number of pages supported by TP Editor.
-TP Editor v.140.1 is required
-It supports VFDSoft to read parameters. Please go to http://www.delta.com.tw/ to download VFDSoft v1.45.


## Descriptions of Keypad Functions

| Key | Descriptions |
| :---: | :---: |
| RUN | Start Operation Key <br> 1. It is only valid when the source of operation command is from the keypad. <br> 2. It can operate the AC motor drive by the function setting and the RUN LED will be ON. <br> 3. It can be pressed again and again at stop process. <br> 4. When enabling "HAND" mode, it is only valid when the source of operation command is from the keypad. |
| STOP RESET | Stop Command Key. This key has the highest processing priority in any situation. <br> 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. <br> 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. |
| $\begin{gathered} \text { FWD } \\ \text { REV } \end{gathered}$ | Operation Direction Key <br> 1. This key is only control the operation direction NOT for activate the drive. FWD: forward, REV: reverse. <br> 2. Refer to the LED descriptions for more details. |
| ENTER | ENTER Key <br> Press ENTER and go to the next level. If it is the last level then press ENTER to execute the command. |
| ESC | ESC Key <br> ESC key function is to leave current menu and return to the last menu. It is also functioned as a return key in the sub-menu. |
| MENU | Press menu to return to main menu. <br> Menu content: <br> KPC-CE01 does not support function $5 \sim 13$. <br> 1. Detail Parameter <br> 7. Quick/Simple Setup <br> 13. PC Link |



## Descriptions of LED Functions

| LED | Descriptions <br> RUN |
| :--- | :--- |
| Steady ON: operation indicator of the AC motor drive, including DC brake, zero speed, standby, restart <br> 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 |  |



## Digital Keypad: KPC-CC01 Function



## NOTE

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).
3. Charge the digital keypad for 6 minutes before you use it to program Delta's AC Motor Drive.

## 4. Display Icon



## Display item



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

MENU
1.Detail Parameter
2.Copy Parameter
3.Keypad Locked
4.PLC Function
5. Copy PLC
6. Fault Record
7. Quick/Simple Setup
8. Display Setup
9. Time Setup
10. Language Setup
11. Start-up
12. Main page
13. PC Link

1. Detail Parameter

2. Copy Parameter


Copy parameters (Pr)

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


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

| Keypad locked |
| :--- | :--- |$\quad$| Keypad Locked |
| :--- |
| This function is used to lock the keypad. The main page would not display "keypad |
| Press "ENTER" |
| lo lock |
| 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. |

4. PLC Function

| PLC | When activate and stop PLC function, the PLC status will be displayed on main page of Delta default setting. |
| :---: | :---: |
| $\checkmark$ 1.Disable <br> 2.PLC Run <br> 3.PLC Stop <br> PLC function |  |
| 1. Disable <br> 2. PLC run <br> 3. PLC stop | The PLC function of KPC-CE01 can only displays: <br> 1. PLC0 <br> 2. PLC1 <br> 3. PLC2 |

5. Copy PLC

6. Fault record

7. Quick/Simple Setting

| Quick setting |  |
| :--- | :--- |
|  | 1: V/F mode |
| 3: SVC mode |  |
| 6: My mode |  |

Quick Setting: (CP2000 does NOT have PG card)
1)V/F Mode


Items

1. Parameter Protection Password Input (P00-07)
2. Parameter Protection Password Setting (P00-08)
3. Control Mode (P00-10)
4. Control of Speed Mode (P00-11)
5. Load Selection (P00-16)
6. Carrier Frequency (P00-17)
7. Source of the Master Frequency Command (AUTO) (P00-20)
8. Source of the Operation Command (AUTO) (P00-21)
9. Stop Method (P00-22)
10. Digital Keypad STOP function (P00-32)
11. Max. Operation Frequency (P01-00)
12. Base Frequency of Motor 1 (P01-01)
13. Max. Output Voltage Setting of Motor 1 (P01-02)
14. Mid-point Frequency 1 of Motor 1 (P01-03)
15. Mid-point Voltage 1 of Motor 1 (P01-04)
16. Mid-point Frequency 2 of Motor 1 (P01-05)
17. Mid-point Voltage 2 of Motor 1 (P01-06)
18. Min. Output Frequency of Motor 1 (P01-07)
19. Min. Output Voltage of Motor 1 (P01-08)
20. Output Frequency Upper Limit (P01-10)
21. Output Frequency Lower Limit (P01-11)
22. Accel. Time 1 (P01-12)
23. Decel Time 1 (P01-13)
24. Over-voltage Stall Prevention (P06-01)
25. Derating Protection (P06-55)
26. Software Brake Level (P07-00)
27. Speed Search during Start-up (P07-12)
28. Emergency Stop (EF) \& Force to Stop Selection (P07-20)
29. Filter Time of Torque Command (P07-24)
30. Filter Time of Slip Compensation (P07-25)
31. Torque Compensation Gain (P07-26)
32. Slip Compensation Gain (P07-27)
3)SVC Mode

01: Password Input (Decode)


Items

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


8．Display setup


9．Time setting


10．Language setup

| Language <br> $1:$ English <br> 2：繁體中文 <br> 3 3：簡體中文 | Language selection． |
| :--- | :--- |

11．Startup Page Setting

|  | 1．Default picture 1 <br> DELTA LOGO |
| :---: | :---: |
| Start－up |  |
| 1．Default 1 | 2．Default picture 2 |
| 2．Default 2 | 3．User defined：optional accessory is require（TPEditor \＆USB／RS－485 |
| 3．User define | Install an editing accessory would allow users to design their own start－up page． If editor accessory is not installed，＂user defined＂option will display a blank page． |
|  | USB／RS－485 Communication Interface－IFD6530 |
|  | Please refer to Chapter 07 Optional Accessories for more detail． |
|  | TPEditor |
|  | TPEditor Installation Instruction is on page 10－16 and TPEditor V1．03 is available for download at： <br> http：／／www．delta．com．tw／product／em／download／download main．asp？act＝3\＆pid＝3\＆cid＝3\＆tpid＝3 |

12. Main page

|  | 1. Default page |
| :---: | :---: |
| Main Page | Default picture and editable picture are available upon selection. |
| 1.Default 2. User define | $\begin{array}{cl} \text { ثF } & 60.00 \mathrm{~Hz} \\ \text { H } & 0.00 \mathrm{~Hz} \\ \text { A } & 0.00 \\ \text { 14: 25:56 } \end{array}$ |
| Press $\square$ ENTER to select. | F 600.00 Hz >>> H >>> A >>> U (circulate) <br> 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 display a blank page. |
|  | USB/RS-485 Communication Interface-IFD6530 |
|  | Please refer to Chapter 07 Optional Accessories for more detail. TPEditor |
|  | TPEditor Installation Instruction is on page 10-16 and TPEditor V1.03 is available for download at: <br> http://www.delta.com.tw/product/em/download/download_main.asp?act=3\&pid=3\&cid=3\&tpid=3 |

13. PC Link


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

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

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

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

## Other display

When fault occur, the menu will display:


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

## Optional accessory for digital keypad: RJ45 Extension Lead

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

Note:
a. Keypad version 1.00 supports up to 4 main pages. If you download over 4 main pages, it will only support the first 4 downloaded main pages.
b. By pressing keypads, you can only switch pages from pates. It doesn’t support entering words or images.
c. Downloading baud rate supports 9600 bps, 19200 bps and 38400 bps .
d. The VFD communication address to read and write are at 0 x 22 xx

Definition of Communication address:

| Address | Read/Write |  | Definition | Description |
| :---: | :---: | :---: | :---: | :---: |
| 2200h | R | b15~b0 | Output current (A) |  |
| 2201h | R | b15~b0 | Counter Value ( c ) |  |
| 2202h | R | b15~b0 | Actual Frequency (H) |  |
| 2203h | R | b15~b0 | DC-Bus Voltage (U) |  |
| 2204h | R | b15~b0 | Output Voltage(A) |  |
| 2205h | R | b15~b0 | Power Factor Angle (n) |  |
| 2206h | R | b15~b0 | Output Power(P) |  |
| 2207h | R | b15~b0 | Actual Motor Speed( r ) |  |
| 2208h | R | b15~b0 | Output Torque (t) |  |
| 2209h | R | b15~b0 | PG Position (G) |  |
| 220Ah | R | b15~b0 | Feedback PV value ( b ) |  |
| 220Bh | R | b15~b0 | AVI in percentage (1.) |  |
| 220Ch | R | b15~b0 | ACI in percentage (2.) |  |
| 220Dh | R | b15~b0 | AUI in percentage (3.) |  |
| 220Eh | R | b15~b0 | Heat Sink temperature (t.) |  |
| 220Fh | R | b15~b0 | IBGT temperature (T) |  |
| 2210h | R | b15~b0 | DI ON/OFF status ( i) |  |
| 2211h | R | b15~b0 | DO ON/OFF status (o) |  |
| 2212h | R | b15~b0 | Multi-Speed (S) |  |
| 2213h | R | b15~b0 | DI CPU pin status (i.) |  |
| 2214h | R | b15~b0 | DO CPU pin status (o.) |  |
| 2215h | R | b15~b0 | Running number of Encoder (Z) |  |
| 2216h | R | b15~b0 | Pulse Input Frequency (4) |  |
| 2217h | R | b15~b0 | Pulse Input Position (4.) |  |

## TPEditor Installation Instruction

1) TPEditor: Setup \& Basic Functions
1. Run TPEditor version 1.30
2. Go to File (F) $\rightarrow$ 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.

| Ye= Frimest |  |
| :---: | :---: |
| HDAL - FLC |  |
| Sen Devise Type |  |
| DELTA VFD-C hvater | 4 |
| TP Type |  |
| VFD-C Keghd | $\bullet$ |
| FieNlent |  |
| TTP00 |  |
| OR |  |

3. You are now at the designing page. Go to Edit (E) $\rightarrow$ 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 version 1.00 and can support up to 4 pages.

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

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

2. Static Text

A
. Open a blank page, click once on this button following windows will pop up.


On the right hand side of the Static Text Setting, you can adjust the frame setting, the text direction, the alignment and the font setting. Once you finish all the adjustments that you need.
You can continue to input your text in the blank space of Static Text Setting window. When you finish inputting your text, click on OK to continue your next step or click cancel to abort the current step.
34. Static Bitmap $\rightarrow$ 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 an image that you need and click open, then that image will appear in the Static Bitmap window.
35. Geometric Bitmap
$\square$ $\rightarrow$ As shown in the picture on the left side, there are 11 kinds of geometric bitmap to choose. Open a new blank page then click once on a geometric bitmap icon that you need. Then drag that icon and enlarge it to the size that you need on that blank page. For example, if you drag this icon $\qquad$ to a blank page, you will see the following window.

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


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

3) Edit Main Page

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


From left to right: Static Text, ASCII Display, Static Bitmap, Scale, Bar Graph, Button, Clock Display, Units, Numeric Input, 11 geometric bitmaps and different width of lines. The application of Static Text, Static Bitmap, and geometric bitmap is the same as the editing startup page.
2. Numeric/ASCII Display A): Go to Objects (O) $\rightarrow$ Click once on the Numeric/ASCII Display(A) $\mathbf{N}$ Numeric/ASCII Display(A) where you want to create an object $\rightarrow$ Double click on the object to set up Related Devices, Frame Setting , Fonts and Alignment.


Related Device: Choose the VFD Communication Port that you need, if you want to read output frequency (H), set the VFD Communication Port to $\$ 2202$. For other values, please refer to ACMD ModBus Comm Address List.
3. Scale Setting ${ }^{\overline{7 \cdot-1}}$ : On the Tool Bar, click on this ${ }^{\frac{7 \cdot-1}{2}}$ for Scale Setting. You can also edit Scale Setting in the Property Window on the right hand side of your computer screen.

a. Scale Position: Click on the drop down list to choose which position that you need to place a scale.
b. Scale Side: Click on the drop down list to choose if you want to number your scale from smaller number to bigger number or from big to small. Click OK to accept this setting or click Cancel to abort.
c. Font Setting: Click on the drop down list to choose the Font setting that you need then click OK to accept the setting or click Cancel to abort.
d. Value Length: Click on the drop down to choose 16bits or 32 bits. Then click OK to accept the setting or click Cancel to abort.
e. Main Scale \& Sub Scale: In order to divide the whole scale into equal parts, key in the numbers of your choices for main scale and sub scale.
f. Maximum value \& Minimum Value are the numbers on the two ends of a scale. They can be negative numbers but the input numbers are limited by value.
g. Follow the Scale setting mentioned above; you will have a scale as shown below.

4. Bar Graph setting :

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

a. <Button Type> allows you set up buttons' functions. But Page Jump is the only supported function currently.
b. Page Jump setting: After you choose the Page Jump function in the drop down list, you will see this Page Jump Setting Menu
c. <Function Key> allows you to assign functions to the following keys on the KPC-CC01 keypad: F1, F2, F3, F4, Up, Down, Left and Right. Please note that the Up and Down keys are locked by TPEditor. These two keys cannot be programmed. If you want to program Up and Down keys, go to Tool $\rightarrow$ Function Key Settings (F) $\rightarrow$ Re-Define Up/Down $\operatorname{Key}(\mathrm{R})$.

d. There are no supported functions other than the setting mentioned above.
6. Clock Display Setting : Click once on this button 1

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


In the clock display setting, you can choose to display Time, Day or Date on the Keypad. To adjust time, go to \#9 on the Keypad's menu. You can also adjust Frame Setting, Font Setting and Alignment.
7. Unit Measurement $\mathbb{A}$ : Click once on this Button:

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


Choose from the drop down list the Metrology and the Unity Name that you need.
As for Metrology, you have the following choices Length, Square Measure, Volume/Solid Measure, Weight, Speed, Time and Temperature. The unit name changes automatically when you change metrology type.
8. Numeric Input Setting ${ }^{\mid c \sqrt{2} \text {. }}$

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 <Writing> 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 as 4, then press F1 on Keypad Then you can press Up and Down key on the keypad to increase or decrease the value. Press Enter Key on the keypad to confirm your setting. You can also go to parameter table 01-44 to verify if your input correctly the value.
9. Download TP Page

| - TP Page |
| :---: |
| $0:$ |
| Boot Page |

: Press Up or Down key on the keypad until you reach \#13 PC Link. Then press Enter on the keypad and you will see the word "Waiting" on keypad's screen. Now choose a page that you have created then go to Communication (M) $\rightarrow$ Write to TP (W) to start downloading the page to the keypad


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

## 11 Summaries of Parameter Settings

## 00 Drive Parameters

$\square$ NOTE IM: Induction Motor; PM: Permanent Magnet Motor


|  | Parameter | Function | Setting | Factory Setting |
| :---: | :---: | :---: | :---: | :---: |
| N | 00-03 | Start-up Display Selection | ```0: F (frequency command) H (output frequency) U (multi-function display, see Pr.00-04) 3: A (output current)``` | 0 |
| N | 00-04 | Content of Multi-function Display (User Defined) | 0: Display output current (A) <br> 1: Display counter value (c) <br> 2: Display actual output frequency (H.) <br> 3: Display DC-BUS voltage (v) <br> 4: Display output voltage (E) <br> 5: Display output power angle (n) <br> 6: Display output power in $\mathrm{kW}(\mathrm{P})$ <br> 8: Display estimate output torque \% (t) <br> 10: Display PID feedback in \% (b) <br> 11: Display AVI1 in \% (1.) <br> 12: Display ACI in \% (2.) <br> 13: Display AVI2 in \% (3.) <br> 14: Display the temperature of IGBT in ${ }^{\circ} \mathrm{C}$ (i.) <br> 15: Display the temperature of heat sink in ${ }^{\circ} \mathrm{C}$ (c.) <br> 16: The status of digital input (ON/OFF) (i) <br> 17: The status of digital output (ON/OFF) (o) <br> 18: Multi-step speed (S) <br> 19: The corresponding CPU pin status of digital input (d.) <br> 20: The corresponding CPU pin status of digital output (0.) <br> 25: Overload counting ( $0.00 \sim 100.00 \%$ ) (h.) <br> 26: Ground Fault GFF (Unit :\%)( G.) <br> 27: DC Bus voltage ripple (Unit: Vdc) (r.) <br> 28: Display PLC data D1043 (C) <br> 30: Display output of user defined (U) <br> 31: H page x Pr.00-05 Display user Gain(K) | 3 |
|  | 00-05 | Coefficient Gain in Actual Output Frequency | 0~160.00 | 0 |
|  | 00-06 | Software version | Read Only | \#.\#\# |
| N | 00-07 | Parameter Protection Password Input | $0 \sim 65535$ <br> $0 \sim 4$ : Recording \# of times of password attemps | 0 |
| N | 00-08 | Parameter Protection Password Setting | $0 \sim 65535$ <br> 0 : No password protection / password is entered correctly (Pr00-07 <br> 1: Parameter is locked | 0 |
| N | 00-09 | Display advanced parameters | Bit 0: Group 0 <br> Bit 1: Group 1 <br> Bit 2: Group 2 <br> Bit 3: Group 3 <br> Bit 4: Group 4 <br> Bit 5: Group 5 <br> Bit 6: Group 6 <br> Bit 7: Group 7 <br> Bit 8: Group 8 <br> Bit 9: Group 9 | 0 |


|  | Parameter | Function | Setting | Factory <br> Setting |
| :---: | :---: | :---: | :---: | :---: |
|  | 00-11 | Velocity Control Mode | 0: VF (V/F control) <br> 2 : SVC (Sensor-Less Vector Control) | 0 |
| $N$ | 00-16 | Loading mode selection | 0 : Light Duty <br> 1: Normal Duty | 0 |
|  | 00-17 | Carrier Frequency (KHz) | Light Duty  <br> $1-20 \mathrm{HP}$ $2 \sim 15 \mathrm{KHz}$ <br> $25-60 \mathrm{HP}$ $2 \sim 10 \mathrm{KHz}$ <br> $75-125 \mathrm{HP}$ $2 \sim 9 \mathrm{KHz}$ <br> Normal Duty  <br> $1-15 \mathrm{HP}$ $2 \sim 15 \mathrm{KHz}$ <br> $20-50 \mathrm{HP}$ $2 \sim 10 \mathrm{KHz}$ <br> $60-100 \mathrm{HP}$ $2 \sim 9 \mathrm{KHz}$ | $\begin{aligned} & 8 \\ & 6 \\ & 4 \\ & 2 \\ & 2 \\ & 2 \end{aligned}$ |
|  | 00-18 | Reserved |  |  |
|  | 00-19 | PLC command mask(SOOC, SOOF, SOTC, SOPC) | 0~65535 | 0 |
| N | 00-20 | Source of the MASTER Frequency Command (AUTO) | 0: Digital keypad <br> 1: RS-485 serial communication <br> 2: External analog input (Pr.03-00) <br> 3: External UP/DOWN terminal <br> 6: CANopen communication card <br> 8: Communication card (no CANopen card) | 0 |
| $N$ | 00-21 | Source of the Opertaion Command (AUTO) | 0 : Digital keypad <br> 1: External analog input (Pr.03-00) <br> 2: RS-485 serial communication <br> 3: External UP/DOWN terminal <br> 5: Communication card ( not included CANopen card) | 0 |
| N | 00-22 | Stop method | 0 : Ramp to stop <br> 1: Coast to stop | 0 |
| N | 00-23 | Motor Operating Direction Control | 0: Enable forward/reverse <br> 1: Reverse disable <br> 2: Forward disable | 0 |
| N | 00-24 | Memory of Communication <br> 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 <br> Bit 4~15: user define on unit 000xh: Hz <br> 001xh: rpm <br> 002xh: \% <br> 003xh:kg | 0 |


|  | Parameter | Function | Setting | Factory Setting |
| :---: | :---: | :---: | :---: | :---: |
|  | 00-26 | Max. User Defined Value | 0: Disable <br> 0000b: 0~65535 (No decimal place in Pr.00-25 setting) <br> 0001b: 0.0~6553.5 (One decimal place in Pr.00-25 setting) <br> 0010b: 0.0~655.35(Two decimal place in Pr.00-25 setting) <br> 0011b: 0.0~65.536 (Three decimal place in Pr.00-25 setting) | 0 |
|  | 00-27 | User Defined Value | Read Only | Read Only |
|  | 00-28 | Reserved | 65535 | 0 |
|  | 00-29 | Reserved | 65535 | 0 |
| N | 00-30 | Source of the Master Frequency Command (HAND) | 0: Digital keypad <br> 1: RS-485 serial communication <br> 2: External analog input (Pr.03-00) <br> 3: External UP/DOWN terminal <br> 6: CANopen communication card <br> 8: Communication card (no CANopen card) | 0 |
| N | 00-31 | Source of the Operation Command (HAND) | 0: Digital keypad <br> 1: External terminals. Keypad STOP disabled. <br> 2: RS-485 serial communication. Keypad STOP disabled. <br> 3: CANopen communication card <br> 5: Communication card (not include CANopen card) |  |
|  | 00-32 | Digital Keypad STOP Function | 0: STOP key disable <br> 1: STOP key enable | 0 |
|  | $\begin{aligned} & 00-33 \\ & \sim \\ & 00-47 \end{aligned}$ | Reserved |  |  |
|  | 00-48 | Display Filter Time (Current) | 0.001~65.535 | 0.100 |
|  | 00-49 | Display Filter Time (Keypad) | 0.001~65.535 | 0.100 |
|  | 00-50 | Software Version (date) | 0~65535 | Read Only |

01 Basic Parameter

|  | Parameter | Explanation | Settings | Factory Setting |
| :---: | :---: | :---: | :---: | :---: |
|  | 01-00 | Max. Operating Frequency (Hz) | $50.00 \sim 600.00 \mathrm{~Hz}$ | $\begin{aligned} & 60.00 / \\ & 50.00 \end{aligned}$ |
|  | 01-01 | Motor1: Max Output Frequency(Hz) | $0.00 \sim 600.00 \mathrm{~Hz}$ | $\begin{aligned} & 60.00 / \\ & 50.00 \\ & \hline \end{aligned}$ |
|  | 01-02 | Motor1: Max Output Voltage (V) | 230 V models: $0.0 \mathrm{~V} \sim 255.0 \mathrm{~V}$ <br> 460V models: $0.0 \mathrm{~V} \sim 510.0 \mathrm{~V}$ | $\begin{aligned} & 220.0 \\ & 400.0 \end{aligned}$ |
|  | 01-03 | Mid-point Frequency 1 of Motor 1 | $0.00 \sim 600.00 \mathrm{~Hz}$ | 3.0 |
| $N$ | 01-04 | Mid-point Voltage 1 of Motor 1 | $\begin{aligned} & 230 \mathrm{~V}: 0.0 \mathrm{~V} \sim 240.0 \mathrm{~V} \\ & 460 \mathrm{~V}: 0.0 \mathrm{~V} \sim 480.0 \mathrm{~V} \end{aligned}$ | $\begin{aligned} & 110 \\ & 220 \end{aligned}$ |
|  | 01-05 | Mid-point Frequency 2 of Motor 1 | 0.00~600.00Hz | 0.50 |
| $N$ | 01-06 | Mid-point Voltage 2 of Motor 1 | $\begin{aligned} & 230 \mathrm{~V}: 0.0 \mathrm{~V} \sim 240.0 \mathrm{~V} \\ & 460 \mathrm{~V}: 0.0 \mathrm{~V} \sim 480.0 \mathrm{~V} \end{aligned}$ | $\begin{aligned} & 4.0 \\ & 8.0 \end{aligned}$ |
|  | 01-07 | Min. Output Frequency of Motor 1 | $0.00 \sim 600.00 \mathrm{~Hz}$ | 0.00 |
| $N$ | 01-08 | Min. Output Voltage of Motor 1 | $\begin{aligned} & 230 \mathrm{~V}: 0.0 \mathrm{~V} \sim 240.0 \mathrm{~V} \\ & 460 \mathrm{~V}: 0.0 \mathrm{~V} \sim 480.0 \mathrm{~V} \end{aligned}$ | $\begin{aligned} & 0.0 \\ & 0.0 \end{aligned}$ |
|  | 01-09 | Start-Up Frequency | $0.00 \sim 600.00 \mathrm{~Hz}$ | 0.50 |
| N | 01-10 | Output Frequency Upper Limit | 0.00~600.00Hz | 600.00 |
| N | 01-11 | Output Frequency Lower Limit | $0.00 \sim 600.00 \mathrm{~Hz}$ | 0 |
| $N$ | 01-12 | Accel. Time 1 | Pr.01-45=0: 0.00~600.00 second <br> Pr.01-45=1: 0.00~6000.0 second | $\begin{aligned} & 10.00 \\ & 10.0 \end{aligned}$ |
| N | 01-13 | Decel. Time 1 | Pr.01-45=0: 0.00~600.00 second <br> Pr.01-45=1: 0.00~6000.0 second | $\begin{aligned} & 10.00 \\ & 10.0 \end{aligned}$ |
| $N$ | 01-14 | Accel. Time 2 | Pr.01-45=0: 0.00~600.00 second <br> Pr.01-45=1: 0.00~6000.0 second | $\begin{aligned} & 10.00 \\ & 10.0 \end{aligned}$ |
| $N$ | 01-15 | Decel. Time 2 | Pr.01-45=0: 0.00~600.00 second <br> Pr.01-45=1: 0.00~6000.0 second | $\begin{aligned} & 10.00 \\ & 10.0 \end{aligned}$ |
| $N$ | 01-16 | Accel. Time 3 | Pr.01-45=0: 0.00~600.00 second <br> Pr.01-45=1: 0.00~6000.0 second | $\begin{aligned} & 10.00 \\ & 10.0 \end{aligned}$ |
| $N$ | 01-17 | Decel. Time 3 | Pr.01-45=0: 0.00~600.00 second Pr.01-45=1: 0.00~6000.0 second | $\begin{aligned} & 10.00 \\ & 10.0 \end{aligned}$ |
| $N$ | 01-18 | Accel. Time 4 | Pr.01-45=0: 0.00~600.00 second <br> Pr.01-45=1: 0.00~6000.0 second | $\begin{aligned} & 10.00 \\ & 10.0 \end{aligned}$ |
| $N$ | 01-19 | Decel. Time 4 | Pr.01-45=0: 0.00~600.00 second <br> Pr.01-45=1: 0.00~6000.0 second | $\begin{aligned} & 10.00 \\ & 10.0 \end{aligned}$ |
| N | 01-20 | JOG Acceleration Time | Pr.01-45=0: 0.00~600.00 second Pr.01-45=1: 0.00~6000.0 second | $\begin{aligned} & 10.00 \\ & 10.0 \end{aligned}$ |
| $N$ | 01-21 | JOG Deceleration Time | Pr.01-45=0: 0.00~600.00 second Pr.01-45=1: 0.00~6000.0 second | $\begin{aligned} & 10.00 \\ & 10.0 \end{aligned}$ |
| $N$ | 01-22 | JOG Frequency | $0.00 \sim 600.00 \mathrm{~Hz}$ | 6.00 |


|  | Parameter | Explanation | Settings | Factory Setting |
| :---: | :---: | :---: | :---: | :---: |
| $N$ | 01-23 | Frequency of 1st Acceleration / Deceleration \& Frequency of 4th Acceleration / Deceleration. | 0.00~600.00Hz | 0.00 |
| $N$ | 01-24 | S-curve for Acceleration Departure Time 1 | Pr.01-45=0: 0.00~25.00 second <br> Pr.01-45=1: 0.0~250.0 second | $\begin{aligned} & 0.20 \\ & 0.2 \end{aligned}$ |
| N | 01-25 | S-curve for Acceleration Arrival Time 2 | Pr.01-45=0: 0.00~25.00 second <br> Pr.01-45=1: 0.0~250.0 second | $\begin{aligned} & 0.20 \\ & 0.2 \end{aligned}$ |
| $N$ | 01-26 | S-curve for Deceleration Departure Time 1 | Pr.01-45=0: 0.00~25.00 second Pr.01-45=1: 0.0~250.0 second | $\begin{aligned} & 0.20 \\ & 0.2 \end{aligned}$ |
| N | 01-27 | S-curve for Deceleration Arrival Time 2 | Pr.01-45=0: 0.00~25.00 second Pr.01-45=1: 0.0~250.0 second | $\begin{aligned} & 0.20 \\ & 0.2 \end{aligned}$ |
|  | 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 <br> 1: Zero-speed operation <br> 2: Output at Minimum Frequency (the $4^{\text {th }}$ output frequency) | 0 |
|  | 01-35 | Motor 2: Max Output Frequency (Hz) | 0.00~600.00Hz | $\begin{aligned} & 60.00 / \\ & 50.00 \end{aligned}$ |
|  | 01-36 | Motor 2: Max Output Voltage (V) | 230V models: $0.0 \mathrm{~V} \sim 255.0 \mathrm{~V}$ <br> 460 V models: $0.0 \mathrm{~V} \sim 510.0 \mathrm{~V}$ | $\begin{aligned} & 200.0 \\ & 400.0 \end{aligned}$ |
|  | 01-37 | Mid-point Frequency 1 of Motor 2 | $0.00 \sim 600.00 \mathrm{~Hz}$ | 3 |
| $N$ | 01-38 | Mid-point Voltage 1 of Motor 2 | 230V models: $0.0 \mathrm{~V} \sim 240.0 \mathrm{~V}$ <br> 460 V models: $0.0 \mathrm{~V} \sim 480.0 \mathrm{~V}$ | $\begin{aligned} & 110 / \\ & 220 \end{aligned}$ |
|  | 01-39 | Mid-point Frequency 2 of Motor 2 | $0.00 \sim 600.00 \mathrm{~Hz}$ | 0.50 |
| $N$ | 01-40 | Mid-point Voltage 2 of Motor 2 | 230 V models: $0.0 \mathrm{~V} \sim 240.0 \mathrm{~V}$ <br> 460 V models: $0.0 \mathrm{~V} \sim 480.0 \mathrm{~V}$ | $\begin{aligned} & 4.0 \\ & 8.0 \end{aligned}$ |
| $N$ | 01-41 | Min. Output Frequency of Motor 2 | $0.00 \sim 600.00 \mathrm{~Hz}$ | 0.00 |
|  | 01-42 | Min. Output Voltage of Motor 2 | 230 V models: $0.0 \mathrm{~V} \sim 240.0 \mathrm{~V}$ 460 V models: $0.0 \mathrm{~V} \sim 480.0 \mathrm{~V}$ | $\begin{aligned} & 0.0 \\ & 0.0 \end{aligned}$ |
|  | 01-43 | V/f Curve Selection | 0 : normal V/F curve <br> 1: Curve to the power of 1.5 <br> 2: Curve to the power of 2 | 0 |


|  | Parameter | Explanation | Settings | Factory Setting |
| :---: | :---: | :---: | :---: | :---: |
| N | 01-44 | Optimal <br> Acceleration/Deceleration Setting | 0: Linear accel. /decel. <br> 1: Auto accel., Linear decel. <br> 2: Linear accel., Auto decel. <br> 3: Auto accel. / decel. <br> 4: Linear, stall prevention by auto accel./decel. (limit by Pr.01-12 to 01-21) | 0 |
|  | 01-45 | Time Unit for Accel. /Decel. and S Curve | 0: Unit: 0.01 sec <br> 1: Unit: 0.1 sec | 0 |
|  | 01-46 | CANopen Quick Stop Time | $\begin{aligned} & \text { Pr. 01-45=0: } 0.00 \sim 600.00 \mathrm{sec} \\ & \text { Pr. } 01-45=1: 0.0 \sim 6000.0 \mathrm{sec} \end{aligned}$ | 1.00 |
|  | $\begin{aligned} & \text { 01-47 } \\ & \stackrel{\sim}{01-50} \end{aligned}$ | Reserved |  |  |

## 02 Digital Input/Output Parameters

| Parameter | Explanation | Settings | Factory Setting |
| :---: | :---: | :---: | :---: |
| 02-00 | 2-wire/3-wire Operation Control | 0: 2-wire mode, power on for operation control 1: 2-wire mode 2, power on for operation control <br> 2: 3-wire, power on for operation control | 0 |
| 02-01 | Multi-function Input Command 1 (MI1) | 0 : No function | 1 |
| 02-02 | Multi-function Input Command 2 (MI2) | 1: Multi-step speed command $1 /$ multi-step position command 1 | 2 |
| 02-03 | Multi-function Input Command 3 (MI3) | 2: Multi-step speed command 2/multi-step position command 2 | 3 |
| 02-04 | Multi-function Input Command 4 (MI4) | 3: Multi-step speed command $3 /$ multi-step position command 3 | 4 |
| 02-05 | Multi-function Input Command 5 (MI5) | 4: Multi-step speed command $4 /$ multi-step position command 4 | 0 |
| 02-06 | Multi-function Input Command 6 (MI6) | 5: Reset | 0 |
| 02-07 | Multi-function Input Command 7 (MI7) | 6: JOG command (By KPC-CC01 or external control) | 0 |
| 02-08 | Multi-function Input Command 8 (MI8) | 7: Acceleration/deceleration speed inhibit | 0 |
| 02-26 | Input terminal of I/O extension card (MI9) | 8: The $1^{\text {st }}, 2^{\text {nd }}$ acceleration/deceleration time selection | 0 |
| 02-27 | Input terminal of I/O extension card (MI10) | 9: The $3^{\text {rd }}, 4^{\text {th }}$ acceleration/deceleration time selection | 0 |
| 02-28 | Input terminal of I/O extension card (MI12) | 10: EF Input (Pr.07-20) | 0 |
| 02-29 | Input terminal of I/O extension card (MI12) | 11: B.B input from external (Base Block) | 0 |
| 02-30 | Input terminal of I/O extension card (MI13) | 12: Output stop | 0 |
| 02-31 | Input terminal of I/O extension card (MI14) | 13: Cancel the setting of optimal accel. /decel. time | 0 |
|  |  | 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 |  |
|  |  | 27: ASR1/ASR2 selection |  |
|  |  | 28: Emergency stop (EF1) |  |
|  |  | 29: Signal confirmation for Y-connection |  |
|  |  | 30: Signal confirmation for $\Delta$-connection |  |
|  |  | 38: Disable EEPROM write function |  |
|  |  | 40: Force coast to stop |  |
|  |  | 41: HAND switch |  |
|  |  | 42: AUTO switch |  |
|  |  | 44~47 : Reserved |  |
|  |  | 49: Drive enable |  |




|  | Parameter | Explanation | Settings | Factory Setting |
| :---: | :---: | :---: | :---: | :---: |
| N |  |  | 61: Motor\#7 Output |  |
|  |  |  | 62: Motor\#8 Output |  |
|  | 02-18 | Multi-function output direction | 0~65535 ( 0 : N.O. ; 1 : N.C. ) | 0 |
| $N$ | 02-19 | Terminal counting value attained | 0~65500 | 0 |
| $N$ | 02-20 | Preliminary counting value attained (not return to 0) | 0~65500 | 0 |
| $N$ | 02-21 | Digital Output Gain (DFM) | $1 \sim 166$ | 1 |
| $N$ | 02-22 | Desired Frequency Attained 1 | $0.00 \sim 600.00 \mathrm{~Hz}$ | $\begin{aligned} & 60.00 / \\ & 50.00 \end{aligned}$ |
| $N$ | 02-23 | The Width of the Desired Frequency Attained 1 | $0.00 \sim 600.00 \mathrm{~Hz}$ | 2.00 |
| $N$ | 02-24 | Desired Frequency Attained 2 | $0.00 \sim 600.00 \mathrm{~Hz}$ | $\begin{array}{\|l\|} \hline 60.00 / \\ 50.00 \\ \hline \end{array}$ |
| N | 02-25 | The Width of the Desired Frequency Attained 2 | $0.00 \sim 600.00 \mathrm{~Hz}$ | 2.00 |
|  | 02-32 | Brake Delay Time | 0.000~65.000 秒 | 0.000 |
| N | 02-33 | Output Current Level Setting for Multi-function External Terminals | 0~100\% | 0 |
| $N$ | 02-34 | Output frequency setting for multi-function output terminal | $0.00 \sim 600.00 \mathrm{~Hz}$ | 0.00 |
| N | 02-35 | External Operation Control Selection after Reset and Activate | 0: Disabled <br> 1: Drive runs if run command exists after reset | 0 |
| N | 02-47 | Zero-speed Level of Motor | 0~65535 rpm | 0 |
| N | 02-48 | Max. Frequency of Resolution Switch | $0.01 \sim 600.00 \mathrm{~Hz}$ | 60.00 |
| $N$ | 02-49 | Switch the delay time of Max. output frequency | 0.000 $\sim 65.000$ seconds | 0.000 |
| $N$ | 02-50 | Status of Multi-function Input Terminal | Monitor the status of multi-function input terminals | Read <br> Only |
| $N$ | 02-51 | Status of Multi-function Output Terminal | Monitor the status of multi-function output terminals | Read <br> Only |
|  | 02-52 | Display External Output terminal occupied by PLC | Monitor the status of PLC input terminals | Read Only |
|  | 02-53 | Display Analog Input Terminal occupied by PLC | Monitor the status of PLC output terminals | Read Only |
|  | 02-54 | Display the Frequency Command Memory of External Terminal | Read Only | Read Only |
|  | 02-57 | Mix active by Internal or External Selection | 0~65535 | 0 |
|  | 02-58 | Internal Mix active value | 0~65535 | 0 |

## 03 Analog Input/Output Parameter

|  | Parameter | Explanation | Settings | Factory Setting |
| :---: | :---: | :---: | :---: | :---: |
| $N$ | 03-00 | Analog Input 1 (AVI1) | 0 : No function <br> 1: Frequency command (torque limit under torque control mode) <br> 4: PID target value <br> 5: PID feedback signal <br> 6: PTC thermistor input value <br> 11: PT100 thermistor input value <br> 12~17: Reserved | 1 |
| $N$ | 03-01 | Analog Input 2(ACI) |  |  |
| $N$ | 03-02 | Analog Input 3 (AVI2) |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| $N$ | 03-03 | AVI1 Analog Input Bias | -100.0~100.0\% | 0 |
| $N$ | 03-04 | ACI Analog Input Bias | -100.0~100.0\% | 0 |
| N | 03-05 | AVI2 Analog Positive Voltage Input Bias | -100.0~100.0\% | 0 |
| $N$ | 03-06 | Reserved |  |  |
| N | 03-07 | AVI1 positive/negative bias mode | 0 : No bias <br> 1: Lower than bias=bias <br> 2: Greater than bias=bias <br> 3: The absolute value of the bias voltage while serving as the center <br> 4: Serve bias as the center | 0 |
| N | 03-08 | ACI positive/negative bias mode |  |  |
| $N$ | 03-09 | AVI2 positive/negative bias mode |  |  |
| N | 03-10 | Reserved |  |  |
|  | 03-11 | Analog Input Gain 1 (AVI1) | $\begin{aligned} & -500.0 \sim 500.0 \% \\ & -500.0 \sim 500.0 \% \\ & -500.0 \sim 500.0 \% \end{aligned}$ | $\begin{aligned} & 100.0 \\ & 100.0 \\ & 100.0 \end{aligned}$ |
| $N$ | 03-12 | Analog Input Gain 2 (ACI) |  |  |
| N | 03-13 | Analog Positive Input Gain 3 (AVI2) |  |  |
| $N$ | 03-14 | Reserved |  |  |
| $N$ | 03-15 | Analog Input Filter Time (AVI1) | 0.00~20.00 seconds | 0.01 |
| $N$ | 03-16 | Analog Input Filter Time (ACI) | 0.00~20.00 seconds | 0.01 |
| N | 03-17 | Analog Input Filter Time (AVI2) | 0.00~20.00 seconds | 0.01 |
| N | 03-18 | Addition Function of the Analog Input | 0: Disable addition function (AVI1, ACI, AVI2) <br> 1: Enable addition function | 0 |
| N | 03-19 | Loss of the ACI Signal | 0: Disable <br> 1: Continue operation at the last frequency <br> 2: Decelerate to 0 Hz <br> 3: Stop immediately and display ACE | 0 |
| $N$ | 03-20 | Multi-function Output 1 (AFM1) | 0 : Output frequency ( Hz ) | 0 |
| N | 03-23 | Multi-function Output 2 (AFM2) | 1: Frequency command (Hz) | 0 |
|  |  |  | 2: Motor speed (Hz) |  |
|  |  |  | 3: Output current (rms) |  |



| Parameter | Explanation | Settings | Factory <br> Setting |
| :--- | :--- | :--- | :---: |
| $03-56$ | AVI Point 3- percent | $0 \sim 100 \%$ | 100 |
| $03-57$ | ACI Point 1 - voltage | $0 \sim 10.00 / 0 \sim 20.00$ | 4.00 |
| $03-58$ | ACI Point 1- percent | $0 \sim 100 \%$ | 0 |
| $03-59$ | ACI Point 2 - voltage | $0 \sim 10.00 / 0 \sim 20.00$ | 12.00 |
| $03-60$ | ACI Point2 - percent | $0 \sim 100 \%$ | 50 |
| $03-61$ | ACI Point 3 - voltage | $0 \sim 10.00 / 0 \sim 20.00$ | 20.00 |
| $03-62$ | ACI Point3 - percent | $0 \sim 100 \%$ | 100 |
| $03-63$ | AUI Point1 - voltage | $0 \sim 10.00 \mathrm{~V}$ | 0 |
| $03-64$ | AUI Point 2- percent | $0 \sim 100 \%$ | 0 |
| $03-65$ | AUI Point 2- voltage | $0 \sim 10.00 \mathrm{~V}$ | 5.00 |
| $03-66$ | AUI Point2 -percent | $0 \sim 100 \%$ | 50 |
| $03-67$ | AUI Point 3- voltage | $0 \sim 10.00 \mathrm{~V}$ | 10.00 |
| $03-68$ | AUI Point 3 - percent | $0 \sim 100 \%$ | 100 |

## 04 Multi-step Speed Parameters

|  | Parame ter | Explanation | Settings | Factory Setting |
| :---: | :---: | :---: | :---: | :---: |
| $N$ | 04-00 | 1st Step Speed Frequency | 0.00~600.00Hz | 0 |
| N | 04-01 | 2nd Step Speed Frequency | $0.00 \sim 600.00 \mathrm{~Hz}$ | 0 |
| $N$ | 04-02 | 3rd Step Speed Frequency | 0.00~600.00Hz | 0 |
| N | 04-03 | 4th Step Speed Frequency | $0.00 \sim 600.00 \mathrm{~Hz}$ | 0 |
| N | 04-04 | 5th Step Speed Frequency | 0.00~600.00Hz | 0 |
| N | 04-05 | 6th Step Speed Frequency | $0.00 \sim 600.00 \mathrm{~Hz}$ | 0 |
| N | 04-06 | 7th Step Speed Frequency | $0.00 \sim 600.00 \mathrm{~Hz}$ | 0 |
| N | 04-07 | 8th Step Speed Frequency | $0.00 \sim 600.00 \mathrm{~Hz}$ | 0 |
| N | 04-08 | 9th Step Speed Frequency | $0.00 \sim 600.00 \mathrm{~Hz}$ | 0 |
| N | 04-09 | 10th Step Speed Frequency | $0.00 \sim 600.00 \mathrm{~Hz}$ | 0 |
| N | 04-10 | 11th Step Speed Frequency | 0.00~600.00Hz | 0 |
| N | 04-11 | 12th Step Speed Frequency | $0.00 \sim 600.00 \mathrm{~Hz}$ | 0 |
| N | 04-12 | 13th Step Speed Frequency | $0.00 \sim 600.00 \mathrm{~Hz}$ | 0 |
| N | 04-13 | 14th Step Speed Frequency | 0.00~600.00Hz | 0 |
| N | 04-14 | 15th Step Speed Frequency | $0.00 \sim 600.00 \mathrm{~Hz}$ | 0 |

## 05 Motor Parameters

|  | Parameter | Explanation | Settings | Factory <br> Setting |
| :---: | :---: | :---: | :---: | :---: |
|  | 05-00 | Motor Auto Tuning | 0: No function <br> 1: Measure induction motor in dynamic status (motor spinning) (Rs, Rr, Lm, Lx, no-load current) <br> 2: Measure induction motor in static status (motor not spinning) <br> 7: Dead time compensation rate | 0 |
|  | 05-01 | Full-Load current of Induction Motor 1 (Amps) | 10~120\% of the drive's rated current | 0 |
| N | 05-02 | Rated Power of Induction Motor 1 (kW) | 0~655.35kW | 0 |
| N | 05-03 | Rated Rotational Speed of Induction Motor 1 (rpm) | $\begin{aligned} & 0 \sim 65535 \\ & 1710(60 \mathrm{~Hz} 4 \text { poles }) ; 1410(50 \mathrm{~Hz} 4 \text { poles }) \end{aligned}$ | 1710 |
|  | 05-04 | Pole Number of Induction Motor 1 | 2~20 | 4 |
|  | 05-05 | No Load Current of Induction Motor 1 (Amps) | 0~ Pr.05-01 of factory setting | 0 |
|  | 05-06 | Stator Resistance (Rs) of Induction Motor 1 | 0~65535m | 0 |
|  | 05-07 | Rotor Resistance (Rr) of Mo1 | 0~65535m | 0 |
|  | 05-08 | Magnetizing Inductance (Lm) og Induction Motor 1 | 0~65535mH | 0 |
|  | 05-09 | Stator Inductance (Lx) of Induction Motor 1 | 0~65535mH | 0 |
|  | $\begin{aligned} & \text { 05-10 } \\ & \stackrel{\sim}{05-12} \\ & \hline \end{aligned}$ | Reserved |  |  |
|  | 05-13 | Rated Current of Induction <br> Motor 2 ( Amps) | 0~65535 | 0 |
| N | 05-14 | Rated Power of Induction Motor 2 (kW) | 0~655.35kW | 0 |
| N | 05-15 | Rated Rotational Speed of Induction Motor 2 (rpm) | $\begin{aligned} & 0 \sim 65535 \\ & 1710(60 \mathrm{~Hz} 4 \text { poles }) ; 1410(50 \mathrm{~Hz} 4 \text { poles) } \end{aligned}$ | 1710 |
|  | 05-16 | Pole Number of Induction Motor 2 | 2~20 | 4 |
|  | 05-17 | No-load Current of Induction Motor 2 (A) | 0~Parameter05-01 factory setting | 0 |
|  | 05-18 | Stator Resistance (Rs) of Induction Motor 2 | 0~65.535 | 0 |
|  | 05-19 | Rotor Resistance (Rr) of Motor 2 | $0 \sim 65.535 \Omega$ | 0 |
|  | 05-20 | Magnetizing Inductance (Lm) og Induction Motor 2 | 0~65535mH | 0 |
|  | 05-21 | Stator Inductance (Lx) of Induction Motor 2 | 0~65535mH | 0 |
| $N$ | 05-22 | Induction Motor 1/ Motor 2 Selection | $\begin{aligned} & \text { 1: motor } 1 \\ & \text { 2: motor } 2 \end{aligned}$ | 1 |
| N | 05-23 | Frequency for <br> Y-connection/ $\triangle$-connectio <br> n Switch of Induction <br> Motor | 0.00~600.00Hz | 60.00 |


| Parameter | Explanation | Settings | Factory Setting |
| :---: | :---: | :---: | :---: |
| 05-24 | Y-connection/ $\triangle$-connectio n Switch of Induction Motor | 0 : Disable <br> 1 : Enable | 0 |
| 05-25 | Delay Time for Y-connection/ $\triangle$-connectio n Switch of Induction Motor | 0.000 $\sim 60.000$ seconds | 0.200 |
| $\begin{aligned} & 05-26 \\ & \sim \\ & 05-30 \end{aligned}$ | Reserved |  |  |
| 05-31 | Accumulated Motor Operation Time (minutes) | 00~1439 | 0 |
| 05-32 | Accumulative Motor Operation Time (day) | 00~65535 | 0 |
| 05-33 | Induction Motor and Permanent Magnet Motor Selection | $\begin{aligned} & \text { 0: IM } \\ & \text { 1: PM } \end{aligned}$ | 0 |
| 05-34 | Full Load current of <br> Permanent Magnet Motor(A) | 0.0~6553.5Amps | 0 |
| 05-35 | Rated Power of Permanent <br> Magnet Motor (kW) | $0.00 \sim 655.35 \mathrm{~kW}$ | 0 |
| 05-36 | Rated Rotational Speed of Permanent Magnet Motor (rpm) | 0~65535 rpm | 2000 |
| 05-37 | Pole number of Permanent Magnet Motor | 0~65535 | 10 |
| 05-38 | Inertia of Permanent Magnet Motor | 0~6553.5 kg.cm ${ }^{2}$ | 0 |
| 05-39 | Stator Resistance of PM Motor | $0.000 \sim 65.535 \Omega$ | 0.000 |
| 05-40 | Permanent Magnet Motor Ld | 0.00~655.35mH | 0 |
| 05-41 | Permanent Magnet Motor Lq | 0.00~655.35mH | 0 |
| 05-42 | Offset angle of PM Motor pole | 0.0~360.0 | 0 |
| 05-43 | Ke parameter of PM Motor | 0~65535 (Unit: V/1000rpm) | 0 |

06 Protection Parameters

|  | Parameter | Explanation | Settings | Factory Setting |
| :---: | :---: | :---: | :---: | :---: |
| N | 06-00 | Low Voltage Level | $\begin{aligned} & 230 \mathrm{~V}: 160.0 \sim 220.0 \mathrm{Vdc} \\ & 460 \mathrm{~V}: 320.0 \sim 440.0 \mathrm{Vdc} \end{aligned}$ | $\begin{aligned} & 180 \\ & 360 \end{aligned}$ |
| $N$ | 06-01 | Over-voltage Stall Prevention | $\begin{aligned} & 230 \mathrm{~V}: 350.0 \sim 450.0 \mathrm{Vdc} \\ & 460 \mathrm{~V}: 700.0 \sim 900.0 \mathrm{Vdc} \end{aligned}$ | $\begin{aligned} & 380.0 \\ & 760.0 \end{aligned}$ |
| N | 06-02 | Reserved |  |  |
| N | 06-03 | Over-current Stall Prevention during Acceleration | Normal duty: 0~130\%(100\%: drive's rated current); Light duty: $0 \sim 130 \%$ (100\%: drive's rated current) | Normal duty:120; <br> Light duty:120 |
| N | 06-04 | Over-current Stall Prevention during Operation | Normal Load: 0~130\%(100\%: drive's rated current); Light duty: $0 \sim 130 \%$ ( $100 \%$ : drive's rated current) | Normal duty:120; Light duty:120 |
| N | 06-05 | Accel. /Decel. Time Selection of Stall Prevention at Constant Speed | 0 : by current accel/decel time <br> 1: by the 1st accel/decel time <br> 2: by the 2nd accel/decel time <br> 3: by the 3rd accel/decel time <br> 4: by the 4th accel/decel time <br> 5: by auto accel/decel | 0 |
| N | 06-06 | Over-torque Detection Selection (OT1) | 0 : No function <br> 1: Over-torque detection during constant speed operation, continue to operate after detection <br> 2: Over-torque detection during constant speed operation, stop operation after detection <br> 3: Over-torque detection during operation, continue to operate after detection <br> 4: Over-torque detection during operation, stop operation after detection | 0 |
| N | 06-07 | Over-torque Detection Level (OT1) | 10~200\% ( 100\%: drive's rated current ) | 120 |
| N | 06-08 | Over-torque Detection Time (OT1) | $0.0 \sim 60.0$ seconds | 0.1 |
| N | 06-09 | Over-torque Detection Selection (OT2) | 0 : No function <br> 1: Over-torque detection during constant speed operation, continue to operate after detection <br> 2: Over-torque detection during constant speed operation, stop operation after detection <br> 3: Over-torque detection during operation, continue to operation after detection <br> 4: Over-torque detection during operation, stop operation after detection | 0 |
| N | 06-10 | Over-torque Detection Level (OT2) | 10~200\% ( 100\%: drive's rated current ) | 120 |
| N | 06-11 | Over-torque Detection Time (OT2) | $0.0 \sim 60.0$ seconds | 0.1 |
| $N$ | 06-12 | Maximum Torque Limit | 0~200\% (100\%: drive's rated current) | 150\% |
| N | 06-13 | Electronic Thermal Relay Selection (Motor 1) | 0 : Motor with constant torque output <br> 1: Motor with variable torque output <br> 2: Electronic Thermal Relay disabled | 2 |
| N | 06-14 | Electronic Thermal Characteristic for Motor 1 | 30.0~600.0 seconds | 60.0 |


|  | Parameter | Explanation | Settings | Factory Setting |
| :---: | :---: | :---: | :---: | :---: |
| $N$ | 06-15 | Heat Sink Over-heat (OH) Warning | $0.0 \sim 110.0^{\circ} \mathrm{C}$ | 85.0 |
| $N$ | 06-16 | Stall Prevention Limit Level | 0~100\% (Parameter06-03, Parameter06-04) | 50 |
|  | 06-17 | Current Error Record | 0 : No fault record | 0 |
|  | 06-18 | Second Most Recent Error Record | 1: Over-current during acceleration (ocA) | 0 |
|  | 06-19 | Third Most Recent Error Record | 2: Over-current during deceleration (ocd) | 0 |
|  | 06-20 | Fourth Most Recent Error Record | 3: Over-current during constant speed(ocn) | 0 |
|  | 06-21 | Fifth Most Recent Error Record | 4: Ground fault (GFF) | 0 |
|  | 06-22 | Sixth Most Recent Error Record | 5: IGBT short-circuit (occ) | 0 |
|  |  |  | 6: Over-current at stop (ocS) |  |
|  |  |  | 7: Over-voltage during acceleration (ovA) |  |
|  |  |  | 8: Over-voltage during deceleration (ovd) |  |
|  |  |  | 9: Over-voltage during constant speed (ovn) |  |
|  |  |  | 10: Over-voltage at stop (ovS) |  |
|  |  |  | 11: Low-voltage during acceleration (LvA) |  |
|  |  |  | 12: Low-voltage during deceleration (Lvd) |  |
|  |  |  | 13: Low-voltage during constant speed (Lvn) |  |
|  |  |  | 14: Stop mid-low voltage (LvS) |  |
|  |  |  | 15: Phase loss protection (PHL) |  |
|  |  |  | 16: IGBT over-heat (oH1) |  |
|  |  |  | 17: Capacitance over-heat (oH2) (over 40hp) |  |
|  |  |  | 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) (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 (uc1) |  |
|  |  |  | 29: Under current 2 (uc2) |  |
|  |  |  | 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) |  |


|  | Parameter | Explanation | Settings | Factory Setting |
| :---: | :---: | :---: | :---: | :---: |
|  |  |  | 42~47 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 : Reserved |  |
|  |  |  | 54: Communication error (cE1) |  |
|  |  |  | 55: Communication error (cE2) |  |
|  |  |  | 56: Communication error (cE3) |  |
|  |  |  | 57: Communication error (cE4) |  |
|  |  |  | 58: Communication Time-out (cE10) |  |
|  |  |  | 59: PU Time-out (cP10) |  |
|  |  |  | 60: Brake transistor error (bF) |  |
|  |  |  | 61: Y-connection/ $\triangle$-connection switch error (ydc) |  |
|  |  |  | 62: Decel. Energy Backup Error (dEb) |  |
|  |  |  | 63: Slip error (oSL) |  |
|  |  |  | 64~65: Reserved |  |
|  |  |  | 73: External safety gate S1 |  |
|  |  |  | 74: FIRE mode output |  |
|  |  |  | 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) |  |
|  |  |  | 101: CANopen software disconnect1 (CGdE) |  |
|  |  |  | 102: CAN open software disconnect2 (CHbE) |  |
|  |  |  | 103: CANopen synchronous error (CSYE) |  |
|  |  |  | 104: CANopen hardware disconnect (CbFE) |  |
|  |  |  | 105: CANopen index setting error (CIdE) |  |
|  |  |  | 106: CANopen slave station number setting error (CAdE) |  |
|  |  |  | 107: CANopen index setting exceed limit (CFrE) |  |
| N | 06-23 | Fault Output Option 1 | $0 \sim 65535$ (refer to bit table for fault code) | 0 |
| N | 06-24 | Fault Output Option 2 | 0~65535(refer to bit table for fault code) | 0 |
| N | 06-25 | Fault Output Option 3 | 0~65535(refer to bit table for fault code) | 0 |
| N | 06-26 | Fault Output Option 4 | 0~65535(refer to bit table for fault code) | 0 |
| N | 06-27 | Electronic Thermal Relay Selection 2 (Motor 2) | 0 : Motor with constant torque output <br> 1: Motor with variable torque output <br> 2: Electronic Thermal Relay disabled | 2 |
| N | 06-28 | Electronic Thermal Operating Time of Motor 2 (Seconds) | 30.0~600.0(Seconds) | 60.0 |
| N | 06-29 | PTC Detection Selection | 0 : Warn and keep operation <br> 1: Warn and ramp to stop <br> 2: Warn and coast to stop <br> 3: No warning | 0 |
| $N$ | 06-30 | PTC Level | 0.0~100.0\% | 50.0 |


|  | Parameter | Explanation | Settings | Factory Setting |
| :---: | :---: | :---: | :---: | :---: |
| N | 06-31 | Frequency Command when Malfunction | $0.00 \sim 655.35 \mathrm{~Hz}$ | Read Only |
|  | 06-32 | Output Frequency when Malfunction | $0.00 \sim 655.35 \mathrm{~Hz}$ | Read Only |
|  | 06-33 | Output Voltage when Malfunction | 0.0~6553.5 V | Read Only |
|  | 06-34 | DC Voltage at Malfunction | 0.0~6553.5 V | Read Only |
|  | 06-35 | Output Current at Malfunction | 0.00~655.35 Amp | Read Only |
|  | 06-36 | IGBT Temperature at Malfunction | $0.0 \sim 6553.5{ }^{\circ} \mathrm{C}$ | Read Only |
|  | 06-37 | Capacitance Temperature at Malfunction | $0.0 \sim 6553.5{ }^{\circ} \mathrm{C}$ | Read Only |
|  | 06-38 | Motor Speed in rpm at Malfunction | 0~65535 | Read Only |
|  | 06-39 | Reserved | 0~65535 | Read Only |
|  | 06-40 | Status of Multi-function Input Terminal when Malfunction | 0~65535 | Read Only |
|  | 06-41 | Status of Multi-function Output Terminal when Malfunction | 0~65535 | Read Only |
|  | 06-42 | Drive Status when Malfunction | 0~65535 | Read Only |
|  | 06-43 | Reserved |  |  |
|  | 06-44 | Reserved |  |  |
|  | 06-45 | Action for detected Output Phase Loss (OPhL) | 0 : Warn and keep operation <br> 1: Warn and ramp to stop <br> 2: Warn and coast to stop <br> 3: No warning | 3 |
|  | 06-46 | Time of detected Output Phase Loss | 0~65.535 seconds | 0.5 |
|  | 06-47 | Detected Current Bandwidth | 0~655.35\% | 1.0 |
|  | 06-48 | DC Brake Time of Output Phase Loss | $0 \sim 65.535$ seconds | 0.1 |
|  | 06-49 | Reserved |  |  |
|  | 06-50 | Time of detected Input Phase Loss | 0.00~600.00 seconds | 0.20 |
|  | 06-51 | Reserved |  |  |
|  | 06-52 | Ripple of the detected Input Phase Loss’ Ripple | 230V models: $0.0 \sim 160$ Vdc 460V models : $0.0 \sim 320$ Vdc | 30/60 |
|  | 06-53 | Action for detected Input Phase Loss (OrP) | 0 : warn and ramp to stop <br> 1: warn and coast to stop | 0 |
|  | 06-54 | Reserved |  |  |


| Parameter | Explanation | Settings | Factory Setting |
| :---: | :---: | :---: | :---: |
| 06-55 | Derating Protection | 0 : Constant rated current and limit carrier wave by loaded current and temperature <br> 1: Constant carrier frequency and limit loaded current by setting carrier wave <br> 2: Constant rated current(same as setting 0), but current limit is closed | 0 |
| 06-56 | PT100 Detection Level 1 | 0~10000 v | 5000 |
| 06-57 | PT100 Detection Level 2 | 0~10000 v | 7000 |
| 06-58 | PT100 Level 1 Frequency Protect | $0 \sim 600.00 \mathrm{~Hz}$ | 0 |
| 06-59 | Reserved |  |  |
| 06-60 | Software Detection GFF <br> Current Level (\% rated current of the drive) | 0~6553.5\% | 60.0 |
| 06-61 | Software detection of GFF Low pass Filter gain | $0 \sim 655.35 \mathrm{sec}$ | 0.10 |
| 06-62 | Disable Level of dEb | 230V models: 0~220.0 Vdc 460V models: $0 \sim 440.0$ Vdc | $\begin{aligned} & 180.0 \\ & 360.0 \end{aligned}$ |
| 06-63 | Fault Record 1 (Min) | 0~65535 minutes | Read Only |
| 06-64 | Fault Record 2 (Min) | 0~65535 minutes | Read Only |
| 06-65 | Fault Record 3 (Min) | 0~65535 minute | Read <br> Only |
| 06-66 | Fault Record 4 (Min) | 0~65535 minutes | Read <br> Only |
| 06-67 | Fault Record 5 (Min) | 0~65535 minutes | Read <br> Only |
| 06-68 | Fault Record 6 (Min) | 0~65535 minutes | Read Only |
| 06-69 | Number of Days of Malfunction (days) | Read Only | Read <br> Only |
| 06-70 | Duration of Malfunction (minutes) | Read Only | Read Only |
| 06-71 | Low Current Setting Level | 0~100.0\% | 0 |
| 06-72 | Low Current Detection Time | $0 \sim 360.00$ seconds | 0 |


| Parameter | Explanation | Settings | Factory Setting |
| :---: | :---: | :---: | :---: |
| 06-73 | Options when low current occurs | 0 : No function <br> 1 : Warn and coast to stop <br> 2 : Warn and ramp to stop by 2nd deceleration time <br> 3 : Warn and operation continues | 0 |
| 06-80 | Fire mode | 0 : No function <br> 1: Forward operation <br> 2: Reverse Operation | 0 |
| 06-81 | Operating Frequency when running Fire Mode(Hz) | 0.00 to 60000 Hz | 6000 |
| 06-82 | Bypass Fire Mode enabled | 0: Disable Bypass <br> 1: Enable Bypass | 0 |
| 06-83 | Delayed Time when Bypass Fire Mode | 0.0 to 6550.0 sec | 0 |
| 06-84 | Auto reset counter of Fire Mode | 0~10 | 0 |
| 06-85 | Length of time to reset auto-counter (seconds) | 0.0 to 6000.0 sec | 600 |

## 07 Special Parameters

|  | Parameter | Explanation | Settings | Factory Setting |
| :---: | :---: | :---: | :---: | :---: |
| $N$ | 07-00 | Setup Software Brake Level | 230 V series: 350.0~450.0Vdc <br> 460V series: 700.0~900.0Vdc | $\begin{aligned} & 380.0 \\ & 760.0 \end{aligned}$ |
| $N$ | 07-01 | DC Brake Current Level | 0~100\% | 0 |
| $N$ | 07-02 | DC Brake Time at Start-up | 0.0~60.0 seconds | 0.0 |
| $N$ | 07-03 | DC Brake Time at Stop | $0.0 \sim 60.0$ seconds | 0.0 |
| $N$ | 07-04 | Startup Frequency for DC Brake | 0.00~600.00Hz | 0.00 |
| $N$ | 07-05 | Reserved |  |  |
| $N$ | 07-06 | Restart after Momentary Power Down | 0: Stop operation <br> 1: Speed search starting from last speed before the moment of power down. <br> 2: Speed search starting from minimum output frequency | 0 |
| $N$ | 07-07 | Maximum Power Loss Duration | 0.1~20.0 seconds | 2.0 |
| $N$ | 07-08 | Base Block Time | $0.1 \sim 5.0$ seconds | 0.5 |
| N | 07-09 | Current Limit for Speed Search | 20~200\% | 100 |
| $N$ | 07-10 | Base Block Speed Search (oc, ov, bb) | 0 : Stop operation <br> 1: Speed search starting from last speed before the moment of base block. <br> 2: Speed search starting from minimum output frequency | 0 |
| $N$ | 07-11 | \# of Auto Reset after Errors Occurred | 0~10 | 0 |
| $N$ | 07-12 | Speed Search while Start-up | 0 : Disable <br> 1: Speed search starting from maximum output frequency <br> 2: Speed search starting from start-up motor frequency <br> 3: Speed search starting from minimum output frequency | 0 |
|  | 07-13 | Deceleration Time at Momentary <br> Power Down ( dEb function: <br> Deceleration Energy Backup) | 0: Disable <br> 1: 1st decel. time <br> 2: 2nd decel. time <br> 3: 3rd decel. time <br> 4: 4th decel. time <br> 5: system decel. time <br> 6: Auto decel. time | 0 |
|  | 07-14 | DEB Return Time | $0.0 \sim 25.0 \sec (0 \sim 250)$ | 0 |
|  | 07-15 | Dwell Time at Accel. | 0.00~600.00sec (0~60000) | 0 |
|  | 07-16 | Dwell Frequency at Accel. | 0.00~600.00Hz(0~60000) | 0 |
|  | 07-17 | Dwell Time at Decel. | $0.00 \sim 600.00 \sec (0 \sim 60000)$ | 0 |
|  | 07-18 | Dwell Frequency at Decel. | 0.00~600.00Hz(0~60000) | 0 |
| $N$ | 07-19 | Fan Cooling Control | 0 : Fan always ON <br> 1: 1 minute after the AC motor drive stops, fan will be OFF <br> 2: When the AC motor drive runs, the fan is ON. When the AC motor drive stops, the fan is OFF <br> 3: Fan turns ON when the preliminary heat sink's temperature reached around $60^{\circ} \mathrm{C}\left(140^{\circ} \mathrm{F}\right)$. <br> 4: Fan always OFF | 0 |


|  | Parameter | Explanation | Settings | Factory Setting |
| :---: | :---: | :---: | :---: | :---: |
| $N$ | 07-20 | Emergency Stop (EF) \& Force to Stop Selection | 0 : Coast stop <br> 1: By deceleration Time 1 <br> 2: By deceleration Time 2 <br> 3: By deceleration Time 3 <br> 4: By deceleration Time 4 <br> 5: System Deceleration <br> 6: Automatic Deceleration | 0 |
| $N$ | 07-21 | Auto Energy-sAVI1ng Operation | 0: Disable <br> 1: Enable | 0 |
| $N$ | 07-22 | Energy-sAVI1ng Gain | 10~1000\% | 100 |
| $N$ | 07-23 | Auto Voltage Regulation(AVR) Function | 0: Enable AVR <br> 1: Disable AVR <br> 2: Disable AVR during deceleration | 0 |
| $N$ | 07-24 | Filter Time of Torque Command (V/F and SVC control mode) | 0.001~10.000seconds | 0.020 |
| $N$ | 07-25 | Filter Time of Slip Compensation (V/F and SVC control mode) | 0.001~10.000 seconds | 0.100 |
| $N$ | 07-26 | Torque Compensation Gain (V/F and SVC control mode) | 0~10 | 0 |
| $N$ | 07-27 | Slip Compensation Gain (V/F and SVC control mode) | 0.00~10.00 | 0.00 |
| $N$ | 07-28 | Reserved |  |  |
| $N$ | 07-29 | Slip Deviation Level | 0.0~100.0\% | 0 |
| $N$ | 07-30 | Detection Time of Slip <br> Deviation | $0.0 \sim 10.0$ seconds | 1.0 |
| $N$ | 07-31 | Over Slip Treatment | 0 : Warn and keep operation <br> 1: Warn and ramp to stop <br> 2: Warn and coast to stop <br> 3: No warning | 0 |
| $N$ | 07-32 | Motor Hunting Gain | 0~10000 | 1000 |
|  | 07-33 | Recovery Time to Pr.07-11 (\# of auto reset after error occurred) | 00~60000 seconds | 60.0 |
|  | 07-34 | Kp: Automatic Acceleration\} <br> Deceleration | 0~65535 | 40 |
|  | 07-35 | Ki: Automatic <br> Acceleration\Deceleration | 0~65535 | 0.001 |
|  | 07-36 | Power Generating Slip <br> Compensation Gain | 0.00~1.00 | 1.00 |
|  | 07-37~07-49 | Reserved |  |  |
|  | 07-50 | PWM Fan Speed 0~100\% | 0~100 | 60 |

## 08 High-function PID Parameters

|  | Parameter | Explanation | Settings | Factory Setting |
| :---: | :---: | :---: | :---: | :---: |
| N | 08-00 | Input Terminal for PID feedback | 0: No function <br> 1: Negative PID feedback: input from external terminal AVI1 (Pr.03-00) <br> 4: Positive PID feedback from external terminal AVI1 (Pr.03-00) | 0 |
| $N$ | 08-01 | Proportional Gain (P) | 0.0~500.0\% | 1.0 |
| N | 08-02 | Integral Time (I) | 0.00~100.00 seconds | 1.00 |
| N | 08-03 | Derivative Time (D) | 0.00~1.00seconds | 0.00 |
| N | 08-04 | Upper Limit of Integral Control | 0.0~100.0\% | 100.0 |
| N | 08-05 | PID Output Frequency Limit | 0.0~110.0\% | 100.0 |
|  | 08-06 | Reserved |  |  |
| N | 08-07 | PID Delay Time | 0.0~35.0 seconds | 0.0 |
| N | 08-08 | Feedback Signal Detection Time | 0.0~3600.0 seconds | 0.0 |
| N | 08-09 | Options on Feedback Error | 0 : Warn and keep operation <br> 1: Warn and ramp to stop <br> 2: Warn and coast to stop <br> 3: Warn and operate at last frequency | 0 |
| $N$ | 08-10 | Sleep Frequency | $0.00 \sim 600.00 \mathrm{~Hz}$ or $0 \sim 200.00 \%$ | 0.00 |
| $N$ | 08-11 | Wake-up Frequency | $0.00 \sim 600.00 \mathrm{~Hz}$ or $0 \sim 200.00 \%$ | 0.00 |
| N | 08-12 | Sleep Time | $0.0 \sim 6000.0$ seconds | 0.0 |
| $N$ | 08-13 | PID Deviation Level | 1.0~50.0\% | 10.0 |
| $N$ | 08-14 | PID Deviation Time | 0.1~300.0 seconds | 5.0 |
| $N$ | 08-15 | Filter Time for PID Feedback | $0.1 \sim 300.0$ seconds | 5.0 |
| $N$ | 08-16 | PID Compensation Selection | 0 : Parameter setting <br> 1: Analog input | 0 |
| N | 08-17 | PID Compensation | -100.0~+100.0\% | 0 |
|  | 08-18 | Setting of Sleep mode function | 0: Follow PID output command <br> 1: Follow PID feedback signal |  |
|  | 08-19 | Integral Limit during Wakeup | 0~200.0\% |  |
|  | 08-20 | PID Mode Selection | 0 : Serial connection <br> 1: Parallel connection | 0 |
|  | 08-21 | Enable PID to Change Operating Direction | 0 : Operating direction cannot be changed <br> 1: Operating direction can be changed | 0 |

## 09 Communication Parameters

|  | Parameter | Explanation | Settings | Factory Setting |
| :---: | :---: | :---: | :---: | :---: |
| N | 09-00 | COM1 Communication Address | 1~254 | 1 |
| N | 09-01 | COM1 Transmission Speed | 4.8~115.2Kbps | 9.6 |
| N | 09-02 | COM1 Transmission Fault Treatment | 0 : Warn and continue operation <br> 1: Warn and ramp to stop <br> 2: Warn and coast to stop <br> 3: No warning and continue operation | 3 |
| N | 09-03 | COM1 Time-out Detection | $0.0 \sim 100.0$ seconds | 0.0 |
| N | 09-04 | COM1 Communication Protocol | 0: 7N1 (ASCII) <br> 1: 7N2 (ASCII) <br> 2: 7E1 (ASCII) <br> 3: 701 (ASCII) <br> 4: 7E2 (ASCII) <br> 5: 7 O 2 (ASCII) <br> 6: 8N1 (ASCII) <br> 7: 8N2 (ASCII) <br> 8: 8E1 (ASCII) <br> 9: 801 (ASCII) <br> 10: 8E2 (ASCII) <br> 11: 802 (ASCII) <br> 12: 8N1 (RTU) <br> 13: 8N2 (RTU) <br> 14: 8E1 (RTU) <br> 15: 801 (RTU) <br> 16: 8E2 (RTU) <br> 17: 8 O 2 (RTU) | 1 |
| $N$ | $\begin{aligned} & \text { 09-05 } \\ & \sim \\ & 09-08 \end{aligned}$ | Reserved |  |  |
| N | 09-09 | Response Delay Time | 0.0~200.0ms | 2.0 |
| N | 09-10 | Main Communication Frequency (Hz) | $0.00 \sim 600.00 \mathrm{~Hz}$ | 60.00 |
| N | 09-11 | Block Transfer 1 | 0~65535 | 0 |
| $N$ | 09-12 | Block Transfer 2 | 0~65535 | 0 |
| N | 09-13 | Block Transfer 3 | 0~65535 | 0 |
| N | 09-14 | Block Transfer 4 | 0~65535 | 0 |
| N | 09-15 | Block Transfer 5 | 0~65535 | 0 |
| N | 09-16 | Block Transfer 6 | 0~65535 | 0 |
| N | 09-17 | Block Transfer 7 | 0~65535 | 0 |
| N | 09-18 | Block Transfer 8 | 0~65535 | 0 |
| $N$ | 09-19 | Block Transfer 9 | 0~65535 | 0 |
| N | 09-20 | Block Transfer 10 | 0~65535 | 0 |
| N | 09-21 | Block Transfer 11 | 0~65535 | 0 |
| $N$ | 09-22 | Block Transfer 12 | 0~65535 | 0 |



| Parameter | Explanation | Settings | Factory Setting |
| :---: | :---: | :---: | :---: |
|  |  | 14: (Error State) |  |
| 09-43 | Reset CAN Initial Idx | bit0: reset address 20XX to 0 . bit1: reset address 264X to 0 bit2: reset address 26AX to 0 bit3: reset address 60XX to 0 | 65535 |
| 09-45 | CANopen Master function | $\begin{aligned} & \text { 0: Use 420XX } \\ & \text { 1: Use 60XX } \end{aligned}$ | 0 |
| 09-46 | CANopen Master Address | 1~127 | 100 |
| $\begin{aligned} & \text { 09-47 } \\ & \sim \\ & 09-49 \end{aligned}$ | Reserved |  |  |
| 09-50 | BACnet Dnet | 0~127 | 10 |
| 09-51 | BACnet Baud Rate | 96~384 | 384 |
| 09-52 | BACnet Device ID L | 0~9999 | 1 |
| 09-53 | BACnet Device ID H | 0~419 | 0 |
| 09-54 | Reserved |  |  |
| 09-55 | BACnet Max Address | 0~127 | 127 |
| 09-56 | BACnet Password | 0~65535 | 0 |
| 09-60 | Identification of Communication Card | 0 : No communication card <br> 1: DeviceNet Slave <br> 2: Profibus-DP Slave <br> 3: CANopen Slave <br> 4: Modbus-TCP Slave <br> 5: EtherNet/IP Slave <br> 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 | \#\# |
| $\begin{aligned} & \text { 09-64 } \\ & \sim \\ & 09-69 \end{aligned}$ | Reserved |  |  |
| 09-70 | Address of Communication Card | DeviceNet: 0-63 <br> Profibus-DP: 1-125 | 1 |
| 09-71 | Communication Card Speed | Standard DeviceNet: <br> 0: 100Kbps <br> 1: 125Kbps <br> 2: 250Kbps <br> 3: 1Mbps (Delta only) <br> Non standard DeviceNet: (Delta only) <br> 0: 10Kbps <br> 1: 20Kbps <br> 2: 50Kbps <br> 3: 100Kbps <br> 4: 125Kbps <br> 5: 250Kbps <br> 6: 500Kbps <br> 7: 800Kbps <br> 8: 1Mbps | 2 |


| Parameter | Explanation | Settings | Factory Setting |
| :---: | :---: | :---: | :---: |
| 09-72 | Other settings of communication card speed | 0: Disable <br> In this mode, baud rate can only be $0,1,2,3$ in standard DeviceNet speed <br> 1: Enable <br> In this mode, the baud rate of DeviceNet can be same as CANopen (0-8). | 0 |
| 09-75 | IP Configuration of the Communication Card | $\begin{aligned} & \text { 0: Static IP } \\ & \text { 1: Dynamic IP (DHCP) } \end{aligned}$ | 0 |
| 09-76 | IP Address 1 of the Communication Card | 0~255 | 0 |
| 09-77 | IP Address 2 of the Communication Card | 0~255 | 0 |
| 09-78 | IP Address 3 of the Communication Card | 0~255 | 0 |
| 09-79 | IP Address 4 of the Communication Card | 0~255 | 0 |
| 09-80 | Address Mask 1 of the Communication Card | 0~255 | 0 |
| 09-81 | Address Mask 2 of the Communication Card | 0~255 | 0 |
| 09-82 | Address Mask 3 of the Communication Card | 0~255 | 0 |
| 09-83 | Address Mask 4 of the Communication Card | 0~255 | 0 |
| 09-84 | 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 <br> 1: Reset to return to the factory setting | 0 |
| 09-91 | Additional Setting for Communication Card | Bit 0: Enable IP Filter : <br> 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. <br> 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 |

## 12 PUMP Parameter

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

# Chapter 12 Description of Parameter Settings 

## 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
[1] Pr. 00-00 displays the identity code of the AC motor drive. Using the following table to check if Pr.00-01 setting is the rated current of the AC motor drive. Pr.00-01 corresponds to the identity code Pr.00-01.

1 The factory setting is the rated current for normal duty. Please set Pr.00-10 to 0 to display the rated current for the light duty.

| 230 V 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) | 3 | 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 <br> Motor Drive | 26 | 28 | 30 | 32 | 34 |
| Rated Current of <br> Light Duty (A) | 146 | 180 | 215 | 276 | 322 |
| Rated Current of <br> Normal Duty (A) | 120 | 146 | 180 | 215 | 255 |


| 460 V 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 | 3.7 | 5 | 7.5 | 10.5 | 12 | 14 | 22.5 | 30 | 36 | 45 | 56 | 72 |
| Rated Current of Normal Duty (A) | 1.7 | 3.0 | 4.0 | 6.0 | 9.0- | 10.5 | 12 | 18 | 24 | 32 | 38 | 45 | 60 |


| Frame | 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 <br> Motor Drive | 29 | 31 | 33 | 35 | 37 | 39 | 41 | 43 | 45 | 47 | 49 | 51 | 53 |  |  |
| Rated Current of <br> Light Duty (A) | 91 | 110 | 144 | 180 | 220 | 246 | 310 | 343 | 460 | 530 | 616 | 683 | 770 |  |  |


| Rated Current of <br> Normal Duty (A) | 73 | 91 | 110 | 150 | 180 | 220 | 260 | 310 | 370 | 460 | 550 | 616 | 683 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |

## 00-02 Parameter Reset

Factory Setting: 0

| Settings | 0: No Function |
| :--- | :--- |
|  | 1: Write protection for parameters |
|  | 6: Reset PLC (including CANopen Master Index) |
|  | 7: Reset CANopen Index (Slave) |
| 8: keypad lock |  |
|  | 9: All parameters are reset to factory settings(base frequency is 50 Hz ) |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 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 9 or 10: all parameters are reset to factory settings. If the password is set in $\mathrm{Pr} .00-08$, it needs to input the password set in Pr.00-07 to reset to factory settings.

## ~ 00-03 Start-up Display Selection

Factory setting: 0

| Settings | 0: Display the frequency command (F) |
| :--- | :--- |
| 1: Display the actual output frequency (H) |  |
| 2: Display User define (U) |  |
| 3: Output current (A) |  |

This parameter determines the start-up display page after power is applied to the drive. User defined choice display according to the setting in Pr.00-04.

## * 00-04 Content of Multi-function Display (user defined)

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

11: Display AVI1 in \% (1.), 0~10V/4-20mA/0-20mA corresponds to $0 \sim 100 \%$ (Refer to Note 2)
12: Display ACI in \% (2.), $\quad 4 \sim 20 \mathrm{~mA} / 0 \sim 10 \mathrm{~V} / 0-20 \mathrm{~mA}$ corresponds to $0 \sim 100 \%$ (Refer to Note 2 )

13: Display AVI2 in \% (3.), $-10 \mathrm{~V} \sim 10 \mathrm{~V}$ corresponds to $-100 \sim 100 \%$ (Refer to Note 2)
14: Display the temperature of IGBT in ${ }^{\circ} \mathbf{C}$ (i.)
15: Display the temperature of capacitance in ${ }^{\circ} \mathbf{C}$ (c.)
16: The status of digital input (ON/OFF) refer to Pr.02-20 (i) (Refer to Note3)
17: Display digital output status ON/OFF (Pr.02-15) (o) (refer to NOTE 4)
18: Display the multi-step speed that is executing (S)
19: The corresponding CPU pin status of digital input (d) (refer to NOTE 3)
20: The corresponding CPU pin status of digital output (0.) (refer to NOTE 4)
25: Overload counting (0.00~100.00\%) (h.)
26: GFF Ground Fault (Unit :\%)(G.)
27:DC Bus voltage ripple (Unit: Vdc)(r.)
28: Display PLC register D1043 data (C) display in hexadecimal
30 : Display output of user defined (U)
31 : H page x 00-05 Display user Gain(K)
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 $\operatorname{Pr} .03-07$ 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 0000000010000110 in binary and 0086h in HEX. When Pr.00-04 is set to " 16 " or " 19 ", it will display " 0086 h " 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


Meanwhile, if Pr.00-04 is set to 17 or 20, it will display in hexadecimal " 0001 h " 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: 0.00
Settings $0 \sim 160.00$
1 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
$\begin{array}{ll}\text { Settings } & 0 \sim 65535 \\ \text { Display } & 0 \sim 4 \text { ( \# of times of password attempts) }\end{array}$
$\square$ 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 setThis parameter is for you to set up a password to protect your parameter settings from unauthorized modifications. For the very first set up, enter directly a password of your choice. Once you finish entering that password, the setting of the parameter 8 will be 1 . Then the password protection is activated. If you want to modify any parameter, go to parameter 00-07, enter the password that you set up here. If the right password is entered, then the parameter $00-08$ will be 0 and you can modify any parameter.
Id Once you decode the parameter protection number at Parameter 00-07 and the set the parameter to 0 , then the password protection will be canceled. The will not be password protection when you re-start CP2000.

Password setting is permanently effective. If you need to modify any parameter, decode the parameter protection at Parameter 00-07.
[a] How to re-start the parameter protection after the password is decode?
Method01: Go to parameter 00-08, enter once a new password.
Method02: Reboot CP2000 to restore the setting
Method03: Input any value into Pr.00-07 (Do not enter the password).


## 00-09 Display Advanced Parameters

Factory Setting: 0
Settings Bit 0: Group 0
Bit 1: Group 1
Bit 2: Group 2
Bit 3: Group 3
Bit 4: Group 4
Bit 5: Group 5
Bit 6: Group 6
Bit 7: Group 7
Bit 8: Group 8
Bit 9: Group 9
(Bin Setting and Display for LCD Keypad)

## 00-11 Velocity Control Mode

Factory Setting: 0
Settings $0: V / F$ (V/F control)
2 : SVC (Sensorless Vector Control)
[1] 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.
[1] When setting Pr.00-11 to 0 , the V/F control diagram is shown as follows.
Fcmd
Pr00-20

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


## ~ 00-16 Loading mode selection

Factory Setting: 0
Settings 0 : Light duty
1: Normal duty

Light duty 230 V series \& 460 V series: When the output current is $110 \%$ of the rated output current, the endurance time is 60 seconds. When the output current is $130 \%$ 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.
(1) Normal duty 230 V series \& 460 V 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.

## 00-17 Carrier Frequency

Factory Setting: As shown in table below
Settings $\quad 2 \sim 15 \mathrm{kHz}$This parameter determinates the PWM carrier frequency of the AC motor drive.

| 230V series |  |  | $1-20 \mathrm{HP}[0.75-15 \mathrm{~kW}]$ |
| :--- | :--- | :--- | :--- |
| Models | $25-60 \mathrm{HP}[18.5-45 \mathrm{~kW}]$ | $75-125 \mathrm{HP}[55-90 \mathrm{~kW}]$ |  |
| Settings | $02 \sim 15 \mathrm{kHz}$ | $02 \sim 10 \mathrm{kHz}$ | $02 \sim 09 \mathrm{kHz}$ |
| Normal Duty Factory Setting | 2 kHz | 2 kHz | 2 kHz |
| Heavy Duty Factory Setting | 8 kHz | 6 kHz | 4 kHz |

Chapter 12 Description of Parameter Settings

| 460V series |  |  |  |
| :---: | :---: | :---: | :---: |
| Models | $\begin{aligned} & 1-25 \mathrm{HP} \\ & {[0.75-18.5 \mathrm{~kW}]} \end{aligned}$ | 30-100HP [22-75kW] | 125-536HP [90-400kW] |
| Settings | 02~15kHz | 02~10kHz | 02~09kHz |
| Normal Duty Factory Setting | 2 kHz | 2 kHz | 2 kHz |
| Heavy Duty Factory Setting | 8 kHz | 6 kHz | 4 kHz |


| Carrier <br> Frequency | Acoustic <br> Noise | Electromagnetic <br> Noise or Leakage <br> Current | Heat <br> Dissipation | Current <br> Wave |
| :---: | :---: | :---: | :---: | :---: |
| 1 kHz | Significant <br> 8 kHz | Minimal <br> Minimal | Significant | Significant |

[1] 由 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.
[1] 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

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) |  |It is used to set the source of the master frequency in AUTO mode.

1 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).
$\mathbb{1}$ 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)
$\square$ It is used to set the source of the operation frequency in AUTO mode.
[D] 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.


Rampto Stop and Coast toStop

1. Ramp to stop: the AC motor drive decelerates from the setting of deceleration time to 0 or minimum output frequency (Pr. 01-09) and then stop (by Pr.01-07).
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.
च 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.
$\square$ 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

## N 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
B Bit 0~3: user define on decimal place
0000b: no decimal place
0001b: one decimal place
0010b: two decimal place
0011b: three decimal place
Bit 4~15: user define on unit
000xh: Hz
001xh: rpm
002xh: \%
003xh: kg
[1] Bit 0~3: F \& H page unit and Pr.00-26 decimal display is supported up to 3 decimal places.
(1) Bit 4~15: F \& H page unit and Pr.00-26 unit display is supported up to 4 types of unit display.

## 00 - 26 Max. User Defined Value

Factory Setting: 0

| Settings | 0: Disable |
| :--- | :--- |
|  | 0000B: $0 \sim 65535$ (No decimal place in Pr.00-25 setting) |
|  | 0001B: $0.0 \sim 6553.5$ (One decimal place in Pr.00-25 setting) |
|  | 0010B: $0.0 \sim 655.35$ (Two decimal place in Pr.00-25 setting) |
|  | 0011B: $0.0 \sim 65.536$ (Three decimal place in Pr.00-25 setting) |

User define is enabled when Pr.00-26 is not 0 . The setting of Pr.00-26 corresponds to Pr.01.00 (Max. output frequency of the drive).
Example: User define: $100.0 \%$, Pr. $01.00=60.00 \mathrm{~Hz}$
Pr. 00.25 setting is 0021 h ; 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 Reserved
00-29 Reserved

* 00-30

Source of the Master Frequency Command (HAND)
Factory Setting: 0
Settings 0: Digital keypad
1: RS-485 serial communication
2: External analog input (Pr.03-00)
3: External UP/DOWN terminal
6: CANopen communication card
8: Communication card (no CANopen card)
(1) 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)
DD It is used to set the source of the operation frequency in HAND mode.參 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.
N 00-32 Enable Digital Keypad STOP Function
Factory Setting: 0
Settings 0: STOP key disable
1: STOP key enable
00-33
$\sim 00-47^{\text {Reserved }}$
00-48 Display Filter Time (Current)
Factory Setting: 0.100
Settings $\quad 0.001 \sim 65.535$
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 $\quad 0.001 \sim 65.535$
[1] 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
[10] This parameter displays the drive's software version by date.

## 01 Basic Parameter

$\mathbb{N}$ The parameter can be set during operation.
01-00 Maximum Output Frequency
Factory Setting: 60.00/50.00
Settings $50.00 \sim 600.00 \mathrm{~Hz}$
[1] This parameter determines the AC motor drive's Maximum Output Frequency. All the AC motor drive frequency command sources (analog inputs 0 to $+10 \mathrm{~V}, 4$ to $20 \mathrm{~mA}, 0$ to $20 \mathrm{mAand} \pm 10 \mathrm{~V}$ ) are scaled to correspond to the output frequency range.

## 01-01 Motor1: Max Output Frequency(Hz) (Base Frequency/Motor Rated Frequency)

Factory Setting: 60.00/50.00
Settings $\quad 0.00 \sim 600.00 \mathrm{~Hz}$

01 - 02 Motor1: Max Output Voltage (V)
01 - 03 Mid-point Frequency 1 of Motor 1
Factory Setting:
220.00/400.00

Factory Setting: 3.0
Settings 230 V series $0.0 \sim 240.0 \mathrm{~V}$ 460 V series $0.0 \sim 480.0 \mathrm{~V}$
Settings $\quad 0.00 \sim 600.00 \mathrm{~Hz}$

N 01-04 Mid-point Voltage 1 of Motor 1
Factory Setting: 11.0/22.0
Settings 230 V series $0.0 \sim 255.0 \mathrm{~V}$ 460 V series $0.0 \sim 510.0 \mathrm{~V}$

01-05 Mid-point Frequency 2 of Motor 1
Factory Setting: 0.50
Settings $\quad 0.00 \sim 600.00 \mathrm{~Hz}$

N 01-06 Mid-point Voltage 2 of Motor 1
Factory Setting: 4.0/8.0
Settings 230 V series $0.0 \sim 240.0 \mathrm{~V}$ 460 V series $0.0 \sim 480.0 \mathrm{~V}$

## 01-07 Min. Output Frequency of Motor 1

Factory Setting: 0.00
Settings $\quad 0.00 \sim 600.00 \mathrm{~Hz}$

N 01-08 Min. Output Voltage of Motor 1
Factory Setting: 0.0/0.0
Settings 230 V series $0.0 \sim 240.0 \mathrm{~V}$
460 V series $0.0 \sim 480.0 \mathrm{~V}$

## 01-09 Start-Up Frequency

Factory Setting: 0.50
Settings $\quad 0.0 \sim 600.00 \mathrm{~Hz}$
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)


Factory Setting: 600.00
Settings $\quad 0.00 \sim 600.00 \mathrm{~Hz}$

## * 01-11 Output Frequency Lower Limit

Factory Setting: 0.00
Settings $\quad 0.00 \sim 600.00 \mathrm{~Hz}$
[1] The upper/lower output frequency setting is used to limit the actual output frequency. If the frequency setting is higher than the upper limit, it will run with the upper limit frequency. If output frequency is lower than the output frequency lower limit and frequency setting is higher than min. frequency, it will run with lower limit frequency. The upper limit frequency should be set to be higher than the lower limit frequency.
(1) Pr.01-10 setting must be $\geq$ Pr.01-11 setting. Pr.01-00 setting is regarded as $100.0 \%$.

II This setting will limit the max. Output frequency of drive. If frequency setting is higher than Pr.01-10, the output frequency will be limited by Pr.01-10 setting.When the drive starts the function of slip compensation (Pr.07-27) or PID feedback control, drive output frequency may exceed frequency command but still be limited by this setting.
(1)] Related parameters: Pr.01-00 Max. Operation Frequency and Pr.01-11 Output Frequency Lower Limit


V/f curve

LD This setting will limit the min. output frequency of drive. When drive frequency command or feedback control frequency is lower than this setting, drive output frequency will limit by the lower limit of frequency.
[D] When the drive starts, it will operate from min. output frequency (Pr.01-05) and accelerate to the setting frequency. It won't limit by this parameter setting.
[1] The setting of output frequency upper/lower limit is used to prevent the personal misoperation, the overheat due to too low operation frequency and the damage due to too high speed.

If If output frequency upper limit setting is 50 Hz and frequency setting is 60 Hz , max. output frequency will be 50 Hz .

If If the output frequency lower limit setting is 10 Hz and min. operation frequency setting (Pr.01-05) is 1.5 Hz , it will operate by 10 Hz when the frequency command is greater than Pr.01-05 and less than 10 Hz . If the frequency command is less than Pr.01-05, the drive will be in ready status and no output.

【 If the frequency output upper limit is 60 Hz and frequency setting is also 60 Hz , it won't exceed 60 Hz even after slip compensation. If the output frequency needs to exceed 60 Hz , it can increase output frequency upper limit or max. operation frequency.
~ 01-12 Accel. Time 1

* 01-13 Decel. Time 1

N 01-14 Aceel. Time 2
~ 01-15 Decel. Time 2
N 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
N 01-21 JOG Deceleration Time
Factory Setting: 10.00/10.0
Settings Parameters 01-45=0:0.00~600.00 seconds
Parameters 01-45=1:0.00~6000.0 seconds
Ma 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 0.00 Hz .The Acceleration/Deceleration Time is invalid when using Pr.01-44 Optimal Acceleration/Deceleration Setting.
[a] The Acceleration/Deceleration Time 1, 2, 3, 4 are selected according to the Multi-function Input Terminals settings. The factory settings are Accel./Decel. Time 1.

When enabling torque limits and stalls prevention function, actual accel./decel. time will be longer than the above action time.
$[\mathbb{1}$ 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.

1 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.
[4] 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.
[1] 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.


* 01-22 JOG Frequency (JOG)

Factory Setting: 6.00
Settings $\quad 0.00 \sim 600.00 \mathrm{~Hz}$
1 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 0 Hz 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.

凹 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.

## N 01-23 Frequency of 1st Acceleration / Deceleration \& <br> Frequency of $4^{\text {th }}$ Acceleration / Deceleration.

Factory Setting: 0.00
Settings $\quad 0.00 \sim 600.00 \mathrm{~Hz}$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.


* 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
[1] 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.
[D] The S-curve function is disabled when accel./decel. time is set to 0 .
[1] When Pr.01-12, 01-14, 01-16, 01-18 $\geq$ Pr.01-24 and Pr.01-25, the Actual Accel. Time $=\operatorname{Pr} .01-12,01-14,01-16,01-18+(\operatorname{Pr} .01-24+\operatorname{Pr} .01-25) / 2$When Pr.01-13, 01-15, 01-17, 01-19 $\geq$ Pr.01-26 and Pr.01-27, the Actual Decel. Time $=\operatorname{Pr} .01-13,01-15,01-17,01-19+(\operatorname{Pr} .01-26+\operatorname{Pr} .01-27) / 2$


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 $\quad 0.00 \sim 600.00 \mathrm{~Hz}$

1 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.

1 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 $01-28 \geq 01-29 \geq 01-30 \geq 01-31 \geq 01-32 \geq 01-33$. 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.
[1]
The setting of frequency command ( F ) can be set within the range of skip frequencies. At this moment, the output frequency $(\mathrm{H})$ 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 (the 4 th output |

[1] When the frequency is less than Fmin (Pr.01-07 or Pr.01-41), it will operate by this parameter.
[1] 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.In V/F and SVC modes


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

Factory Setting: 60.00/50.00
Settings $\quad 0.00 \sim 600.00 \mathrm{~Hz}$

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

Factory Setting: 200.0/400.0
Settings 230V series $0.0 \sim 255.0 \mathrm{~V}$
460V series $0.0 \sim 510.0 \mathrm{~V}$
[1] The setting of this parameter follows that rated output voltage on the nameplate. If the motor uses 220 V , then the setting will be 220.0 V . If the motor uses 200 V , then the setting will be 200.0 V .
(1) There are several kinds of motor available in the market and the power systems differ from country to country. The most feasible and simplest way to solve this issue is to install a variable frequency drive such as CP2000. Then problems such as different voltage and frequency will be easily solved to bring a motor into full play.

## 01-37 Motor 2: Middle Output Frequency 1

Factory Setting: 3.00
Settings $\quad 0.00 \sim 600.00 \mathrm{~Hz}$
N 01-38 Motor 2: Middle Output Voltage 1
Factory Setting: 11.0/22.0

Settings 230 V series $0.0 \sim 240.0 \mathrm{~V}$<br>460 V series $0.0 \sim 480.0 \mathrm{~V}$

## 01-39 Motor 2: Middle Output Frequency 2

Factory Setting: 0.50
Settings $\quad 0.00 \sim 600.00 \mathrm{~Hz}$
^ 01-40 Motor 2: Middle Output Voltage 2
Factory Setting: 4.0/8.0
Settings 230V series $0.0 \sim 240.0 \mathrm{~V}$
460 V series $0.0 \sim 480.0 \mathrm{~V}$

## 01-41 Motor 2: Minimum Output Frequency

Factory Setting: 0.00
Settings $\quad 0.00 \sim 600.00 \mathrm{~Hz}$
N 01-42 Motor 2: Minimum Output Voltage

Settings 230 V series $0.0 \sim 255.0 \mathrm{~V}$
460 V series $0.0 \sim 510.0 \mathrm{~V}$
Factory Setting: 0.0/0.0

The setting of V/F curve usually follows the load characteristics of a motor. If the workload exceed a motor's capacity, pay attentions to its heat dissipation, dynamic balance and bearing lubrication.
1 If the setting of the voltage at low frequency is too high, it might cause a motor to be broken down, be overheated, have stall prevention and/or have over current protection. So please be very careful when setting up parameter to avoid any damages on the motor and the drive.Parameters 01-35 ~ 01-42 are to set up V/F curve of Motor 2. When multi-function input terminals $02-02 \sim 02-08$ and 02-26 $\sim 02-31$ (expansion card) are set to 14 and enabled, then the drive will operate by following V/F curve of Motor 2.

The V/F curve of Motor 1 is shown as below. The V/F Curve of Motor 2 will be the like.


## VIF Curve

Common setting of V/F curve
(1) General purpose

| Motor spec. 60 Hz |  |  |
| :---: | :---: | :---: |
| 220 | Pr. | Setting |
|  | 01-00 | 60.0 |
|  | 01-01 | 60.0 |
|  | 01-02 | 220.0 |
|  | $\begin{aligned} & 01-03 \\ & 01-05 \end{aligned}$ | 1.50 |
|  | $\begin{aligned} & \text { 01-04 } \\ & 01-06 \end{aligned}$ | 10.0 |
| $\begin{array}{ll} \hline 1.5 & 60.0 \end{array}$ | 01-07 | 1.50 |
|  | 01-08 | 10.0 |

Motor spec. 50 Hz

| V $\uparrow$ |  |  |  |
| :---: | :---: | :---: | :---: |
| 220 | / | Pr. | Setting |
|  |  | 01-00 | 50.0 |
|  |  | 01-01 | 50.0 |
|  |  | 01-02 | 220.0 |
|  |  | $01-03$ | 1.30 |
|  |  |  |  |
| 10 |  | $\begin{aligned} & \text { 01-04 } \\ & \text { 01-06 } \end{aligned}$ | 12.0 |
|  | 1.3 50.0 ${ }^{\text {F }}$ | 01-07 | 1.30 |
|  |  | 01-08 | 12.0 |

(2) Fan \& Hydraulic Machinery

## Motor spec. 60 Hz



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

## Motor spec. 50 Hz



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

## ( 3 ) High Starting Torque

## Motor spec. 60 Hz

## Motor spec. 50 Hz



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



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

## 01 - 43 V/F Curve Selection

Factory Setting: 0

$$
\begin{array}{ll}
\text { Settings } & 0: \text { V/F curve determined by group } 01 \\
& 1: 1.5 \text { power curve } \\
& \text { 2: Square curve }
\end{array}
$$

[1] 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.
Lad When setting to 1 or 2 , the $2^{\text {nd }}$ and the $3^{\text {rd }}$ voltage frequency setting are invalid.
(1) 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.


## N 01-44 Optimal Acceleration/Deceleration Setting

Settings 0: Linear accel. /decel.<br>1: Auto accel., Linear decel.<br>2: Linear accel., Auto decel.<br>3: Auto accel. / decel.<br>4: Linear, stall prevention by auto accel./decel. (limit by

凹a 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.
[1] Setting 0 Linear accel./decel.: it will accelerate/decelerate according to the setting of Pr.01-12~01-19.
凹a Setting 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.

1 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 <br> Settings 0 : Unit 0.01 second <br> 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 secondsIt is to set up the length of time required when a drive decelerates from its max. operation frequency (Pr.01-00) to 0.00 Hz in CANopen control mode. .

## 01-47

$\sim 01-50$ Reserved

## 02 Digital Input/Output Parameter $\sim$ The parameter can be set during operation.

02-00 2-wire/3-wire Operation Control
Factory Setting: 0

$$
\begin{array}{ll}
\text { Settings } & 0: 2 \text { wire mode } 1 \\
& 1: 2 \text { wire mode } 2 \\
& \text { 2: } 3 \text { wire mode }
\end{array}
$$

1 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 <br> Two-wire mode 1 FWD/STOP <br> REV/STOP | FWD/STOP <br> REV/STOPFWD:("OPEN": STOP) <br> ("CLOSE":FWD) <br> REV:("OPEN": STOP) <br> DCM |
| When setting is 1 <br> 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) <br> 02 - 28 Input terminal of I/O extension card (MI12) <br> 02 - 29 Input terminal of I/O extension card (MI13) <br> 02 - 30 Input terminal of I/O extension card (MI14) <br> 02 - 31 Input terminal of I/O extension card (MI15)

Settings
0 : No function
1: multi-step speed command $1 /$ multi-step position command 1
2: multi-step speed command 2/multi-step position command 2
3: multi-step speed command 3/multi-step position command 3
4: multi-step speed command 4/multi-step position command 4
e5: Reset
6: JOG command ( By KPC-CC01 or external control )
7: acceleration/deceleration speed not allow
8: the $1^{\text {st }}, 2^{\text {nd }}$ acceleration/deceleration time selection
9: the $3^{\text {rd }}, 4^{\text {th }}$ 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

27: ASR1/ASR2 selection
28: Emergency stop (EF1)
29: Signal confirmation for Y-connection
30: Signal confirmation for $\Delta$-connection
38: Disable write EEPROM function
40: Enforced coast to stop
41: HAND switch
42 : AUTO switch
44~47: Reserved
49: Drive enabled
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: Max. Reverse Disabled
57: Max. Forward Disabled

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 disabled
65: Disable Motor \#5 disabled
66: Disable Motor\#6 disabled
67: Disable Motor\#7 disabled
68: Disable Motor\#8 disabled
$\square$ This parameter selects the functions for each multi-function terminal.
(4) 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 $8 \sim 15$ ( 0 means ON, 1 means OFF) at Parameter 02-12.
[1] 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 /Multi-step position command 1 | 15-step speeds or 15-step positions could be conducted through the digital status of the 4 terminals. It will be 16 in total if the master speed is included. (Refer to Parameter set 4) |
| 2 | Multi-step speed command 2 <br> /Multi-step position command 2 |  |
| 3 | Multi-step speed command 3 /Multi-step position command 3 |  |
| 4 | Multi-step speed command 4 <br> /Multi-step position command 4 |  |
| 5 | Reset | After the error of the drive is eliminated, use this terminal to reset the drive. |


| Settings | Functions | Descriptions |
| :---: | :---: | :---: |
| 6 | JOG Command | 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. |
| 7 | Acceleration / Deceleration Speed Inhibit | 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. |
| 8 9 | The $1^{\text {st }}, 2^{\text {nd }}$ acceleration or deceleration time selection The $3^{\text {rd }}, 4^{\text {th }}$ acceleration or deceleration time selection | 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. |
| 10 | EF Input (EF: External Fault) | 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) |
| 11 | External B.B. Input (Base Block) | $07-08 \cdot$ 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. |


| Settings | Functions | Descriptions <br> If this contact is ON, output of the drive will be cut off <br> immediately, and the motor will then be free run. Once it is turned <br> to OFF, the drive will accelerate to the setting frequency <br> Voltage |
| :--- | :--- | :--- |
| 12 | Output stop | Frequency <br> Setting <br> frequency |
| 13 | Cancel the setting of the <br> optimal accel./decel. time | Before using this function, Pr.01-44 should be set to mode 01, 02, <br> 03 or 04 first. When this function is enabled, OFF is for auto mode <br> and ON is for linear accel./decel. |
| 14 | Switch between drive settings <br> 1 and 2 | When the contact is ON: use parameters of motor 2. When it is <br> Operation |
| command parameters of motor 1. |  |  |


| Settings | Functions | Descriptions |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 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. <br> Voltage |  |  |  |
| 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 $\triangle$ connection | When the control mode is $\mathrm{V} / \mathrm{F}$ 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. |  |  |  |
| 40 | Enforced coast to stop | When this contact is ON during an operation, the drive will free run to stop. |  |  |  |
| 41 | HAND switch | ■ 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. <br> ■ When switching by the keypad KPC-CC01 during an operation, the drive will be switched to the status after stop. <br> $\boxtimes$ 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. <br> ■ Digital keypad displays the drive's status such as HAND/OFF/AUTO |  |  |  |
| 42 | AUTO switch |  |  |  |  |
|  |  |  | Bit 1 |  |  |
|  |  | OFF | 0 | 0 |  |
|  |  | AUTO | 0 | 1 |  |
|  |  | HAND | 1 | 0 |  |



## ~ 02-09 UP/DOWN Key Mode

Factory Setting: 0

$$
\begin{array}{ll}
\text { Settings } & 0: \mathrm{UP} / D O W N \text { by the accel./decal. Time } \\
& 1: \mathrm{UP} / D O W N \text { constant speed (by parameter 02-10) }
\end{array}
$$

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

Factory Setting: 0.01
Settings $\quad 0.01 \sim 1.00 \mathrm{~Hz} / \mathrm{ms}$
These settings are used when multi-function input terminals are set to 19 or 20. Refer to Pr.02-09 and 02-10 for the frequency up/down command.

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


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


N 02-11 Digital Input Response Time
Factory Setting: 0.005
Settings $0.000 \sim 30.000$ seconds
[1] 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.

Factory Setting: 0
Settings $\quad 0 \sim 65535$ ( $0:$ N.O. ; 1:N.C. )
The setting of this parameter is in hexadecimal.
[D] 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.
[al User can change terminal status by communicating.
For example, MI1 is set to 1 (multi-step speed command 1), MI2 is set to 2 (multi-step speed command 2). Then the forward $+2^{\text {nd }}$ step speed command=1001(binary) $=9$ (Decimal). Only need to set Pr.02-12=9 by communication and it can forward with $2^{\text {nd }}$ 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 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| MI14 | MI13 | MI12 | MI11 | MI10 | MI9 | MI8 | MI7 | MI6 | MI5 | MI4 | MI3 | MI2 | MI1 | REV |

* 02-13 Relay1: Multi Output Terminal

Factory Setting: 11
N 02-14 Relay2: Multi Output Terminal
Factory Setting: 1
N 02-15 Relay3: Multi Output Terminal
Factory Setting: 0

* 02-16 Reserved
~ 02 - 17 Reserved
N 02-36 Expansion Card Output Terminal (MO3)
N 02-37 Expansion Card Output Terminal (MO4)
N 02-38 Expansion Card Output Terminal (MO5)
^ 02-39 Output terminal of the I/O extension card (MO6)
* 02-40 Output terminal of the I/O extension card (MO7)

N 02-41 Output terminal of the I/O extension card (MO8)
N 02-42 Output terminal of the I/O extension card (MO9)
N 02-43 Output terminal of the I/O extension card (MO10)
N 02-44 Output terminal of the I/O extension card (MO11)
N 02-45 Output terminal of the I/O extension card (MO12)
N 02-46 Output terminal of the I/O extension card (MO13)

## 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
8: Over torque 2
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: Base block
20: Warning output
21: Over voltage warning
22: Over-current stall prevention warning
23: Over-voltage stall prevention warning
24: Operation mode indication
25: Forward command
26: Reverse command
27: Output when current $>=\operatorname{Pr} .02-33$ ( $>=02-33$ )
28: Output when current $<=\operatorname{Pr} .02-33$ ( $<=02-33$ )
29: Output when frequency $>=\operatorname{Pr} .02-34$ ( $>=02-34$ )
30: Output when frequency $<=\operatorname{Pr} .02-34$ ( $<=02-34$ )
31: Y-connection for the motor coil
32: $\triangle$-connection for the motor coil
33: Zero speed (actual output frequency)
34: Zero speed include stop(actual output frequency)
35: Error output selection 1(Pr.06-23)

36: Error output selection 2(Pr.06-24)
37: Error output selection 3(Pr.06-25)
38: Error output selection 4(Pr.06-26)
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
$\mathbb{1}$ This parameter selects the functions for each multi-function terminal.
$\square$ The terminals of Pr.02-36~Pr.02-41 will only be displayed after using with optional card EMC-D42A and EMC-R6AA
1 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
1 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 <br> Attained | Active when the AC motor drive reaches the output frequency setting. |
| 3 | Desired Frequency <br> Attained 1 (Pr.02-22) | Active when the desired frequency (Pr.02-22) is attained. |
| 4 | Desired Frequency <br> Attained 2 (Pr.02-24) | Active when the desired frequency (Pr.02-24) is attained. |
| 5 | Zero Speed (frequency <br> command) | Active when frequency command $=0$. (the drive should be at RUN mode) |
| 6 | Zero Speed with Stop <br> (frequency command) | Active when frequency command =0 or stop. <br> 7 |
| Over Torque 1 | Active when detecting over-torque. Refer to Pr.06-07 (over-torque detection <br> level-OT1) and Pr.06-08 (over-torque detection time-OT1). Refer to <br> Pr.06-06~06-08. |  |
| 8 | Over Torque 2 | Active when detecting over-torque. Refer to Pr.06-10 (over-torque detection <br> level-OT2) and Pr.06-11 (over-torque detection time-OT2). Refer to <br> Pr.06-09~06-11. |


| Settings | Functions |  |
| :--- | :--- | :--- |
| 9 | Drive Ready | Active when the drive is ON and no abnormality detected. |
| 10 | Low voltage warn (Lv) | $\begin{array}{l}\text { Active when the DC Bus voltage is too low. (refer to Pr.06-00 low voltage } \\ \text { level) }\end{array}$ |
| 11 | $\begin{array}{l}\text { Malfunction Indication } \\ \text { Mechanical Brake } \\ \text { Release (Pr.02-32) }\end{array}$ | $\begin{array}{l}\text { Active when fault occurs (except Lv stop). } \\ \text { When drive runs after Pr.02-32, it will be ON. This function should be used } \\ \text { Overheat }\end{array}$ |
| 12 | $\begin{array}{l}\text { Software Brake Signal } \\ \text { Indication }\end{array}$ | Active when IGBT it is recommended to use contact "b"(N.C). |
| (refer to Pr.06-15) |  |  |$\}$


| Settings | Functions | Descriptions |
| :---: | :---: | :---: |
| 40 | Speed Attained <br> (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 <br> Contactor enabled |  |
| 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 |

Example of crane function


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

^ 02-18 Multi-output Direction
Factory Setting: 0
Settings $0 \sim 65535$ (0:N.O.; 1:N.C.)
[1] 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 $\operatorname{Pr} 02-13=1$, 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 | MO2 | MO1 | 保留 | RY2 | RY1 |

N 02-19 Terminal count value attained (returns to 0 )
Factory Setting: 0
Settings $\quad 0 \sim 65500$
[1] 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 .
[1] 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 .

N 02-20 Preliminary count value attained (not return to 0 )
Factory Setting: 0
Settings $0 \sim 65500$
10] 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:

(output signal)
Preliminary Counter V alue
RY1 Pr.02-13=17 $\quad 02-13,02-14,02-36,02-37$

|  |  |  |
| :--- | :---: | :---: |
| Terminal Counter Value |  |  |
| RY2 Pr.02-14 $=18$ | $02-14=17$ | $\square$ |

## N 02-21 Digital Output Gain (DFM )

Factory Setting: 1
Settings $\quad 1 \sim 166$
It is used to set the signal for the digital output terminals (DFM-DCM) and digital frequency output (pulse X work period=50\%). Output pulse per second = output frequency X Pr.02-21.

N 02-22 Desired Frequency Attained 1
Factory Setting: 60.00/50.00
Settings $\quad 0.00 \sim 600.00 \mathrm{~Hz}$
N 02-24 Desired Frequency Attained 2
Factory Setting: 60.00/50.00
Settings $\quad 0.00 \sim 600.00 \mathrm{~Hz}$
N 02-23 The Width of the Desired Frequency Attained 1
Factory Setting: 2.00
Settings $\quad 0.00 \sim 600.00 \mathrm{~Hz}$

N 02-25 The Width of the Desired Frequency Attained 2
Factory Setting: 2.00
Settings $\quad 0.00 \sim 600.00 \mathrm{~Hz}$
ID 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 $\quad 0.000 \sim 65.000$ 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 is recommended to use this function with DC brake.

[1] If this parameter is applied without DC brake, it will be invalid. Refer to the following operation timing.


## N 02-33 Output Current Level Setting for Multi-function Output Terminals

Factory Setting: 0
Settings 0~100\%
10 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 ).

N 02-34 Output Boundary for Multi-function Output Terminals
Factory Setting: 0.00
Settings $0.00 \sim \pm 60.00 \mathrm{~Hz}$
1 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 ).
[1] 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 )

N 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.
(1)] 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.

Factory Setting： 0
Settings 0～65535 rpm
【 此參數功能需搭配多機能輸出端子設定値 43 使用。This parameter should be used with the multi－function output terminals（set to 43）．It needs to be used with PG cared and motor with encoder feedback．
nad This parameter is used to set the level of motor zero－speed．When the actual speed is lower than this setting，the corresponding multi－function output terminal 43 will be ON as shown as follows．

＾02－48 Max．Frequency of Resolution Switch
Factory Setting： 60.00
Settings $\quad 0.01 \sim 600.00 \mathrm{~Hz}$
N 02－49 Switch the delay time of Max．output frequency
Factory Setting： 0.000
Settings $0.000 \sim 65.000$ 秒
It is used to improve the unstable speed or unstable position due to the insufficient of analog resolution． It needs to be used with external terminal（set to 43）．After setting this parameter，it needs to adjust the analog output resolution of controller simultaneously by this setting．


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

Weight
Bit
$0=O n$
$1=O f f$


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.

Weights

| $\begin{array}{llllll}2^{5} & 2^{4} & 2^{3} & 2^{2} & 2^{1} & 2^{0}\end{array}$ |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | 1 | 0 | 1 | 0 | $0 \leftarrow$ MI1 |
|  | MI2MI3MI4MI5MI6 |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

$$
\begin{aligned}
& 0=O N \\
& 1=O F F \\
& \text { Settings } \\
& =\text { bit } 5 \times 2^{5}+\text { bit } 4 \times 2^{4}+\text { bit } 2 \times 2^{2} \\
& =1 \times 2^{5}+1 \times 2^{4}+1 \times 2^{2} \\
& =32+16+4=52 \\
& \\
& \begin{array}{lll}
\text { NOTE } \\
2^{5}=322^{4}=16 & 2^{3}=8 & 2^{2}=4 \\
2^{1}=2 & 2^{2}=1
\end{array} \\
& \hline
\end{aligned}
$$

## 02-51 Status of Multi-function Output Terminal

## For Example:

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

$$
\begin{aligned}
& 0=O N \\
& 1=O F F
\end{aligned}
$$




$$
\begin{array}{lll}
\text { NOTE } & \\
2^{7}=128 & 2^{6}=64 & \\
2^{5}=32 & 2^{4}=16 & 2^{3}=8 \\
2^{2}=4 & 2^{1}=2 & 2^{0}=1
\end{array}
$$

02-52 Display External Output terminal occupied by PLC
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

Weights
Bit


0: not used by PLC
1: used by PLC
Displays
$=$ bit $5 \times 2^{5}+$ bit $4 \times 2^{4}+$ bit $2 \times 2^{2}$
$=1 \times 2^{5}+1 \times 2^{4}+1 \times 2^{2}$
$=32+16+4=52$

$$
\begin{aligned}
& \text { Note } \\
& 2^{14}=16384 \quad 2^{13}=8192 \quad 2^{12}=4096 \\
& 2^{11}=2048 \quad 2^{10}=1024 \quad 2^{9}=512 \\
& 2^{8}=256 \quad 2^{7}=128 \quad 2^{6}=64 \\
& 2^{5}=322^{4}=16 \quad 2^{3}=8 \quad 2^{2}=4 \\
& 2^{1}=2 \quad 2^{0}=1
\end{aligned}
$$

02-53 Display Analog Input Terminal occupied by PLC
Factory Setting: Read Only
Pr.02-53 shows the external multi-function output terminal that used by PLC.
Weights Bit


| NOTE |  |  |
| :--- | :--- | :--- |
| $2^{7}=128$ | $2^{6}=64$ |  |
| $2^{5}=32$ | $2^{5}=16$ | $2^{3}=8$ |
| $2^{2}=4$ | $2^{1}=2$ | $2^{0}=1$ |

For example:
If the value of Pr.02-53 displays 0003h (Hex), it means RY1and RY2 are used by PLC.
$0=$ NOT used by PLC
Weights
Bit


$$
\begin{aligned}
& \text { Display value } \\
& \begin{aligned}
3 & =2+1 \\
& =1 \times 2^{1}+1 \times 2^{0} \\
& =\text { bit } 1 \times 2^{1}+\text { bit } 0 \times 2^{0}
\end{aligned}
\end{aligned}
$$

02 - 54 Display the Frequency Command Memory of External TerminalFactory 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.
02-57 Mix Active by Internal or External
Factory Setting : 0
Settings 0~65535
02 - 58 Internal Mix Active Value
Factory Setting : 0
Setings 0~65535

03 Analog Input/Output Parameter ( $N$ The parameter can be set during operation)
N 03-00 Analog Input 1 (AVI1)
Factory Setting: 1
N 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 (torque limit under torque
control mode)
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
12~17: Reserved
1 When it is frequency command or TQC speed limit, the corresponding value for $0 \sim \pm 10 \mathrm{~V} / 4 \sim 20 \mathrm{~mA}$ is $0-$ max. output frequency(Pr.01-00)

^ 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 .

N 03-04 Analog Input Bias 1 (ACI)
Factory Setting: 0
Settings -100.0~100.0\%
1 It is used to set the corresponding ACI voltage of the external analog input 0 .
$\square$
N 03-05 AVI2 Analog Positive Input Bias
Factory Setting: 0
Settings -100.0~100.0\%
1 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: $0 \sim 10 \mathrm{~V}(4-20 \mathrm{~mA})$ corresponds to $0-60 \mathrm{~Hz}$.
~ $03-06$ Reseved
Factory Setting: 0
Settings -

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

* 03-10 Reserved

Factory Setting: 0
Settings 0: Zero bias
1: Lower than bias=bias
2: Greater than bias=bias
3: The absolute value of the bias voltage while serving as the center
4: Serve bias as the center
In a noisy environment, it is advantageous to use negative bias to provide a noise margin. It is recommended NOT to use less than 1 V to set the operation frequency.


03-11~03-14 gain is positive
0 Zerobias
1 Lower than bias=bias
2 Greater than bias=bias
3 The absolute value of the bias voltage
3 while serving as the center
4 Serve bias as the center

* 03-11 Analog Input Gain 1 (AVII)

N 03-12 Analog Input Gain 2 (ACI)
N 03-13 Analog Positive Input Gain 3 (AVI2)
N 03-14 Analog Negative Input Gain 4 (AVI2)
Factory Setting: 100.0
Settings $\quad-500.0 \sim 500.0 \%$
Parameters 03-03 to 03-14 are used when the source of frequency command is the analog voltage/current signal.

N 03-15 Analog Input Filter Time (AVI1)
N 03-16 Analog Input Filter Time (ACI)
N 03-17 Analog Input Filter Time (AVI2)
Factory Setting: 0.01
Settings $\quad 0.00 \sim 20.00$ secondsThese input delays can be used to filter noisy analog signalWhen 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.

N 03-18 Addition Function of the Analog Input
Factory Setting: 0
Settings 0 : Disable (AVI1 , ACI, AVI2)

$$
1 \text { : Enable }
$$

When Pr.03-18 is set to 0 and the analog input setting is the same, the priority for AVI1, ACI and AVI2 are AVI1>ACI>AVI2.


Fcommand $=\left[(\text { ay bias })^{*} \text { gain }\right]^{*} \frac{\text { Fmax }(01-00)}{10 \mathrm{~V} \text { or } 16 \mathrm{~mA}}$
Fcommand: the corresp onding
frequen cy for 10V or 20 mA
ay: 10 or 16 mA
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 |

1 This parameter determines the behAVI1or when ACI is lost.
1 When Pr.03-29 is set to 1 , it means ACI terminal is for $0-10 \mathrm{~V}$ voltage input. At this moment, Pr.03-19 will be invalid.

1 When setting is 1 or 2, it will display warning code "AnL" on the keypad. It will be blinking until the loss of the ACI signal is recovered or drive is stop

N 03-20 Multi-function Output 1 (AFM1)
Factory Setting: 0
N 03-23 Multi-function Output 2 (AFM2)
Factory Setting: 0
Settings 0~23
Function Chart

| Settings | Functions | Descriptions |
| :--- | :--- | :--- |
| 0 | Output frequency $(\mathrm{Hz})$ | Max. frequency Pr.01-00 is regarded as $100 \%$. |
| 1 | Frequency command $(\mathrm{Hz})$ | Max. frequency Pr.01-00 is regarded as $100 \%$. |
| 2 | Motor speed $(\mathrm{Hz})$ | 600 Hz is regarded as $100 \%$ |
| 3 | Output current $(\mathrm{rms})$ | $(2.5 \mathrm{X}$ rated current) is regarded as $100 \%$ |
| 4 | Output voltage | $(2 \mathrm{X}$ rated voltage) is regarded as $100 \%$ |
| 5 | DC Bus Voltage | $450 \mathrm{~V}(900 \mathrm{~V})=100 \%$ |
| 6 | Power factor | $-1.000 \sim 1.000=100 \%$ |
| 7 | Power | Rated power is regarded as $100 \%$ |
| 8 | Output torque | Full-load torque is regarded as $100 \%$ |

Chapter 12 Description of Parameter Settings

| 9 | AVI1 \% | $(0 \sim 10 \mathrm{~V}=0 \sim 100 \%)$ |
| :--- | :--- | :--- |
| 10 | ACI \% | $(0 \sim 20 \mathrm{~mA}=0 \sim 100 \%)$ |
| 21 | RS485 analog output | For communication output (CMC-MOD01, CMC-EIP01, <br> CMC-PN01, CMC-DN01) |
| 22 | Analog output for communication | For communication output (CMC-MOD01, CMC-EIP01, <br> CMC-PN01, CMC-DN01) |
| 23 | Constant voltage output | Voltage output level can be controls by Pr.03-32 and Pr03-33. <br> $0 \sim 100 \%$ of Pr.03-32 corresponds to 0~10V of AFM1. |

N 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\%
[D] It is used to adjust the analog voltage level (Pr.03-20) that terminal AFM outputs.
10] This parameter is set the corresponding voltage of the analog output 0 .
N 03-22 Analog Output 1 Value in REV Direction (AFM1)
Factory Setting: 0
N $03-25$ Analog Output 2 Value in REV Direction (AFM2)
Factory Setting: 0
Settings 0: Absolute value in REV direction
1: Output 0 V in REV direction; output $0-10 \mathrm{~V}$ in FWD direction
2: Output 5-0V in REV direction; output 5-10V in FWD direction


N 03-26 Display Low-Pass Filter (AFM1) AFM1 Filter
N 03-27 Display Low-Pass Filter (AFM2) AFM2 Filter
Factory Setting: 0
Settings $\quad 0.001 \sim 65.535$ seconds

N 03-28 AVI1 Selection
Factory Setting: 0
Settings $\quad 0: 0-10 \mathrm{~V}$
1: $0-20 \mathrm{~mA}$
2: $4-20 \mathrm{~mA}$
N 03-29 ACI Selection
Factory Setting: 0
Settings $\quad 0: 4-20 \mathrm{~mA}$
1: 0-10V
2: $0-20 \mathrm{~mA}$
1 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.

N 03-30 Display Status of PLC Output Terminal
Factory Setting: 0
Settings 0~65535
Monitor the status of PLC analog output terminals
[1] P.03-30 shows the external multi-function output terminal that used by PLC


| $\underset{7}{\mathrm{NOTE}_{7}}$ | 6 |  |
| :---: | :---: | :---: |
| $2=128$ | $2=64$ |  |
| 5 |  | 3 |
| $2=32$ | $2=16$ | 2 =8 |
| 2 | 1 | 0 |
| $2=4$ | 2 =2 | 2 = |

(1)] For Example:

If the value of Pr.02-30 displays 0002h(Hex), it means AFM1and AFM2 are used by PLC.
$0=$ Not used by PLC
1 =Used by PLC
Weights
Bit


$$
\begin{aligned}
& \text { Display value } \\
& \begin{array}{l}
2=1 \times 2^{1}+0 \times 2^{0} \\
=\text { bit } 1 \times 2^{1}+\text { bit } 0 \times 2^{0}
\end{array}
\end{aligned}
$$

03-31 AFM2 0-20mA Output Selection
Factory Setting: 0
Settings $\quad 0: 0-20 \mathrm{~mA}$ 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\%
03-50 AI calculated selection
Factory Setting : 0
Settings $0 \sim 7$

03-51 AVI Point1 - voltage
Factory Setting : 0
Setting $\quad 0 \sim 10.00 / 0 \sim 20.00$

03-52 AVI Point 1- percentage
Factory Setting : 0\%
Setting $\quad 0 \sim 100 \%$

03-53 AVI Point 2- voltage
Factory Setting : 5.00
Setting $\quad 0 \sim 10.00 / 0 \sim 20.00$
03-54 AVI Point2-percent
Factory Setting : 50\%
Setting $0 \sim 100 \%$

03-55 AVI Point 3 - voltage
Factory Setting : 10.00
Setting $\quad 0 \sim 10.00 / 0 \sim 20.00$
03-56 AVI Point 3- percent
Factory Setting : 50\%
Setting $\quad 0 \sim 100 \%$

03-57 ACI Point 1 - voltage
Factory Setting : 4.00
Setting $\quad 0 \sim 10.00 / 0 \sim 20.00$

03-58 ACI Point 1- percent
Factory Setting : 0\%
Setting $0 \sim 100 \%$

03-59 ACI Point 2 - voltage
Factory Setting : 12.00
Setting $\quad 0 \sim 10.00 / 0 \sim 20.00$

03-60 ACI Point2 - percent
Factory Setting : 50\%
Setting $0 \sim 100 \%$

03-61 ACI Point 3 - voltage
Factory Setting : 20.00
Setting $\quad 0 \sim 10.00 / 0 \sim 20.00$
03-62 ACI Point3 - percent
Factory Setting : 100
Setting $\quad 0 \sim 100 \%$

03-63 AUI Point1 - voltage
Factory Setting : 0V
Setting $\quad 0 \sim 10.00 \mathrm{~V}$

03-64 AUI Point 2- percent
Factory Setting : 0\%
Setting $\quad 0 \sim 100 \%$

03-65 AUI Point 2- voltage
Factory Setting : 5.00V
Setting $\quad 0 \sim 10.00 \mathrm{~V}$

03-66 AUI Point2 -percent
Factory Setting : 50\%
Setting $0 \sim 100 \%$

03-67 AUI Point 3- voltage
Factory Setting :10.00V
Setting $\quad 0 \sim 10.00 \mathrm{~V}$

03-68 AUI Point 3 - percent
Factory Setting :100\%
Setting $0 \sim 100 \%$

## 04 Multi-Step Speed Parameters

## The parameter can be set during operation.

N 04-00 1st Step Speed Frequency
N 04-01 2nd Step Speed Frequency
N 04-02 3rd Step Speed Frequency
N 04-03 4th Step Speed Frequency
N 04-04 5th Step Speed Frequency
N 04-05 6th Step Speed Frequency
N 04-06 7th Step Speed Frequency
N 04-07 8th Step Speed Frequency
~ 04-08 9th Step Speed Frequency
N 04-09 10th Step Speed Frequency
N 04-10 11th Step Speed Frequency
N 04-11 12th Step Speed Frequency
N 04-12 13th Step Speed Frequency
N 04-13 14th Step Speed Frequency
N 04-14 15th Step Speed Frequency
Factory Setting: 0.00
Settings $\quad 0.00 \sim 600.00 \mathrm{~Hz}$
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 $0.0 \sim 600.0 \mathrm{~Hz}$ during operationExplanation 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)


## 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）
7：Dead time compensation rate

## Induction Motor

［ad Start auto tuning by press the【Run】 key and the measured value will be written into motor 1 （Pr．05－05 ～05－09，Rs，Rr，Lm，Lx，no－load current）and motor 2 （Pr．05－17 to Pr．05－21）automatically．

AUTO－Tuning Process（dynamic motor）：
1．Make sure that all the parameters are set to factory settings and the motor wiring is correct．
2．Make sure the motor has no－load before executing auto－tuning and the shaft is not connected to any belt or gear motor．It is recommended to set to 2 if the motor can＇t separate from the load．
3.

|  | Motor 1 | Motor 2 |
| :---: | :---: | :---: |
| Motor Rated <br> Frequency | $01-01$ | $01-35$ |
| Motor Rated <br> Voltage | $01-02$ | $01-36$ |
| Motor Full－load <br> Current | $05-01$ | $05-13$ |
| Motor Rated <br> Power <br> Motor Rated <br> Speed | $05-02$ | $05-14$ |
| Motor Pole <br> Numbers | $05-03$ | $05-15$ |

4．Set Pr．05－00＝1 and press the the【Run】key，the drive will begin auto－tuning．Please be aware motor starts spinning when the【Run】 key is pressed．
5．When auto－tuning is complete，please check if the measured values are written into motor 1
（Pr．05－05～05－09）and motor 2 （Pr．05－17～05－21）automatically．
6．Mechanical equivalent circuit

※ If Pr．05－00 is set to 2，it needs to input Pr．05－05 for motor 1／Pr．05－17 for motor 2.

## NOTE

च In torque／vector control mode，it is not recommended to have motors run in parallel．
$\checkmark$ It is not recommended to use torque／vector control mode if motor rated power exceeds the rated power of the AC motor drive
$\boxtimes$ 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 無載電流一般爲額定電流之 20～50\％。
$\checkmark \quad$ The rated speed can＇t be larger or equal to $120 \mathrm{f} / \mathrm{p}$（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： 0
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 $7.5 \mathrm{HP}(5.5 \mathrm{~kW})$ is 25 and factory setting is 22.5 A ．The range for setting will be 10～30A．（25＊40\％＝10A and 25＊120\％＝30A）
N 05－02 Rated Power of Induction Motor $1(\mathrm{~kW})$
Factory Setting： 0
Settings $\quad 0 \sim 655.35 \mathrm{~kW}$
［1］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 （ 60 Hz 4 poles ）
1410 （ 50 Hz 4 poles ）
Settings $0 \sim 65535$
10 It is used to set the rated speed of the motor and need to set according to the value indicated on the motor nameplate．

05－04 Pole Number of Induction Motor 1
Factory Setting： 4
Settings 2～20
10 It is used to set the number of motor poles（must be an even number）．

05 - 05 No-load Current of Induction Motor 1 (A)
Unit: Ampere
Factory Setting: 0
Settings 0 to the factory setting in Pr.05-01
Factory setting is $40 \%$ of the drive's rated current. .
05-06 Stator Resistance(Rs) of Induction Motor 1
Factory Setting: 0.000
Settings $\quad 0 \sim 65.535 \Omega$

05-07 Rotor Resistance (Rr) of Mo1
Factory Setting : 0
Settings $\quad 0 \sim 65.535 \Omega$

05 - 08 Magnetizing Inductance (Lm) og Induction Motor 1
Factory Setting : 0
Settings $\quad 0 \sim 65535 \mathrm{mH}$

05-09 Stator Inductance (Lx) of Induction Motor 1
Factory Setting : 0
Settings $0 \sim 65535 \mathrm{mH}$

|  | $05-07$ |
| :--- | :--- |
|  | $05-08$ |
|  | $05-09$ |
|  | Reserved |
|  | $05-10$ |
|  | $05-11$ |
|  | $05-12$ |

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

Unit: Ampere
Factory Setting: 0
Settings 10~120\%
10 This value should be set according to the rated frequency of the motor as indicated on the motor nameplate. The factory setting is $90 \% \mathrm{X}$ rated current.

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

N 05-14 Rated Power of Induction Motor $2(\mathrm{~kW})$
Factory Setting: \#.\#\#
Settings $\quad 0 \sim 655.35 \mathrm{~kW}$
It is used to set rated power of the motor 2. The factory setting is the power of the drive.
N 05-15 Rated Speed of Induction Motor 2 (rpm)
Factory Setting: 1710
1710(60Hz 4 poles) ;
$1410(50 \mathrm{~Hz} 4$ poles)

Settings 0~65535
Ind is used to set the rated speed of the motor and need to set according to the value indicated on the motor nameplate.

05-16 Pole Number of Induction Motor 2

Factory Setting: 4
Settings 2~20
10 It is used to set the number of motor poles (must be an even number)
05-17 No-load Current of Induction Motor 2 (A)
Unit: Ampere
Factory Setting: 0
Settings 0 to the factory setting in Pr.05-01
The factory setting is $40 \% \mathrm{X}$ rated current.
05-18 Stator Resistance (Rs) of Induction Motor 2
Factory Setting: 0.000
Settings $0 \sim 65.535 \Omega$

15-19 Rotor Resistance (Rr) of Motor 2
Factory Setting : 0
Settings $0 \sim 65535 \mathrm{~m} \Omega$

115 -
Factory Setting : 0
Settings $\quad 0 \sim 65535 \mathrm{mH}$

155-27 Stator Inductance (Lx) of Induction Moroe 2
Factory Setting : 0
Settings 0~65535mH

## 05 - 22 Induction Motor 1/ 2 Selection

Factory Setting: 1
Settings 1: Motor 1
2: Motor 2
[a] It is used to set the motor that driven by the AC motor drive.
$05-23$ Frequency for Y-connection/ $\triangle$-connection Switch of Induction Motor
Factory Setting: 60.00
Settings $\quad 0.00 \sim 600.00 \mathrm{~Hz}$
$05-24$ Y-connection/ $\triangle$-connection Switch of Induction Motor IM

Factory Setting: 0
Settings 0: Disable
1: Enable

## N 05-25 Delay Time for Y-connection/ $\triangle$-connection Switch of Induction Motor

Factory Setting: 0.200
Settings $\quad 0 \sim 60.000$ 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/ $\Delta$-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.
(1) Pr.05-24 is used to enable/disable Y-connection/ $\tilde{\Delta}$-connection Switch.
[a] 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 $\tilde{\Delta}$-connection: At the same time, it will also affect motor parameters.
[10] Pr.05-25 is used to set the switch delay time of Y-connection/प्-connection.
(1)] When output frequency reaches Y-connection/ $\Delta$-connection switch frequency, drive will delay by Pr.05-25 before multi-function output terminals are active.


Y- $\triangle$ connection switch: can be used for wide range motor
Y -connection for low speed: higher torque can be used for rigid tapping
$\triangle$-connection for high speed: higher torque can be used for high-s peed drilling



## 05-26 <br> -05-30 <br> Reserved

05-31 Accumulative Motor Operation Time (Min)
Factory Setting: 00
Settings 00~1439
05-32 Accumulative Motor Operation Time (day)
Factory Setting: 0
Settings 00~65535Pr. 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 operationFactory Setting: 180.0/360.0
Settings 230V models: 160.0~220.0V

460V models: 320.0~440.0V
[1] It is used to set the Lv level. When the drive is in the low voltage, it will stop output and free to stop.


LD] When the setting is 0.0 , the over-voltage Stall prevention is disabled.During deceleration, the DC bus voltage may exceed its Maximum Allowable Value due to motor regeneration. When this function is enabled, the AC motor drive will not decelerate further and keep the output frequency constant until the voltage drops below the preset value again.
(1) 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 stopWhen the over-voltage stall prevention is enabled, drive deceleration time will be larger than the settingWhen there is any problem as using deceleration time, refer to the following items to solve it.

1. Add the suitable deceleration time.
2. Add brake resistor (refer to appendix B-1 for details) to consume the electrical energy that regenerated from the motor with heat type.
$>$ Related parameters: Pr.01-13, 01-15, 01-17, 01-19 (settings of decel. time 1~4), Pr.02-13~02-14


## 06-02 Reserved

N 06-03 Over-current Stall Prevention during Acceleration

> | Settings | Normal duty $: 0 \sim 130 \% ~(100 \%$ drive’s rated current ) | Factory Setting: 120 |
| :--- | :--- | :--- |
|  | Light duty $: 0 \sim 130 \% ~(100 \%$ drive’s rated current ) | Factory Setting: 120 |

[1] If the motor load is too large or drive acceleration time is too short, the AC drive output current may increase abruptly during acceleration and it may cause motor damage or trigger protection functions (OL or OC). This parameter is used to prevent this situation
During acceleration, the AC drive output current may increase abruptly and exceed the value specified by Pr.06-03 due to rapid acceleration or excessive load on the motor. When this function is enabled, the AC drive will stop accelerating and keep the output frequency constant until the current drops below the maximum value.When the over-current stall prevention is enabled, drive deceleration time will be larger than the settingWhen the Over-Current Stall Prevention occurs due to too small motor capacity or in the factory setting, please decrease Pr.06-03 setting.When there is any problem by using acceleration time, refer to the following items to solve it

Related parameters: Pr.01-12, 01-14, 01-16, 01-18 (settings of accel. time 1~4), Pr.01-44

1. Add the suitable acceleration time.
2. Related parameters: Pr01-12, 01-14, 01-16, 01-18 for Acceleration Time 1, Time 2, Time 3 and Time 4; Pr.01-44 for Optimal Acceleration/Deceleration Setting to 1, 3 or 4 (auto accel.), Pr.02-13~02-14 for (Multi-function Output 1 RY1, RY2), Pr. 02-16~02-17 for Multi-function Output (MO1, 2)

^ 06-04 Over-current Stall Prevention during Operation

Settings Normal duty : $0 \sim 160 \%$ ( $100 \%$ drive's rated current)
Factory Setting: 120\%
Light duty : 0~130\% ( $100 \%$ drive’s rated current)
Factory Setting: 120\%
1 It is a protection for drive to auto decrease output frequency when the motor is over-load abruptly during motor constant operation.

10 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.


N 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 2 nd 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
[1] 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.
[10] When Pr.06-06 and Pr.06-09 are set to 2 or 4, it will display a warning message and will have an abnormal record.

* 06-07 Over-torque Detection Level (OT1)

Factory Setting: 120
Settings 10 to $250 \%$ (100\%: drive's rated current)
^ 06-08 Over-torque Detection Level (OT1
Factory Setting: 0.1
Settings $\quad 0.0 \sim 60.0$ seconds

06 - 10 Over-torque Detection Level (OT2)

Factory Setting: 120
Settings $\quad 10 \sim 200 \%$ ( $100 \%$ drive's rated current )
06-11 Over-torque Detection Time (OT2)
Factory Setting: 0.1
Settings $\quad 0.0 \sim 60.0$ 秒
$\square$ Over torque detection is determine by the following method: if the output current exceeds the over-torque detection level (Pr.06-07, factory setting: 150\%) and also exceeds Pr.06-08 Over-Torque Detection Time, the fault code "ot1/ot2" will appear. If a Multi-Functional Output Terminal is to over-torque detection (setting 7 or 8 ), the output is on. Please refer to Pr.02-13~02-14 for details.


* 06-12 Maximum Current Limit

Factory Setting: 150
Settings $\quad 0 \sim 200 \%$ ( $100 \%$ drive's rated current)
This parameter sets the max. current output of the drive.
N 06-13 Electronic Thermal Relay Selection (Motor 1)
N 06-27 Electronic Thermal Relay Selection (Motor 2)
Factory Setting: 2
Settings 0: Inverter motor
1: Standard motor
2: Disable
[1] It is used to prevent self-cooled motor overheats under low speed. User can use electronic thermal relay to limit driver's output power.

N 06-14 Electronic Thermal Characteristic for Motor 1
N 06-28 Electronic Thermal Characteristic for Motor 2
Factory Setting: 60.0
Settings $\quad 30.0 \sim 600.0$ seconds
[10] The parameter is set by the $150 \%$ of motor rated current and the setting of Pr.06-14 and Pr.06-28 to prevent the motor damaged from overheating. When it reaches the setting, it will display "EoL1/EoL2" and the motor will be in free running.


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

Factory Setting: 85.0
Settings $\quad 0.0 \sim 110.0^{\circ} \mathrm{C}$

* 06-16 Stall Prevention Limit Level

Factory Setting: 50
Settings $\quad 0 \sim 100 \%$ (Refer to Pr.06-03 and 06-04 )
When operation frequency is larger than Pr.01-01
For example: $\operatorname{Pr} 06-03=150 \%$, $\operatorname{Pr} .06-04=100 \%$ and $\operatorname{Pr} .06-16=80 \%$ :
Stall Prevention Level during acceleration $=06-03 \times 06-16=150 \times 80 \%=120 \%$.
Stall Prevention Level at constant speed $=06-04 \times 06-16=100 \times 80 \%=80 \%$
(1)] When operation frequency is larger than Pr.01-01 (Base Frequency/Motor Rated Frequency);
e.g. $\operatorname{Pr} 06-03=150 \%$, $\operatorname{Pr} .06-04=100 \%$ and $\operatorname{Pr} .06-16=80 \%$

Stall Prevention Level during acceleration $=06-03 x 06-16=150 x 80 \%=120 \%$.
Stall Prevention Level at constant speed $=06-04 \times 06-16=100 \times 80 \%=80 \%$.
06 - 17 Present Fault Record
06 - 18 Second Most Recent Fault Record
06 - 19 Third Most Recent Fault Record
06 - 20 Fourth Most Recent Fault Record
06-21 Fifth Most Recent Fault Record
$06-22$ Sixth Most Recent Fault Record

Settings:

0 : No fault record
1: Over-current during acceleration (ocA)
2: Over-current during deceleration (ocd)
3: Over-current during constant speed(ocn)
4: Ground fault (GFF)
5: IGBT short-circuit (occ)
6: Over-current at stop (ocS)
7: Over-voltage during acceleration (ovA)
8: Over-voltage during deceleration (ovd)
9: Over-voltage during constant speed (ovn)
10: Over-voltage at stop (ovS)
11: Low-voltage during acceleration (LvA)
12: Low-voltage during deceleration (Lvd)
13: Low-voltage during constant speed (Lvn)
14: Stop mid-low voltage (LvS)
15: Phase loss protection (OrP)
16: IGBT over-heat (oH1)
17: Capacitance over-heat (oH2) (for 40hp above)
18: tH1o (TH1 open: IGBT over-heat protection error)
19: tH2o (TH2 open: capacitance over-heat protection error)

20: Reserved
21: Drive over-load (oL)
22: Electronics thermal relay 1 (EoL1)
23: Electronics thermal relay 2 (EoL2)
24: Motor PTC overheat (oH3) (PTC)
25: Reserved
26: Over-torque 1 (ot1)
27: Over-torque 2 (ot2)
28: Low current (uC)
29: Home limit error (LMIT)
30: Memory write-in error (cF1)
31: Memory read-out error (cF2)
32: Reserved
33: U-phase current detection error (cd1)
34: V-phase current detection error (cd2)
35: W-phase current detection error (cd3)
36: Clamp current detection error (Hd0)
37: Over-current detection error (Hd1)
38: Over-voltage detection error (Hd2)
39: occ IGBT short circuit detection error (Hd3)

40：Auto tuning error（AUE）
41：PID feedback loss（AFE）
42：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：Reserved
54：Communication error（CE1）
55：Communication error（CE2）
56：Communication error（CE3）
57：Communication error（CE4）
58：Communication Time－out（CE10）
59：PU Time－out（CP10）
60：Brake transistor error（bF）
61：Y－connection／$\triangle$－connection switch error（ydc）
62：Decel．Energy Backup Error（dEb）
63：Slip error（oSL）
64：Reserved
65 ：Reserved
66～72 ：Reserved
73 ：External safety gate S1
74：火災模式輸出 Output in Fire Mode
75～78：Reserved
79：Uocc U phase over current（Detection begins as RUN is pressed，software protection）
80：Vocc V phase over current（Detection begins as RUN is pressed，software protection）
81：Wocc W phase over current（Detection begins as RUN is pressed，software protection）
82：OPHL U phase output phase loss
83：OPHL Vphase output phase loss
84：OPHL Wphase output phase loss
85～100 ：Reserved
101：CGdE CANopen software disconnect1
102：CHbE CANopen software disconnect2
103：CSYE CANopen synchronous error

104: CbFE CANopen hardware disconnect
105: CIdE CANopen index setting error
106: CAdE CANopen slave station number setting error
107: CFrE CANopen index setting exceed limit
[1] When the fault occurs and force stopping, it will record in this parameter.
(1) At stop with low voltage Lv (LvS warn, no record). During operation with mid-low voltage Lv (LvA, Lvd, Lvn error, will record).
(1) 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 Faut Output Option 4
Factory Setting: 0
Settings 0 to 65535 sec (refer to bit table for fault code)
[1] 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) | $\bullet$ |  |  |  |  |  |  |
| 2: Over-current during deceleration (ocd) | $\bullet$ |  |  |  |  |  |  |
| 3: Over-current during constant speed(ocn) | $\bullet$ |  |  |  |  |  |  |
| 4: Ground fault (GFF) | $\bullet$ |  |  |  |  |  |  |
| 5: IGBT short-circuit (occ) | $\bullet$ | $\bullet$ |  |  |  |  |  |
| 6: Over-current at stop (ocS) |  | $\bullet$ |  |  |  |  |  |
| 7: Over-voltage during acceleration (ovA) |  | $\bullet$ |  |  |  |  |  |
| 8: Over-voltage during deceleration (ovd) |  | $\bullet$ |  |  |  |  |  |
| 9: Over-voltage during constant speed (ovn) |  | $\bullet$ |  |  |  |  |  |
| 10: Over-voltage at stop (ovS) |  | $\bullet$ |  |  |  |  |  |
| 11: Low-voltage during acceleration (LvA) |  | $\bullet$ |  |  |  |  |  |
| 12: Low-voltage during deceleration (Lvd) |  | $\bullet$ |  |  |  |  |  |
| 13: Low-voltage during constant speed (Lvn) |  | $\bullet$ |  |  |  |  |  |
| 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) |  |  |  |  |  |  |  |



| 59: PU Time-out (CP10) |  |  |  |  |  |  | - |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 60: Brake transistor error (bF) |  |  |  |  |  | - |  |
| 61: Y-connection/ $\triangle$-connection switch error (ydc) |  |  |  |  |  | - |  |
| 62: Decel. Energy Backup Error (dEb) |  | - |  |  |  |  |  |
| 63: Slip error (oSL) |  |  |  |  |  | - |  |
| 64: Electromagnet switch error (ryF) |  |  |  |  |  | - |  |
| 65 : Reserved |  |  |  |  |  | - |  |
| 73: External safety gate S1 |  |  |  | - |  |  |  |
| 74~78 : Reserved |  |  |  |  |  |  |  |
| 79: U phase over current (Uocc) | - |  |  |  |  |  |  |
| 80: V phase over current (Vocc) | - |  |  |  |  |  |  |
| 81: W phase over current (Wocc) | - |  |  |  |  |  |  |
| 82: OPHL U phase output phase loss | - |  |  |  |  |  |  |
| 83: OPHL Vphase output phase loss | - |  |  |  |  |  |  |
| 84: OPHL Wphase output phase loss | - |  |  |  |  |  |  |
| 85~100 : Reserved |  |  |  |  |  |  |  |
| 101: CGdE CANopen software disconnect1 |  |  |  |  |  |  | - |
| 102: CHbE CANopen software disconnect2 |  |  |  |  |  |  | - |
| 103: CSYE CANopen synchronous error |  |  |  |  |  |  | - |
| 104: CbFE CANopen hardware disconnect |  |  |  |  |  |  | - |
| 105: CIdE CANopen index setting error |  |  |  |  |  |  | - |
| 106: CAdE CANopen slave station number setting error |  |  |  |  |  |  | - |
| 107: CFrE CANopen index setting exceed limit |  |  |  |  |  |  | - |

N 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.

Settings 0.0~100.0\%
$\square$ It needs to set AVI1/ACI/AVI2 analog input function Pr.03-00~03-02 to 6 (P.T.C. thermistor input value).
1 It is used to set the PTC level, and the corresponding value for $100 \%$ is max. analog input value.

Frequency Command for Malfunction
Factory Setting: Read Only
Settings $\quad 0.00 \sim 655.35 \mathrm{~Hz}$
When malfunction occurs, use can check the frequency command. If it happens again, it will overwrite the previous record.

06-32 Output Frequency at Malfunction
Factory Setting: Read Only
Settings 0.00~655.35Hz
When malfunction occurs, use can check the current frequency command. If it happens again, it will overwrite the previous record.

06-33 Output Voltage at Malfunction
Factory Setting: Red Only
Settings $0.0 \sim 6553.5 \mathrm{~V}$
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 $\quad 0.0 \sim 6553.5 \mathrm{~V}$
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 $\quad 0.0 \sim 6553.5^{\circ} \mathrm{C}$
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 $\quad 0.0 \sim 6553.5^{\circ} \mathrm{C}$
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 $\quad 0.0 \sim 6553.5^{\circ} \mathrm{C}$
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 0~65535
06-41 Status of Multi-function Output Terminal at Malfunction
Factory Setting: Read Only
Settings $0 \sim 65535$
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 0~65535
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 <br> 06-44 Reserved

06-45 Treatment for Output Phase Loss Detection (OPHL)
Factory Setting: 3

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

OPHL: Output Phase Loss

06-46 Deceleration Time of Output Phase Loss
Factory Setting: 0.500
Settings $\quad 0.000 \sim 65.535$ seconds

06-47 Current Bandwidth
Factory Setting: 1.00
Settings 0.00~655.35\%

06-48 DC Brake Time of Output Phase Loss
Factory Setting: 0.100
Settings $\quad 0.000 \sim 65.535$ seconds

06-49 Reserved
06 - 50 Time for Input Phase Loss Detection
Factory Setting: 0.20
Settings $\quad 0.00 \sim 600.00$ seconds
06-51 Reserved
$06-52$ Ripple of Input Phase Loss
Factory Setting: 30.0 / 60.0
Settings 230V models: $0.0 \sim 160.0$ Vdc 460 V models $0.0 \sim 320.0 \mathrm{Vdc}$

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 protect
06-54 Reserved

06-55 Derating Protection
Factory Setting: 0
Settings $\quad 0$ : constant rated current and limit carrier wave by load current and temperature
1: constant carrier frequency and limit load current by setting carrier wave
2: constant rated current(same as setting 0 ), but close current limit

Setting 0: When the rated current is constant, carrier frequency (Fc) outputted by PWM will auto decrease according to surrounding temperature, overload output current and time. If overload situation is not frequent and only cares the carrier frequency operated with the rated current for a long time and carrier wave changes during short overload, it is recommended to set to 0 .
Refer to the following diagram for the level of carrier frequency. Take VFD007C43A in normal duty as example, surrounding temperature $50^{\circ} \mathrm{C}$ with independent installation and UL open-type. When the carrier frequency is set to 15 kHz , 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 12 kHz . In addition, it will also decrease the carrier frequency when overload. When the carrier frequency is 15 kHz 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 15 kHz and the rated current is decreased to $72 \%$, it will have OL protection when the current is $120 \% * 72 \%=86 \%$ for a minute. Therefore, it needs to operate by the curve to keep the carrier frequency.

Setting 2: It sets the protection method and action to 0 and disables the current limit for the Ratio*160\% of output current in the normal duty and Ratio* $180 \%$ of output current in the heavy duty. The advantage is that it can provide higher output current when the setting is higher than the factory setting of carrier frequency. The disadvantage is that it decreases carrier wave easily when overload.

## Derating Curve diagram while Light Duty and Normal Duty



## Derating Curve diagram while Light Duty and

## Normal Duty (continues)

Setting $=1$

Light Duty
$\left(40^{\circ} \mathrm{C}\right.$ : UL open type and type1)
Normal Duty


Setting $=0$ or 2

Light Duty
$\left(30^{\circ} \mathrm{C}\right.$ : UL open type and type1)
Normal Duty
( $40^{\circ} \mathrm{C}$ : UL open-type)
$\left(30^{\circ} \mathrm{C}\right.$ : UL type 1 or open type_size by size)
230 V

(1) It should go with Pr. 00-16 and Pr.00-17 for setting.

$\|$ NOTE
※ (As shown in the left figure), The mounting clearances are not for installing the drive in a confined space (such as cabinet or electric box). When installing in a confined space, except the same minimum mounting clearances, it needs to have the ventilation equipment or air conditioner to keep the surrounding temperature lower than the operation temperature.
※ The following table shows heat dissipation and the required air volume when installing a single drive in a confined space. When installing multiple drives, the required air volume shall be multiplied by the number the drives.
※ Please refer to the chart "Air Flow Rate for Cooling" for ventilation equipment design and selection.
※ Please refer to the chart "Power Dissipation" for air conditioner design and selection.
※ For more detail, please refer to Chapter 2 Installation.
Minimum Mounting Distance

| Frame | A $(\mathrm{mm})$ | B $(\mathrm{mm})$ | C $(\mathrm{mm})$ | D $(\mathrm{mm})$ |
| :--- | :--- | :--- | :--- | :--- |
| A $\sim \mathrm{C}$ | 60 | 30 | 10 | 0 |
| D $\sim$ | 100 | 50 | - | 0 |
| G | 200 | 100 | - | 0 |
| H | 350 | 0 | 0 | $200\left(100, \mathrm{Ta}=40^{\circ} \mathrm{C}\right)$ |


| Air flow rate for cooling |  |  |  |  |  |  | Power Dissipation |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Model No. | Flow Rate (cfm) |  |  | Flow Rate ( $\mathrm{m}^{3} / \mathrm{hr}$ ) |  |  | Power Dissipation (watt) |  |  |
|  | External | Internal | Total | External | Internal | Total | Loss <br> External <br> (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 |
| VFD015CP43A/4EA-21 | - - | - | - | - | - | - | 44 | 31 | 75 |
| Air flow rate for cooling |  |  |  |  |  |  | Power Dissipation |  |  |
| Model No. | Flow Rate (cfm) |  |  | Flow Rate ( ${ }^{3} / \mathrm{hr}$ ) |  |  | Power Dissipation (watt) |  |  |
|  | External | Internal | Total | External | Internal | Total | Loss <br> External <br> (Heat sink) | Internal | Total |
| VFD037CP43A/4EA-21 | 14 | - | 14 | 24 | - | 24 | 92 | 60 | 152 |
| VFD040CP43A/4EA-21 | 10 | - | 10 | 17 | - | 17 | 124 | 81 | 205 |
| VFD055CP43A/4EA-21 | 10 | - | 10 | 17 | - | 17 | 135 | 99 | 234 |
| VFD075CP43A/4EA-21 | 10 | - | 10 | 17 | - | 17 | 165 | 98 | 263 |
| VFD110CP43A/4EA-21 | 40 | 14 | 54 | 68 | 24 | 92 | 275 | 164 | 439 |
| VFD150CP43A/4EA-21 | 66 | 14 | 80 | 112 | 24 | 136 | 370 | 194 | 564 |
| VFD185CP43A/4EA-21 | 58 | 14 | 73 | 99 | 24 | 124 | 459 | 192 | 651 |
| VFD220CP43A/4EA-21 | 99 | 21 | 120 | 168 | 36 | 204 | 455 | 358 | 813 |
| VFD300CP43A/4EA-21 | 99 | 21 | 120 | 168 | 36 | 204 | 609 | 363 | 972 |
| VFD370CP43A/4EA-21 | 126 | 21 | 147 | 214 | 36 | 250 | 845 | 405 | 1250 |
| VFD450CP43A-00/43A-21 | 179 | 30 | 209 | 304 | 51 | 355 | 1056 | 459 | 1515 |
| VFD550CP43A-00/43A-21 | 179 | 30 | 209 | 304 | 51 | 355 | 1163 | 669 | 1832 |

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| VFD750CP43A-00/43A-21 | 179 | 30 | 209 | 304 | 51 | 355 | 1639 | 657 | 2296 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 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 |
| VFD1320CP43A-00/43A-21 | 223 | 73 | 296 | 379 | 124 | 503 | 2417 | 1157 | 3574 |
| VFD1600CP43A-00/43A-21 | 224 | 112 | 336 | 381 | 190 | 571 | 3269 | 1235 | 4504 |
| VFD1850CP43A-00/43A-21 | 289 | 112 | 401 | 491 | 190 | 681 | 3632 | 1351 | 4983 |
| VFD2200CP43A-00/43A-21 |  |  | 454 |  |  | 771 |  |  | 6358 |
| VFD2800CP43A-00/43A-21 |  |  | 454 |  |  | 771 |  |  | 7325 |
| VFD3150CP43A-00/43C-00/43C-21 |  |  | 769 |  |  | 1307 |  |  | 8513 |
| VFD3550CP43A-00/43C-00/43C-21 |  |  | 769 |  |  | 1307 |  |  | 9440 |
| VFD4000CP43A-00/43C-00/43C-21 |  |  | 769 |  |  | 1307 |  |  | 10642 |
| ※ The required airflow shown in chart is for installing single drive in a confined space <br> ※ 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. <br> ※ When installing multiple drives, volume of heat dissipation should be the heat dissipated for single drive X the number of the drives. <br> ※ Heat dissipation for each model is calculated by rated voltage, current and default carrier |  |  |

06-56 PT100 Detection Level 1
Factory Setting: 5.000
Settings 0.000~10.000V
06-57 PT100 Detection Level 2
Factory Setting: 7.000
Settings $\quad 0.000 \sim 10.000 \mathrm{~V}$

06 - 58 PT100 Level 1 Frequency Protection
Factory Setting: 0.00
Settings $\quad 0.00 \sim 600.00 \mathrm{~Hz}$
06-59 Reserved

Factory Setting: 60.0
Settings $\quad 0.0 \sim 6553.5 \%$

06-61 Software Detection GFF Filter Time
Factory Setting: 0.10
Settings 0.0~655.35 秒

06-62 Disable Level of dab
Factory Setting: 180.0/360.0
Settings 230V models: 0.0~220.0 Vdc 460 V models $0.0 \sim 440.0 \mathrm{Vdc}$

06-63 Fault Record 1 (min)
06-64 Fault Record 2 (min)
06-65 Fault Record 3 (min)
06-66 Fault Record 4 (min)
06-67 Fault Record 5 (min)
06-68 Fault Record 6 (min)
Factory Setting: Read Only
Settings 0~65535 minutes
1 Pr.06-63 to Pr.06-68 are used to record the operation time for 6 malfunctions and it can also check if there is any wrong with the drive according to the internal time.

When the malfunction occurs during operation, it records fault in Pr.06-17~06-22 and operation time is recorded in Pr.06-63~06-68.
For example: When the first fault ovA occurs after operation 3000 min., second fault ovd occurs at 3482 min., third fault ovA occurs at 4051 min., fourth fault ocA at 5003 min., fifth fault ocA at 5824 min., sixth fault ocd occurs at 6402 min. and seven fault ocS at 6951 min..
It'll be recorded as the following table

It will be recorded as the table below.

| First Fault | Pr.06-17 | ovA | Pr.06-63 | 3000 |
| :---: | :---: | :---: | :---: | :---: |
| Second Fault | Pr. 06-17 | ovd | Pr. 06-63 | 3482 |
|  | Pr. 06-18 | ovA | Pr. 06-64 | 3000 |
| Third Fault | Pr. 06-17 | ovA | Pr. 數 06-63 | 4051 |
|  | Pr. 06-18 | ovd | Pr. 06-64 | 3482 |
|  | Pr. 06-19 | ovA | Pr. 06-65 | 3000 |


| Seventh Fault | Pr. 06-17 | ocS |
| :--- | :--- | :--- |
|  | $\operatorname{Pr} 06-18$ | ocA |
|  | $\operatorname{Pr} 06-19$ | ocA |
|  | $\operatorname{Pr} 06-20$ | ovA |
|  | $\operatorname{Pr} 06-21$ | ovd |
|  | $\operatorname{Pr} 06-22$ | ovA |
| $\operatorname{Pr} 06-64$ | 5824 |  |
| $\operatorname{Pr} 06-65$ | 5003 |  |
| $\operatorname{Pr} 06-66$ | 4051 |  |
| $\operatorname{Pr} 06-67$ | 3482 |  |
| $\operatorname{Pr} 06-68$ | 3000 |  |

06 - 69 Number of Days of Malfunction (V)

Factory Setting: Read Only
Settings Read Only

06-70 Duration of Malfunction
Factory Setting: Read Only
Settings Read Only

06-71 Low Current Setting Level
Factory Setting: 0.0
Settings $\quad 0.0 \sim 100.0 \%$
06-72 Low Current Detecting Time
Factory Setting: 0.00
Settings $\quad 0.00 \sim 360.00$ 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 $2^{\text {nd }}$ deceleration time |  |
|  | $3:$ warn and operation continue |

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 operating 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 (hz)
Factory Setting: 6000
Settings $\quad 0.00 \sim 600.00 \mathrm{hz}$

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: 0.00
Settings 0: Disable Bypass
1: Enable Bypass

06-83 Bypass Delay Time on Fire Mode
Factory Setting: 0.00
Settings $\quad 0.00 \sim 6550.0$ seconds
06-84 Auto-restart counter of Fire Mode
Factory Setting: 0.00
Settings $\quad 0 \sim 10$
06-85 Length of Time to reset auto counter (seconds)
Settings $\quad 0.00 \sim 6000.0$ se Factory Setting: 0.00
The settings of Pr06-82 to Pr06-85 decide if switch motors to operating under mains electricity.

Diagram of Bypass function’s Sequence


When $\operatorname{Pr} 06-82$ 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 (PHL) | V | V(able to | V |

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|  |  |  | auto-reset) |  |
| :---: | :---: | :---: | :---: | :---: |
| 16 | Over heat 1 (oH1) | V | V(able to auto-reset) | V |
| 17 | Over heat $2(\mathrm{oH} 2)$ | 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 |
| 20 | Main Power OFF | V | Not-detectable | Not-detectable |
| 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 |
| 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 lock (ccodE) | V | Not-detectable | 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 |

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| 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 | MC Fault over Frame E | V | Not-detectable | Not-detectable |
| 66 | Unknow oc | V(RS) | V(able to auto-reset) | V |
| 67 | Unknow ov | V (RS) | V(able to auto-reset) | V |
| 73 | S1-Emergy STOP | V | V | Not-detectable |
| 74 | Fire Mode | V | V(keeps on operating) | V(keeps on operating) |
| 79 | A PHASE SHORT | V | V(able to auto-reset) | V |
| 80 | B PHASE SHORT | V | V(able to auto-reset) | V |
| 81 | C PHASE SHORT | V | V(able to auto-reset) | V |
| 82 | Output Phase Lose A | V | V(able to auto-reset) | V |
| 83 | Output Phase Lose B | V | V(able to auto-reset) | V |
| 84 | Output Phase Lose C | V | V(able to auto-reset) | V |
| 99 | CPU Trap | V | V | V |
| 101 | Guarding T-out | V | Not-detectable | Not-detectable |
| 102 | Heartbeat T-out | V | Not-detectable | Not-detectable |
| 103 | SYNC T-out | V | Not-detectable | Not-detectable |
| 104 | CAN Bus Off | V | Not-detectable | Not-detectable |
| 105 | CAN Idx exceed | V | Not-detectable | Not-detectable |
| 106 | CAN Address set | V | Not-detectable | Not-detectable |
| 107 | CAN FRAM fail | V | Not-detectable | Not-detectable |

## 07 Special Parameters

Software Brake Level

Factory Setting: 380.0/760.0
The parameter can be set during operation

DIT 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
Id it only valid for the models below 30 kW of 460 series and 22 kW 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.

N 07-02 DC Brake Time at Start-up
Factory Setting: 0.0
Settings $\quad 0.00 \sim 60.0$ seconds
[D 馬 The motor may be in the rotation status due to external force or itself inertia. If the drive is used with the motor at this moment, it may cause motor damage or drive protection due to over current. This parameter can be used to output DC current before motor operation to stop the motor and get a stable start. This parameter determines the duration of the DC Brake current after a RUN command. When it is set to 0.0 , it is invalid.

N 07-03 DC Brake Time at Stop
Factory Setting: 0.00
Settings $\quad 0.00 \sim 60.00$ seconds
1ad The motor may be in the rotation status after drive stop outputting due to external force or itself inertia and can't stop accurately. This parameter can output DC current to force the motor drive stop after drive stops to make sure that the motor is stop

Dad This parameter determines the duration of the DC Brake current during stopping. To DC brake at stop, this function will be valid when Pr.00-22 is set to 0 or 2 . When setting to 0.0 , it is invalid
$>$ Related parameters: Pr.00-22 Stop Method, Pr.07-04 Start-point for DC Brake
N 07-04 Start-Point for DC Brake
Factory Setting: 0.00
Settings $\quad 0.00 \sim 600.00 \mathrm{~Hz}$
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.

$1 \mathbb{1}$ 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
$1 \mathbb{D C}$ Brake at stop is used to shorten the stopping time and also to hold a stopped load in position, such as crane or cutting machine.

## 07-05 Reserved

Factory Setting:
Settings
^ 07-06 Restart after Momentary Power Down
Factory Setting: 0
Settings 0: Stop operation
1: Speed search for last frequency command
2: Speed search for the minimum output frequency
14 This parameter determines the operation mode when the AC motor drive restarts from a momentary power loss.

1 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.

1 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.
(1) 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 $0.1 \sim 20.0$ seconds
$1 \mathbb{1}$ 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 $\leq 5$ seconds and the AC motor drive displays "LU".
But if the AC motor drive is powered off due to overload, even if the maximum allowable power loss time is $\leq 5$ seconds, the operation mode as set in Pr.07-06 is not executed. In that case it starts up normally

Factory Setting: 0.5
Settings $0.1 \sim 5.0$ 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

N 07-09 Current Limit for Speed Search
Factory Setting: 100
Settings 20~200\%
Following a momentary power loss, the AC motor drive will start its speed search operation only if the output current is greater than the value set by Pr.07-09.

When executing speed search, the V/f curve is operated by group 1 setting. The maximum current for the optimum accel./decel. and start speed search is set by Pr.07-09.

1 The speed search level will affect the synchronous time. It will get the synchronization faster when this parameter is set to larger value. But too large value may active overload protection

* 07-10 Treatment to Reboots After Fault

Factory Setting: 0

| Settings | $0:$ Stop operation |
| :--- | :--- |
|  | 1: Speed search starts with current speed |
|  | 2: Speed search starts with minimum output frequency |

0 Fault includes: bb,oc,ov,occ etc. To restart after oc, ov, occ, Pr.07-11 can not be set to 0
N 07-11 \# of Automatic Reboots After Fault
Factory Setting: 0
Settings $\quad 0 \sim 10$
1 The maximum automatic rest and reboots times for the AC motor drive when faults (oc, ov, occ) occur is up to 10 times. When this parameter is set to 0 , there will be no reset or reboots. When auto reset and reboots are enabled, the AC motor drive perform a speed search before activate the drive.When the number of fault occur exceed Pr.07-11 and is within the duration less than Pr.07-33, the drive will refuse to re-start. Please press "RESET" key to continue the operation 。

Factory Setting: 0
Settings 0: Disable
1: Speed search from maximum output frequency
2: Speed search from start-up motor frequency
3: Speed search from minimum output frequency
This parameter is used for starting and stopping a motor with a high inertia. A motor with high inertia will take 2-5 minutes or longer to stop completely. By setting this parameter, the user does not need to wait for the motor to come to a complete stop before restarting the AC motor drive. If a PG card and encoder is used on the drive and motor, then the speed search will start from the speed that is detected by the encoder and accelerate quickly to the commanded frequency. The output current is set by the Pr.07-09.

N 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.
N 07-14 dEb Return Time
Factory Setting: 0.0
Settings $\quad 0.0 \sim 25.0$ 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 heavy-load


## NOTE

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

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


## NOTE

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

07-16 Dwell Frequency at Accel
Factory Setting: 0.00
Settings $\quad 0.00 \sim 600.00$ seconds
07-17 Dwell Frequency at Accel.
Factory Setting: 0.00
Settings $\quad 0.00 \sim 600.00 \mathrm{~Hz}$
N 07-18 Dwell Frequency at Decel.
Factory Setting: 0.00
Settings $\quad 0.00 \sim 600.00 \mathrm{~Hz}$
Pr.07-15 to Pr.07-18 is for heavy load to prevent OV or OC occurs.

[1]
Dwell at accel./decel.
N 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 $60^{\circ} \mathrm{C}$ ) is attained.
4: Fan always OFF
$\square$ 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
Uatting 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 $60^{\circ} \mathrm{C}$. Fan will be OFF, when capacitance temperature is lower than $40^{\circ} \mathrm{C}$.

Lad Setting 4: Fan is always OFF

07-20 Emergency Stop (EF) \& Force Stop

| Settings | $0:$ Coast to stop |
| :--- | :--- |
|  | 1: Stop by $1^{\text {st }}$ deceleration time |
|  | 2: Stop by $2^{\text {nd }}$ deceleration time |
|  | 3: Stop by $3^{\text {rd }}$ deceleration time |
|  | 4: Stop by $4^{\text {th }}$ deceleration time |
|  | 5: System Deceleration |
| 6: Automatic Deceleration |  |

(1) 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-sAVI1ng Operation

Factory Setting: 0
Settings 0 : Disable
1 : Enable
When Pr. $\overline{07-21}$ 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.

N 07-22 Energy-sAVI1ng Gain
Factory Setting: 100
Settings 10~1000\%
[10] When Pr.00-19 is set to 1 , this parameter can be used to adjust the gain of energy-sAVI1ng. 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.

Factory Setting: 0
Settings 0: Enable AVR
1: Disable AVR
2: Disable AVR during deceleration
(1) The rated voltage of the motor is usually $220 \mathrm{~V} / 200 \mathrm{VAC} 60 \mathrm{~Hz} / 50 \mathrm{~Hz}$ and the input voltage of the AC motor drive may vary between 180 V to $264 \mathrm{VAC} 50 \mathrm{~Hz} / 60 \mathrm{~Hz}$. 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.
(1)] AVR function automatically regulates the AC motor drive output voltage to the motor rated voltage. For instance, if V/f curve is set at $200 \mathrm{VAC} / 50 \mathrm{~Hz}$ and the input voltage is at 200 V to 264 VAC , then the motor Output Voltage will automatically be reduced to a maximum of $200 \mathrm{VAC} / 50 \mathrm{~Hz}$. If the input voltage is at 180 V to 200VAC, output voltage to motor and input power will be in direct proportion.

L
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.
(1) 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.

N 07-24 Filter Time of Torque Command (V/F and SVC control mode)
Factory Setting: 0.020
Settings $\quad 0.000 \sim 1.000$ seconds
10. 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.

N 07-25 Filter Time of Slip Compensation (V/F and SVC control mode)
Factory Setting: 0.100
Settings $0.001 \sim 10.000$ seconds
[1] It can set Pr.05-22 and 05-23 to change the response time of compensation.
Id If Pr.05-22 and 05-23 are set to 10seconds, the response time of compensation is the slowest. But the system may be unstable when the setting is too short.

Factory Setting: 0
Settings 0~10
[1]
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.
$\square$ 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.
$\square$ When Pr.07-26 is set to large, it may cause motor overflux and result in too large output current, motor overheat or triggers protection function.

07-27 Slip Compensation Gain (V/F and SVC control mode)
Factory Setting: 0.00
Settings $\quad 0.00 \sim 10.00$
[1] 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
1 When the control method (Pr.00-11) is changed from V/f mode to vector mode, this parameter will auto be set to 1.00 . Otherwise, it will be set to 0.00 . Please do the compensation of slip after overload and acceleration. The compensation value should be increased from small to large gradually. That is to add the output frequency with motor rated slip X Pr.07-27 Slip Compensation Gain when the motor is rated load. If the actual speed ratio is slow than expectation, please increase the setting. Otherwise, decrease the setting.

## 07-28 Reserved

* 07-29 Slip Deviation Level

Factory Setting: 0

| Settings | $0 \sim 1000 \%$ |
| :--- | :--- |
|  | $0:$ Not-detectable |

Factory Setting: 1.0
Settings $0.0 \sim 10.0$ 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
[1] Pr.07-29 to Pr.07-31 are used to set allowable slip level/time and over slip treatment when the drive is running.
" $07-32$ Moor thuming Gin
Factory Setting: 1000
Settings $0 \sim 10000$
0 : Disable
The motor will have current wave motion in some specific area. It can improve this situation by setting this parameter. (When it is high frequency or run with PG, it can be set to 0 . when the current wave motion happens in the low frequency, please increase Pr.05-29.)

N 07-33 Recovery Time to Pr.07-11 (\# of automatic reboots after 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.

07-34 Auto Acceleration/Deceleration (Kp)
Factory Setting: 40
Settings 0~65535

07-35 Auto Acceleration/Deceleration (Ki)
Factory Setting: 0.001
Settings 0~65535

# 07 - 36 Power Generating Slip Compensation Gain 

Factory Setting: 1.00
Settings $0.00 \sim 1.00$

## 07-37 ~07-49 <br> Reserved

07-50 PWM Fan Speed
Factory Setting: 60
Settings 0~100\%

# 08 High-function PID Parameters 

$\checkmark$ The parameter can be set during operation.
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)
[1] Negative feedback means: +target value - feedback. It is used for the detection value will be increased by increasing the output frequency.
[1] Positive feedback means: -target value + feedback. It is used for the detection value will be decreased by increasing the output frequency.
[D] 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 $0 \sim+10 \mathrm{~V}$ voltage or $4-20 \mathrm{~mA}$ current. $\$
[D] PID control loop:

$\mathrm{K}_{\mathrm{p}}$ : Proportional gain $(\mathrm{P}) \quad \mathrm{T}_{\mathrm{i}}$ : Integral time (I) $\mathrm{T}_{\mathrm{d}}$ : Derivative control(D) S : Operator
(1)] Concept of PID control
6. Proportional gain $(\mathrm{P})$ : the output is proportional to input. With only proportional gain control, there will always be a steady-state error.
7. 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.
8. 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 $(\mathrm{P})+$ differential control $(\mathrm{D})$ can be used to improve the system state during PID adjustment.
[1] 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 $4-20 \mathrm{~mA}$ signal corresponding to $0-10$ bar as feedback to the drive.

9. Pr.00-04 is set to 10 (Display PID analog feedback signal value (b) (\%))
10. Pr.01-12 Acceleration Time will be set as required
11. Pr.01-13 Deceleration Time will be set as required
12. Pr. $00-21=0$ to operate from the digital keypad
13. Pr. $00-20=0$, the set point is controlled by the digital keypad
14. Pr.08-00=1 (Negative PID feedback from analog input)
15. ACI analog input Pr. 03-01 set to 5, PID feedback signal.
16. 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))
[10] Refer to Pr.08-00 to 08-21 for PID parameters settings.

Proportional Gain (P)
Factory Setting: 1.0
Settings $0.0 \sim 500$
1 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.

## N 08-02 Integral Time (I)

Factory Setting: 1.00

$$
\begin{array}{ll}
\text { Settings } & 0.00 \sim 100.00 \text { seconds } \\
& 0.00: \text { Disable }
\end{array}
$$

1 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.
[a] 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.

Factory Setting: 0.00
Settings $0.00 \sim 1.00$ seconds
1 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 oscillationThe 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\%
[1 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 $(\operatorname{Pr} .01-00) \times(\operatorname{Pr} .08-04$ \%).

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

Factory Setting: 100.0
Settings 0.0~110.0\%
This parameter defines the percentage of output frequency limit during the PID control. The formula is Output Frequency Limit = Maximum Output Frequency (Pr.01-00) X Pr.08-05 \%.

## 08-06 Reserved

N 08-07 PID Delay Time
Factory Setting: 0.0
Settings $0.0 \sim 35.0$ secondsIt is used to set the time that required for the low-pass filter of PID output. Increasing the setting, it may affect the drive's response speed.The frequency output of PID controller will filter after primary delay filter time. It can smooth the change of the frequency output. The longer primary delay filter time is set, the slower response time it will be.The unsuitable primary delay filter time may cause system oscillation.

(1) PI Control: controlled by the P action only, and thus, the deviation cannot be eliminated entirely. To eliminate residual deviations, the $\mathrm{P}+\mathrm{I}$ 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.

## N 08-08 Feedback Signal Detection Time

Factory Setting: 0.0

## Settings $\quad 0.0 \sim 3600.0$ seconds

(1) This parameter is only valid when the feedback signal is ACI.
[1] 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.
[1] 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 |

(1) This parameter is only valid when the feedback signal is ACI.

Dal AC motor drive acts when the feedback signals (analog PID feedback) are abnormal.
~ 08-10 Sleep Frequency
Factory Setting: 0.00
Settings $\quad 0.00 \sim 600.00 \mathrm{~Hz}$

* 08-11 Wake-up Frequency

Factory Setting: 0.00
Settings $\quad 0.00 \sim 600.00 \mathrm{~Hz}$
~ 08-12 Sleep Time
Factory Setting: 0.0
Settings $\quad 0.00 \sim 600.00$ seconds
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.

$\sim 08-13$ Pid Deviation Level
Factory Setting: 10.0

N 08-14 PID Deviation Time
Factory Setting: 5.0
Settings $\quad 0.1 \sim 300.0$ 秒

N 08-15 Filter Time for PID Feedback
Factory Setting: 5.0
Settings $\quad 0.1 \sim 300.0$ 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, the PID control fault occurs. The treatment will be done as Pr.08-09 setting.

N 08-16 PID Compensation Selection
Factory Setting: 0
Settings 0: Parameter setting
1: Analog input
^ 08-17 PID Compensation
Factory Setting: 0
Settings $\quad-100.0 \sim+100.0 \%$

## 08-18 Setting of Sleep mode function

Factory Setting: 0
Settings 0: Follow PID output command; 1: Follow PID feedback signal
When $\operatorname{Pr} 08-18=0$, $\operatorname{Pr} 08-10, \operatorname{Pr} 08-10$, $\operatorname{Pr} 08-11$, unit is Hz , setting range is $0 \sim 600.00 \mathrm{~Hz}$.
When $\operatorname{Pr} 08-18=1$, $\operatorname{Pr} .08-10$, $\operatorname{Pr} 08-11$, unit is \%, setting range is $0 \sim 200.00 \%$
08-19 Integral Limit during Wakeup
Factory Setting: 50.0\%
Settings 0~200\%
There are three types of Sleep mode and Wakeup mode.

## 01: Frequency command(Not using PID, Pr08-00=0)

Output Frequency $\leqq$ Sleep Frequency, the drive goes to Sleep mode, 0 Hz .

## Sleep Mode diagram



## 02: Internal PID Frequency Calculation Command

When arriving at the sleep frequency, the system starts to calculatibng sleep time and the output frequency starts to decrease. Then when the drive passes the setting of Pr01-11 Output Frequency Lower Limit (if there is a preset value), and passes the setting of Pr01-07 Min. Output Frequency, and if it passes the preset sleep time, the system will go to seelp at 0 Hz .

If the system is not yet reaching the preset sleep time, it will reamains at $\operatorname{Pr01-11(if~there~is~a~preset)~or~}$ will stay at Pr01-07 then go to sleep at 0 Hz .

## Internal PID calculation frequency command of CP2000



## 03: Percentage of PID's Target Value (Set PID, Pr08-00 $\neq 0$ )

When reaching the percentage of PID's Target Value and the percentage of the feedback value, the system Starts to calculate the sleep time. The output frequency decreases immediately Then the system will pasas $\operatorname{Pr01-11}$ (if there is a preset). Then it will pass Pr01-07. If the system passes the preset sleep time, it will go to sleep at 0 Hz . However, if it doesn't reach the preset sleep time, it will remain at $\operatorname{Pr} 01-11$ (if there is a preset value) or $\mathrm{Pr} 01-07$ then go to sleep at 0 Hz


Factory Setting: 0

## Settings 0: Serial connection <br> 1: Parallel connection

1 PI Control: controlled by the P action only, and thus, the deviation cannot be eliminated entirely. To eliminate residual deviations, the $\mathrm{P}+\mathrm{I}$ control will generally be utilized. And when the PI control is utilized, it could eliminate the deviation incurred by the targeted value changes and the constant external interferences. However, if the I action is excessively powerful, it will delay the responding toward the swift variation. The P action could be used solely on the loading system that possesses the integral components.PD Control: when deviation occurred, the system will immediately generate some operation load that is greater than the load generated single handedly by the D action to restrain the increment of the deviation. If the deviation is small, the effectiveness of the P action will be decreasing as well. The control objects include occasions with integral component loads, which are controlled by the P action only, and sometimes, if the integral component is functioning, the whole system will be vibrating. On such occasions, in order to make the $P$ action's vibration subsiding and the system stabilizing, the PD control could be utilized. In other words, this control is good for use with loadings of no brake functions over the processes.

PID Control: Utilize the I action to eliminate the deviation and the D action to restrain the vibration, thereafter, combine with the P action to construct the PID control. Use of the PID method could obtain a control process with no deviations, high accuracies and a stable system.

## Serial Connection



## Parallel connection



08-21 Enable PID to Change the Operation Direction
Factory Setting: 0
Settings 0: Disable change of direction
1: Enable change of direction

## 09 Communication Parameters

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

| $6 \leftarrow 1$ | Serial communication |
| :---: | :---: |
|  | 1:+EV |
|  | 2:GND |
|  | 3:SG- |
|  | 4:SG+ |
| RS-485 | 5:NC |
|  | 6:NC |

N 09-00 COM1 Communication Address
Factory Setting: 1
Settings 1~254
$\llbracket$ 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

N 09-01 COM1 Transmission Speed
Factory Setting: 9.6
Settings $\quad 4.8 \sim 115.2 \mathrm{kbits} / \mathrm{s}$
This parameter is used to set the transmission speed between the RS485 master (PLC, PC, etc.) and AC motor drive.

N 09-02 cOM1 Transmission Fault Treatment
Factory Setting: 3
Settings 0 : Warn and keep operation
1: Warn and ramp to stop
2: Warn and coast to stop
3: No warning and continue operation
This parameter is set to how to react if transmission errors occur
N 09-03 com1 Time-out Detection
Factory Setting: 0.0
Settings $\quad 0.0 \sim 100.0$ seconds
0.0 : Disable

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

* 09-04 COM1 Communication Protocol

Factory Setting: 1

$$
\begin{array}{ll}
\text { Settings } & 0: 7, \mathrm{~N}, 1 \text { for ASCII } \\
& 1: 7, \mathrm{~N}, 2 \text { for ASCII } \\
& 2: 7, \mathrm{E}, 1 \text { for ASCII } \\
& 3: 7, \mathrm{O}, 1 \text { for ASCII } \\
& 4: 7, \mathrm{E}, 2 \text { for ASCII }
\end{array}
$$

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
1 Computer Link Control by PC or PLC (Computer Link)
$\square$ 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.
$1 \mathbb{1}$ 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 ' ( 36 Hex ) and ' 4 ' ( 34 Hex ).

## 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 ASCll)
(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 $=\quad$ ' $(3 A H)$ |
| :--- | :--- |
| Address Hi | Communication Address |
| Address Lo | 8-bit address consists of 2 ASCll codes |
| Function Hi | Command code: |
| Function Lo | 8-bit command consists of 2 ASCII codes |
| DATA (n-1) | Contents of data: |
| $\ldots . .$. | Nx8-bit data consist of 2n ASCII codes |
| DATA 0 | LRC16, maximum of 32 ASCII codes |
| LRC CHK Hi | 8-bit check sum consists of 2 ASCII codes |
| LRC CHK Lo | End characters: |
| END Hi | 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 ( $\mathrm{n}-1$ ) | Contents of data: |
| $\ldots \ldots .$. | $\mathrm{n} \times 8$-bit data, $\mathrm{n}<=16$ |
| DATA 0 |  |
| CRC CHK Low | CRC check sum: |
| CRC CHK High | 16-bit check sum consists of 28 -bit characters |
| 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.
00 H : broadcast to all AC drives
01 H : AC drive of address 01
0FH: AC drive of address 15
10 H : 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 2102 H , AMD address is 01 H .
ASCII mode:

| Command Message: |  | Response Message |  |
| :---: | :---: | :---: | :---: |
| STX | ' : ' | STX | ' $:$ ' |
| Address | '0' | Address | '0' |
|  | '1' |  | '1' |
| Function | '0' | Function | '0' |
|  | '3' |  | '3' |
| Starting address | '2' | Number of data (count by byte) | '0' |
|  | '1' |  | '4' |
|  | '0' | Content of starting address 2102 H | '1' |
|  | '2' |  | '7' |
| Number of data (count by word) | '0' |  | ${ }^{7} 7$ |
|  | ${ }^{\prime} 0$ |  | ${ }^{\prime} 0$ |
|  | '0' | Content of address 2103H | ${ }^{\prime} 0$ |
|  | '2' |  | ${ }^{\prime} 0$ |
| LRC Check | 'D' |  | ${ }^{\prime} 0$ |
|  | ${ }^{\prime} 7$ |  | '0' |
| END | CR | LRC Check | ${ }^{\prime} 7$ |
|  | LF |  | '1' |
|  |  | END | CR |
|  |  |  | LF |
|  |  |  |  |

RTU mode :

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

06 H : single write, write single data to register.
Example: writing data $6000(1770 \mathrm{H})$ to register 0100 H . AMD address is 01 H 。
ASCII mode :

| Command Message: |  | Response Message |  |
| :---: | :---: | :---: | :---: |
| STX | ' $'$ | STX | $\because ’$ |
| Address | '0' | Address | '0' |
|  | '1' |  | '1' |
| Function | '0' | Function | '0' |
|  | '6' |  | ${ }^{6} 6$ |
| Data address | '0' | Data address | '0' |
|  | '1' |  | '1' |
|  | '0' |  | '0' |
|  | '0' |  | '0' |
| Data content | '1' | Data content | '1' |
|  | ${ }^{\prime} 7$ |  | ${ }^{7} 7$ |
|  | '7' |  | '7' |


|  | $' 0 ’$ |
| :--- | :--- |
| LRC Check | $\cdot 7 ’$ |
|  | $\cdot 1 ’$ |


|  | $‘ 0 ’$ |
| :--- | :--- |
| LRC Check | $\not 7^{\prime}$ |
|  | $1^{\prime}$ |
|  | CR |

RTU mode :

| Command Message: |  | Response Message |  |
| :---: | :---: | :---: | :---: |
| Address | 01H | Address | 01H |
| Function | 06H | Function | 06H |
| Data address | 01H | Data address | 01H |
| Data address | 00H | Data address | 00H |
| Data content | 17H | ata content | 17H |
|  | 70H | Data content | 70H |
| CRC CHK Low | 86H | CRC CHK Low | 86H |
| CRC CHK High | 22H | CRC CHK High | 22H |

10 H : 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 01 H .

## ASCII Mode

ASCII mode :

| Command Message: |  | Response Message |  |
| :---: | :---: | :---: | :---: |
| STX | ' $'$ | STX | ':' |
| ADR 1 | '0' | ADR 1 | '0' |
| ADR 0 | '1' | ADR 0 | '1' |
| CMD 1 | '1' | CMD 1 | '1' |
| CMD 0 | '0' | CMD 0 | '0' |
| Starting data address | '0' | Starting data address | '0' |
|  | '5' |  | '5' |
|  | '0' |  | '0' |
|  | '0' |  | '0' |
| Number of data (count by word) | ${ }^{\prime} 0$ | Number of data (count by word) | ${ }^{\prime} 0$ |
|  | ${ }^{\prime} 0$ |  | ${ }^{\prime} 0$ |
|  | '0' |  | ${ }^{\prime} 0$ |
|  | '2' |  | '2' |
| Number of data (count by byte) | '0' | LRC Check | 'E' |
|  | '4' |  | '8' |
| The first data content | '1' | END | CR |
|  | '3' |  | LF |
|  | '8' |  |  |
|  | '8' |  |  |
| The second data content | '0' |  |  |
|  | 'F' |  |  |
|  | 'A' |  |  |
|  | '0' |  |  |
| LRC Check | '9' |  |  |
|  | 'A' |  |  |
| END | CR |  |  |
|  | LF |  |  |

RTU Mode :

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

## 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,
$01 \mathrm{H}+03 \mathrm{H}+21 \mathrm{H}+02 \mathrm{H}+00 \mathrm{H}+02 \mathrm{H}=29 \mathrm{H}$, the 2 's-complement negation of 29 H is $\underline{\mathbf{D}} \mathrm{H}$.

## 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 $\leftarrow$ a pointer to the message buffer
Unsigned char length $\leftarrow$ the quantity of bytes in the message buffer
The function returns the CRC value as a type of unsigned integer.
Unsigned int crc_chk(unsigned char* data, unsigned char length)

```
    {
    int j;
    unsigned int reg_crc=0Xffff;
    while(length--){
        reg_crc ^= *data++;
        for(j=0;j<8;j++){
        if(reg_crc & 0x01){ /* LSB(b0)=1 */
            reg_crc=(reg_crc>>1)^ 0Xa001;
        }else{
            reg_crc=reg_crc >>1;
        }
    }
}
```

return 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 $\operatorname{Pr} 4-01$ is 0401 H . |  |
| Command Write only | 2000H | Bit0~3 | 0 : No function |
|  |  |  | 1: Stop |
|  |  |  | 2: Run |
|  |  |  | 3: Jog + Run |
|  |  | Bit4~5 | 00B: No function |
|  |  |  | 01B: FWD |
|  |  |  | 10B: REV |
|  |  |  | 11B: Change direction |
|  |  | Bit6~7 | 00B: 1st accel/decel |
|  |  |  | 01B: 2nd accel/decel |
|  |  |  | 10B: 3rd accel/decel |
|  |  |  | 11B: 4th accel/decel |
|  |  | Bit08~11 | 0000B: master speed |
|  |  |  | 0001B: 1st accel/decel. |
|  |  |  | 0010B: 2nd accel/decel |
|  |  |  | 0011B: 3rd accel/decel |
|  |  |  | 0100B: 4th accel/decel |
|  |  |  | 0101B: 5th accel/decel |
|  |  |  | 0110B: 6th accel/decel |
|  |  |  | 0111B: 7th accel/decel |
|  |  |  | 1000B: 8th accel/decel |
|  |  |  | 1001B: 9th accel/decel |
|  |  |  | 1010B: 10th accel/decel |


| Read onl |  |  | 1011B: 11th accel/decel |
| :---: | :---: | :---: | :---: |
|  |  |  | 1100B: 12th accel/decel |
|  |  |  | 1101B: 13th accel/decel |
|  |  |  | 1110B: 14th accel/decel |
|  |  |  | 1111B: 15th accel/decel |
|  |  | Bit12 | 1: enable bit06-11 function |
|  |  | Bit13~14 | 00B: No function |
|  |  |  | 01B: operated by digital keypad |
|  |  |  | 10B: operated by Pr.00-21 setting |
|  |  |  | 11B: change operation source |
|  |  | Bit15 | Reserved |
|  | $\frac{2001 \mathrm{H}}{2002 \mathrm{H}}$ | Frequency command |  |
|  |  | Bit 0 | Bit 0 |
|  |  | Bit 1 | Bit 1 |
|  |  | Bit 2 | Bit 2 |
|  |  | Bit 3-15 | Bit 3-15 |
|  | 2100H | Error code: refer to Pr.06-17 to Pr.06-22 |  |
|  | 2119H | Bit0 | 1: FWD command |
|  |  | Bit1 | 1: Operation status |
|  |  | Bit2 | 1: Jog command |
|  |  | Bit3 | 1: REV command |
|  |  | Bit4 | 1: REV command |
|  |  | 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 |
|  |  | Bit13~15 | 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 |  |
|  | 2116H | Multi-function display (Pr.00-04) |  |
|  | 211BH | Max. setting frequency |  |
|  | 2200H | Display output current (A) |  |
|  | 2201H | Display counter value of TRG terminal (c) |  |
|  | 2202H | Display actual output frequency (H) |  |
|  | 2203H | Display DC-BUS voltage (u) |  |
|  | 2204H | Display output voltage of U, V, W (E) |  |
|  | 2205H | Display output power angle of U, V, W (n) |  |
|  | 2206H | Display actual motor speed kW of U, V, W (P) |  |
|  | 2207H | Display motor speed in rpm estimated by the drive or encoder feedback (r00: positive speed, -00 : negative speed) |  |
|  | 2208H | Display positive/negative output torque N -m estimated by the drive ( t 0.0 : positive torque, -0.0 : negative torque) |  |
|  | 2209H | Display PG feedback (as NOTE 1) |  |
|  | 220AH | Display PID feedback value after enabling PID function in \% (b) |  |
|  | 220BH | Display signal of AVI1 analog input terminal, $0-10 \mathrm{~V}$ corresponds to $0-100 \%$ (1.) (as NOTE 2) |  |


| 220 CH | Display signal of ACI analog input terminal, 4-V20mA/0-10V <br> corresponds to 0-100\% (2.) (as NOTE 2) |
| :--- | :--- |
| 220 DH | Display signal of AVI2 analog input terminal, -10V~10V <br> corresponds to -100~100\% (3.) (as NOTE 2) |
| 220 EH | Display the IGBT temperature of drive power module in ${ }^{\circ} \mathrm{C}$ (c.) <br> 220 FH <br> 2210 H <br>  <br> 2211 H <br> The status of digital input (ON/OFF), refer to Pr.02-10 (as NOTE <br> 3 ) <br> The status of digital output (ON/OFF), refer to Pr.02-15 (as NOTE <br> $4)$ <br> 2212 H <br> 2213 H |
| 2214 H | The corresponding CPU pin status of digital input (d.) (as NOTE 3) <br> The corresponding CPU pin status of digital output (O.) (as NOTE <br> 4) |
| 2215 H | Reserved |
| 2216 H | Reserved |
| 2217 H | Reserved |
| 2218 H | Position command tracing error (P.) |
| 2219 H | Display times of counter overload (0.) |
| 221 AH | Display GFF in \% (G.) |
| 221 BH | Reserved |
| 221 CH | Display PLC register D1043 data (C) |
| 221 DH | Pole of Permanent Magnet Motor |
| 221 EH | User page displays the value in physical measure |
| 221 FH | Output Value of Pr.00-05 |

## 4. Exception response:

The AC motor drive is expected to return a normal response after receiving command messages from the master device. The following depicts the conditions when no normal response is replied to the master device.
The AC motor drive does not receive the messages due to a communication error; thus, the AC motor drive has no response. The master device will eventually process a timeout condition.
The AC motor drive receives the messages without a communication error, but cannot handle them. An exception response will be returned to the master device and an error message "CExx" will be displayed on the keypad of AC motor drive. The $x x$ 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 | 01H |
| :---: | :---: | :---: | :---: |
| Address | '0' | Function | 86H |
|  | '1' | Exception code | 02H |
| Function | '8' | CRC CHK Low | C3H |
|  | '6' | CRC CHK High | A1H |
| Exception code | '0' |  |  |
|  | '2' |  |  |
| LRC CHK | '7' |  |  |
|  | '7' |  |  |
| END | CR |  |  |
|  | LF |  |  |

The explanation of exception codes:

| Exception code | Explanation |
| :--- | :--- |
| 1 | Illegal data value: <br> The data value received in the command message is not available for the AC <br> drive. |
| 2 | Illegal data address: <br> The data address received in the command message is not available for the AC <br> 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

N 09-09 Response Delay Time
Factory Setting: 2.0
Settings $0.0 \sim 200.0 \mathrm{~ms}$
This parameter is the response delay time after AC drive receives communication command as shown in the following.

RS-485 BUS


N 09-10 Main Frequency of the Communication
Factory Setting: 60.00
Settings $\quad 0.00 \sim 600.00 \mathrm{~Hz}$
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

N 09-11 Block Transfer 1
N 09-12 Block Transfer 2
N 09-13 Block Transfer 3
N 09-14 Block Transfer 4
N 09-15 Block Transfer 5
N 09-16 Block Transfer 6
N 09-17 Block Transfer 7
~ 09-18 Block Tranfer 8
~ 09-19 Block Transfer 9

* 09-20 Block Transfer 10

N 09-21 Block Transfer 11

* 09-22 Block Transfer 12

N 09-23 Block Transfer 13
N 09-24 Block Transfer 14
N 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.
$09-27$
$\sim 09-29$ Reserved

09-30 Communication Decoding Method
Factory Setting: 0
Settings 0 : by 20XX
1 : by 60XX

## 09-31 COM 1 Protocol

Setting 0: RS485 Factory Setting: 0
1: Bacnet

09-34 PLC frequency setting
Setting 0: Before PID control
Factory Setting: 0
1: After PID control

09-35 PLC address
Factory Setting: 2
Settings 1~254

09-36 CANopen Slave Address
Factory Setting: 0
Settings 0: Disable
09-37 CANopen Speed
Factory Setting: 0
Settings $0: 1 \mathrm{M}$
1: 500k
2: 250k
3: 125k
4: 100k (Data only)
5: 50k
09-38 CANopen Frequency Gain
Factory Setting: 100
Settings $0 \sim 200$
09-39 CANopen Warning Record
Factory Setting: Read Only
Settings bit 0 : CANopen Guarding Time out
bit 1 : CANopen Heartbeat Time out
bit 2 : CANopen SYNC Time out
bit 3 : CANopen SDO Time out
bit 4 : CANopen SDO buffer overflow
bit 5 : Can Bus Off
bit 6 : Error protocol of CANOPEN

## 09-40 CANopen Decoding Method

Factory Setting: 1
Settings $\quad 0:$ Communication definition of CP2000 series
1 : CANopen Standard DS402 protocol
09-41 CANopen Status

|  | Factory Setting: Read Only |
| :--- | :--- |
| Settings | 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 $\quad 0$ : Not ready for use state1: Inhibit start state2: Ready to switch on state3: Switched on state4: Enable operation state
7: Quick stop active state
13: Err reaction activation state
14: Error state
09 - 43 Reset CANopen Index
Factory Setting: 65535
Settings $\quad 0 \sim 65535$
09-44 Reserved

Factory Setting: 0

Factory Setting: 0

Factory Setting: 0
Settings 0: Disable
Settings 0: Disable
Settings 0: Disable
1: Enable
1: Enable
1: Enable
09-45 CANopen Master Function
09-45 CANopen Master Function
09-45 CANopen Master Function
09-46 CANopen Master AddressFactory Setting: 100
Settings 1~127
$09-47 ~ 09$ - ..... 49
Reserved
09-50 BACnet Address
Factory Setting: 1
Settings 0~127
09-51 BACnet Baud Rate
Factory Setting: 384
Settings 96~384

| 09-52 | BACnet Device ID L |  |  |
| :---: | :---: | :---: | :---: |
|  |  |  | Factory Setting: 1 |
|  | Settings | 0~9999 |  |
| 09-53 | BACnet Device ID H |  |  |
|  |  |  | Factory Setting: 0 |
|  | Settings | 0~419 |  |
| 09-55 | BACnet Max Address |  |  |
|  |  |  | Factory Setting: 127 |
|  | Settings | 0~127 |  |
| 09-56 | BACnet Password |  |  |
|  |  |  | Factory Setting: 0 |
|  | Settings | 0~65535 |  |
| 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
$09-64$
$\sim 09-69$ 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)
$0: 10 \mathrm{Kbps}$
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
[1] 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 $0 \sim 255$

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 $0 \sim 255$

09-84 Getway Address 1 of the Communication Card
09-85 Getway Address 2 of the Communication Card
09-86 Getway Address 3 of the Communication Card
09-87 Getway Address 4 of the Communication Card
Factory Setting: 0
Settings 0~255

09 - 88 Password for Communication Card (Low word)
09 - 89 Password for Communication Card (High word)
Factory Setting: 0
Settings 0~99

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)
Enable to write internet parameters (1bit). This bit will change to disable when it finishes sAVI1ng the update of internet parameters.

Bit 2: Login password enable(1bit)
Enable login password (1bit). This bit will be changed to disable when it finishes sAVI1ng the update of internet parameters.

## 09-92 Status of Communication Card

Factory Setting: 0
Settings Bit 0: password enable
When the communication card is set with password, this bit is enabled. When the password is clear, this bit is disabled.

## 12 Pump Parameter

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 |  |

1a 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)

## D】 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

N $12-01$ Number of Motors to be connected
Factory Setting: 1
Settings 1 to 8
[1]
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
Cetting 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.

N 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.
N 12-04 Delay Time due to the Deceleration ( or the Decrement) at Motor Switching (seconds)

N 12-05 Delay time while fixed quantity circulation at Motor Switching (seconds)
Factory Setting: 100
Settings 0.0 to 3600.0 seconds

## $1 \mathbb{1}$ 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 0 Hz 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

## 1 Parameter Setting

| Parameter <br> setting | Description |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| P12-00=2 | Choose Fixed quantity circulation with PID |  |  |  |  |  |  |  |  |  |
| P12-01 $=\mathrm{X}$ | 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 | 02 | 03 | 04 | 05 | 06 | 07 | 08 |  |
|  | 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 |  |  |  |  |  |  |  |  |  |
| 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 $=\mathrm{X}$ | Delay time while fixed quantity circulation at Motor Switching with PID (unit: seconds) |
| :--- | :--- |
| $\mathrm{P} 12-06=\mathrm{X}$ | 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
$\mathbb{L}$. 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.
N 12-07 Action to do when Fixed Quantity Circulation breaks down
Factory Setting: 0

Settings 0 : Turn off all output<br>1: Motors powered by mains electricity continues to operate

N 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 $\operatorname{Pr} 12-08$ and remains at the the time setiing 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 0 Hz 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 0 Hz .

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

| Parameter <br> Setting | Description |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{P} 12-00=3$ | Choose Fixed quantity control |  |  |  |  |  |  |  |  |  |
| $\mathrm{P} 12-01=\mathrm{X}$ | 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 | Motor \#1 by Mains |
|  | P02-14 |  | 56 | 56 | 56 | 56 | 56 | 56 | 56 | Motor \#2 by Mains |
|  | P02-15 |  |  | 57 | 57 | 57 | 57 | 57 | 57 | Motor \#3 by Mains |
|  | P02-36 |  |  |  | 58 | 58 | 58 | 58 | 58 | Motor \#4 by Mains |
|  | P02-37 |  |  |  |  | 59 | 59 | 59 | 59 | Motor \#5 by Mains |
|  | P02-38 |  |  |  |  |  | 60 | 60 | 60 | Motor \#6 by Mains |
|  | P02-39 |  |  |  |  |  |  | 61 | 61 | Motor \#7 by Mains |
|  | P02-40 |  |  |  |  |  |  |  | 62 | Motor \#8 by Mains |
|  | Table 2: Setting of Multi-function Output Terminal on Circulating Motors |  |  |  |  |  |  |  |  |  |
| P12-05=X | Delay time while fixed quantity circulation at Motor Switching (seconds) |  |  |  |  |  |  |  |  |  |
| P12-06=X | Frequency when switching motors at fixed quantity circulation (Hz) |  |  |  |  |  |  |  |  |  |

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

## Time circulation and Fixed quantity circulation with PID

This mode combines 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.

## Time circulation and Fixed quantity control with PID

This mode combines 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.

## 13 Product Applications

## 1. Multi Motors on Fixed Quantity Circulation Control

 (V/F control; 1 VFD vs. 3 Motors)Wiring Diagram (Optional Card: EMC-RA66 Relay card x 1)


## 2. Applied Parameter Table

| Parameter | Function | Decimal <br> Place | Max. <br> Value | Mini. Value | Factory Setting | Applied <br> Setting |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 00-00 | Identity Code of the AC Motor Drive | 0 | 65535 | 0 | 0 | 17 |
| 00-01 | Rated Current (Amps) | 2 | 655.35 | 0.00 | 0.00 | 22.50 |
| 00-22 | Stop method | 0 | 1 | 0 | 0 | 1 |
| 01-00 | Max. Operating Frequency (Hz) | 2 | 600.00 | 50.00 | 60.00 | 50.00 |
| 01-01 | M1: Max Output Frequency (Hz) | 2 | 600.00 | 0.00 | 60.00 | 50.00 |
| 01-02 | M1: Max Output Voltage (V) | 1 | 510.0 | 0.0 | 400.0 | 380.0 |
| 01-35 | M2: Max Output Frequency (Hz) | 2 | 600.00 | 0.00 | 60.00 | 50.00 |
| 01-36 | M2: Max Output Voltage (V) | 1 | 510.0 | 0.0 | 400.0 | 380.0 |
| 02-13 | RLY1: Multi Output Terminal | 0 | 62 | 0 | 11 | 55 |
| 02-14 | RLY2: Multi Output Terminal | 0 | 62 | 0 | 1 | 56 |
| 02-15 | RLY3: Multi Output Terminal | 0 | 62 | 0 | 0 | 57 |
| 02-22 | Desired arrival frequency $1(\mathrm{~Hz})$ | 2 | 600.00 | 0.00 | 60.00 | 50.00 |
| 02-24 | Desired arrival frequency $2(\mathrm{~Hz}$ ) | 2 | 600.00 | 0.00 | 60.00 | 50.00 |
| 02-36 | Expansion Card Output Terminal (MO3) | 0 | 62 | 0 | 0 | 58 |
| 02-37 | Expansion Card Output Terminal (MO4) | 0 | 62 | 0 | 0 | 59 |
| 02-38 | Expansion Card Output Terminal <br> (MO5) | 0 | 62 | 0 | 0 | 60 |
| 02-51 | Multi Function Output Terminal status | 0 | 65535 | 0 | 0 | 4 |
| 02-54 | Display the Saved Memory of the <br> Frequency Command Executed by <br> External Terminal | 2 | 600.00 | 0.00 | 60.00 | 50.00 |
| 03-00 | AVI analog input function | 0 | 17 | 0 | 1 | 5 |
| 03-03 | AVI analog input bias (\%) | 1 | 100.0 | -100.0 | 0.0 | 0.2 |
| 03-07 | AVI positive/negative bias mode | 0 | 4 | 0 | 0 | 1 |
| 05-01 | IM Motor 1 Full-Load current (Amps) | 2 | 27.00 | 2.25 | 0.00 | 16.19 |
| 05-02 | IM1 Motor 1 Rated Power (kW) | 2 | 655.35 | 0.00 | 0.00 | 11.00 |
| 05-03 | IM1 Motor 1 Rated Rotational Speed (rpm) | 0 | 65535 | 0 | 1710 | 1410 |
| 05-05 | IM1Motor1 No Load Current (Amps) | 2 | 16.19 | 0.00 | 0.00 | 7.19 |
| 05-13 | IM Moto 2 Rated Current ( Amps) | 2 | 27.00 | 2.25 | 0.00 | 16.19 |
| 05-14 | IM Motor 2 Rated Power (kW) | 2 | 655.35 | 0.00 | 0.00 | 11.00 |
| 05-15 | IM2 Motor 2 Rated Rotational Speed (rpm) | 0 | 65535 | 0 | 1710 | 1410 |


| Parameter | Function | Decimal <br> Place | Vax. <br> Value | Mini. <br> Value | Factory <br> Setting | Applied <br> Setting |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| $05-17$ | IM Motor 2 No Load Current (Amps) | 2 | 16.19 | 0.00 | 0.00 | 7.19 |
| $05-31$ | Accumulated Motor Functioning Time <br> (minutes) | 0 | 1439 | 0 | 0 | 27 |
| $08-00$ | PID feedback Terminal option | 0 | 6 | 0 | 0 | 1 |
| $08-01$ | Proportional Gain (\%) | 1 | 500.0 | 0.0 | 80.0 | 1.0 |
| $08-25$ | Reserved | 0 | 65535 | 0 | 0 | 500 |
| $08-29$ | Reserved | 0 | 65535 | 0 | 0 | 3000 |
| $08-30$ | Reserved | 1 | 500.0 | 0.0 | 80.0 | 1.0 |
| $08-31$ | Proportional Gain 2 (\%) | 0 | 65535 | 0 | 0 | 10 |
| $08-34$ | Reserved | 2 | 600.00 | 0.00 | 60.00 | 50.00 |
| $09-10$ | Main Communication Frequency (Hz) | 2 | 5 | 0 | 0 | 2 |
| $12-00$ | Circulative Control | 0 | 8 | 1 | 1 | 3 |
| $12-01$ | Multi Motor Control | 1 | 3600.0 | 0.0 | 1.0 | 10.0 |
| $12-04$ | Motor Switch Delay Time while <br> Deceleration ( or Decrement) (seconds) | 2 | 600.00 | 0.00 | 60.00 | 50.00 |
| $12-06$ | Frequency when switching motors at | 2 | 600.00 | 0.00 | 0.00 | 20.00 |
| $12-08$ | Fixed quantity circulation (Hz) |  |  |  |  |  |
| (Hz) | 2 | 0 |  |  |  |  |

### 2.1 Blown Film Extrusion Machine:

## SVC Mode (Sensorless Vector Control)

Load: 18.5KW, $50 \mathrm{~Hz}, 380 \mathrm{~V}, 6 \mathrm{p}, 37.7 \mathrm{~A}, 970 \mathrm{rpm}$
Wiring: See wiring diagram of the Frame B

## Applied Parameter Table

| Parameter | Function | Decimal <br> Place | Max. <br> Value | Mini. <br> Value | Factory Setting | Applied Setting |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 00-00 | ID code of the AC Motor Drive | 0 | 65535 | 0 | 0 | 21 |
| 00-01 | Rated Current (Amps) | 2 | 655.35 | 0.00 | 0.00 | 32.00 |
| 00-11 | Speed Mode Control | 0 | 4 | 0 | 0 | 2 |
| 00-16 | Loading mode selection | 0 | 1 | 0 | 0 | 1 |
| 00-23 | Motor Operating Direction Control | 0 | 2 | 0 | 0 | 2 |
| 01-00 | Max. Operating Frequency (Hz) | 2 | 600.00 | 50.00 | 60.00 | 50.00 |
| 01-01 | M1: Max. Output Frequency (Hz) | 2 | 600.00 | 0.00 | 60.00 | 50.00 |
| 01-02 | M1: Max Output Voltage (V) | 1 | 510.0 | 0.0 | 400.0 | 380.0 |
| 01-35 | M2: Max Output Frequency (Hz) | 2 | 600.00 | 0.00 | 60.00 | 50.00 |
| 01-36 | M2: Max Output Voltage (V) | 1 | 510.0 | 0.0 | 400.0 | 380.0 |
| 02-22 | Desired Arrival Frequency 1 (Hz) | 2 | 600.00 | 0.00 | 60.00 | 50.00 |
| 02-24 | Desired Arrival Frequency 2 (Hz) | 2 | 600.00 | 0.00 | 60.00 | 50.00 |
| 05-01 | IM Motor 1 Full-Load current (Amps) | 2 | 38.40 | 3.20 | 0.00 | 30.00 |
| 05-02 | IM Motor 1 Rated Power (kW) | 2 | 655.35 | 0.00 | 0.00 | 15.00 |
| 05-03 | IM Motor 1 Rated Rotational Speed (rpm) | 0 | 65535 | 0 | 1710 | 1460 |
| 05-05 | IM1 Motor 1 No Load Current (Amps) | 2 | 30.00 | 0.00 | 0.00 | 8.99 |
| 05-06 | Reserved | 3 | 65.535 | 0.000 | 0.000 | 0.347 |
| 05-07 | Reserved | 3 | 65.535 | 0.000 | 0.000 | 0.401 |
| 05-08 | Reserved | 1 | 6553.5 | 0.0 | 0.0 | 146.5 |
| 05-09 | Reserved | 1 | 6553.5 | 0.0 | 0.0 | 9.4 |
| 05-13 | IM2 Motor 2 Full Load Current (Amps) | 2 | 38.40 | 3.20 | 0.00 | 28.79 |
| 05-14 | IM2 Motor 2 Rated Power (kW) | 2 | 655.35 | 0.00 | 0.00 | 18.50 |
| 05-15 | IM2 Motor 2 Rotational Speed (rpm) | 0 | 65535 | 0 | 1710 | 1410 |
| 05-17 | IM2 Motor 2 No Load Current (Amps) | 2 | 28.79 | 0.00 | 0.00 | 12.79 |
| 05-31 | Accumulated Motor Functioning Time (minutes) | 0 | 1439 | 0 | 0 | 11 |

Chapter 13 Product Applications

| Parameter | Function | Decimal <br> Place | Max. <br> Value | Mini. <br> Value | Factory <br> Setting | Applied <br> Setting |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| $07-27$ | Slip Compensation Gain | 2 | 10.00 | 0.00 | 0.00 | 1.00 |
| $08-25$ | Reserved | 0 | 65535 | 0 | 0 | 500 |
| $08-29$ | Reserved | 0 | 65535 | 0 | 0 | 3000 |
| $08-30$ | Reserved | 0 | 65535 | 0 | 0 | 1000 |
| $08-34$ | Reserved | 0 | 65535 | 0 | 0 | 10 |
| $09-10$ | Main Communication Frequency (Hz) | 2 | 600.00 | 0.00 | 60.00 | 50.00 |

### 2.2 Air Compressor Machine:

## SVC mode (Sensorless Vector Control

Load: 18.5KW CP2000 to control an 11 kW motor at 23Amps, 1450 rpm
Wiring: See wiring diagram of the Frame B
Applied Parameter Table

| Parameter | Function | Decimal Place | Max. <br> Value | Mini. Value | Factory Setting | Applied Setting |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 00-00 | ID Code of the AC Motor Drive | 0 | 65535 | 0 | 0 | 21 |
| 00-01 | Rated Current (Amps) | 2 | 655.35 | 0.00 | 0.00 | 36.00 |
| 00-11 | Velocity Control Mode | 0 | 4 | 0 | 0 | 2 |
| 00-17 | Carrier Frequency (KHz) | 0 | 15 | 2 | 8 | 6 |
| 00-21 | Source of AUTO Functioning Command | 0 | 5 | 0 | 0 | 1 |
| 00-22 | Stop Method | 0 | 1 | 0 | 0 | 1 |
| 01-00 | Max. Operating Frequency (Hz) | 2 | 600.00 | 50.00 | 60.00 | 50.00 |
| 01-01 | M1: Max. Output Frequency (Hz) | 2 | 600.00 | 0.00 | 60.00 | 50.00 |
| 01-02 | M1: Max Output Voltage (V) | 1 | 510.0 | 0.0 | 400.0 | 380.0 |
| 01-35 | M2: Max Output Frequency (Hz) | 2 | 600.00 | 0.00 | 60.00 | 50.00 |
| 01-36 | M2: Max Output Voltage (V) | 1 | 510.0 | 0.0 | 400.0 | 380.0 |
| 02-22 | Desired Arrival Frequency 1 (Hz) | 2 | 600.00 | 0.00 | 60.00 | 50.00 |
| 02-24 | Desired Arrival Frequency 2 (Hz) | 2 | 600.00 | 0.00 | 60.00 | 50.00 |
| 02-54 | Frequency command memory of External <br> Terminal (Hz) | 2 | 600.00 | 0.00 | 60.00 | 50.00 |
| 05-01 | IM Motor 1 Full-Load current (Amps) | 2 | 43.20 | 3.60 | 0.00 | 23.00 |
| 05-02 | IM Motor 1 Rated Power (kW) | 2 | 655.35 | 0.00 | 0.00 | 11.00 |
| 05-03 | IM1 Motor 1 Rated Rotational Speed (rpm) | 0 | 65535 | 0 | 1710 | 1410 |
| 05-05 | IM1 Motor 1 No Load Current (Amps) | 2 | 23.00 | 0.00 | 0.00 | 6.89 |
| 05-06 | Reserved | 3 | 65.535 | 0.000 | 0.000 | 0.705 |
| 05-07 | Reserved | 3 | 65.535 | 0.000 | 0.000 | 0.528 |
| 05-08 | Reserved | 1 | 6553.5 | 0.0 | 0.0 | 189.1 |
| 05-09 | Reserved | 1 | 6553.5 | 0.0 | 0.0 | 14.5 |
| 05-13 | IM2 Motor 2 Full Load Current (Amps) | 2 | 43.20 | 3.60 | 0.00 | 28.79 |
| 05-14 | IM2 Motor 2 Rated Power (kW) | 2 | 655.35 | 0.00 | 0.00 | 18.50 |
| 05-15 | IM2 Motor 2 Rotational Speed (rpm) | 0 | 65535 | 0 | 1710 | 1410 |
| 05-17 | IM2 Motor 2 No Load Current (Amps) | 2 | 28.79 | 0.00 | 0.00 | 12.79 |
| 05-31 | Accumulated Motor Functioning Time(minutes) | 0 | 1439 | 0 | 0 | 8 |


| Parameter | Function | Decimal <br> Place | Max. <br> Value | Mini. <br> Value | Factory <br> Setting | Applied <br> Setting |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| $07-27$ | Slip Compensation Gain | 2 | 10.00 | 0.00 | 0.00 | 1.00 |
| $08-25$ | Reserved | 0 | 65535 | 0 | 0 | 500 |
| $08-29$ | Reserved | 0 | 65535 | 0 | 0 | 3000 |
| $08-30$ | Reserved | 0 | 65535 | 0 | 0 | 1000 |
| $08-34$ | Reserved | 0 | 65535 | 0 | 0 | 10 |
| $09-10$ | Main Communication Frequency $(\mathrm{Hz})$ | 2 | 600.00 | 0.00 | 60.00 | 50.00 |

## Chapter 14 Warning Codes


(1) Display error signal
(2) Abbreviate error code

The code is displayed as shown on KPC-CE01.
(3) Display error description

| Display on LCM Keypad | Descriptions |
| :---: | :---: |
| Warning CE01 Comm. Error 1 | Modbus function code error |
| Warning CE02 HAND Comm. Error 2 | Address of Modbus data is error |
| Warning CE03 Como Comm. Error 3 | Modbus data error |
|  | Modbus communication error |
| Warning <br> CE10 <br> Comm. Error 10 | Modbus transmission time-out |
| Warning CP10 Kañ Keypad time out | Keypad transmission time-out |
|  | Keypad COPY error 1 |
| Warning SE2 SaND Save Error 2 | Keypad COPY error 2 |
| Warning SE3 Copy Model Err 3 | Keypad COPY error 3 |


| Warning oH1 <br> Over heat 1 warn | IGBT over-heating warning |
| :---: | :---: |
| Warning $\mathrm{oH} 2$ <br> Over heat 2 warn | Capacity over-heating warning |
| Warning PID PID FBK Error | PID feedback error |
| Warning <br> ANL <br> Analog loss | ACl signal error When Pr03-19 is set to 1 and 2. |
| Warning ${ }^{\text {un }}$ <br> UC <br> Under Current | Low current |
|  | Auto tuning error |
| Warning oSPD <br> Over Speed Warn | Over-speed warning |
| Warning <br> DAvE Deviation Warn | Over speed deviation warning |
| Warning ${ }^{\text {PANO }}$ <br> PHL <br> Phase Loss | Phase loss |
|  | Over torque 1 |
|  | Over torque 2 |
| Warning $\quad$ HANO oH3 Motor Over Heat | Motor over-heating |
|  | Over slip |


|  | Auto tuning processing |
| :---: | :---: |
| Warning CGdn Guarding T-out | CAN guarding time-out 1 |
| Warning CHbn Heartbeat T-out | CAN heartbeat time-out 2 |
|  | CAN synchrony time-out |
|  | CAN bus off |
| Warning CSdn SDOT-out | CAN SDO transmission time-out |
| Warning CSbn Buf Overflow | CAN SDO received register overflow |
| Warning Cbtn Boot up fault | CAN boot up error |
|  | CAN format error |
| Warning CIdn CAND CAN/S Idx exceed | CAN index error |
|  | CAN station address error |
| Warning CFrn CAND CAN/S FRAM fail | CAN memory error |
| Warning PLod Opposite Defect | PLC download error |


|  | Save error of PLC download |
| :---: | :---: |
| Warning <br> PLdA <br> Data defect | Data error during PLC operation |
| Warning PLFn Function defect | Function code of PLC download error |
|  | PLC register overflow |
| Warning <br> PLFF <br> Function defect | Function code of PLC operation error |
| Warning PLSn Check sum error | PLC checksum error |
| Warning PLEd No end command | PLC end command is missing |
| Warning <br> PLCr PLC MCR error | PLC MCR command error |
| Warning <br> PLdF <br> Download fail | PLC download fail |
|  | PLC scan time exceed |
| Warning <br> PCGd <br> CAN/M Guard err | CAN Master guarding error |
| Warning ${ }^{\text {PANO }}$ PCbF CAN/M bus off | CAN Master bus off |


| Warning <br> PCnL <br> CAN/M Node Lack | CAN Master node error |
| :---: | :---: |
| Warning PCCt CAN/M Cycle Time | CAN/M cycle time-out |
| Warning PCSF CANDM SDO Over | CAN/M SDOover |
| Warning PCSd CAN/M Sdo Tout | CAN/M SDO time-out |
| Warning <br> PCAd <br> CAN/M Addres set | CAN/M station address error |
| Warning ECid ExCom ID failed | Duplicate MAC ID error Node address setting error |
| Warning ECLv ExCom pwr loss | Low voltage of communication card |
| Warning ECtt ExCom Test Mode | Communication card in test mode |
| Warning <br> ECbF ExCom Bus off | DeviceNet bus-off |
| Warning ECnP ExCom No power | DeviceNet no power |
| Warning ECFF ExCom Facty def | Factory default setting error |


| Warning ECiF ExCom Inner err | Serious internal error |
| :---: | :---: |
| Warning <br> ECio ExCom IONet brk | IO connection break off |
|  | Profibus parameter data error |
|  | Profibus configuration data error |
| Warning <br> ECEF <br> ExCom Link fail | Ethernet Link fail |
|  | Communication time-out for communication card and drive |
|  | Check sum error for Communication card and drive |
|  | Communication card returns to default setting |
| Warning ECOO ExCom MTCP over | Modbus TCP exceed maximum communication value |
| Warning ECo1 ExComo EIP over | EtherNet/IP exceed maximum communication value |
| Warning ECiP ExCom IP fail | IP fail |
| Warning <br> EC3F <br> ExCom Mail fail | Mail fail |
| Warning Ecby ExCom Busy | Communication card busy |

## Chapter 15 Fault Codes and Descriptions


(1) Display error signal
(2) Abbreviated error code
The code is displayed as shown on KPC-CE01
(3) Display error description.

| Fault Name | Fault Descriptions | Corrective Actions |
| :---: | :---: | :---: |
|  | Over-current during acceleration (Output current exceeds triple rated current during acceleration.) | 1. Short-circuit at motor output: Check for possible poor insulation at the output. <br> 2. Acceleration Time too short: Increase the Acceleration Time. <br> 3. AC motor drive output power is too small: Replace the AC motor drive with the next higher power model. |
|  | Over-current during deceleration (Output current exceeds triple rated current during deceleration.) | 1. Short-circuit at motor output: Check for possible poor insulation at the output. <br> 2. Deceleration Time too short: Increase the Deceleration Time. <br> 3. AC motor drive output power is too small: Replace the AC motor drive with the next higher power model. |
|  | Over-current during steady state operation (Output current exceeds triple rated current during constant speed.) | 1. Short-circuit at motor output: Check for possible poor insulation at the output. <br> 2. Sudden increase in motor loading: Check for possible motor stall. <br> 3. AC motor drive output power is too small: Replace the AC motor drive with the next higher power model. |
|  | Hardware failure in current detection | Return to the factory |
| Fault <br> GFF <br> Ground fault | 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. <br> NOTE: The short circuit protection is provided for AC motor drive protection, not for protecting the user. <br> 1. Check the wiring connections between the AC motor drive and motor for possible short circuits, also to ground. <br> 2. Check whether the IGBT power module is damaged. <br> 3. Check for possible poor insulation at the output. |


| Fault Name | Fault Descriptions | Corrective Actions |
| :---: | :---: | :---: |
| Fault <br> occ <br> Short Circuit | Short-circuit is detected between upper bridge and lower bridge of the IGBT module | Return to the factory |
|  | 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. <br> 2. Check for possible voltage transients. <br> 3. If DC BUS over-voltage due to regenerative voltage, please increase the Deceleration Time or add an optional brake resistor. |
|  | 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. <br> 2. Check for possible voltage transients. <br> 3. If DC BUS over-voltage due to regenerative voltage, please increase the Deceleration Time or add an optional brake resistor. |
| $\square$ <br> Fault <br> ovn <br> 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. <br> 2. Check for possible voltage transients. <br> 3. If DC BUS over-voltage due to regenerative voltage, please increase the Deceleration Time or add an optional brake resistor. |
|  | Hardware failure in voltage detection | 1. Check if the input voltage falls within the rated AC motor drive input voltage range. <br> 2. Check for possible voltage transients. |
| Fault LvA Lvano Lvat accel | DC BUS voltage is less than Pr.06-00 during acceleration | 1. Check if the input voltage is normal <br> 2. Check for possible sudden load |
|  | DC BUS voltage is less than Pr.06-00 during deceleration | 1. Check if the input voltage is normal <br> 2. Check for possible sudden load |
| Fault Lvn Lvano Lvormal SPD | DC BUS voltage is less than Pr.06-00 in constant speed | 1. Check if the input voltage is normal <br> 2. Check for possible sudden load |
| Fault <br> LvS <br> Lv at stop | DC BUS voltage is less than Pr.06-00 at stop | 1. Check if the input voltage is normal <br> 2. Check for possible sudden load |


| Fault Name | Fault Descriptions | Corrective Actions |
| :---: | :---: | :---: |
| Fault <br> OrP <br> Phase lacked | Phase Loss | Check Power Source Input if all 3 input phases are connected without loose contacts. <br> For models 40 hp and above, please check if the fuse for the AC input circuit is blown. |
|  | IGBT overheating IGBT temperature exceeds protection level 1 to $15 \mathrm{HP}: 90^{\circ} \mathrm{C}$ 20 to $100 \mathrm{HP}: 100^{\circ} \mathrm{C}$ | 1. Ensure that the ambient temperature falls within the specified temperature range. <br> 2. Make sure that the ventilation holes are not obstructed. <br> 3. Remove any foreign objects from the heatsinks and check for possible dirty heat sink fins. <br> 4. Check the fan and clean it. <br> 5. Provide enough spacing for adequate ventilation. |
| Fault ${ }^{\text {OH2NO }}$ Heat Sink OH | Heatsink overheating Capacitance temperature exceeds $90^{\circ} \mathrm{C}$ cause heatsink overheating. | 1. Ensure that the ambient temperature falls within the specified temperature range. <br> 2. Make sure heat sink is not obstructed. Check if the fan is operating <br> 3. Check if there is enough ventilation clearance for AC motor drive. |
| Fault <br> oH3 <br> Motor over heat | Motor overheating The AC motor drive detects that the internal temperature exceeds Pr.06-30 (PTC level) | 1. Make sure that the motor is not obstructed. <br> 2. Ensure that the ambient temperature falls within the specified temperature range. <br> 3. Take the next higher power AC motor drive model. |
|  | IGBT Hardware Error | Return to the factory |
| Fault tH2o <br> Thermo 2 open | Capacitor Hardware Error | Return to the factory |
| Fault PWR Power RST OFF | Power off |  |
|  | Overload The AC motor drive detects excessive drive output current. | 1. Check if the motor is overloaded. <br> 2. Take the next higher power AC motor drive model. |


| Fault Name | Fault Descriptions | Corrective Actions |
| :---: | :---: | :---: |
| Fault <br> EoL1 <br> Thermal relay 1 | Electronics thermal relay 1 protection | 1. Check the setting of electronics thermal relay (Pr.06-14) <br> Take the next higher power AC motor drive model |
| AND <br> Fault <br> EoL2 <br> Thermal relay 2 | Electronics thermal relay 2 protection | 1. Check the setting of electronics thermal relay (Pr.06-28) <br> 2. Take the next higher power AC motor drive model |
| Faul <br> HAND <br> ot1 <br> Over torque 1 | These two fault codes will be displayed when output current exceeds the over-torque detection level (Pr.06-07 or | 1. Check whether the motor is overloaded. <br> 2. Check whether motor rated current setting (Pr.05-01) is suitable |
| Fault ot2 <br> Over torque 2 | (Pr.06-08 or Pr.06-11) and it is set to 2 or 4 in Pr.06-06 or Pr.06-09. | model. |
| Fault <br> uC <br> Under torque | Low current detection | Check Pr.06-71, Pr.06-72, Pr.06-73. |
| LMIT | Limit error |  |
| Fault cF1 | Internal EEPROM can not be programmed. | 1. Press "RESET" key to the factory setting <br> 2. Return to the factory. |
| Fault cF2 | Internal EEPROM can not be read. | 1. Press "RESET" key to the factory setting <br> 2. Return to the factory. |
| Fault <br> cd1 | U-phase error | Reboots the power. If fault code is still displayed on the |


| Fault Name | Fault Descriptions | Corrective Actions |
| :---: | :---: | :---: |
| Fault <br> cd2 <br> lbs sensor err | V-phase error | Reboots the power. If fault code is still displayed on the keypad please return to the factory |
| $\begin{aligned} & \text { Fault } \quad \text { cd3 } \\ & \text { Ics sensor err } \end{aligned}$ | W-phase error | Reboots the power. If fault code is still displayed on the keypad please return to the factory |
| $\qquad$ | CC (current clamp) | Reboots the power. If fault code is still displayed on the keypad please return to the factory |
| Fault <br> Hd1 <br> Oc HW error | OC hardware error | Reboots the power. If fault code is still displayed on the keypad please return to the factory |
| Fault <br> Hd2 <br> Ov HW error | OV hardware error | Reboots the power. If fault code is still displayed on the keypad please return to the factory |
| Fault <br> Hd3 <br> occ HW error | Occ hardware error | Reboots the power. If fault code is still displayed on the keypad please return to the factory |
| $\qquad$ | Auto tuning error | 1. Check cabling between drive and motor <br> 2. Try again. |
| Fault <br> AFE <br> PID Fbk error | PID loss (ACI) | 1. Check the wiring of the PID feedback <br> 2. Check the PID parameters settings |
| $\qquad$ | ACI loss | 1. Check the ACI wiring <br> 2. Check if the ACI signal is less than 4 mA |
| HAND <br> Fault <br> EF <br> External fault | External Fault | 1. Input EF (N.O.) on external terminal is closed to GND. Output U, V, W will be turned off. <br> 2. Give RESET command after fault has been cleared. |


| Fault Name | Fault Descriptions | Corrective Actions |
| :---: | :---: | :---: |
| Fault  <br> HANO  <br> EF1  <br> Emergency stop  | Emergency stop | 1. When the multi-function input terminals MII to MI6 are set to emergency stop, the AC motor drive stops output $\mathrm{U}, \mathrm{V}, \mathrm{W}$ and the motor coasts to stop. <br> 2. Press RESET after fault has been cleared. |
|  | External Base Block | 1. When the external input terminal (B.B) is active, the $A C$ motor drive output will be turned off. <br> 2. Deactivate the external input terminal (B.B) to operate the AC motor drive again. |
| Fault $\quad$ HeNo 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. |
|  | Software code error |  |
| Fault CE1 PC err command | Illegal function code | Check if the function code is correct (function code must be $03,06,10,63$ ) |
| Fault CE2 PC err address | Illegal data address ( 00 H to 254 H ) | Check if the communication address is correct |
| $\begin{aligned} & \text { Fault } \\ & \quad \text { CE3 } \\ & \text { PC err data } \end{aligned}$ | Illegal data value | Check if the data value exceeds max./min. value |
| Fault <br> CE4 <br> PC slave fault | Data is written to read-only address | Check if the communication address is correct |
| Fault CE10 PC time out | Modbus transmission time-out |  |
| $\begin{aligned} & \text { Fault } \\ & \text { CP10 } \\ & \text { Pu time out } \end{aligned}$ | Keypad transmission time-out |  |


| Fault Name | Fault Descriptions | Corrective Actions |
| :---: | :---: | :---: |
| Fault <br> bF <br> Braking fault | Brake resistor fault | If the fault code is still displayed on the keypad after pressing "RESET" key, please return to the factory. |
| Fault <br> $y d c$ <br> Y-delta connect | Y-connection/ $\Delta$-connecti on switch error | 1. Check the wiring of the $Y$-connection $/ \Delta$-connection <br> 2. Check the parameters settings |
| Fault  <br>   <br> dEb  <br> 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 <br> 2. Check if input power is stable |
| Fault <br> oSL <br> 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 <br> 2. Check the settings of Pr.05-26 and Pr.05-27 |
| Fault S1 S1-emergy stop | Emergency stop for external safety |  |
| Fault <br> Fire <br> On Fire | Fire Mode |  |
| Fault Uocc A phase short | Phase A short circuit |  |
| Vocc B phase short | Phase B short circuit |  |
| $\qquad$ | Phase C short circuit |  |
| Fault ryF <br> MC Fault | The electromagnet switch of the power board is not sealed. (For larger power model: Frame E and above) |  |


| Fault Name | Fault Descriptions Corrective Actions |
| :---: | :---: |
| Fault <br> ocU <br> Unknow over Amp | Unknown over current |
| Fault <br> ovU <br> Unknow over volt. | Unknown over voltage |
| Fault <br> OPHL <br> U phase lacked | Output phase loss (Phase U) |
| FaultOPHL <br> $V$ phase lacked | Output phase loss (Phase V) |
| Fault ${ }^{\text {OPHL }}$ W phase lacked | Output phase loss (Phase W) |
| Fault <br> TRAP <br> CPU Trap Error | CPU trap error |
| Fault <br> CGdE <br> Guarding T-out | CANopen guarding error |
| Fault CHbE Heand Heartbeat T-out | CANopen heartbeat error |
| $\qquad$ CSYE <br> SYNC T-out | CANopen synchronous error |
| Fault <br> CbFE <br> Can bus off | CANopen bus off error |


| Fault Name | Fault Descriptions ${ }^{\text {Corrective Actions }}$ |
| :---: | :---: |
| Fault <br> CIdE <br> Canbus Index Err | CANopen index error |
| Fault <br> CAdE <br> Can bus Add. Err | CANopen station address error |
| Fault <br> CFrE <br> Can bus off | CANopen memory error |

## Chapter 16 CANopen Overview

Newest version is available at http://www.delta.com.tw/industrialautomation/

1 CANopen Overview<br>2 CANopen Wiring<br>3 How to control by CANopen<br>3-1 CANopen Control Mode<br>3-2 DS402 Standard Mode<br>3-3 Delta Standard Mode<br>4 CANopen Supporting Index<br>5 CANopen Fault Code<br>6 CANopen LED Function

Built-in EMC-COP01 card is included in VFDXXXC23E/VFDXXXC43E models.
The built-in CANopen function is a kind of remote control. Master can control the AC motor drive by using CANopen protocol. CANopen is a CAN-based higher layer protocol. It provides standardized communication objects, including real-time data (Process Data Objects, PDO), configuration data (Service Data Objects, SDO), and special functions (Time Stamp, Sync message, and Emergency message). And it also has network management data, including Boot-up message, NMT message, and Error Control message. Refer to CiA website http://www.can-cia.org/ for details. The content of this instruction sheet may be revised without prior notice. Please consult our distributors or download the most updated version at http://www.delta.com.tw/industrialautomation

## Delta CANopen supporting functions:

■ Support CAN2.0A Protocol;
■ Support CANopen DS301 V4.02;
■ Support DSP-402 V2.0.

## Delta CANopen supporting services:

■ PDO (Process Data Objects): PDO1~ PDO2
■ SDO (Service Data Object):
Initiate SDO Download;
Initiate SDO Upload;
Abort SDO;
SDO message can be used to configure the slave node and access the Object Dictionary in every node.
■ SOP (Special Object Protocol):
Support default COB-ID in Predefined Master/Slave Connection Set in DS301 V4.02;
Support SYNC service;
Support Emergency service.
■ NMT (Network Management):
Support NMT module control;
Support NMT Error control;
Support Boot-up.

## Delta CANopen not supporting service:

Time Stamp service

### 16.1 CANopen Overview

## CANopen Protocol

CANopen is a CAN-based higher layer protocol, and was designed for motion-oriented machine control networks, such as handling systems. Version 4 of CANopen (CiA DS301) is standardized as EN50325-4. The CANopen specifications cover application layer and communication profile (CiA DS301), as well as a framework for programmable devices (CiA 302), recommendations for cables and connectors (CiA 303-1) and SI units and prefix representations (CiA 303-2).


## RJ-45 Pin Definition



| PIN | Signal | Description |
| :---: | :---: | :--- |
| 1 | CAN_H | CAN_H bus line (dominant high) |
| 2 | CAN_L | CAN_L bus line (dominant low) |
| 3 | CAN_GND | Ground $/ 0 \mathrm{~V} / \mathrm{V}$ - |
| 6 | CAN_GND | Ground $/ 0 \mathrm{~V} / \mathrm{V}$ - |

## Pre-Defined Connection Set

To reduce configuration effort for simple networks, CANopen define a mandatory default identifier allocation scheme. The 11-bit identifier structure in predefined connection is set as follows:

| COB Identifier (CAN Identifier) |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |  |  |  |
| Node Number |  |  |  |  |  |  |  |  |  |  |  |  |  |


| Object | Function Code | Node Number | COB-ID | Object Dictionary Index |
| :---: | :---: | :---: | :---: | :---: |
| Broadcast messages |  |  |  |  |
| NMT | 0000 | - | 0 | - |
| SYNC | 0001 | - | 80H | 1005H, 1006H, 1007H |
| TIME STAMP | 0010 | - | 100 H | 1012H, 1013H |
| Point-to-point messages |  |  |  |  |
| Emergency | 0001 | 1-127 | 81H-FFH | 1014H, 1015H |
| TPDO1 | 0011 | 1-127 | 181H-1FFH | 1800H |
| RPDO1 | 0100 | 1-127 | 201H-27FH | 1400H |
| TPDO2 | 0101 | 1-127 | 281H-2FFH | 1801H |
| RPDO2 | 0110 | 1-127 | 301H-37FH | 1401H |
| TPDO3 | 0111 | 1-127 | 381H-3FFH | 1802H |
| RPDO3 | 1000 | 1-127 | 401H-47FH | 1402H |
| TPDO4 | 1001 | 1-127 | 481H-4FFH | 1803H |
| RPDO4 | 1010 | 1-127 | 501H-57FH | 1403H |
| Default SDO (tx) | 1011 | 1-127 | 581H-5FFH | 1200H |
| Default SDO (rx) | 1100 | 1-127 | 601H-67FH | 1200H |
| NMT Error Control | 1110 | 1-127 | 701H-77FH | 1016H, 1017H |

## CANopen Communication Protocol

It has services as follows:

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

NMT (Network Management Object)
The Network Management (NMT) follows a Master/Slave structure for executing NMT service. Only one NMT master is in a network, and other nodes are regarded as slaves. All CANopen nodes have a present NMT state, and NMT master can control the state of the slave nodes. The state diagram of a node is shown as follows:

(1) After power is applied, it is auto in initialization state
A: NMT
(2) Enter pre-operational state automatically
B: Node Guard
(3) (6) Start remote node
C: SDO
(4) (7) Enter pre-operational state
D: Emergency
(5) (8) Stop remote node
E: PDO
(9) (10) (11) Reset node
(12) (13) (14) Reset communication
F: Boot-up
(15) Enter reset application state automatically
(16) Enter reset communication state automatically

|  | Initializing | Pre-Operational | Operational | Stopped |
| :---: | :---: | :---: | :---: | :---: |
| PDO |  |  | $\circ$ |  |
| SDO |  | $\circ$ | $\circ$ |  |
| SYNC |  | $\circ$ | $\circ$ |  |
| Time Stamp |  | $\circ$ | $\circ$ |  |
| EMCY |  | $\circ$ | $\circ$ |  |
| Boot-up | $\circ$ |  |  |  |
| NMT |  | $\circ$ | $\circ$ | $\circ$ |

NMT Protocol is shown as follows:

| NMT Master Request | Start Remote Node byte 0 byte 1 |  | CS |  |
| :---: | :---: | :---: | :---: | :---: |
|  |  | NMT Slave(s) | Value | Definition |
|  |  | Indication(s) | 1 | Start |
| $\xrightarrow[\text { request }]{ }$ | COB-ID=0 | $\rightarrow$ Indication | 2 | Stop |
|  |  | $\longrightarrow$ Indication |  | Stop |
|  |  | $\rightarrow$ Indication | 128 | Enter Pre-Operational |
|  |  |  | 129 | Reset Node |
|  |  |  | 130 | Reset Communication |

## SDO (Service Data Objects)

SDO is used to access the Object Dictionary in every CANopen node by Client/Server model. One SDO has two COB-ID (request SDO and response SDO) to upload or download data between two nodes. No data limit for SDOs to transfer data. But it needs to transfer by segment when data exceeds 4 bytes with an end signal in the last segment.

The Object Dictionary (OD) is a group of objects in CANopen node. Every node has an OD in the system, and OD contains all parameters describing the device and its network behavior. The access path of OD is the index and sub-index, each object has a unique index in OD, and has sub-index if necessary. The request and response frame structure of SDO communication is shown as follows:

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

N: Bytes not use
E : normal(0)/expedited(1)
S: size indicated

## PDO (Process Data Object)

PDO communication can be described by the producer/consumer model. Each node of the network will listen to the messages of the transmission node and distinguish if the message has to be processed or not after receiving the message. PDO can be transmitted from one device to one another device or to many other devices. Every PDO has two PDO services: a TxPDO and a RxPDO. PDOs are transmitted in a non-confirmed mode.

PDO Transmission type is defined in the PDO communication parameter index (1400h for the 1st RxPDO or 1800h for the 1st TxPDO), and all transmission types are listed in the following table:

| Type Number | PDO |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Cyclic | Acyclic | Synchronous | Asynchronous | RTR only |  |  |
| 0 |  | $\circ$ | $\circ$ |  |  |  |  |
| $1-240$ | $\circ$ |  | $\circ$ |  |  |  |  |
| $241-251$ |  |  |  |  |  |  | Reserved |
| 252 |  |  | $\circ$ |  | $\circ$ |  |  |
| 253 |  |  |  | $\circ$ | $\circ$ |  |  |
| 254 |  |  |  | $\circ$ |  |  |  |
| 255 |  |  |  | $\circ$ |  |  |  |

Type number 1-240 indicates the number of SYNC message between two PDO transmissions.
Type number 252 indicates the data is updated (but not sent) immediately after receiving SYNC.
Type number 253 indicates the data is updated immediately after receiving RTR.
Type number 254: Delta CANopen doesn't support this transmission format.
Type number 255 indicates the data is asynchronous transmission.

All PDO transmission data must be mapped to index via Object Dictionary. Example:




PDO1 data value Data 0, Data 1, Data 2, Data 3, Data 4, Data 5, Data 6, Data 7, 0xF3, 0x00,

|  | Index | Sub | Definition | Value | R/W | Size |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | V |  |  |  |  |
| PDO1 Map | 0x1A00 | Q | 0. Number | 1 | R/W | U8 |
|  | 0x1A00 | 1 | 1. Mapped Object | 0x60410010 | R/W | U32 |
|  | 0x1A00 | 2 | 2. Mapped Object | 0 | P/W | U32 |
|  | 0x1A00 | 3 | 3. Mapped Object | 0 | R/M | U32 |
|  | 0x1A00 | 4 | 4. Mapped Object | 0 | R/W | U32 |
|  |  |  |  |  |  | - |
|  | $0 \times 6041$ | 0 | Status Word | - 0xF3 | R/W | U16 |

## EMCY (Emergency Object)

Emergency objects are triggered when hardware failure occurs for a warning interrupt. The data format of a emergency object is a 8 bytes data as shown in the following:

| Byte | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Content | Emergency Error Code | Error register <br> (Object 1001H) | Manufacturer specific Error Field |  |  |  |  |  |

Please refer to Chapter 5 CANopen error codes for emergency definition of CP2000.

Example:

| NO | Cris | [日月18] | 14ig | [00] | [0] | 1 V 2 | [08] | 108 | (0) | Ds | $02 \mid$ | Tris | Lownyrim | * |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | [15 | II | 1 | 81 | DI |  |  |  |  |  |  | 998. 1.50088111 | (1)S] |  |
| 2 | 081 | 0 | 8 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 9.9633469867147 | EMG node 1 |  |
| 3 | 701 | 0 | 1 | 00 |  |  |  |  |  |  |  | 95633470027134 | NMT Eirnode 1 |  |
| 4 | 601 | 0 | 8 | 28 | 40 | 60 | 00 | TE | 00 | 00 | 00 | 9263445h552765 | 500 RX MaMasten ) mode $1^{\text {a }}$ |  |
| 5 | 581 | 0 | 8 | 60 | 40 | 60 | 00 | 00 | 00 | 0 O | 01 | $95538457 / 84884$ | SDO Teqsiavel\|rode 1 |  |
| 6 | 601 | 0 | 8 | IB | 40 | 60 | 0 | \% | 00 | 00 | 01 | 43641854704500 |  |  |
| 7 | 501 | 0 | 8 | 60 | 40 | 60 | 0 | 00 | 00 | 00 | 00 | 98541655252416 | 500 TXSlavel Lnode] |  |
| 8 | 601 | 0 | 8 | 40 | 41 | 62 | 00 | 00 | 00 | 00 | 00 | 9364490425033 | 300 Fovimactel ) noce I |  |
| 9 | 501 | 0 | 8 | 68 | 41 | 60 | 00 | 37 | 05 | 00 | On | 97644909145739 | 500 İgistaver mode 1 |  |
| 10 | 0000 | 0 | 0 |  |  |  |  |  |  |  |  | 93645699436227 | STMC |  |
| 11 | 201 | 11 | 2 | 11 | 22 |  |  |  |  |  |  | \$5645160329635 | POO F5-MMastell 1 node 1 |  |

Master send NM message to slave 1 for RESET request.
Slave 1 responds no error
Slave 1 responds a boot up message
Master enter Index6040 = 7EH in slave 1
Slave 1 responds OK
Master enter Index6040=7FH in slave 1
Slave 1 responds OK
Master enter value for Index6041 to slave 1
Slave 1 responds 0640H
Master enter SYNC
Master enter PD01=2211H to slave 1

### 16.2 CANopen Wiring

An external adapter card: EMC-COP01 is used for CANopen wiring; establish CANopen to VFD CP2000 connection. The link is enabled by using RJ45 cable. The two farthest ends must be terminated with $120 \Omega$ terminating resistors.


### 16.3 How to Control by CANopen

### 16.3.1 CANopen Control Mode

There are two control modes for CANopen; Pr. 09.40 set to 1 is the factory setting mode DS402 standard and Pr.09.40 set to 0 is Delta's standard setting mode.

### 16.3.2 DS402 Standard Mode

To control the AC motor drive by CANopen, please set the parameters by the following steps:

1. Wiring for hardware (refer to Chapter 2 Wiring for CANopen)
2. Operation source setting: set Pr. 00.21 to 3 (CANopen communication. Keypad STOP/RESET disabled.)
3. Frequency source setting: set Pr. 02.00 to 6 (CANopen communication)
4. 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))
6. 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.)
7. Switch to CP2000 operation mode via the NMT string; control word $0 \times 6040$ (bit 0 , bit 1, bit 2, bit 3 and bit 7) and status word $0 \times 6041$.

For example:

1. If the multi-function input terminal MI set Quick Stop to disable, enable the responsive terminal of such MI terminal.
2. Set index 6040 H to 7 EH .
3. Set index 6040 H to 7 FH , the drive is now in operation mode.
4. Set index 6042 H to $1500(\mathrm{rpm})$, the default setting for pole is $4(50 \mathrm{~Hz})$. Set the pole in Pr. 05.04 (Motor1) and Pr. 05.16 (Motor 2).

Calculation for motor speed: $n=f \times \frac{120}{p}$
where $\mathrm{n}=$ ramp per minute (rpm);

$$
\begin{aligned}
& \mathrm{P}=\text { poles } \\
& \mathrm{f}=\text { frequency }(\mathrm{Hz})
\end{aligned}
$$

Example 1: set motor running in forward direction, $f=30 \mathrm{~Hz}, \mathrm{P}=4$.

$$
(120 * 30) / 4=900 \mathrm{rpm}
$$

Example 2: set motor running in reverse direction, $\mathrm{f}=20 \mathrm{~Hz}, \mathrm{P}=6$.
$(120 * 15) / 6=300 \mathrm{rpm} ; 300 \mathrm{rpm}=0 \times 012 \mathrm{C}$
Also,
Bit15 defines the positive and negative sign.

$$
\text { i.e. Index } 6042=-300=\left(300^{\prime}+1\right)=012 C^{\prime}+1=\text { FED3H }+1=\text { FED4H }
$$

Switching mode:

< Status Switching Graph>
8. The operation of AC motor drive in DS402 standard is controlled by the Control Word 0x6040 (bit4~bit6), as shown in the following chart:

| bit 6 | bit 5 | bit 4 | Outcome |
| :---: | :---: | :---: | :---: |
| ramp function reference | ramp function disable | ramp function enable |  |
| 0 | 0 | 0 | STOP |
| 1 | 0 | 0 | STOP |
| 0 | 1 | 0 | STOP |
| 1 | 1 | 0 | STOP |
| 0 | 0 | 1 | STOP |
| 1 | 0 | 1 | LOCK |
| 0 | 1 | 1 | (at present frequency) |
| 1 | 1 | 1 | STOP |

9. Follow the same steps, refer to status switching process for status word $0 \times 6041$ (bit 0 to bit 6 ), bit $7=$ warn, bit $9=1$ (permanently), bit 10= target frequency reached, bit 11= output exceeds maximum frequency.

### 16.3.3 Delta Standard Mode

1. Wiring (refer to Chapter 2 Wiring for CANopen).
2. Operating source setting: set Pr.00.21 to 3 (Select CANopen communication mode)
3. Frequency source setting: set Pr. 00.20 to 6
4. CANopen station setting: set Pr.09.36 (CANopen communication address 1-127; 0 is to disable CANopen station setting)
5. CANopen baud rate setting: set Pr. 09.37 (Baud rate options: $1 \mathrm{M}(0), 500 \mathrm{~K}(1), 250 \mathrm{~K}(2), 125 \mathrm{~K}(3)$, 100K(4) and 50K(5)
6. CANopen decode method setting: set Pr.09.40 to 0 .
7. 20XX address (old): in index 2020.01 enter 0002H for motor run; 0001H for motor stop. In index 2020.02 enter 1000, frequency will be 10.00 Hz . Refer to Index 2020 and 2021 for more detail.

### 16.4 CANopen Supporting Index

Basic Index Support by CP2000:

| Index | Sub | Definition | Factory Setting | R/W | Size | Note |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1000H | 0 | Device type | 00010192H | R | U32 |  |
| 1001H | 0 | Error register | 0 | R | U8 |  |
| 1005H | 0 | COB-ID SYNC message | 80H | R | U32 |  |
| 1006H | 0 | Communication cycle period | 0 | RW | U32 | Unit: us <br> The setting value should be in a multiple of 500us (integer) within the range 500 us to 16 ms |
| 1008H | 0 | Manufacturer device name | 0 | R | U32 |  |
| 1009H | 0 | Manufacturer hardware version | 0 | R | U32 |  |
| 100AH | 0 | Manufacturer software version | 0 | R | U32 |  |
| 100 CH | 0 | Guarding time | 0 | RW | U16 | Unit: ms |
| 100DH | 0 | Guarding factor | 0 | RW | U8 |  |
| 1010H | 0 | Store Parameter | 2 | R | U8 |  |
|  | 1 | Save all parameters | 0 | RW | U32 |  |
|  | 2 | Save communication parameter | 1 | RW | U32 |  |
| 1011H | 0 | Restore Parameter | 2 | R | U8 |  |
|  | 1 | Restore all parameters | 0 | RW | U32 |  |
|  | 2 | Restore communication parameter | 1 | RW | U32 |  |
| 1014H | 0 | COB-ID emergency | $0000080 \mathrm{H}+\text { Node-I }$ | R | U32 |  |
| 1015H | 0 | Inhibit time EMCY | 0 | RW | U16 | Unit:100us <br> The setting value should be in a multiple of 10 (integer) |
| 1016H | 0 | Consumer heartbeat time | 1 | R | U8 |  |
|  | 1 | Consumer 1 | 0 | RW | U32 | Unit: 1ms <br> Disable Guarding time to function properly |
| 1017H | 0 | Producer heartbeat time | 0 | RW | U16 | Unit: 1ms <br> Disable Guarding time to function properly |
| 1018H | 0 | Number | 0 | R | U8 |  |
|  | 1 | Vender ID | 000001DDH | R | U32 |  |
|  | 2 | Product code | $\begin{array}{r} \text { 2A00+machine } \\ \text { code } \end{array}$ | R | U32 |  |
|  | 3 | Revision | 00010000H | R | U32 |  |
| 1200H | 0 | Server SDO Parameter | 2 | R | U8 |  |
|  | 1 | COB-ID Client -> Server | $0000600 \mathrm{H}+\text { Node-I }$ | R | U32 |  |
|  | 2 | COB-ID Client <- Server | 0000580H+Node-I | R | U32 |  |
| 1400H | 0 | Number | 2 | R | U8 |  |


| Index | Sub | Definition | Factory Setting | R/W | Size | Note |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 1 | COB-ID used by PDO | 00000200H+Node- | RW | U32 |  |
|  | 2 | Transmission Type | 5 | RW | U8 | 00:Acyclic\& Synchronous |
|  |  |  |  |  |  | 01~240:Cyclic \& Synchronous |
|  |  |  |  |  |  | 255:Asynchronous |
| 1401H | 0 | Number | 2 | R | U8 |  |
|  | 1 | COB-ID used by PDO | 80000300H+NodeID | RW | U32 |  |
|  | 2 | Transmission Type | 5 | RW | U8 | 00: Acyclic \& Synchronous |
|  |  |  |  |  |  | 01~240:Cyclic \& Synchronous |
|  |  |  |  |  |  | 255:Asynchronous |
| 1402H | 0 | Number | 2 | R | U8 |  |
|  | 1 | COB-ID used by PDO | 80000400H+NodeID | RW | U32 |  |
|  | 2 | Transmission Type | 5 | RW | U8 | 00: Acyclic \& Synchronous |
|  |  |  |  |  |  | 01~240:Cyclic \& Synchronous |
|  |  |  |  |  |  | 255:Asynchronous |
| 1403H | 0 | Number | 2 | R | U8 |  |
|  | 1 | COB-ID used by PDO | $80000500 \mathrm{H}+$ NodeID | RW | U32 |  |
|  | 2 | Transmission Type | 5 H | RW | U8 | 00: Acyclic \& Synchronous |
|  |  |  |  |  |  | 01~240:Cyclic \& Synchronous |
|  |  |  |  |  |  | 255:Asynchronous |
| 1600H | 0 | Number | 2 | RW | U8 |  |
|  | 1 | 1.Mapped Object | 60400010H | RW | U32 |  |
|  | 2 | 2.Mapped Object | 60420010H | RW | U32 |  |
|  | 3 | 3.Mapped Object | 0 | RW | U32 |  |
|  | 4 | 4.Mapped Object | 0 | RW | U32 |  |
| 1601H | 0 | Number | 3 | RW | U8 |  |
|  | 1 | 1.Mapped Object | 20264110H | RW | U32 |  |
|  | 2 | 2.Mapped Object | 2026A110H | RW | U32 |  |
|  | 3 | 3.Mapped Object | 2026A210H | RW | U32 |  |
|  | 4 | 4.Mapped Object | 0 | RW | U32 |  |
| 1602H | 0 | Number | 3 | RW | U8 |  |
|  | 1 | 1.Mapped Object | 60400010H | RW | U32 |  |
|  | 2 | 2.Mapped Object | 607A0020H | RW | U32 |  |
|  | 3 | 3.Mapped Object | 60600008H | RW | U32 |  |
|  | 4 | 4.Mapped Object | 0 | RW | U32 |  |
| 1603H | 0 | Number | 3 | RW | U8 |  |
|  | 1 | 1.Mapped Object | 60400010H | RW | U32 |  |
|  | 2 | 2.Mapped Object | 60710010H | RW | U32 |  |
|  | 3 | 3.Mapped Object | 60600008 H | RW | U32 |  |
|  | 4 | 4.Mapped Object | 0 | RW | U32 |  |


| Index | Sub | Definition | Factory Setting | R/W | Size | Note |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1800H | 0 | Number | 5 | R | U8 |  |
|  | 1 | COB-ID used by PDO | 00000180H+Node- | RW | U32 |  |
|  | 2 | Transmission Type | 5 | RW | U8 | 00: Acyclic \& Synchronous |
|  |  |  |  |  |  | 01~240:Cyclic \& Synchronous |
|  |  |  |  |  |  | 255:Asynchronous |
|  | 3 | Inhibit time | 0 | RW | U16 | Unit: 100us <br> The setting value should be in a multiple of 10 (integer) |
|  | 4 | CMS-Priority Group | 3 | RW | U8 |  |
|  | 5 | Event timer | 0 | RW | U16 | Unit: 1ms |
| 1801H | 0 | Number | 5 | R | U8 |  |
|  | 1 | COB-ID used by PDO | 80000280H+NodeID | RW | U32 |  |
|  | 2 | Transmission Type | 5 | RW | U8 | 00: Acyclic \& Synchronous |
|  |  |  |  |  |  | 01~240:Cyclic \& Synchronous |
|  |  |  |  |  |  | 255:Asynchronous |
|  | 3 | Inhibit time | 0 | RW | U16 | Unit: 100us <br> The setting value should be in a multiple of 10 (integer) |
|  | 4 | CMS-Priority Group | 3 | RW | U8 |  |
|  | 5 | Event timer | 0 | RW | U16 | Unit: 1ms |
| 1802H | 0 | Number | 5 | R | U8 |  |
|  | 1 | COB-ID used by PDO | 80000380H+Node- | RW | U32 |  |
|  | 2 | Transmission Type | 5 | RW | U8 | 00: Acyclic \& Synchronous |
|  |  |  |  |  |  | 01~240:Cyclic \& Synchronous |
|  |  |  |  |  |  | 255:Asynchronous |
|  | 3 | Inhibit time | 0 | RW | U16 | Unit: 100us <br> The setting value should be in a multiple of 10 (integer) |
|  | 4 | CMS-Priority Group | 3 | RW | U8 |  |
|  | 5 | Event timer | 0 | RW | U16 | Unit: 1ms |
| 1803H | 0 | Number | 5 | R | U8 |  |
|  | 1 | COB-ID used by PDO | 80000480H+NodeID | RW | U32 |  |
|  | 2 | Transmission Type | 5 | RW | U8 | 00: Acyclic \& Synchronous |
|  |  |  |  |  |  | 01~240:Cyclic \& Synchronous |
|  |  |  |  |  |  | 255:Asynchronous |
|  | 3 | Inhibit time | 0 | RW | U16 | Unit: 100us <br> The setting value should be in a multiple of 10 (integer) |
|  | 4 | CMS-Priority Group | 3 | RW | U8 |  |
|  | 5 | Event timer | 0 | RW | U16 | Unit: 1ms |
| 1A00H | 0 | Number | 2 | RW | U8 |  |
|  | 1 | 1.Mapped Object | 60410010H | RW | U32 |  |
|  | 2 | 2.Mapped Object | 60430010H | RW | U32 |  |


| Index | Sub | Definition | Factory Setting | R/W | Size | Note |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 3 | 3.Mapped Object | 0 | RW | U32 |  |
|  | 4 | 4.Mapped Object | 0 | RW | U32 |  |
| 1A01H | 0 | Number | 4 | RW | U8 |  |
|  | 1 | 1.Mapped Object | 20260110H | RW | U32 |  |
|  | 2 | 2.Mapped Object | 20266110H | RW | U32 |  |
|  | 3 | 3.Mapped Object | 20266210H | RW | U32 |  |
|  | 4 | 4.Mapped Object | 20266310H | RW | U32 |  |
| 1A02H | 0 | Number | 3 | RW | U8 |  |
|  | 1 | 1.Mapped Object | 60410010H | RW | U32 |  |
|  | 2 | 2.Mapped Object | 60640020H | RW | U32 |  |
|  | 3 | 3.Mapped Object | 60610008 H | RW | U32 |  |
|  | 4 | 4.Mapped Object | 0 | RW | U32 |  |
| 1A03H | 0 | Number | 3 | RW | U8 |  |
|  | 1 | 1.Mapped Object | 60410010H | RW | U32 |  |
|  | 2 | 2.Mapped Object | 60770010H | RW | U32 |  |
|  | 3 | 3.Mapped Object | 60610008 H | RW | U32 |  |
|  | 4 | 4.Mapped Object | 0 | RW | U32 |  |

CP2000 Index:
Parameter index corresponds to each other as following:

## Index

$2000 \mathrm{H}+$ Group

## sub-Index

member+1

For example:
Pr.10.15 (Encoder Slip Error Treatment)

Group

$$
10(0 \bar{A} \mathrm{H}) \quad-\quad 15(0 \mathrm{FH})
$$

Index $=2000 \mathrm{H}+0 \mathrm{AH}=200 \mathrm{~A}$
Sub Index $=0 \mathrm{FH}+1 \mathrm{H}=10 \mathrm{H}$

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 |




Delta Standard Mode (New definition):

| Index | subR | R/W | bit | Bit | Bit name | Limit |  | Speed | Torque mode |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 2060h00h R |  |  |  |  |  |  |  |  |  |
|  | 01h | RW | 0 | 0 | CMD_ACT | 4 | fcmd $=0$ |  | Tcmd $=0$ |
|  |  |  |  | Pulse 0 |  |  |  |  |  |
|  |  |  |  | 1 |  |  | $\mathrm{fcmd}=\mathrm{Fset}($ Fpid $)$ |  | Tcmd = Tset |
|  |  |  |  | Pulse 1 |  |  |  |  |  |
|  |  |  | 1 |  | EXT_CMD | 4 | Pulse 00 | None |  |
|  |  |  |  |  |  |  | Pulse 01 | Forward running |  |
|  |  |  | 2 |  |  |  | Pulse 10 | Reverse running |  |
|  |  |  |  |  |  |  | Pulse 11 | Change current running direction |  |
|  |  |  | 3 | 0 | HALT | 3 | Running till target speed is reached |  | Free (running till target torque is reached) |
|  |  |  |  | 1 |  |  | Temporary stop according to deceleration setting |  | Lock (torque stop at present speed) |
|  |  |  | 4 | 0 | LOCK | 4 | Running reached | target speed is |  |



| Index | subP | R/W | bit | Bit | Bit name | Limit | Speed | Torque mode |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 03h | R |  |  | - |  |  |  |
|  | 04h | R | - |  | Pos Cmd |  | - | - |
|  | 05h | R |  |  |  |  | Actual position (Absolute) | Actual position (Absolute) |
|  | 06h | R |  |  | Torq Cmd |  |  |  |
|  | 07h | R |  |  |  |  | Actual torque | Actual torque |

DS402 Standard

| Index | $\begin{gathered} \text { Su } \\ \text { b } \end{gathered}$ | Definition | Factory <br> Setting | R/W | Size | $\begin{gathered} \text { Uni } \\ \mathrm{t} \end{gathered}$ | $\begin{array}{\|c} \hline \text { PD } \\ \mathrm{O} \\ \mathrm{Map} \end{array}$ | Mod e | 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: 100 ms , 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 <br> 6 slow down on quick stop ramp and stay in QUICK STOP |
| 605Ch | 0 | Disable operation option code | 1 | RW | S16 |  | No |  | 0 : Disable drive function 1: Slow down with slow down ramp; disable of the drive function |
| 6060h | 0 | Mode of operation | 2 | RW | S8 |  | Yes |  | 1: Profile Position Mode <br> 2: Velocity Mode <br> 4: Torque Profile Mode <br> 6: Homing Mode |
| 6061h | 0 | Mode of operation display | 2 | RO | S8 |  | Yes |  | Same as above |
| 6064h | 0 | pp Position actual value | 0 | RO | S32 |  | Yes | pp |  |
| 6071h | 0 | tq Target torque | 0 | RW | S16 | $\begin{gathered} 0.1 \\ \% \end{gathered}$ | 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 | $\begin{gathered} 0.1 \\ \% \end{gathered}$ | Yes | tq |  |
| 6078h | 0 | tq current actual value | 0 | RO | S16 | $\begin{gathered} 0.1 \\ \% \end{gathered}$ | Yes | tq |  |
| 6079h |  | tq DC link circuit voltage | 0 | RO | U32 | mV | Yes | tq |  |


| Index | Su <br> b | Definition | Factory <br> Setting | R/W | Size | Uni <br> $t$ | PD <br> O <br> Map | Mod | Note |
| :--- | :---: | :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 607Ah | 0 | pp Target position | 0 | $R W$ | S32 | 1 | Yes | pp |  |

### 16.5 CANopen Fault Code

| Display | Fault code | Description | CANopen fault code | CANopen fault register (bit 0~7) |
| :---: | :---: | :---: | :---: | :---: |
| ocd Oc at decel | 000AH | Over-current during deceleration | 2310 H | 1 |
| Fault <br> ocn <br> Oc at normal SPD | 000BH | Over-current during steady status operation | 2310 H | 1 |
| Fault <br> GFF <br> Ground fault | 000CH | Ground fault. When (one of) the output terminal(s) is grounded, short circuit current is more than $50 \%$ of AC motor drive rated current. <br> NOTE: The short circuit protection is provided for AC motor drive Protection, not for protection of the user. | 2240H | 1 |
| Fault <br> OCC <br> Short Circuit | 000DH | Short-circuit is detected between upper bridge and lower bridge of the IGBT module. | 2240H | 1 |
| $\qquad$ | O00EH | Over-current at stop. Hardware failure in current detection | 2310H | 1 |
| ovA <br> Ov at accel | 000FH | Over-current during acceleration. <br> Hardware failure in current detection | 3210 H | 2 |
| Fault <br> ovn <br> Ov at normal SPD | 0010H | Over-current during steady speed. Hardware failure in current detection. 230V: 450Vdc; 460V: 900Vdc | 3210 H | 2 |
|  | 0011H | Over-voltage at stop. Hardware failure in current detection | 3210 H | 2 |
| Fault <br> LvA <br> Lv at accel | 0012H | DC BUS voltage is less than Pr. 06.00 during acceleration. | 3220 H | 2 |







| HAND <br> Fault <br> CHbE <br> Heartbeat T-out | 0041H | Heartbeat time-out | 8130H | 4 |
| :---: | :---: | :---: | :---: | :---: |
| HAND <br> Fault <br> CSyE <br> SYNC T-out | 0042H | CAN synchrony error | 8700H | 4 |
| HAND <br> Fault <br> CbFE <br> CAN/S bus off | 0043H | CAN bus off | 8140H | 4 |
| HAND <br> Fault <br> CIdE <br> CAN/S Idx exceed | 0044H | Can index exceed | 8110H | 4 |
| Fault <br> CAdE <br> CAN/S add. set | 0045H | CAN address error | $0 \times 8100$ | 4 |
| HAND <br> Fault <br> CFdE <br> CAN/S FRAM fail | 0046H | CAN frame fail | $0 \times 8100$ | 4 |

### 16.6 CANopen LED Function

There are two CANopen flash signs: RUN and ERR.
RUN LED:

| LED status | Condition | CANopen State |
| :---: | :---: | :---: |
| OFF |  | Initial |
| Blinking | $\mathrm{ON}-\underset{\mathrm{OFF}}{\stackrel{200}{200}+\stackrel{200}{\mathrm{~ms}}+\square \square \square \square \square} \square \square \square$ | Pre-Operation |
| Single flash |  | Stopped |
| ON |  | Operation |

ERR LED:

| LED status | Condition/ State |
| :---: | :---: |
| OFF | No Error |
| Single <br> flash | One Message fail |
| Double <br> flash | Guarding fail or heartbeat fail |
| Triple flash | SYNC fail |
| ON | Bus off |

# Chapter 17 PLC Function 

17.1 PLC Overview
17.2 Start-up
17.3 PLC Ladder Diagram
17.4 PLC Devices
17.5 Commands
17.6 Error Code and Troubleshoot
17.7 CANopen Master Application

### 17.1 PLC Overview

### 17.1.1 Introduction

The built in PLC function in CP2000 allows following commands: WPLSoft, basic commands and application commands; the operation methods are the same as Delta DVPPLC series. Other than that, CANopen master provides 8 station synchronous control and 126 asynchronous controls.
$\square$,
In CP2000, CANopen master synchronous control complies with DS402 standard and supports control mode as return to origin point, speed, torque and point to point control; CANopen slave supports two control modes, speed and torque.

### 17.1.2 Ladder Diagram Editor - WPLSoft

WPLSoft is a program editor of Delta DVP-PLC series and CP2000 series for WINDOWS. Besides general PLC program planning and general WINDOWS editing functions, such as cut, paste, copy, multi-windows, WPLSoft also provides various Chinese/English comment editing and other special functions (e.g. register editing, settings, the data readout, the file saving, and contacts monitor and set, etc.).
Following is the system requirement for WPLSoft:

| Item | System Requirement |
| :--- | :--- |
| Operation System | Windows 95/98/2000/NT/ME/XP |
| CPU | Pentium 90 and above |
| Memory | 16MB and above (32MB and above is recommended) |
| Hard Disk | Capacity: 50 MB and above <br> CD-ROM (for installing WPLSoft) |
| Monitor | Resolution: 640×480, 16 colors and above, <br> It is recommended to set display setting of Windows to <br> 800 $\times 600$. |
| Mouse | General mouse or the device compatible with Windows |
| Printer | Printer with Windows driver |
| RS-232 port | At least one of COM1 to COM8 can be connected to <br> PLC |
| Applicable Models | All Delta DVP-PLC series and CP2000 series |

### 17.2 Start-up

### 17.2.1 The Steps for PLC Execution

Please operate PLC follows the five steps.

1. Press menu key on KPC-CCO1 $\rightarrow$ select 3: PLC $\rightarrow$ ENTER. (See the figure below)


## $\Rightarrow$ NOTE

Operate the KPC-CE01 (the optional digital keypad) by following steps (switch PLC mode to PLC2 for program download/upload):
A. Go to "PLC0" page by pressing the MODE key
B. Change to "PLC2" by pressing the "UP" key and then press the "ENTER" key after confirmation
C. If succeeded, "END" is displayed and back to "PLC2" after one or two seconds.

The PLC warning that is displayed before the program is downloaded to CP2000 can be ignored, please continue the operation.

## PCO

Disable

## PLE:

Run PLC

## P! P

PLC Stop
2. Connection: Please connect the RJ-45 of AC motor drive to computer via RS485-to-RS232 converter.

3. Run the program.

```
PLC
* 1.Disable
    2.PLC Run
    3.PLC Stop
```

- PLC function, select function 2 (PLC Run).

1: Disable (PLCO)
2: PLC Run (PLC1)
3: PLC Stop (PLC2)
Optional accessories: Digital keypad KPC-CE01, display PLC function as shown in the ().
When external input terminals (MI1~MI8) are set to PLC Mode select bit0 (51) or PLC Mode select bit1 (52), it will force to switch to PLC mode regardless the terminal is ON or OFF.

Meanwhile, switching via keypad is disabled. Please refer to the chart below:

| PLC Mode | PLC Mode select bit1(52) | PLC Mode select bit0 (51) |
| :---: | :---: | :---: |
| Disable (PLC 0) | OFF | OFF |
| PLC Run (PLC 1) | OFF | ON |
| PLC Stop (PLC 2) | ON | OFF |
| Previous state | ON | ON |

When KPC-CE01 execute PLC function:

1. When switching the page from PLC to PLC1, it will execute PLC. The motion of PLC (Execute/Stop) is controlled by WPL editor.
2. When switching the page from PLC to PLC2, it will stop PLC. Again the motion of PLC (Execute/Stop) is controlled by WPL editor.
3. The control of external terminals follows the same method.

## NOTE

When input/output terminals (FWD REV MI1~MI8 MI10~15, Relay1, Relay2 RY10~RY15, MO1~MO2 MO10~MO11,) are used in PLC program, they cannot be used in other places. Fro example, when PLC program (PLC1 or PLC2) is activated, such as when it controls Y0, the corresponding output terminals Relay (RA/RB/RC) will be used. At this moment, Pr. 03.00 setting will be invalid since the terminal has been used by PLC. Refer to Pr.02-52, 02-53, 03-30 to check which DI DO AO are occupied by PLC.

### 17.2.2 I/O Device Reference Table

## Input device:

| Device | X0 | X 1 | X 2 | X 3 | X 4 | X 5 | X 6 | X 7 | X 10 | X 11 | X 12 | X 13 | X 14 | X 15 | X 16 | X 17 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathbf{1}$ | FWD | REV | MI1 | MI2 | MI3 | MI4 | MI5 | $\mathrm{MI6}$ | $\mathrm{MI7}$ | $\mathrm{MI8}$ |  |  |  |  |  |  |
| $\mathbf{2}$ |  |  |  |  |  |  |  |  |  |  | MI 10 | MI 11 | MI 12 | MI 13 | MI 14 | MI 15 |
| $\mathbf{3}$ |  |  |  |  |  |  |  |  |  |  | MI 10 | MI 11 | MI 12 | MI 13 |  |  |

1: I/O extension card
2: I/O extension card EMC-D611A (D1022=4)
3: I/O extension card EMC-D42A (D1022=5)
Output device:

| Device | YO | Y1 | Y2 | Y3 | Y4 | Y5 | Y6 | Y7 | Y10 | Y11 | Y12 | Y13 | Y14 | Y15 | Y16 | Y17 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | RY | RY2 |  | MO1 | MO2 |  |  |  |  |  |  |  |  |  |  |  |
| 2 |  |  |  |  |  | MO10 | MO11 |  |  |  |  |  |  |  |  |  |
| 3 |  |  |  |  |  | RY10 | RY11 | RY12 | RY13 | RY14 | RY15 |  |  |  |  |  |

1: I/O extension card
2: I/O extension card EMC-D42A (D1022=5)
3: I/O extension card EMC-R6AA (D1022=6)

### 17.2.3 WPLSoft Installation

Download PLC program toCP2000: Refer to D. 3 to D. 7 for program coding and download the editor (WPLSoft V2.09) at DELTA website http://www.delta.com.tw/industrialautomation/


### 17.2.4 Program Input



### 17.2.5 Program Download

Please download the program by following steps:
Step 1. Press 领 button for compiler after inputting program in WPLSoft.
Step 2. After compiler is finished, choose the item "Write to PLC" in the communication items.
After finishing Step 2, the program will be downloaded from WPLSoft to the AC motor drive by the communication format.

### 17.2.6 Program Monitor

If you execute "start monitor" in the communication item during executing PLC, the ladder diagram will be shown as follows.


### 17.2.7 Restriction of PLC

1. The protocol of PLC is $7, \mathrm{~N}, 2,9600$, station number 2
2. Make sure that the AC drive is in stop status.
3. Stop the PLC before upload/download the program.
4. When using WPR command, do not change the value over $10^{9}$ times or serious error would result.
5. Set Pr. 00.04 to 28 to display the value in PLC register D1043, as shown in the figure follows:

| Digital Keypad KPC-CC01 can display 0~65535 | Digital keypad KPC-CE01 can display 0~9999 $[9990$ <br> When exceed 9999: <br> [1 0000 |
| :---: | :---: |

6. When PLC is Stop, communication RS-485 is occupied by PLC.
7. When PLC is in Run and Stop mode, PrO0.02 can not be set to 9 or 10, which means can not return to factory setting.
8. Set Pr. 00.02 to 6 , return to factory setting of PLC.

### 17.3 Ladder Diagram

### 17.3.1 Program Scan Chart of the PLC Ladder Diagram

Calculate the result by ladder diagram algorithm (it doesn't sent to the outer output point but the inner equipment will output immediately.)


Repeats the execution in cycle.

### 17.3.2 Ladder Diagram

Ladder diagram is a diagram language that applied on the automatic control and it is also a diagram that made up of the symbols of electric control circuit. PLC procedures are finished after ladder diagram editor edits the ladder diagram. It is easy to understand the control flow that indicated with diagram and also accept by technical staff of electric control circuit. Many basic symbols and motions of ladder diagram are the same as mechanical and electrical equipments of traditional automatic power panel, such as button, switch, relay, timer, counter and etc.
The kinds and amounts of PLC internal equipment will be different with brands. Although internal equipment has the name of traditional electric control circuit, such as relay, coil and contact. It doesn't have the real components in it. In PLC, it just has a basic unit of internal memory. If this bit is 1 , it means the coil is ON and if this bit is 0 , it means the coil is OFF. You should read the corresponding value of that bit when using contact (Normally Open, NO or contact a). Otherwise, you should read the opposite sate of corresponding value of that bit when using contact (Normally Closed, NC or contact b). Many relays will need many bits, such as 8 -bits makes up a byte. 2 bytes can make up a word. 2 words make up double word. When using many relays to do calculation, such as add/subtraction or shift, you could use byte, word or double word. Furthermore, the two equipments, timer and counter, in PLC not only have coil but also value of counting time and times.
In conclusion, each internal storage unit occupies fixed storage unit. When using these equipments, the corresponding content will be read by bit, byte or word.
Brief introduction to the internal devices of PLC:

| Internal Device | Function |
| :---: | :--- |
| Input Relay | Input relay is the basic storage unit of internal memory that corresponds to <br> external input point (it is the terminal that used to connect to external input switch <br> and receive external input signal). Input signal from external will decide it to |


|  | display 0 or 1 . You couldn't change the state of input relay by program design or forced ON/OFF via WPLSoft. The contacts (contact $a, b$ ) can be used unlimitedly. If there is no input signal, the corresponding input relay could be empty and can't be used with other functions. <br> - Equipment indication method: $\mathrm{X} 0, \mathrm{X} 1 \ldots \mathrm{X} 7, \mathrm{X} 10, \mathrm{X} 11 \ldots$ The symbol of equipment is $X$ and numbering in octal. |
| :---: | :---: |
| Output Relay | Output relay is the basic storage unit of internal memory that corresponds to external output point (it is used to connect to external load). It can be driven by input relay contact, the contact of other internal equipment and itself contact. uses a normally open contact to connect to external load and other contacts can be used unlimitedly as input contacts. It doesn't have the corresponding output relay, if need, it can be used as internal relay. <br> $\square$ Equipment indication: Y0, Y1...Y7, Y10, Y11... The symbol of equipment is Y and numbering in octal. |
| Internal Relay | The internal relay doesn't connect directly to outside. It is an auxiliary relay in PLC. Its function is the same as the auxiliary relay in electric control circuit. Each auxiliary relay has the corresponding basic unit. It can be driven by the contact of input relay, output relay or other internal equipment. Its contacts can be used unlimitedly. Internal auxiliary relay can't output directly, it should output with output point. <br> ■ Equipment indication: M0, M1...M799. The symbol of equipment is M and numbering in decimal system. |
| Counter | Counter is used to count. It needs to set counter before using counter (i.e. the pulse of counter). There are coil, contacts and storage unit of counter in counter. When coil is from OFF to ON, that means input a pulse in counter and the counter should add 1. There are 16-bit, 32-bit and high-speed counter for user to use. <br> ■ Equipment indication: C0, C1... C79. The symbol of equipment is C and numbering in decimal system. |
| Timer | Timer is used to control time. There are coil, contact and timer storage. When coil is ON , its contact will act (contact a is close, contact b is open) when attaining desired time. The time value of timer is set by settings and each timer has its regular period. User sets the timer value and each timer has its timing period. Once the coil is OFF, the contact won't act (contact $a$ is open and contact $b$ is close) and the timer will be set to zero. <br> - Equipment indication: T0, T1...T159. The symbol of equipment is T and numbering in decimal system. The different number range corresponds with the different timing period. |
| Data register | PLC needs to handle data and operation when controlling each order, timer value and counter value. The data register is used to store data or parameters. It stores 16 -bit binary number, i.e. a word, in each register. It uses two continuous number of data register to store double words. <br> - Equipment indication: D0, D1,...,D399. The symbol of equipment is D and numbering in decimal system. |

The structure of ladder diagram and information:

| Ladder Diagram | Complanation | Device |
| :--- | :--- | :--- | :--- |
| Normally open, contact a | LD | X, Y, M, T, C |

### 17.3.3 The Edition of PLC Ladder Diagram

The program edited method is from left power line to right power line. (The right power line will be omitted during the edited of WPLSoft.) After editing a row, go to editing the next row. The maximum contacts in a row are 11 contacts. If you need more than 11 contacts, you could have the new row and start with continuous line to continue more input devices. The continuous number will be produced automatically and the same input point can be used repeatedly. The drawing is shown as follows.


The operation of ladder diagram is to scan from left upper corner to right lower corner. The output handling, including the operation frame of coil and application command, at the most right side in ladder diagram.
Take the following diagram for example; we analyze the process step by step. The number at the right corner is the explanation order.


The explanation of command order:

| 1 | LD | YO |
| :--- | :---: | :---: |
| 2 | OR | MO |
| 3 | AND | X1 |
| 4 | LD | X3 |
|  | AND | M1 |
|  | ORB |  |
| 5 | LD | Y1 |
|  | AND | X4 |

The explanation of command order:

6 | LD | TO |
| :---: | :---: |
|  | AND |
|  | M3 |

ORB
7 ANB
8 OUT Y1
MR TO K10
The detail explanation of basic structure of ladder diagram

1. LD (LDI) command: give the command LD or LDI in the start of a block.


The structures of command LDP and LDF are similar to the command LD. The difference is that command LDP and LDF will act in the rising-edge or falling-edge when contact is ON as shown in the following.

2. AND (ANI) command: single device connects to a device or a block in series.


The structures of ANDP and ANDF are the same but the action is in rising-edge or falling-edge.
3. OR (ORI) command: single device connects to a device or a block.


OR command OR command


OR command

The structures of ORP and ORF are the same but the action is in rising-edge or falling-edge.
4. ANB command: a block connects to a device or a block in series.

5. ORB command: a block connects to a device or a block in parallel.


If there are several blocks when operate ANB or ORB, they should be combined to blocks or network from up to down or from left to right.
6. MPS, MRD, MPP commands: Divergent memory of multi-output. It can produce many various outputs.
7. The command MPS is the start of divergent point. The divergent point means the connection place between horizontal line and vertical line. We should determine to have contact memory command or not according to the contacts status in the same vertical line. Basically, each contact could have memory command but in some places of ladder diagram conversion will be omitted due to the PLC operation convenience and capacity limit. MPS command can be used for 8 continuous times
and you can recognize this command by the symbol " $T$ ".
8. MRD command is used to read memory of divergent point. Because the logical status is the same in the same horizontal line, it needs to read the status of original contact to keep on analyzing other ladder diagram. You can recognize the command MRD by the symbol "F".
9. MPP command is used to read the start status of the top level and pop it out from stack. Because it is the last item of the horizontal line, it means the status of this horizontal line is ending.


### 17.3.4 The Example for Designing Basic Program

## Start, Stop and Latching

In the same occasions, it needs transient close button and transient open button to be start and stop switch. Therefore, if you want to keep the action, you should design latching circuit. There are several latching circuits in the following:

## Example 1: the latching circuit for priority of stop

When start normally open contact $\mathrm{X} 1=\mathrm{On}$, stop normally contact $\mathrm{X} 2=\mathrm{Off}$, and $\mathrm{Y} 1=\mathrm{On}$ are set at the same time, if $X 2=O n$, the coil Y1 will stop acting. Therefore, it calls priority of stop.


## Example 2: the latching circuit for priority of start

When start normally open contact $\mathrm{X} 1=\mathrm{On}$, stop normally contact $X 2=O f f$ and $Y 1=O n$ (coil Y1 will be active and latching) are valid at the same time, if $\mathrm{X} 2=O n$, coil Y 1 will be active due to latched contact. Therefore, it calls priority of start.


## Example 3: the latching circuit of SET and RST commands

The figure at the right side is latching circuit that made up of RST and SET command. It is top priority of stop when RST command is set behind SET command. When executing PLC from up to down, The coil Y1 is ON and coil Y 1 will be OFF when X 1 and X2 act at the same time, therefore it calls priority of stop.
It is top priority of start when SET command is set after RST command. When X1 and X 2 act at the same time, Y 1 is ON so it calls top priority of start.

Top priority of stop


Top priority of start


## The common control circuit

## Example 4: condition control

X1 and X3 can start/stop Y1 separately, X2 and X4 can start/stop Y2 separately and they are all self latched circuit. Y 1 is an element for Y 2 to do AND function due to the normally open contact connects to Y 2 in series. Therefore, Y 1 is the input of Y 2 and Y 2 is also the input of Y 1 .


## Example 5: Interlock control

The figure above is the circuit of interlock control. Y1 and Y2 will act according to the start contact X 1 and X 2 . Y 1 and Y 2 will act not at the same time, once one of them acts and the other won't act. (This is called interlock.) Even if X1 and X2 are valid at the same time, Y1 and Y2 won't act at the same time due to up-to-down scan of ladder diagram. For this ladder diagram, Y 1 has higher priority than Y 2 .


## Example 6: Sequential Control



If add normally close contact Y 2 into Y 1 circuit to be an input for Y 1 to do AND function. (as shown in the left side) Y 1 is an input of Y 2 and Y 2 can stop Y1 after acting. In this way, Y1 and Y2 can execute in sequential.

## Example 7: Oscillating Circuit

The period of oscillating circuit is $\Delta T+\Delta T$

Y1


The figure above is a very simple ladder step diagram. When starting to scan Y1 normally close contact, Y1 normally close contact is close due to the coil Y1 is OFF. Then it will scan Y1 and the coil Y1 will be ON and output 1. In the next scan period to scan normally close contact Y1, Y1 normally close contact will be open due to Y1 is ON. Finally, coil Y1 will be OFF. The result of repeated scan, coil $Y$ will output the vibrating pulse with cycle time $\Delta T(O n)+\Delta T$ (Off).

The vibrating circuitry of cycle time $\Delta T(O n)+\Delta T$ (Off):


The figure above uses timer T0 to control coil Y 1 to be ON. After Y 1 is ON , timer TO will be closed at the next scan period and output Y1. The oscillating circuit will be shown as above. ( n is the setting of timer and it is decimal number. T is the base of timer. (clock period))

## Example 8: Blinking Circuit



The figure above is common used oscillating circuit for indication light blinks or buzzer alarms. It uses two timers to control On/OFF time of Y1 coil. If figure, n 1 and n 2 are timer setting of T1 and T2. T is the base of timer (clock period)

Example 9: Triggered Circuit


In figure above, the rising-edge differential command of XO will make coil MO to have a single pulse of $\Delta T$ (a scan time). Y1 will be ON during this scan time. In the next scan time, coil MO will be OFF, normally close M0 and normally close Y1 are all closed. However, coil Y1 will keep on being ON and it will make coil Y1 to be OFF once a rising-edge comes after input X0 and coil M0 is ON for a scan time. The timing chart is as shown above. This circuit usually executes alternate two actions with an input. From above timing: when input XO is a square wave of a period T , output coil Y 1 is square wave of a period 2 T .

## Example 10: Delay Circuit




When input X 0 is ON , output coil Y 1 will be ON at the same time due to the corresponding normally close contact OFF makes timer T10 to be OFF. Output coil Y1 will be OFF after delaying 100 seconds (K1000*0.1 seconds $=100$ seconds) once input X0 is OFF and T10 is ON. Please refer to timing chart above.

Example 11: Output delay circuit, in the following example, the circuit is made up of two timers.
No matter input XO is ON or OFF, output $Y 4$ will be delay.


## Example12: Extend Timer Circuit

In this circuit, the total delay time from input X 0 is close and output Y 1 is $\mathrm{ON}=(\mathrm{n} 1+\mathrm{n} 2)^{*} \mathrm{~T}$. where T is clock period. Timer: T11, T12; Timer cycle: T.


### 17.4 PLC Devices Function

| Items | Specifications | Remarks |
| :--- | :--- | :--- |
| Control Method | Stored program, cyclic scan <br> system |  |
| I/O Processing Method | Batch processing (when END <br> instruction is executed) | I/O refresh instruction is <br> available |
| Execution Speed | Basic commands (minimum 0.24 <br> us) | Application commands (1 ~ <br> dozens us) |
| Program Language | Instruction, Ladder Logic, SFC |  |
| Program Capacity | 1000 STEPS | 30 basic commands <br> 50 application commands |
| Commands | 80 commands |  |
| Input/Output Contact | Input (X): 10, output (Y): 4 |  |


|  | Device | Item |  | Range |  | Function |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | X | External Input Relay |  | X0~X17, 16 points, octal number system | Total is 32 points | Correspond to external input point |
|  | Y | External Output Relay |  | Y0~Y17, 16 points, octal number system |  | Correspond to external output point |
|  | M | Auxiliary | For general | M0~M799, 800 points | Total is 192 points | Contacts can switch to On/Off in program |
|  |  |  | For special | $\begin{aligned} & \text { M1000~M1079, } 80 \\ & \text { points } \end{aligned}$ |  |  |
|  | T | Timer | 100ms timer | T0~T159, 160 points | Total is 16 points | When the timer indicated by TMR command attains the setting, the T contact with the same number will be On. |
|  | C | Counter | 16-bit count up for general | C0~C79, 80 points | Total is 80 points | When the counter indicated by CNT command attains the setting, the C contact with the same number will be On. |
|  | T | Present value of timer |  | T0~T15, 160 points |  | When timer attains, the contact of timer will be On. |
|  | C | Present value of counter |  | C0~C79, 16-bit counter, 80 points |  | When timer attains, the contact of timer will be On. |
|  | D | Data register | For latched | D0~D399, 400 points | Total is 1300 points | It can be memory area for storing data. |
|  |  |  | For general | $\begin{aligned} & \text { D1000~D1099, } 100 \\ & \text { points } \end{aligned}$ |  |  |
|  |  |  | For special | $\begin{aligned} & \text { D2000~D2799, } 800 \\ & \text { points } \end{aligned}$ |  |  |
| $\begin{aligned} & \stackrel{\rightharpoonup}{\overleftarrow{T}} \\ & \underset{N}{N} \\ & \tilde{0} \\ & \hline \end{aligned}$ | K | Decimal |  | K-32,768 ~ K32,767 (16-bit operation) |  |  |
|  | H | Hexadecimal |  | H0000 ~ HFFFF (16-bit operation) |  |  |
| Communication port (program read/write) |  |  |  | RS485 (slave) |  |  |
| Analog input/output |  |  |  | Built-in 2 analog inputs and 1 analog output |  |  |
| Function extension module (optional) |  |  |  | EMC-D42A; EMC-R6AA; EMCD611A |  |  |

### 17.4.1 Devices Functions

## The Function of Input/output Contacts

The function of input contact $X$ : input contact $X$ reads input signal and enter PLC by connecting with input equipment. It is unlimited usage times for contact $A$ or contact $B$ of each input contact $X$ in program. The On/Off of input contact $X$ can be changed with the On/Off of input equipment but can't be changed by using peripheral equipment (WPLSoft).

## The Function of Output Contact $Y$

The mission of output contact $Y$ is to drive the load that connects to output contact $Y$ by sending On/Off signal. There are two kinds of output contact: one is relay and the other is transistor. It is unlimited usage times for $A$ or $B$ contact of each output contact $Y$ in program. But there is number for output coil $Y$ and it is recommended to use one time in program. Otherwise, the output result will be decided by the circuit of last output $Y$ with PLC program scan method.


The output of YO will be decided by circuit 2 , i.e. decided by On/Off of X10.

## Value, Constant [K] / [H]

| Constant | K | Decimal | K-32,768 ~ K32,767 (16-bit operation) |
| :--- | :--- | :--- | :--- |
|  | H | Hexadecimal | H0000 ~ HFFFF (16-bit operation) |

There are five value types for DVP-PLC to use by the different control destination. The following is the explanation of value types.
Binary Number (BIN)
It uses binary system for the PLC internal operation or storage. The relative information of binary system is in the following.

| Bit | Bit is the basic unit of binary system, the status are 1 or 0. |
| :--- | :--- |
| Nibble | It is made up of continuous 4 bits, such as b3~b0. It can be used to <br> represent number 0~9 of decimal or 0~F of hexadecimal. |
| Byte | It is made up of continuous 2 nibbles, i.e. 8 bits, b7~b0. It can used to <br> represent 00~FF of hexadecimal system. |
| Word | It is made up of continuous 2 bytes, i.e. 16-bit, b15~b0. It can used to <br> represent 0000~FFFFF of hexadecimal system. |
| Double Word | It is made up of continuous 2 words, i.e. 32 -bit, b31~b0. It can used to <br> represent 00000000~FFFFFFFF of hexadecimal system. |

The relations among bit, nibble, byte, word, and double word of binary number are shown as follows.

> Octal Number (OCT)
The numbers of external input and output terminal of DVP-PLC use octal number.
Example:
External input: $\mathrm{X0} \sim \mathrm{X7}, \mathrm{X} 10 \sim \mathrm{X} 17 \ldots$ (device number)
External output: Y0~Y7, Y10~Y17... (device number)
> Decimal Number, DEC
The suitable time for decimal number to be used in DVP-PLC system.
च To be the setting value of timer T or counter C, such as TMR C0 K50. (K constant)
$\square$ To be the device number of $M, T, C$ and $D$. For example: $M 10, T 30$. (device number)
■ To be operand in application command, such as MOV K123 D0. (K constant)
> Binary Code Decimal (BCD)
It shows a decimal number by a unit number or four bits so continuous 16-bit can use to represent the four numbers of decimal number. BCD code is usually used to read the input value of DIP switch or output value to 7 -segment display to be display.
> Hexadecimal Number (HEX)
The suitable time for hexadecimal number to be used in DVP-PLC system.
$\square$ To be operand in application command. For example: MOV H1A2B D0. (constant H)
> Constant K :
In PLC, it is usually have K before constant to mean decimal number. For example, K100 means 100 in decimal number.
Exception: The value that is made up of $K$ and bit equipment $\mathrm{X}, \mathrm{Y}, \mathrm{M}, \mathrm{S}$ will be bit, byte, word or double word. For example, K2Y10, K4M100. K1 means a 4-bit data and K2~K4 can be 8, 12 and 16-bit data separately.
> Constant H :
In PLC, it is usually have H before constant to mean hexadecimal number. For example, H 100 means 100 in hexadecimal number.

## The Function of Auxiliary Relay

There are output coil and A, B contacts in auxiliary relay M and output relay Y . It is unlimited usage times in program. User can control loop by using auxiliary relay, but can't drive external load directly. There are two types divided by its characteristics.
1.Auxiliary relay for general
2.Auxiliary relay for special
: It will reset to Off when power loss during running. Its state will be Off when power on after power loss.
: Each special auxiliary relay has its special function. Please don't use undefined auxiliary relay.

## The Function of Timer

The unit of timer is $1 \mathrm{~ms}, 10 \mathrm{~ms}$ and 100 ms . The count method is count up. The output coil will be On when the present value of timer equals to the settings. The setting is K in decimal number. Data register $D$ can be also used as settings.

- The real setting time of timer = unit of timer * settings


## The Features and Functions of Counter

| Item | 16-bit counters | General $\quad$ 32-bit counters |
| :--- | :--- | :--- |
| Type | General | High speed |
| Count direction | Count up | Count up/down |
| Settings | $0 \sim 32,767$ | $-2,147,483,648 \sim+2,147,483,647$ |
| Designate for <br> constant | Constant K or data register D | Constant K or data register D (2 for designated) |
| Present value <br> change | Counter will stop when attaining <br> settings | Counter will keep on counting when attaining <br> settings |
| Output contact | When count attains the settings <br> value, contact will be On and <br> latched. | When count up attains settings, contact will be <br> On and latched. <br> When count down attains settings, contact will <br> reset to Off. |
| Reset action | The present value will reset to 0 when RST command is executed and contact will <br> reset to Off. |  |
| Present register | 16 -bit | 32-bit <br> Contact action |
| After scanning, act together. | Act immediately when count attains. It has no <br> relation with scan period. |  |

## Functions:

When pulse input signal of counter is from Off to On, the present value of counter equals to settings and output coil is On. Settings are decimal system and data register D can also be used as settings. 16-bit counters C0~C79:
$\square$ Setting range of 16-bit counter is K0~K32, 767. (K0 is the same as K1. output contact will be On immediately at the first count.
$\checkmark$ General counter will be clear when PLC is power loss. If counter is latched, it will remember the value before power loss and keep on counting when power on after power loss.
$\checkmark$ If using MOV command, WPLSoft to send a value, which is large than setting to C0, register, at the next time that X 1 is from Off to On, C 0 counter contact will be On and present value will be set to the same as settings.
$\square \quad$ The setting of counter can use constant K or register D (not includes special data register D1000~D1044) to be indirect setting.
$\boxtimes$ If using constant $K$ to be setting, it can only be positive number but if setting is data register $D$, it can be positive/negative number. The next number that counter counts up from 32,767 is -32,768.

Example:


1. When $\mathrm{XO}=\mathrm{On}, \mathrm{RST}$ command is executed, CO reset to 0 and output contact reset to Off.
2. When X1 is from Off to On, counter will count up (add 1).
3. When counter CO attains settings $\mathrm{K} 5, \mathrm{CO}$ contact is On and $\mathrm{CO}=$ setting $=\mathrm{K} 5 . \mathrm{C} 0$ won't accept X1 trigger signal and C0 remains K5.


### 17.4.2 Special Auxiliary Relays

| Special <br> M | Function | Read(R)/ <br> Write(W) |
| :--- | :--- | :--- |
| M1000 | Normally open contact (a contact). This contact is On when running and it is <br> On when the status is set to RUN. | Read only |$|$| M1001 | Normally closed contact (b contact). This contact is Off when running and it is <br> Off when the status is set to RUN. | Read only |
| :--- | :--- | :--- |
| M1002 | On only for 1 scan after RUN. Initial pulse is contact a. It will get positive <br> pulse in the RUN moment. Pulse width=scan period. | Read only |
| M1003Off only for 1 scan after RUN. Initial pulse is contact a. It will get negative <br> pulse in the RUN moment. Pulse width=scan period. | Read only |  |
| M1004 | Reserved | Read only |
| M1005 | Fault indication of the AC motor drives | Read only |
| M1006 | Output frequency is 0, M1006 On | Read only |
| M1007 | Operation direction of AC motor drives (FWD: M1007 Off, REV: M1007On) | - |
| M1008 | Reserved | Read only |
| M1010 | Read only |  |
| M1011 | 10ms clock pulse, 5ms On/5ms Off | Read only |
| M1012 | 100ms clock pulse, 50ms On / 50ms Off | Read only |
| M1013 | 1s clock pulse, 0.5s On / 0.5s Off | Read only |
| M1014 | 1min clock pulse, 30s On / 30s Off | Read only |
| M1015 | Frequency attained, M1015=On | Read only |
| M1016 | Parameter read/write error, M1016=On |  |
| M1017 | Succeed to write parameter, M1017 =On | Read only |
| M1018 | Reserved | Read only |
| M1019 | Reserved | Zero flag |
| M1020 | Borrow flag |  |
| M1021 |  |  |


| M1022 | Carry flag | Read only |
| :---: | :---: | :---: |
| M1023 | Divisor is 0 | Read only |
| M1024 | Reserved | - |
| M1025 | RUN(ON) / STOP(OFF) the AC motor drive | Read/Write |
| M1026 | The operation direction of the AC motor drive (FWD: OFF, REV: ON) | Read/Write |
| M1027 | AC motor drive reset | Read/Write |
| M1028 | Reserved |  |
| M1029 | Reserved |  |
| M1030 | Reserved |  |
| M1031 | Reserved |  |
| M1032 | Reserved |  |
| M1033 | Reserved |  |
| M1034 | Enable CANopen real time control | Read/Write |
| M1035 <br> M1039 | Reserved | - |
| M1040 | Power On | Read/Write |
| M1041 | Reserved | - |
| M1042 | Quick stop | Read/Write |
| M1043 | Reserved | - |
| M1044 | Halt | Read/Write |
| M1045 <br> M1047 | Reserved | - |
| M1048 | New position | Read/Write |
| M1049 | Change now | Read/Write |
| M1050 | Reserved |  |
| M1051 | Reserved |  |
| M1052 | Lock | Read/Write |
| $\begin{gathered} \text { M1053 } \\ \sim \\ \text { M1054 } \end{gathered}$ | Reserved | - |
| M1055 | Home | Read/Write |
| M1056 | Power on ready | Read only |
| M1057 | Reserved | - |
| M1058 | On quick stopping | Read only |
| M1059 | CANopen master setting complete | Read only |
| M1060 | Initializing CANopen slave | Read only |
| M1061 | Initialize CANopen slave failed | Read only |
| M1062 | Reserved | - |
| M1063 | Target torque attained | Read only |
| M1064 | Target position attained | Read only |
| M1065 | Set pos ack | Read only |


| M1066 | Read/ Write CANopen data complete | Read only |
| :---: | :--- | :---: |
| M1067 | Read/ Write CANopen data suceed | Read only |
| M1068 <br> M1070 <br> M1071 | Reserved | Home error |
| M1072 | Reserved | Read only |
| M1073 <br> $\tilde{\sim} \tilde{1079}$ | Reserved |  |

### 17.4.3 Special Registers

| Special D | Function | Read(R)/ <br> Write(W) |
| :---: | :---: | :---: |
| D1000 | Reserved | - |
| D1001 | PLC firmware version | Read only |
| D1002 | Program capacity | Read only |
| D1003 | Checksum | Read only |
| $\begin{gathered} \text { D1004 } \\ \sim \sim \\ \text { D1009 } \end{gathered}$ | Reserved | - |
| D1010 | Present scan time (Unit: 0.1ms) | Read only |
| D1011 | Minimum scan time (Unit: 0.1ms) | Read only |
| D1012 | Maximum scan time (Unit: 0.1 ms ) | Read only |
| $\begin{gathered} \text { D1013 } \\ \underset{\sim}{\text { D1019 }} \end{gathered}$ | Reserved | - |
| D1020 | Output frequency (0.000~600.00Hz) | Read only |
| D1021 | Output current (\#\#\#\#.\#A) | Read only |
| D1022 | The ID of the extension card: <br> 0 : no card <br> 1: Relay Card( 6 out ) <br> 2: I/O Card ( 4 in 2 out ) <br> 3~7: Reserved | Read only |
| D1023 | The ID of the extension card: <br> 0 : no card <br> 1: DeviceNet Slave <br> 2: Profibus-DP Slave <br> 3: CANopen Slave <br> 4: Modbus-TCP Slave <br> 5: EtherNet/IP Slave <br> 6~8: Reserved | Read only |
| $\begin{gathered} \mathrm{D} 1024 \\ \underset{\sim}{\mathrm{D} 1026} \end{gathered}$ | Reserved | - |
| D1027 | Frequency command of the PID control | Read only |
| D1028 | The responsive value of AUI AVI (analog voltage input) (0.00~100.00\%) | Read only |
| D1029 | The responsive value of AUI ACI (analog current input) (0.0~100.00\%) | Read only |
| D1030 | The corresponding value for AUI (-100.0~100.00\%) | Read only |


| Special D | Function | Read(R)/ <br> Write(W) |
| :---: | :---: | :---: |
| $\begin{gathered} \text { D1031 } \\ \tilde{\sim} \\ \text { D1035 } \end{gathered}$ | Reserved | - |
| D1036 | AC motor drive error code | Read only |
| D1037 | AC motor drive output frequency | Read only |
| D1038 | DC Bus voltage | Read only |
| D1039 | Output voltage | Read only |
| D1040 | Analog output value AFM1 (-100.00~100.00\%) | Read/Write |
| $\begin{aligned} & \text { D1041 } \\ & \underset{\sim}{\text { D1042 }} \end{aligned}$ | Reserved | - |
| D1043 | User defined (When Pr. 00.04 is set to 28 , the register data will be displayed as C xxx) | Read/Write |
| D1044 | Reserved | - |
| D1045 | Analog output value AFM2 (-100.00~100.00\%) | Read/Write |
| $\begin{aligned} & \text { D1046 } \\ & \text { D1049 } \end{aligned}$ | Reserved | - |
| D1050 | Actual mode <br> 0 : Velocity mode <br> 1: Position mode <br> 2: Torque mode <br> 3: Homing mode | Read only |
| D1051 | Actual position (Low word) | Read only |
| D1052 | Actual position (High word) | Read only |
| D1053 | Actual torque | Read only |
| $\begin{gathered} \text { D1054 } \\ \sim \\ \text { D1059 } \end{gathered}$ | Reserved | Read only |
| D1060 | Mode setting <br> 0 : Velocity Mode <br> 1: Position Mode <br> 2: Torque Mode <br> 3: Homing Mode | Read/Write |
| D1061 | Reserved | - |
| D1062 | Reserved | - |
| D1063 | Year | Read only |
| D1064 | Week | Read only |
| D1065 | Month | Read only |
| D1066 | Day | Read only |
| D1067 | Hour | Read only |
| D1068 | Minute | Read only |
| D1069 | Second | Read only |

CANopen Master Special D (It can be written only when PLC is at STOP)

| Special D | Function | PDO <br> Map | Power <br> Failure <br> Memory | Factory <br> Setting | R/W |
| :---: | :--- | :---: | :---: | :---: | :---: |
| D1070 | The station which completed CANopen <br> initialization (bit0=Machine code0 ......) | NO | NO | 0 | R |
| D1071 | The station which error occurs during CANopen <br> initialization (bit0=Machine code0 ......) | NO | NO | 0 | R |
| D1072 | Reserved | - | - |  | - |


| Special D | Function | $\begin{aligned} & \text { PDO } \\ & \text { Map } \end{aligned}$ | Power Failure Memory | Factory Setting | R/W |
| :---: | :---: | :---: | :---: | :---: | :---: |
| D1073 | CANopen station cut off (bit0=Machine code0 .......) | NO | NO |  | R |
| D1074 | Error code of master error <br> 0 : no error <br> 1: slave setting error <br> 2: synchronous cycle setting error (the setting is too low) | NO | NO | 0 | R |
| D1075 | Reserved | - | - |  | - |
| D1076 | SDO fault (main index value) | NO | NO |  | R |
| D1077 | SDO fault (sub-index value) | NO | NO |  | R |
| D1078 | SDO fault (error code L) | NO | NO |  | R |
| D1079 | SDO fault (error code H) | NO | NO |  | R |
| D1080 | Reserved | - | - |  | - |
| D1081 | Reserved | NO | NO |  | R |
| D1082 | Reserved | NO | NO |  | R |
| D1083 | Reserved | NO | NO |  | R |
| D1084 | Reserved | NO | NO |  | R |
| D1085 | Reserved | NO | NO |  | R |
| D1086 | Reserved | NO | NO |  | R |
| $\begin{gathered} \text { D1087 } \\ \underset{\sim}{\text { D1089 }} \end{gathered}$ | Reserved | - | - |  | - |
| D1090 | Synchronous cycle setting | NO | YES | 4 | RW |
| D1091 | The station for initialization during initializing process. | NO | YES | FFFFH | RW |
| D1092 | Delay time before initializing | NO | YES | 0 | RW |
| D1093 | Break off detection time | NO | YES | 1000 ms | RW |
| D1094 | Times of Break off detection | NO | YES | 3 | RW |
| $\begin{gathered} \text { D1095 } \\ \underset{\sim}{\text { D1096 }} \end{gathered}$ | Reserved | - | - |  | - |
| D1097 | Type of P to P send (PDO) <br> Setting range: 1~240 | NO | YES | 1 | RW |
| D1098 | Type of P to P received (PDO) Setting range: 1~240 | NO | YES | 1 | RW |
| D1099 | Delay time of initialization complete Setting range: 1~60000 sec. | NO | YES | 15 sec | RW |


| Special D | Function | Read(R)/ <br> Write(W) |
| :---: | :--- | :---: |
| D1100 | Target frequency 1 | Read only |
| D1101 | Target frequency 2 | Read only |
| D1102 | Reference frequency | Read only |
| D1103 | Reserved | - |
| D1104 | Reserved | Read only |
| D1105 | Target torque | - |
| D1106 | Reserved |  |


| Special D | Function | Read(R)/ <br> Write(W) |
| :---: | :---: | :---: |
| D1110 |  |  |
| D1111 | Inner COM station cut off (bit0=Machine code0 .......) | Read only |
| D1112 | The station which error occurs during inner COM initialization(bit0=Machine code0 .......) | Read only |
| $\begin{aligned} & \text { D1113 } \\ & \underset{\sim}{\text { D1129 }} \end{aligned}$ | Reserved | - |
| D1130 | Inner COM salve 1 control word | Read only |
| D1131 | Inner COM salve 1 mode | Read only |
| D1132 | Inner COM salve 1 reference command L | Read only |
| D1133 | Inner COM salve 1 reference command H | Read only |
| $\begin{aligned} & \text { D1134 } \\ & \sim \\ & \text { D1137 } \end{aligned}$ | Reserved | - |
| D1138 | Inner COM salve 1 response info L | Read only |
| D1139 | Inner COM salve 1 response info H | Read only |
| D1140 | Inner COM salve 2 control word | Read only |
| D1141 | Inner COM salve 2 mode | Read only |
| D1142 | Inner COM salve 2 reference command L | Read only |
| D1143 | Inner COM salve 2 reference command H | Read only |
| $\begin{gathered} \text { D1144 } \\ \tilde{\sim} \\ \text { D1147 } \end{gathered}$ | Reserved | - |
| D1138 | Inner COM salve 2 response info L | Read only |
| D1139 | Inner COM salve 2 response info H | Read only |
| D1140 | Inner COM salve 3 control word | Read only |
| D1141 | Inner COM salve 3 mode | Read only |
| D1142 | Inner COM salve 3 reference command L | Read only |
| D1143 | Inner COM salve 3 reference command H | Read only |
| $\begin{aligned} & \text { D1144 } \\ & \text { D1147 } \end{aligned}$ | Reserved | - |
| D1138 | Inner COM salve 3 response info L | Read only |
| D1139 | Inner COM salve 3 response info H | Read only |
| D1140 | Inner COM salve 4 control word | Read only |
| D1141 | Inner COM salve 4 mode | Read only |
| D1142 | Inner COM salve 4 reference command L | Read only |
| D1143 | Inner COM salve 4 reference command H | Read only |
| $\begin{gathered} \text { D1144 } \\ \text { D1147 } \end{gathered}$ | Reserved | - |
| D1138 | Inner COM salve 4 response info L | Read only |
| D1139 | Inner COM salve 4 response info H | Read only |
| $\begin{aligned} & \text { D1170 } \\ & \sim \\ & \text { D1199 } \end{aligned}$ | Reserved | - |

CP2000 supports up to 8 CANopen protocol slaves; each slave occupies 100 of special D register and is numbered in 1~8. There are in total of 8 stations.
Slave No.
Slave No. 1
Station number
D2001 Factory code(L)

|  | D2099 | Mapping address $4(\mathrm{H})$ of receiving station Station number |
| :---: | :---: | :---: |
| Slave No. 2 | D2100 |  |
|  | D2101 | Factory code(L) |
|  | ~ | ~ |
|  | D2199 | Mapping address 4(H) of receiving station 4 |
| Slave No. 3 | D2200 | Station number |
|  | D2201 | Factory code(L) |
|  | ~ | ~ |
|  | D2299 | Mapping address $4(\mathrm{H})$ of receiving station 4 |
|  |  |  |
|  | $\sqrt{3}$ |  |
| Slave No. 8 | D2700 | Station number |
|  | D2701 | Factory code(L) |
|  | ~ | ~ |
|  | D2799 | Mapping address 4(H)of receiving station |

Slave No. 0~7

| Special D | Function | $\begin{aligned} & \text { PDO } \\ & \text { Map } \end{aligned}$ | Save | Pre-defined setting | R/W |
| :---: | :---: | :---: | :---: | :---: | :---: |
| $\begin{gathered} \text { D2000+100* } \\ \mathrm{n} \end{gathered}$ | Station number of slave No. n Setting range: 1~127 <br> 0 : CANopen disable | NO |  | 0 | RW |
| $\begin{gathered} \text { D2001+100* } \\ \mathrm{n} \end{gathered}$ | The category of slave No. $n$ <br> 192H: AC motor drive/ AC servo motor and drive <br> 191H: remote I/O module | NO |  | 0 | R |
| $\begin{gathered} \text { D2002+100* } \\ \mathrm{n} \\ \hline \end{gathered}$ | Factory code (L) of slave No. n | NO |  | 0 | R |
| $\begin{gathered} \text { D2003+100* } \\ \mathrm{n} \end{gathered}$ | Factory code (H) of slave No. n | NO |  | 0 | R |
| $\begin{gathered} \text { D2004+100* } \\ \mathrm{n} \end{gathered}$ | Factory product code (L) of slave No. n | NO |  | 0 | R |
| $\begin{gathered} \text { D2005+100* } \\ \mathrm{n} \end{gathered}$ | Factory product code (H) of slave No. n | NO |  | 0 | R |

Basic definition
Slave No. 0~7

| Special D | Function | $\begin{aligned} & \text { PDO } \\ & \text { Map } \end{aligned}$ | Save | Pre-defined setting | CAN Index | PDO |  |  | R/W |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  | 1 | 3 | 4 |  |
| D2006+100*n | Treatment for slave No. n communication disconnect | YES |  | 0 | $\begin{gathered} 6007 \mathrm{H}-001 \\ 0 \mathrm{H} \end{gathered}$ |  |  |  | RW |
| D2007+100*n | Error code of slave No. n | YES |  | 0 | $\begin{gathered} \text { 603FH-001 } \\ 0 \mathrm{H} \end{gathered}$ |  |  | - | R |


| D2008+100*n Control word of slave No. n | YES |  | 0 | $6040 \mathrm{H}-001$ <br> $0 H$ |  | RW |
| :--- | :--- | :--- | :--- | :---: | :---: | :---: | :---: | :---: |
| D2009+100*n Status word of slave No. n | YES |  | 0 | $6041 \mathrm{H}-001$ <br> $0 H$ | R |  |
| D2010+100*n Control mode of slave No. n | YES |  | 2 | $6060 \mathrm{H}-000$ <br> $8 H$ |  | RW |
| D2011+100*n Actual mode of slave No. n | YES |  | 2 | $6061 \mathrm{H}-000$ <br> $8 H$ |  | $R$ |

## Speed Control

Slave No. 0~7

| Special D | Function | PDO <br> Map | Save | Pre-define d Setting | CAN <br> Index | PDO |  |  |  | R/W |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  | 1 | 2 | 3 | 4 |  |
| D2012+100*n | Target speed of slave No. n | YES |  | 0 | $\begin{gathered} 6042 \mathrm{H}-001 \\ 0 \mathrm{H} \end{gathered}$ | $\bullet$ |  |  |  | RW |
| D2013+100*n | Actual speed of slave No. n | YES |  | 0 | $\begin{gathered} 6043 \mathrm{H}-001 \\ \mathrm{OH} \end{gathered}$ | $\bullet$ |  |  |  | R |
| D2014+100*n | Speed deviation of slave No. n | YES |  | 0 | $\begin{gathered} \text { 6044H-001 } \\ 0 \mathrm{H} \end{gathered}$ |  |  |  |  | R |
| D2015+100*n | Accel. Time of slave No. n | YES |  | 1000 | $\begin{gathered} 604 \mathrm{FH}-002 \\ 0 \mathrm{H} \end{gathered}$ |  |  |  |  | R |
| D2016+100*n | Decel. Time of slave No. n | YES |  | 1000 | $\begin{gathered} 6050 \mathrm{H}-002 \\ \mathrm{OH} \end{gathered}$ |  |  |  |  | RW |

Torque control
Slave No. 0~7

| Special D | Function | PDO <br> Map | Save | Pre-defined Setting | CAN <br> Index | PDO |  |  |  | R/W |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  | 1 | 2 | 3 | 4 |  |
| D2017+100*n | Target torque of slave No. n | YES |  | 0 | $\begin{gathered} 6071 \mathrm{H}-001 \\ 0 \mathrm{H} \end{gathered}$ |  |  |  | $\bullet$ | RW |
| D2018+100*n | Actual torque of slave No. n | YES |  | 0 | $\begin{gathered} 6077 \mathrm{H}-001 \\ 0 \mathrm{H} \end{gathered}$ |  |  |  | $\bullet$ | R |
| D2019+100*n | Actual current of slave No. n | YES |  | 0 | $\begin{gathered} 6078 \mathrm{H}-001 \\ \mathrm{OH} \end{gathered}$ |  |  |  |  | R |

Position control
Slave No. 0~7

| Special D | Function | $\begin{aligned} & \text { PDO } \\ & \text { Map } \end{aligned}$ | Save | Pre-defined Setting | CAN Index | PDO |  |  |  | R/W |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  | 1 | 2 | 3 | 4 |  |
| D2020+100*n | Target position(L) of slave No. n | YES |  | 0 | 607AH-002 |  |  | - |  | RW |
| D2021+100*n | Target position(H) of slave No. $n$ | YES |  | 0 | OH |  |  | - |  | RW |
| D2022+100*n | Actual position(L) of slave No. n | YES |  | 0 | 6064H-002 |  |  | $\bullet$ |  | R |


| D2023+100*n | Actual position(H) of slave <br> No. $n$ | YES | 0 | $0 H$ | $R$ |
| :--- | :--- | :--- | :--- | :---: | :---: | :---: | :---: | :---: |
| D2024+100*n | Speed diagram(L) of slave <br> No. $n$ | YES |  | 10000 | $6081 \mathrm{H}-002$ |
| $0 H$ |  |  |  |  |  |$|$| RW |
| :---: |

20XXH address corresponds to MI MO AI AO.
Slave No. $\mathrm{n}=0 \sim 7$

| Special D | Function | PDO <br> Map | Save | Pre-defined Setting | CAN <br> Index | PDO |  |  |  | R/W |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  | 1 | 2 | 3 | 4 |  |
| D2026+100*n | MI status of slave No. n | YES |  | 0 | $\begin{gathered} 2026 \mathrm{H}-011 \\ 0 \mathrm{H} \end{gathered}$ |  | $\bullet$ |  |  | RW |
| D2027+100*n | MO setting of slave No. n | YES |  | 0 | $\begin{gathered} 2026 \mathrm{H}-411 \\ 0 \mathrm{H} \end{gathered}$ |  | $\bullet$ |  |  | RW |
| D2028+100*n | AI1 status of slave No. n | YES |  | 0 | $\begin{gathered} 2026 \mathrm{H}-611 \\ 0 \mathrm{H} \end{gathered}$ |  | $\bullet$ |  |  | RW |
| D2029+100*n | Al2 status of slave No. n | YES |  | 0 | $\begin{gathered} 2026 \mathrm{H}-621 \\ 0 \mathrm{H} \end{gathered}$ |  | $\bullet$ |  |  | RW |
| D2030+100*n | Al3 status of slave No. n | YES |  | 0 | $\begin{gathered} 2026 \mathrm{H}-631 \\ 0 \mathrm{H} \end{gathered}$ |  | $\bullet$ |  |  | RW |
| D2031+100*n | AO1 status of slave No. n | YES |  | 0 | $\begin{gathered} 2026 \mathrm{H}-\mathrm{A} 11 \\ \mathrm{OH} \end{gathered}$ |  | $\bullet$ |  |  | RW |
| D2032+100*n | AO2 status of slave No. n | YES |  | 0 | $\begin{gathered} 2026 \mathrm{H}-\mathrm{A} 2 \\ 10 \mathrm{H} \end{gathered}$ |  | $\bullet$ |  |  | RW |
| D2033+100*n | AO3 status of slave No. n | YES |  | 0 | $\begin{gathered} 2026 \mathrm{H}-\mathrm{A} 3 \\ 10 \mathrm{H} \end{gathered}$ |  | $\bullet$ |  |  | RW |


| Special D | Function | PDO <br> Map | Save | Pre-defined <br> Setting | R/W |
| :---: | :--- | :---: | :---: | :---: | :---: |
| D2034+100*n | Transmission setting of slave No. n | NO | YES | $000 A H$ | RW |
| D2035+100*n | The mapping address 1(L) for slave No. n <br> transmitting station 1 | NO | YES | 0010 H | RW |
| D2036+100*n | The mapping address 1(H) for slave No.n <br> transmitting station 1 | NO | YES | $6040 H$ | RW |
| D2037+100*n | The mapping address 2(L) for slave No. n <br> transmitting station 1 | NO | YES | 0010 H | RW |
| D2038+100*n | The mapping address 2(H) for slave No.n <br> transmitting station 1 | NO | YES | $6042 H$ | RW |
| D2039+100*n | The mapping address 3(L) for slave No. n <br> transmitting station 1 | NO | YES | 0 | RW |
| D2040+100*n | The mapping address 3(H) for slave No.n <br> transmitting station 1 | NO | YES | 0 | RW |
| D2041+100*n | The mapping address 4(L) for slave No. n <br> transmitting station 1 | NO | YES | 0 | RW |
| D2042+100*n | The mapping address 4(H) for slave No.n <br> transmitting station 1 | NO | YES | 0 | RW |


| Special D | Function | $\begin{aligned} & \text { PDO } \\ & \text { Map } \end{aligned}$ | Save | Pre-defined Setting | R/W |
| :---: | :---: | :---: | :---: | :---: | :---: |
| D2043+100*n | The mapping address $1(\mathrm{~L})$ for slave No. n transmitting station 2 | NO | YES | 0110H | RW |
| D2044+100*n | The mapping address $1(\mathrm{H})$ for slave No.n transmitting station 2 | NO | YES | 2026H | RW |
| D2045+100*n | The mapping address 2(L) for slave No. n transmitting station 2 | NO | YES | 6110H | RW |
| D2046+100*n | The mapping address 2(H) for slave No.n transmitting station 2 | NO | YES | 2026H | RW |
| D2047+100*n | The mapping address 3(L) for slave No. n transmitting station 2 | NO | YES | 6210H | RW |
| D2048+100*n | The mapping address 3(H) for slave No.n transmitting station 2 | NO | YES | 2026H | RW |
| D2049+100*n | The mapping address 4(L) for slave No. n transmitting station 2 | NO | YES | 6310H | RW |
| D2050+100*n | The mapping address $4(\mathrm{H})$ for slave No.n transmitting station 2 | NO | YES | 2026H | RW |
| D2051+100*n | The mapping address $1(\mathrm{~L})$ for slave No. n transmitting station 3 | NO | YES | 0010H | RW |
| D2052+100*n | The mapping address $1(\mathrm{H})$ for slave No.n transmitting station 3 | NO | YES | 6040H | RW |
| D2053+100*n | The mapping address 2(L) for slave No. n transmitting station 3 | NO | YES | 0020H | RW |
| D2054+100*n | The mapping address 2(H) for slave No.n transmitting station 3 | NO | YES | 607AH | RW |
| D2055+100*n | The mapping address 3(L) for slave No. n transmitting station 3 | NO | YES | 0 | RW |
| D2056+100*n | The mapping address $3(\mathrm{H})$ for slave No.n transmitting station 3 | NO | YES | 0 | RW |
| D2057+100*n | The mapping address 4(L) for slave No. n transmitting station 3 | NO | YES | 0 | RW |
| D2058+100*n | The mapping address $4(\mathrm{H})$ for slave No.n transmitting station 3 | NO | YES | 0 | RW |
| D2059+100*n | The mapping address $1(\mathrm{~L})$ for slave No. n transmitting station 4 | NO | YES | 0010H | RW |
| D2060+100*n | The mapping address $1(\mathrm{H})$ for slave No.n transmitting station 4 | NO | YES | 6040H | RW |
| D2061+100*n | The mapping address 2(L) for slave No. n transmitting station 4 | NO | YES | 0010H | RW |
| D2062+100*n | The mapping address 2(H) for slave No.n transmitting station 4 | NO | YES | 6071H | RW |
| D2063+100*n | The mapping address 3(L) for slave No. n transmitting station 4 | NO | YES | 0 | RW |
| D2064+100*n | The mapping address $3(\mathrm{H})$ for slave No.n transmitting station 4 | NO | YES | 0 | RW |
| D2065+100*n | The mapping address 4(L) for slave No. n transmitting station 4 | NO | YES | 0 | RW |
| D2066+100*n | The mapping address 4(H) for slave No.n transmitting station 4 | NO | YES | 0 | RW |
| D2067+100*n | Receiving setting of slave No. n | NO | YES | 0000H | RW |


| Special D | Function | $\begin{aligned} & \text { PDO } \\ & \text { Map } \end{aligned}$ | Save | Pre-defined Setting | R/W |
| :---: | :---: | :---: | :---: | :---: | :---: |
| D2068+100*n | The mapping address 1(L) for slave No. n receiving station 1 | NO | YES | 0010H | RW |
| D2069+100*n | The mapping address 1 (H) for slave No.n receiving station 1 | NO | YES | 6041H | RW |
| D2070+100*n | The mapping address 2(L) for slave No. n receiving station 1 | NO | YES | 0010H | RW |
| D2071+100*n | The mapping address 2(H) for slave No.n receiving station 1 | NO | YES | 6043H | RW |
| D2072+100*n | The mapping address 3(L) for slave No. n receiving station 1 | NO | YES | 0 | RW |
| D2073+100*n | The mapping address 3(H) for slave No.n receiving station 1 | NO | YES | 0 | RW |
| D2074+100*n | The mapping address 4(L) for slave No. n receiving station 1 | NO | YES | 0 | RW |
| D2075+100*n | The mapping address 4(H) for slave No.n receiving station 1 | NO | YES | 0 | RW |
| D2076+100*n | The mapping address 1(L) for slave No. n receiving station 2 | NO | YES | 4110H | RW |
| D2077+100*n | The mapping address $1(\mathrm{H})$ for slave No.n receiving station 2 | NO | YES | 2026H | RW |
| D2078+100*n | The mapping address 2(L) for slave No. n receiving station 2 | NO | YES | A110H | RW |
| D2079+100*n | The mapping address 2(H) for slave No.n receiving station 2 | NO | YES | 2026H | RW |
| D2080+100*n | The mapping address 3(L) for slave No. n receiving station 2 | NO | YES | A210H | RW |
| D2081+100*n | The mapping address $3(\mathrm{H})$ for slave No.n receiving station 2 | NO | YES | 2026H | RW |
| D2082+100*n | The mapping address 4(L) for slave No. n receiving station 2 | NO | YES | A310H | RW |
| D2083+100*n | The mapping address $4(\mathrm{H})$ for slave No.n receiving station 2 | NO | YES | 2026H | RW |
| D2084+100*n | The mapping address 1(L) for slave No. n receiving station 3 | NO | YES | 0010H | RW |
| D2085+100*n | The mapping address $1(\mathrm{H})$ for slave No.n receiving station 3 | NO | YES | 6041H | RW |
| D2086+100*n | The mapping address 2(L) for slave No. n receiving station 3 | NO | YES | 0020H | RW |
| D2087+100*n | The mapping address 2(H) for slave No.n receiving station 3 | NO | YES | 6064H | RW |
| D2088+100*n | The mapping address 3(L) for slave No. n receiving station 3 | NO | YES | 0 | RW |
| D2089+100*n | The mapping address 3(H) for slave No.n receiving station 3 | NO | YES | 0 | RW |
| D2090+100*n | The mapping address 4(L) for slave No. n receiving station 3 | NO | YES | 0 | RW |
| D2091+100*n | The mapping address 4(H) for slave No.n receiving station 3 | NO | YES | 0 | RW |
| D2092+100*n | The mapping address 1(L) for slave No. n receiving station 4 | NO | YES | 0010H | RW |


| Special D | Function | PDO <br> Map | Save | Pre-defined <br> Setting | R/W |
| :--- | :--- | :---: | :---: | :---: | :---: |
| D2093+100*n | The mapping address 1(H) for slave No.n <br> receiving station 4 | NO | YES | 6041 H | RW |
| D2094+100*n | The mapping address 2(L) for slave No. n <br> receiving station 4 | NO | YES | 0010 H | RW |
| D2095+100*n | The mapping address 2(H) for slave No.n <br> receiving station 4 | NO | YES | 6077 H | RW |
| D2096+100*nn | The mapping address 3(L) for slave No. n <br> receiving station 4 | NO | YES | 0 | RW |
| D2097+100*n | The mapping address 3(H) for slave No.n <br> receiving station 4 | NO | YES | 0 | RW |
| D2098+100*n | The mapping address 4(L) for slave No. n <br> receiving station 4 | NO | YES | 0 | RW |
| D2099+100*n | The mapping address 4(H) for slave No.n <br> receiving station 4 | NO | YES | 0 | RW |

### 17.4.4 Communication Address for PLC Devices

| Device | Range | Type | Address (Hex) |
| :---: | :---: | :---: | :---: |
| X | $00 \sim 17$ (Octal) | bit | $0400 \sim 040 \mathrm{~F}$ |
| Y | $00 \sim 17$ (Octal) | bit | $0500 \sim 050 \mathrm{~F}$ |
| T | $00 \sim 159$ | bit/word | $0600 \sim 069 F$ |
| M | $000 \sim 799$ | bit | $0800 \sim 0 B 1 F$ |
| M | $1000 \sim 1079$ | bit | $0 B E 8 \sim 0 C 37$ |
| C | $0 \sim 79$ | bit/word | $0000 \sim 0 E 47$ |
| D | $00 \sim 399$ | word | $1000 \sim 118 F$ |
| D | $1000 \sim 1099$ | word | $13 E 8 \sim 144 B$ |
| D | $2000 \sim 2799$ |  | $17 D 0 \sim 1 A E F$ |

## Function Code

| Function Code | Description | Supported Devices |
| :---: | :---: | :---: |
| 01 | Read coil status | Y, M, T, C |
| 02 | Read input status | X,Y,M,T,C |
| 03 | Read one data | T,C,D |
| 05 | Force changing one coil status | Y,M,T,C |
| 06 | Write in one data | T,C,D |
| $0 F$ | Force changing multiple coil |  |
| status | Y,M,T,C |  |
| 10 | Write in multiple data | T,C,D |

Only when PLC is at Stop status, PLC data can be read/write via communication device. When PLC
is at Run status, the communication address should be the mapping address, e.g. for Pr.04-00 it maps to 0400 H .

## NOTE

When PLC function is activated, CP2000 can Read/Write the PLC and drive's parameter by different addresses (pre-defined station number for the AC motor drive is 1 , for PLC station number is 2 )

### 17.5 Commands

### 17.5.1 Basic Commands

Commands

| Commands | Function | Operands |
| :---: | :--- | :---: |
| LD | Load contact A | X, Y, M, T, C |
| LDI | Load contact B | X, Y, M, T, C |
| AND | Series connection with A contact | X, Y, M, T, C |
| ANI | Series connection with B contact | X, Y, M, T, C |
| OR | Parallel connection with A contact | X, Y, M, T, C |
| ORI | Parallel connection with B contact | X, Y, M, T, C |
| ANB | Series connects the circuit block | -- |
| ORB | Parallel connects the circuit block | -- |
| MPS | Save the operation result | -- |
| MRD | Read the operation result (the pointer is | not moving) |
| MPP | Read the result | -- |

## Output Command

| Commands | Function | Operands |
| :---: | :--- | :---: |
| OUT | Drive coil | Y, M |
| SET | Action latched (ON) | Y, M |
| RST | Clear the contacts or the registers | Y, M, T, C, D |

## Timer and Counter

| Commands Function | Operands |  |
| :---: | :--- | :---: |
| TMR | 16-bit timer | T-K or T-D |
| CNT | 16 -bit counter | C-K or C-D (16 bit) |

## Main Control Command

| Commands | Function | Operands |
| :---: | :--- | :---: |
| MC | Connect the common series connection <br> contacts | NO~N7 |
| MCR | Disconnect the common series connection <br> contacts | NO~N7 |

## Rising-edge/falling-edge Detection Commands of Contact

| Commands | Function | Operands |
| :---: | :--- | :---: |
| LDP | Rising-edge detection operation starts | $X, Y, M, T, C$ |
| LDF | Falling-edge detection operation starts | $X, Y, M, T, C$ |
| ANDP | Rising-edge detection series connection | $X, Y, M, T, C$ |
| ANDF | Falling-edge detection series connection | $X, Y, M, T, C$ |
| ORP | Rising-edge detection parallel connection | $X, Y, M, T, C$ |
| ORF | Falling-edge detection parallel connection | $X, Y, M, T, C$ |

## Rising-edge/falling-edge Output Commands

| Commands | Function | Operands |
| :---: | :--- | :---: |
| PLS | Rising-edge output | Y, M |
| PLF | Falling-edge output | Y, M |

End Command

| Commands | Function | Operands |
| :---: | :--- | :---: |
| END | Program end | -- |

## Other Command

| Commands | Function | Operands |
| :---: | :--- | :---: |
| NOP | No function | -- |
| INV | Inverse operation result | -- |
| P | Indicator | P |

### 17.5.2 Explanation for the Command

| Mnemonic | Function |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| LD | Load A contact |  |  |  |  |  |
| Operand | X0~X17 | Y0~Y17 | M0~M799 | T0~159 | C0~C79 | D0~D399 |
|  | $\checkmark$ | $\checkmark$ | $\checkmark$ | $\checkmark$ | $\checkmark$ | - |

L The LD command is used on the A contact that has its start from the left BUS or the A contact that is the start of a contact circuit. Function of the command is to

## Explanation

 save present contents, and at the same time, save the acquired contact status into the accumulative register.Example Ladder diagram $\quad$| Command code | Operation |  |
| :---: | :--- | :--- |
| LD | X0 | Load contact A of XO |

| Mnemonic | Function |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| LDI | Load B contact |  |  |  |  |  |
| Operand | X0~X17 | Y0~Y17 | M0~M799 | T0~159 | C0~C79 | D0~D399 |
|  | $\checkmark$ | $\checkmark$ | $\checkmark$ | $\checkmark$ | $\checkmark$ | - |

The LDI command is used on the B contact that has its start from the left BUS or the $B$ contact that is the start of a contact circuit. Function of the command is to save present contents, and at the same time, save the acquired contact status into the accumulative register.

| Example | Ladder diagram: | Command code: |  | Operation: |
| :--- | :--- | :--- | :--- | :--- |
| LDI | X0 | Load contact B of X0 |  |  |


| Mnemonic | Function |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| AND | Series connection- A contact |  |  |  |  |  |
| Operand | X0~X17 | Y0~Y17 | M0~M799 | T0~159 | C0~C79 | D0~D399 |
|  | $\checkmark$ | $\checkmark$ | $\checkmark$ | $\checkmark$ | $\checkmark$ | - |

The AND command is used in the series connection of A contact. The function of the

## Explanation

 command is to readout the status of present specific series connection contacts first, and then to perform the "AND" calculation with the logic calculation result before the contacts, thereafter, saving the result into the accumulative register.| Example | Ladder diagram: Command code: | Operation: |  |
| :--- | :--- | :--- | :--- |
|  | LDI | X1 | Load contact B of <br> X1 |


| Mnemonic | Function |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ANI | Series connection- B contact |  |  |  |  |  |
| Operand | $\mathrm{X} 0 \sim$ X17 | Y0~Y17 | M0~M799 | T0~159 | C0~C79 | D0~D399 |
|  | $\checkmark$ | $\checkmark$ | $\checkmark$ | $\checkmark$ | $\checkmark$ | - |

The ANI command is used in the series connection of B contact. The function of the command is to readout the status of present specific series connection contacts first, and then to perform the "AND" calculation with the logic calculation result before the contacts, thereafter, saving the result into the accumulative register.

Ladder diagram:

## Example

Command code: Operation:

| LD | X1 | Load contact A of <br> X1 |
| :--- | :--- | :--- |
| ANI | X0 | Connect to contact <br> B of X0 in series |
| OUT | Y1 | Drive Y1 coil |


| Mnemonic | Function |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| OR | Parallel connection- A contact |  |  |  |  |  |
| Operand | X0~X17 | Y0~Y17 | M0~M799 | T0~159 | C0~C79 | D0~D399 |
|  | $\checkmark$ | $\checkmark$ | $\checkmark$ | $\checkmark$ | $\checkmark$ | - |

The OR command is used in the parallel connection of A contact. The function of the command is to readout the status of present specific series connection contacts, and then to perform the "OR" calculations with the logic calculation result before the contacts, thereafter, saving the result into the accumulative register.

Ladder diagram:


Command code: Operation:

| LD | X0 | Load contact A of <br> X0 |
| :---: | :---: | :--- |
| OR | X1 | Connect to contact <br> A of X1 in parallel |
| OUT | Y1 | Drive Y1 coil |


| Mnemonic | Function |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ORI | Parallel connection- B contact |  |  |  |  |  |  |
| Operand | $\mathrm{X} \sim \sim$ X17 | $\mathrm{Y} 0 \sim \mathrm{Y} 17$ | $\mathrm{M} 0 \sim$ M799 | T0~159 | C0~C79 | D0~D399 |  |
|  | $\checkmark$ | $\checkmark$ | $\checkmark$ | $\checkmark$ | $\checkmark$ | - |  |

The ORI command is used in the parallel connection of B contact. The function of the

## Explanation

 command is to readout the status of present specific series connection contacts, and then to perform the "OR" calculations with the logic calculation result before the contacts, thereafter, saving the result into the accumulative register.| Example | Ladder diagram: |  | Command code: |  | Operation: |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | xo |  | LD | X0 | Load contact A of XO |
|  |   <br>   <br>   <br> $\times 1$  |  | ORI | X1 | Connect to contact B of X1 in parallel |
|  |  |  | OUT | Y1 | Drive Y1 coil |


| Mnemonic | Function |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| ANB | Series connection (Multiple Circuits) |  |  |  |
| Operand | None |  |  |  |
| Explanation | To perform the "ANB" calculation between the previous reserved logic results and contents of the accumulative register. |  |  |  |
| Example | Ladder diagram: | Command code: |  | Operation: |
|  | x0 | LD | X0 | Load contact A of X0 |
|  |  | ORI | X2 | Connect to contact B of X2 in parallel |
|  |  | LDI | X1 | Load contact B of X1 |
|  | Block A Block B | OR | X3 | Connect to contact A of X3 in parallel |
|  |  | ANB |  | Connect circuit block in series |
|  |  | OUT | Y1 | Drive Y1 coil |
| Mnemonic | Function |  |  |  |
| ORB | Parallel connection (Multiple circuits) |  |  |  |
| Operand | None |  |  |  |

Explanation
ORB is to perform the "OR" calculation between the previous reserved logic results and contents of the accumulative register.

Command code: Operation:


| LD | X0 | Load contact A of X0 |
| :---: | :--- | :--- |
| ANI | X1 | Connect to contact B of <br> X1 in series |
| LDI | X2 | Load contact B of X2 |
| AND | X3 | Connect to contact A of <br> X3 in series |
| ORB |  | Connect circuit block in <br> parallel |
| OUT | Y1 | Drive Y1 coil |


| Mnemonic | Function |
| :---: | :---: |
| MPS | Store the current result of the internal PLC operations |
| Operand | None |
| Explanation | To save contents of the accumulative register into the operation result. (the result <br> operation pointer pluses 1) |


| Mnemonic | Function |
| :---: | :---: |
| MRD | Reads the current result of the internal PLC operations |
| Operand | None |

## Explanation

Reading content of the operation result to the accumulative register. (the pointer of operation result doesn't move)

| Mnemonic | Function |
| :---: | :---: |
| MPP | Reads the current result of the internal PLC operations |
| Operand | None |

## Explanation

Reading content of the operation result to the accumulative register. (the stack pointer will decrease 1)


Command code: Operation:

| LD | X0 | Load contact A of X0 |
| :---: | :---: | :--- |
| MPS |  | Save in stack |


| Mnemonic | Function |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| OUT | Output coil |  |  |  |  |  |
| Operand | X0~X17 | Y0~Y17 | M0~M799 | T0~159 | C0~C79 | D0~D399 |
|  | - | $\checkmark$ | $\checkmark$ | - | - | - |

Explanation
Output the logic calculation result before the OUT command to specific device.
Motion of coil contact:

|  | Operation result | OUT command |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | Coil | Contact |  |  |
|  |  |  | A contact (normally open) | B contact (normally closed) |  |
|  | FALSE | Off | Non-continuity | Continuity |  |
|  | TRUE | On | Continuity | Non-continuity |  |
| Example | Ladder diagram: |  |  | Command code: | Operation: |
|  |  | $\stackrel{x_{1}}{-} \mid$ | $Y 1$ | LD XO | Load contact B of XO |
|  |  |  |  | AND X1 | Connect to contact A of X 1 in series |
|  |  |  |  | OUT Y1 | Drive Y1 coil |


| Mnemonic | Function |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| SET | Latch (ON) |  |  |  |  |  |
| Operand | X0~X17 | Y0~Y17 | M0~M799 | T0~159 | C0~C79 | D0~D399 |
|  | - | $\checkmark$ | $\checkmark$ | - | - | - |

When the SET command is driven, its specific device is set to be "ON," which will

## Explanation

 keep "ON" whether the SET command is still driven. You can use the RST command to set the device to "OFF",

Command code: Operation:

| LD | X0 | Load contact A of X0 |
| :--- | :--- | :--- |
| AN | Y0 | Connect to contact B of <br> Y0 in series |
| SET | Y1 | Y1 latch (ON) |

## Function

| Mnemonic | Function |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| RST | Clear the contacts or the registers |  |  |  |  |  |
| Operand | $\mathrm{X} 0 \sim \mathrm{X} 17$ | $\mathrm{Y} 0 \sim \mathrm{Y} 17$ | $\mathrm{M} 0 \sim \mathrm{M} 799$ | $\mathrm{~T} 0 \sim 159$ | $\mathrm{C} 0 \sim \mathrm{C} 79$ | D0~D399 |
|  | - | $\checkmark$ | $\checkmark$ | $\checkmark$ | $\checkmark$ | $\checkmark$ |

When the RST command is driven, motion of its specific device is as follows:

## Explanation

| Device | Status |
| :---: | :--- |
| Y, M | Coil and contact will be set to "OFF". |
| T, C | Present values of the timer or counter will be set to 0 , and the coil <br> and contact will be set to "OFF." |
| D | The content value will be set to 0. |

When the RST command is not driven, motion of its specific device is unchanged.


Command code: Operation:

| LD | X0 | Load contact A of X0 |
| :---: | :---: | :--- |
| RST | Y5 | Clear contact Y5 |


| Mnemonic | Function |  |
| :---: | :---: | :---: |
| TMR | 16-bit timer |  |
| Operand | T-K | T0~T159, K0~K32,767 |
|  | T-D | T0~T159, D0~D399 |

Explanation
When TMR command is executed, the specific coil of timer is ON and timer will start to count. When the setting value of timer is attained (counting value $>=$ setting value), the contact will be as following

| NO(Normally Open) | contact | Open <br> collector |
| :---: | :---: | :---: |
| NC(Normally Closed) | contact | Close <br> collector |

When the RST command is not driven, motion of its specific device remains unchanged.

## Example Ladder Diagram:



Command code: Operation:

| LD | X0 | Load contact A of X0 |
| :---: | :---: | :--- |
|  | T5 | Setting of T5 counter |
| TMR | K1000 | is K1000. |


| Mnemonic | Function |  |
| :---: | :---: | :--- |
| CNT | Clear contact or register |  |
| Operand | C-K | C0~C79, K0~K32,767 |
|  | C-D | C0~C79, D0~D399 |
|  |  |  |

Explanation
When the CNT command is executed from OFF $\rightarrow$ ON, which means that the counter coil is driven, and 1 should thus be added to the counter's value; when the counter achieved specific set value (value of counter $=$ the setting value), motion of the contact is as follows:

| NO(Normally Open) contact | Open <br> collector |
| :---: | :---: |
| NC(Normally Close) contact | Close <br> collector |

If there is counting pulse input after counting is attained, the contacts and the counting values will be unchanged. To re-count or to conduct the CLEAR motion, please use the RST command.

| Example |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- |
| Ladder diagram: |  |  |  |  |
|  | XO | CNT | C 2 | K 100 |

Command code: Operation

| LD | X0 $\quad$ Load contact A of |  |
| :---: | :---: | :--- |
| CNT | C2 $\mathbf{K 1 0 0}$ | Setting of C2 counter is |
| K100. |  |  |

## Mnemonic <br> Explanation

MC/MCR Master control Start/Reset
Operand N0~N7

1. $M C$ is the main-control start command. When the MC command is executed, the execution of commands between MC and MCR will not be interrupted. When MC command is OFF, the motion of the commands that between MC and MCR is described as follows:

| Command | Description |
| :--- | :--- |
| Timer | The counting value is set back to zero, the coil and <br> the contact are both turned OFF |
| Accumulative timer | The coil is OFF, and the timer value and the <br> contact stay at their present condition <br> The counting value is back to zero. Both coil and <br> contact are turned OFF. |
| Subroutine timer | The coil is OFF, and the counting value and the <br> contact stay at their present condition |
| Counter | All turned OFF |
| Coils driven up by the OUT <br> command | Devices driven up by the SET <br> and RST commands |
| Stay at present condition |  |

2. MCR is the main-control ending command that is placed at the end of the main-control program and there should not be any contact commands prior to the MCR command.
3. Commands of the MC-MCR main-control program support the nest program structure, with 8 layers as its greatest. Please use the commands in order from NO~ N 7 , and refer to the following:

Ladder Diagram:
Command code: Operation:


| LD | X0 | Load A contact of X0 |
| :---: | :---: | :--- |
| MC | N0 | Enable N0 common <br> series connection <br> contact |
| LD | X1 | Load A contact of X1 <br> OUT |
| Y0 | Drive Y0 coil |  |
| : |  | X2 |
| LD | Xoad A contact of X2 |  |



Usage of the LDF command is the same as the LD command, but the motion is different. It is

Explanation used to reserve present contents and at the same time, saving the detection status of the acquired contact falling-edge into the accumulative register.

Ladder diagram:


Command code: Operation:

| LDF | X0 | Start X0 falling-edge <br> detection |
| :---: | :---: | :--- |
| AND | X1 | Series connection A <br> contact of X1 |
| OUT | Y1 | Drive Y1 coil |


| Mnemonic | Function |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ANDP | Rising-edge series connection |  |  |  |  |  |
| Operand | X0~X17 | Y0~Y17 | M0~M799 | T0~159 | C0~C79 | D0~D399 |
|  | $\checkmark$ | $\checkmark$ | $\checkmark$ | $\checkmark$ | $\checkmark$ | - |

Explanation ANDP command is used in the series connection of the contacts' rising-edge detection.

Command code: | Operation: |
| :--- |

| Mnemonic | Function |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ANDF | Falling-edge series connection |  |  |  |  |  |
| Operand | $\mathrm{X} 0 \sim \mathrm{X} 17$ | Y0~Y17 | M0~M799 | T0~159 | C0~C79 | D0~D399 |
|  | $\checkmark$ | $\checkmark$ | $\checkmark$ | $\checkmark$ | $\checkmark$ | - |



| Mnemonic | Function |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ORP | Rising-edge parallel connection |  |  |  |  |  |
| Operand | X0~X17 | Y0~Y17 | M0~M799 | T0~159 | C0~C79 | D0~D399 |
|  | $\checkmark$ | $\checkmark$ | $\checkmark$ | $\checkmark$ | $\checkmark$ | - |

## Explanation

The ORP commands are used in the parallel connection of the contact's rising-edge detection.

Ladder diagram:


Command code: Operation:

| LD | X0 | Load A contact of X0 |
| :---: | :---: | :--- |
| ORP | X1 | X1 rising-edge <br> detection in parallel <br> connection |
| OUT | Y1 | Drive Y1 coil |


| Mnemonic | Function |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ORF | Falling-edge parallel connection |  |  |  |  |  |
| Operand | $\mathrm{X} \sim \sim$ X17 | $\mathrm{Y} 0 \sim \mathrm{Y} 17$ | $\mathrm{M} 0 \sim \mathrm{M} 799$ | T0~159 | $\mathrm{C} 0 \sim \mathrm{C} 79$ | D0~D399 |
|  | $\checkmark$ | $\checkmark$ | $\checkmark$ | $\checkmark$ | $\checkmark$ | - |



Command code: Operation:

| LD | X0 | Load A contact of X0 |
| :---: | :--- | :--- |
| ORF | X1 | X1 falling-edge <br> detection in parallel <br> connection |
| OUT | Y1 | Drive Y1 coil |


| Mnemonic | Function |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| PLS | Rising-edge output |  |  |  |  |  |
| Operand | $\mathrm{X} 0 \sim$ X17 | Y0~Y17 | M0~M799 | T0~159 | C0~C79 | D0~D399 |
|  | - | $\checkmark$ | $\checkmark$ | - | - | - |



| Timing Diagram: |  |  |
| :--- | :--- | :---: |
| Mnemonic |  |  |
| END | Program End |  |
| Operand |  |  |

It needs to add the END command at the end of ladder diagram program or
Explanation command program. PLC will scan from address o to END command, after the execution it will return to address 0 and scan again.

| Mnemonic | Function |  |
| :---: | :--- | :--- |
| NOP | No action |  |
| Operand |  | None |

NOP command does no operation in the program; the result of executing this
Explanation command will remain the logic operation. Use NOP command if user wants to delete certain command without changing the length of the program.


Command code: Operation:
LD XO Load contact B of XO

NOP
OUT Y1 Drive Y1 coil

| Mnemonic | Function |  |
| :---: | :--- | :--- |
| INV | Inverse operation result |  |
| Operand |  | None |

## Explanation

The operation result (before executing INV command) will be saved inversely into cumulative register.


Command code: Operation:

| LD | X0 | Load contact A of X0 |
| :---: | :---: | :--- |
| INV |  | Operation result <br> inversed |
| OUT | Y1 | Drive Y1 coil |


| Mnemonic | Function |
| :---: | :--- |
| $\mathbf{P}$ | Indicator |
| Operand | P0~P255 |
|  | Indicator P allows API 00 CJ command and API 01 CALL command to skip from 0. <br> Explanation |
|  | Though it is not necessary to start from number 0, same number can not be used <br> twice or serious error would occur. |

Example
Ladder diagram:


Command code: Operation:

| LD | X0 | Load contact A of X0 |
| :---: | :---: | :--- |
| CJ | P10 | Skip command CJ to <br> P10 |
| : |  |  |
| P10 |  | Indicator P10 |
| LD | X1 | Load contact A of X1 |
| OUT | Y1 | Drive Y1 coil |

Skip command CJ to P10 Indicator P10
oad contact A of X1
Drive Y1 coil

### 17.5.3 Description of the Application Commands

|  | API | Mnemonic Codes |  | P <br> Command | Function | STEPS |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 16-bit | 32-bit |  |  | 16bit | 32bit |
| Loop control | 01 | CALL | - | $\checkmark$ | CALL subroutine | 3 | - |
|  | 06 | FEND | - | - | The end of main program | 1 | - |
| Transmission Comparison | 10 | CMP | - | $\checkmark$ | Compare | 7 | 13 |
|  | 11 | ZCP | - | $\checkmark$ | Zone compare | 9 | 17 |
|  | 12 | MOV | - | $\checkmark$ | Data Move | 5 | 9 |
|  | 15 | BMOV | - | $\checkmark$ | Block move | 7 | - |
| Four Fundamental Operations of Arithmetic | 20 | ADD | - | $\checkmark$ | Perform the addition of BIN data | 7 | 13 |
|  | 21 | SUB | - | $\checkmark$ | Perform the subtraction of BIN data | 7 | 13 |
|  | 22 | MUL | - | $\checkmark$ | Perform the multiplication of BIN data | 7 | 13 |
|  | 23 | DIV | - | $\checkmark$ | Perform the division of BIN data | 7 | 13 |
|  | 24 | INC | - | $\checkmark$ | Perform the addition of 1 | 3 | 5 |
|  | 25 | DEC | - | $\checkmark$ | Perform the subtraction of 1 | 3 | 5 |
| Rotation and Displacement | 30 | ROR | - | $\checkmark$ | Rotate to the right | 5 | - |
|  | 31 | ROL | - | $\checkmark$ | Rotate to the left | 5 | - |
| Data <br> Processing | 40 | ZRST | - | $\checkmark$ | Zero Reset | 5 | - |
| Contact type logic operation | 215 | LD\& | DLD\& | - | Contact Logical Operation LD\# | 5 | 9 |
|  | 216 | LD\| | DLD | - | Contact type logic operation LD \# | 5 | 9 |
|  | 217 | LD^ | DLD^ | - | Contact Logical Operation LD\# | 5 | 9 |
|  | 218 | AND\& | DAND\& | - | Contact Logical Operation AND\# | 5 | 9 |
|  | 219 | ANDI | DANDI | - | Contact Logical Operation AND\# | 5 | 9 |
|  | 220 | AND^ | DAND^ | - | Contact Logical Operation AND\# | 5 | 9 |
|  | 221 | OR\& | DOR\& | - | Contact Logical Operation OR \# | 5 | 9 |
|  | 222 | OR\| | DOR\| | - | Contact Logical Operation OR \# | 5 | 9 |


|  | 223 | OR^ | DOR^ | - | Contact Logical Operation OR \# | 5 | 9 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Contact Type Comparison | 224 | LD= | DLD $=$ | - | Load Compare LD※ | 5 | 9 |
|  | 225 | LD> | DLD > | - | Load Compare LD※ | 5 | 9 |
|  | 226 | LD $<$ | DLD $<$ | - | Load Compare LD※ | 5 | 9 |
|  | 228 | LD $<>$ | DLD $<>$ | - | Load Compare LD※ | 5 | 9 |
|  | 229 | LD $<=$ | DLD $<=$ | - | Load Compare LD* | 5 | 9 |
|  | 230 | LD $>=$ | DLD $>=$ | - | Load Compare LD※ | 5 | 9 |
|  | 232 | AND $=$ | DAND $=$ | - | AND Compare※ | 5 | 9 |
|  | 233 | AND > | DAND> | - | AND Compare\% | 5 | 9 |
|  | 234 | AND $<$ | DAND $<$ | - | AND Compare※ | 5 | 9 |
|  | 236 | AND $<>$ | $\text { DAND }<$ | - | AND Compare※ | 5 | 9 |
|  | 237 | AND $<=$ | $\begin{gathered} \text { DAND }< \\ = \end{gathered}$ | - | AND Compare※ | 5 | 9 |
|  | 238 | AND $>=$ | DAND > | - | AND Compare\% | 5 | 9 |
|  | 240 | $\mathrm{OR}=$ | DOR $=$ | - | OR compare $\%$ | 5 | 9 |
|  | 241 | OR> | DOR> | - | OR compare ※ | 5 | 9 |
|  | 242 | OR< | DOR $<$ | - | OR compare ※ | 5 | 9 |
|  | 244 | $\mathrm{OR}<>$ | DOR $<>$ | - | OR compare $\ldots$ | 5 | 9 |
|  | 245 | $\mathrm{OR}<=$ | DOR $<=$ | - | OR compare ※ | 5 | 9 |
|  | 246 | OR $>=$ | DOR $>=$ | - | OR compare ※ | 5 | 9 |
| Special command for AC motor drive | 139 | RPR | - | $\checkmark$ | Read the parameters | 5 | - |
|  | 140 | WPR | - | $\checkmark$ | Write the parameters | 5 | - |
|  | 141 | FPID | - | $\checkmark$ | Drive PID control | 9 | - |
|  | 142 | FREQ | - | $\checkmark$ | Control the drive frequency | 7 | - |
|  | 261 | CANRX | - | $\checkmark$ | Read CANopen Slave data | 9 | - |
|  | 263 | TORQ | - | $\checkmark$ | Set target torque | 5 | - |
|  | 264 | CANTX | - | $\checkmark$ | Write CANopen Slave data | 9 | - |
|  | 265 | CANFLS | - | $\checkmark$ | Update the mapping special D of CANopen | 3 | - |

### 17.5.4 Explanation for the Application Commands

| API | $\square$ | CALL | $\mathbf{P}$ | S |
| :---: | :---: | :---: | :---: | :--- | Call Subroutine 



1. $\mathbf{S}$ : The pointer of call subroutine.
2. Edit the subroutine designated by the pointer after FEND instruction.
3. If only CALL instruction is in use, it can call subroutines of the same pointer number with no limit of times.
4. Subroutine can be nested for 5 levels including the initial CALL instruction. (If entering the sixth level, the subroutine won't be executed.)

| API |  |  |  |  |
| :---: | :---: | :---: | :---: | :--- |
| 06 |  | FEND | - | The end of the main program (First End) |



## Explanation

CALL
Command

1. This instruction denotes the end of the main program. It has the same function as that of END instruction when being executed by PLC.
2. CALL must be written after FEND instruction and add SRET instruction in the end of its subroutine. Interruption program has to be written after FEND instruction and IRET must be added in the end of the service program.
3. If several FEND instructions are in use, place the subroutine and interruption service programs between the final FEND and END instruction.
4. After CALL instruction is executed, executing FEND before SRET will result in errors in the program.


| API |  |  |  |  |  |
| :---: | :--- | :--- | :--- | :--- | :--- |
| 10 | D | CMP | $\mathbf{P}$ | S1 | S2 |


2. The contents in S1 and S2 are compared and result is stored in D.
3. The two comparison values are compared algebraically and the two values are signed binary values. When b15 = 1 in 16-bit instruction, the comparison will regard the value as negative binary values.
5. Designate device YO , and operand D automatically occupies YO , Y 1 , and Y 2 .

Example
6. When $\mathrm{X} 10=\mathrm{On}, \mathrm{CMP}$ instruction will be executed and one of $\mathrm{Y} 0, \mathrm{Y} 1$, and Y 2 will be On. When X10 = Off, CMP instruction will not be executed and Y0, Y1, and Y 2 remain their status before $\mathrm{X} 10=$ Off.
7. If the user need to obtain a comparison result with $\geq \leq$, and $\neq$, make a series parallel connection between Y0 ~ Y2.

8. To clear the comparison result, use RST or ZRST instruction.



| Bit Devices |  |  |  | Word devices |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | X | Y | M | K | H | KnX | KnY | KnM | T | C | D | 16-bit command (9 STEPS) |  |
| $\mathrm{S}_{1}$ |  |  |  | * | * | * | * | * | * | * | * | ZCP ZCPP |  |
| $\mathrm{S}_{2}$ |  |  |  | * | * | * | * | * | * | * | * |  |  |
| S |  |  |  | * | * | * | * | * | * | * | * | 32-bit command (17 STEPS) |  |
| D |  | * | * |  |  |  |  |  |  |  |  | - - - |  |
|  | eran <br> $\mathrm{S}_{1}$ : <br> bou <br> D: |  |  |  |  | arison | S: | arison Comp | paris | $\begin{aligned} & \text { Upr } \\ & \text { on } \mathrm{v} \end{aligned}$ |  | Flag signal: none |  |

Example

1. $\mathbf{S}_{1}$ : Lower bound of zone comparison $\mathbf{S}_{2}$ : Upper bound of zone comparison S : Comparison value

D: Comparison result
2. $S$ is compared with its $\mathbf{S}_{1} \mathbf{S}_{2}$ and the result is stored in $D$.
3. When $\mathbf{S}_{\mathbf{1}}>\mathbf{S}_{2}$, the instruction performs comparison by using $\mathbf{S}_{1}$ as the lower/upper bound.
4. The two comparison values are compared algebraically and the two values are signed binary values. When b15 = 1 in 16-bit instruction or b31 $=1$ in 32-bit instruction, the comparison will regard the value as negative binary values.

1. Designate device M0, and operand D automatically occupies M0, M1 and M2.
2. When $\mathrm{XO}=\mathrm{On}, \mathrm{ZCP}$ instruction will be executed and one of $\mathrm{MO}, \mathrm{M} 1$, and M2 will be On. When X10 = Off, ZCP instruction will not be executed and $\mathrm{MO}, \mathrm{M} 1$, and M 2 remain their status before $\mathrm{X0}=\mathrm{Off}$.
3. If the user need to obtain a comparison result with $\geq \leq$, and $\neq$, make a series parallel connection between $\mathrm{Y} 0 \sim \mathrm{Y} 2$.

4. To clear the comparison result, use RST or ZRST instruction.


| API |  | MOV |  |  | S |
| ---: | :--- | :--- | :--- | :--- | :--- |
| 12 | $\mathbf{D}$ |  | $\mathbf{P}$ |  | Moving the data |


| Bit Devices |  |  |  | Word devices |  |  |  |  |  |  |  | 16-bit command (5 STEPS) |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | X | Y | M | K | H | KnX | KnY | KnM | T | C | D | MOV |  | MOVP |  |
| S |  |  |  | * | * | * | * | * | * | * | * | 32-bit |  |  |  |
| D |  |  |  |  |  |  | * | * | * | * | * | 32-bit | d | (9 STEPS) |  |
| Operand: None |  |  |  |  |  |  |  |  |  |  |  | Flag signal: None |  |  |  |

Explanation

1. S : Source of data
D: Destination of data
2. When this instruction is executed, the content of $S$ will be moved directly to $D$. When this instruction is not executed, the content of $D$ remains unchanged.

Example

1. When $\mathrm{X0}=\mathrm{Off}$, the content in D 10 will remain unchanged. If $\mathrm{XO}=\mathrm{On}$, the value K10 will be moved to D10 data register.
2. When $\mathrm{X} 1=\mathrm{Off}$, the content in D 10 will remain unchanged. If $\mathrm{X} 1=\mathrm{On}$, the present value T0 will be moved to D10 data register.



|  | Bit Devices |  |  | Word devices |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | X | Y | M | K | H | KnX | KnY | KnM | T | C | D |  |
| S |  |  |  |  |  | * | * | * | * | * | * |  |
| D |  |  |  |  |  |  | * | * | * | * | * |  |
| n |  |  |  | * | * |  |  |  |  |  |  |  |

Operand:
Range of $\mathrm{n}=1 \sim 512$
$\frac{16-\text { bit command (7 STEPS) }}{\text { BMOV }}$
32-bit command

Flag signal: None

## Explanation

## Example

1

1. $\mathrm{S}:$ Start of source devices data to be moved
2. The contents in n registers starting from the device designated by S will be moved to n registers starting from the device designated by D . If n exceeds the actual number of available source devices, only the devices that fall within the valid range will be used.

When X10 = On, the contents in registers D0 ~ D3 will be moved to the 4 registers D20 ~ D23.


## Example

Assume the bit devices $\mathrm{KnX}, \mathrm{KnY}, \mathrm{KnM}$ and KnS are designated for moving, the number of digits of $S$ and $D$ has to be the same, i.e. their $n$ has to be the same.

2





## Example

To avoid coincidence of the device numbers to be moved designated by the two operands and cause confusion, please be aware of the arrangement on the
3 designated device numbers.

When $S>D$, the BMOV command is processed in the order as ${ }^{(1)} \rightarrow(2) \rightarrow$ (3)


When $S<D$, the BMOV command is processed in the order as (3) $\rightarrow$ (2) $\rightarrow$ (1)


| API |  | ADD |  | S1 S2 (D) | BIN Addition |
| :---: | :--- | :--- | :--- | :--- | :--- |
| 20 | D |  | $\mathbf{P}$ |  |  |


| Bit Devices |  |  |  | Word devices |  |  |  |  |  |  |  | $\frac{16 \text {-bit command } \frac{(7 \text { STEPS })}{\text { ADD }}}{\text { ADDP }}$ |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | X | Y | M | K | H | KnX | KnY | KnM | T | C | D |  |  |  |
| $\mathrm{S}_{1}$ |  |  |  | * | * | * | * | * | * | * | * | 32-bit command (13 STEPS) |  |  |
| $\mathrm{S}_{2}$ |  |  |  | * | * | * | * | * | * | * | * |  |  |  |
| D |  |  |  |  |  |  | * | * | * | * | * |  |  |  |
| Operands: None |  |  |  |  |  |  |  |  |  |  |  |  | Zero flag Borrow flag Carry flag |  |

1. $\mathbf{S}_{1}$ : Summand $\mathbf{S}_{2}$ : Addend $\mathbf{D}$ : Sum
2. This instruction adds $\mathbf{S}_{1}$ and $\mathbf{S}_{\mathbf{2}}$ in BIN format and store the result in D.
3. The highest bit is symbolic bit $0(+)$ and $1(-)$, which is suitable for algebraic addition, e.g. $3+(-9)=-6$.
4. Flag changes in binary addition

16-bit command:
A. If the operation result $=0$, zero flag M1020 $=$ On.
в. If the operation result $<-32,768$, borrow flag M1021 $=$ On.
c. If the operation result > 32,767, carry flag M1022 = On.

Example 16-bit command:
When $\mathrm{X0}=\mathrm{On}$, the content in D0 will plus the content in D10 and the sum will be stored in D20.


Remarks Flags and the positive/negative sign of the values:


| Bit Devices |  |  |  | Word devices |  |  |  |  |  |  |  | 16-bit command (7 STEPS) |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | X | Y | M | K | H | KnX | KnY | KnM | T | C | D |  |  |  |  |
| $\mathrm{S}_{1}$ |  |  |  | * | * | * | * | * | * | * | * | 32-bit command (13 STEPS) |  |  |  |
| $\mathrm{S}_{2}$ |  |  |  | * | * | * | * | * | * | * | * | - | - |  | - |
| D |  |  |  |  |  |  | * | * | * | * | * | Flag signal: M1020 Zero flag M1021 Borrow flag M1022 Carry flag |  |  |  |
| Operands: None |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

1. $\mathbf{S}_{1}$ : Minuend
$\mathbf{S}_{2}$ : Subtrahend
D: Remainder
2. This instruction subtracts $\mathbf{S}_{\mathbf{1}}$ and $\mathbf{S}_{\mathbf{2}}$ in BIN format and stores the result in $\mathbf{D}$.
3. The highest bit is symbolic bit $0(+)$ and $1(-)$, which is suitable for algebraic subtraction.
4. Flag changes in binary subtraction

In 16-bit instruction:
If the operation result $=0$, zero flag M1020 $=$ On.
If the operation result $<-32,768$, borrow flag M1021 $=$ On.
If the operation result $>32,767$, carry flag M1022 $=$ On.

## Example

In 16-bit BIN subtraction:
When $\mathrm{X0}=\mathrm{On}$, the content in D0 will minus the content in D10 and the remainder will be stored in D20.


| API |  |  |  |  |  |  |
| ---: | :--- | :--- | :--- | :--- | :--- | :--- |
| 22 | D |  | $\mathbf{P}$ | S1 | S2 | D | BIN Multiplication


Explanation

1. $\mathbf{S}_{1}$ : Multiplicand
$\mathbf{S}_{2}$ : Multiplication
D: Product
2. This instruction multiplies $\mathbf{S}_{1}$ by $\mathbf{S}_{\mathbf{2}}$ in BIN format and stores the result in D. Be careful with the positive/negative signs of $\mathbf{S}_{1}, \mathbf{S}_{2}$ and $D$ when doing 16-bit and 32-bit operations.
16-bit command:


Symbol bit = 0 refers to a positive value.
Symbol bit = 1 refers to a negative value.
When D serves as a bit device, it can designate K1 ~ K4 and construct a 16-bit result, occupying consecutive 2 groups of 16 -bit data.

The 16 -bit D0 is multiplied by the 16 -bit D10 and brings forth a 32 -bit product. The higher 16 -bit are stored in D21 and the lower 16-bit are stored in D20. On/Off of the most left bit indicates the positive/negative status of the result value.


| API |  | DIV |  |  |  |  |
| :---: | :--- | :--- | :--- | :--- | :--- | :--- |
| 23 | D |  | $\mathbf{P}$ | S1 | (S2 | BIN Division |


| Bit Devices |  |  |  | Word devices |  |  |  |  |  |  |  | $\frac{16-\text { bit command ( } 7 \text { STEPS) }}{\text { DIV }}$ |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | X | Y | M | K | H | KnX | KnY | KnM | T | C | D |  |  |  |  |
| $\mathrm{S}_{1}$ |  |  |  | * | * | * | * | * | * | * | * |  |  |  |  |
| $\mathrm{S}_{2}$ |  |  |  | * | * | * | * | * | * | * | * | 32-bit command (13 STEPS) |  |  |  |
| D |  |  |  |  |  |  | * | * | * | * | * | - | - |  |  |
| Operands: <br> In 16-bit instruction, D occupies 2 consecutive devices. |  |  |  |  |  |  |  |  |  |  |  | Flag signal: none` |  |  |  |
1. $S_{1}$ : Dividend
$\mathrm{S}_{2}$ : Divisor
D: Quotient and remainder
2. This instruction divides $\mathbf{S}_{1}$ and $\mathbf{S}_{\mathbf{2}}$ in BIN format and stores the result in D . Be careful with the positive/negative signs of $S_{1}, S_{2}$ and $D$ when doing 16-bit and 32-bit operations.

16-bit instruction:


If $D$ is the bit device, it allocates K1~K14 to 16-bit and occupies 2 continuous sets of quotient and remainder.

Example When $\mathrm{XO}=\mathrm{On}$, D0 will be divided by D10; the quotient will be stored in D20 and remainder in D21. On/Off of the highest bit indicates the positive/negative value of the result.

| DIV | D0 | D10 | D20 |  |
| :--- | :--- | :--- | :--- | :--- |
|  | DIV | D0 | D10 | K4Y0 |



| Bit Devices |  |  |  | Word devices |  |  |  |  |  |  |  | 16-bit command (3 STEPS) |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | X | Y | M | K | H | KnX | KnY | KnM | T | C | D |  |  | INCP |  |
| D |  |  |  |  |  |  | * | * | * | * | * | 32-bit command (5 STEPS) |  |  |  |
| Operands: none |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  | Flag signal: none |  |  |  |
| Explanation 1. D: Destination devi |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

1. D: Destination device
2. If the instruction is not a pulse execution one, the content in the designated device $D$ will plus " 1 " in every scan period whenever the instruction is executed.
3. This instruction adopts pulse execution instructions (INCP).
4. In 16-bit operation, 32,767 pluses 1 and obtains -32,768. In 32-bit operation, 2,147,483,647 pluses 1 and obtains -2,147,483,648.

Example When X0 goes from Off to On, the content in DO pluses 1 automatically.


| API |  | DEC |  |  | D |
| :---: | :--- | :--- | :--- | :--- | :--- |
| 25 | $\mathbf{D}$ |  | $\mathbf{P}$ | Decrement: BIN minus 1 |  |


| Bit Devices |  |  |  | Word devices |  |  |  |  |  |  |  | $\frac{16 \text {-bit command ( } 3 \text { STEPS) }}{\text { DEC }}$ |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | X | Y | M | K | H | KnX | KnY | KnM | T | C | D |  |  |  |  |
| Operands: none |  |  |  |  |  |  |  |  |  |  |  | 32-bit command (5 STEPS) |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  | 2-bit | d | ( | - |
|  |  |  |  |  |  |  |  |  |  |  |  | Flag sig | one |  |  |

Explanation D: Destination

1. If the command is not a pulse execution type, the content in the designated device $D$ will minus " 1 " in every scan period whenever the instruction is executed.
2. This instruction adopts pulse execution instructions (DECP).
3. In 16-bit operation, $-32,768$ minuses 1 and obtains 32,767 . In 32-bit operation, $-2,147,483,648$ minuses 1 and obtains 2,147,483,647.

Example When X0 goes from Off to On, the content in D0 minuses 1 automatically.


| API | - | ROR |  | D | D |
| :---: | :--- | :--- | :--- | :--- | :--- |$\quad$ Rotate to the Right


| Bit Devices |  |  |  | Word devices |  |  |  |  |  |  |  | 16 bit command (5 STEPS) |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | X | Y | M | K | H | KnX | KnY | KnM | T | C | D | ROR | RORP |  |
| D |  |  |  |  |  |  | * | * | * | * | * |  |  |  |
| n |  |  |  | * | * |  |  |  |  |  |  | 32-bit command |  |  |
| Operands:D: if in KnY and KnM, only K4 (16-bit) is valid$\mathrm{n}: \mathrm{n}=$ K1~K16 (16-bit) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

Explanation 1. D: Device to be rotated $\mathbf{n}$ : Number of bits to be rotated in 1 rotation
2. This instruction rotates the device content designated by $\mathbf{D}$ to the right for n bits.
3. This instruction adopts pulse execution instructions (RORP).

Example When X 0 goes from Off to On, the 16-bit (4 bits as a group) in D10 will rotate to the right, as shown in the figure below. The bit marked with $※$ will be sent to carry flag M1022.


| API | $\square$ | ROL |  |  |  |
| :---: | :--- | :--- | :--- | :--- | :--- |
| 31 |  | P |  | Rotate to the Left |  |


| Bit Devices |  |  |  | Word devices |  |  |  |  |  |  |  | 16-bit command (5 STEPS) |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | X | Y | M | K | H | KnX | KnY | KnM | T | C | D | ROL |  | ROL |  |
| D |  |  |  |  |  |  | * | * | * | * | * | 32-bit command |  |  |  |
| n |  |  |  | * | * |  |  |  |  |  |  | 32-bit |  |  |  |
| Operands: <br> D: if in KnY and KnM, only K4 (16-bit) is valid <br> n : $\mathrm{n}=\mathrm{K} 1 \sim \mathrm{~K} 16$ (16-bit) |  |  |  |  |  |  |  |  |  |  |  | Flag sig | 1022 | Carry |  |

1. D: Device to be rotated; $\mathbf{n}$ : Number of bits to be rotated in 1 rotation
2. This instruction rotates the device content designated by $\mathbf{D}$ to the left for n bits.
3. This instruction adopts pulse execution instructions (ROLP).

Example When X0 goes from Off to On, the 16-bit (4 bits as a group) in D10 will rotate to the left, as shown in the figure below. The bit marked with $※$ will be sent to carry flag M1022.


| API |  |  |  | (D1) (D2) | Zero Reset |
| :---: | :---: | :---: | :---: | :--- | :--- |
| 40 | ZRST | $\mathbf{P}$ |  |  |  |


| Bit Devices |  |  |  | Word devices |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | X | Y | M | K | H | KnX | KnY | KnM | T | C | D | $16-\mathrm{bit}$ command (5 STEPS) |  |  |
| D |  | * | * |  |  |  |  |  | * | * | * | ZRST | ZRSTP |  |
| $\mathrm{D}_{2}$ |  | * | * |  |  |  |  |  | * | * | * | 32-bit command |  |  |
| Operands: <br> No of $D_{1}$ operand. $\leqq$ No. of $D_{2}$ operand $D_{1}$ and $D_{2}$ must select same device type |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  | Flag signal: none |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |

Explanation
$D_{1}$ : Start device of the range to be reset
$\mathrm{D}_{2}$ : End device of the range to be reset When $\mathbf{D}_{1}>\mathrm{D}_{2}$, only operands designated by $\mathrm{D}_{2}$ will be reset.

## Example

1. When $\mathrm{XO}=$ On, auxiliary relays M300 ~M399 will be reset to Off.
2. When $\mathrm{X} 1=\mathrm{On}, 16$ counters $\mathrm{C} 0 \sim \mathrm{C} 127$ will all be reset (writing in 0 ; contact and coil being reset to Off).
3. When $\mathrm{X} 10=$ On, timers $\mathrm{T} 0 \sim \mathrm{~T} 127$ will all be reset (writing in 0 ; contact and coil being reset to Off).
4. When $\mathrm{X} 3=\mathrm{On}$, data registers $\mathrm{D} 0 \sim \mathrm{D} 100$ will be reset to 0 .


Remarks 1. Devices, e.g. bit devices $\mathrm{Y}, \mathrm{M}, \mathrm{S}$ and word devices $\mathrm{T}, \mathrm{C}, \mathrm{D}$, can use RST instruction.
2. API 16 FMOV instruction is also to send K0 to word devices T, C, D or bit registers KnY, KnM, KnS for reset.


| API |  |  |  |  |
| :---: | :---: | :---: | :---: | :--- |
| $215 \sim$ <br> 217 | D | LD\# | S1) S2 | Contact Logical Operation LD\# |



Explanation

1. $\mathbf{S}_{1}$ : Data source device $1 \quad \mathbf{S}_{2}$ : Data source device 2
2. This instruction compares the content in $\mathbf{S}_{1}$ and $\mathbf{S}_{2}$. If the result is not " 0 ", the continuity of the instruction is enabled. If the result is " 0 ", the continuity of the instruction is disabled.
3. LD\# (\#: \& , |, ^) instruction is used for direct connection with BUS.

| API No. | 16 -bit <br> instruction | 32 -bit <br> instruction | Continuity condition |  |  | No-continuity <br> condition |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 215 | LD\& | DLD\& | $\mathbf{S}_{1}$ | $\&$ | $\mathbf{S}_{2}$ | $\neq 0$ | $\mathbf{S}_{1}$ | $\&$ | $\mathbf{S}_{2}$ | $=0$ |
| 216 | LD\| | DLD\| | $\mathbf{S}_{1}$ | $\mid$ | $\mathbf{S}_{2}$ | $\neq 0$ | $\mathbf{S}_{1}$ | $\mid$ | $\mathbf{S}_{2}$ | $=0$ |
| 217 | LD^ $^{\wedge}$ | DLD $^{\wedge}$ | $\mathbf{S}_{1}$ | $\wedge$ | $\mathbf{S}_{2}$ | $\neq 0$ | $\mathbf{S}_{1}$ | $\wedge$ | $\mathbf{S}_{2}$ | $=0$ |

4. \&: Logical "AND" operation
5. |: Logical "OR" operation
6. ^: Logical "XOR" operation
7. When the result of logical AND operation of CO and $\mathrm{C} 10 \neq 0, \mathrm{Y} 10=\mathrm{On}$.
8. When the result of logical OR operation of D200 and D300 $=0$ and $\mathrm{X} 1=\mathrm{On}$, Y11 = On will be retained.



9. $S_{1}$ : Data source device $1 \quad S_{2}$ : Data source device 2
10. This instruction compares the content in $\mathbf{S}_{1}$ and $\mathbf{S}_{\mathbf{2}}$. If the result is not " 0 ", the continuity of the instruction is enabled. If the result is " 0 ", the continuity of the instruction is disabled.
11. AND\# (\#: \& , $\left.\right|^{\wedge}$ ) is an operation instruction used on series contacts.

| API No. | $\begin{gathered} 16 \text {-bit } \\ \text { instruction } \end{gathered}$ | $\begin{gathered} 32 \text {-bit } \\ \text { instruction } \end{gathered}$ | Continuity condition |  |  |  | No-continuity condition |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 218 | AND\& | DAND\& | $\mathrm{S}_{1}$ | \& | $\mathrm{S}_{2}$ |  | $\mathrm{S}_{1}$ | \& | $\mathrm{S}_{2}$ | $=0$ |
| 219 | AND\| | DAND\| | $\mathrm{S}_{1}$ | \| | $\mathrm{S}_{2}$ | $\neq 0$ | $\mathrm{S}_{1}$ | \| | $\mathrm{S}_{2}$ | $=0$ |
| 220 | $\mathrm{AND}^{\wedge}$ | DAND^ | $\mathrm{S}_{1}$ | $\wedge$ | $\mathrm{S}_{2}$ | $\neq 0$ | $\mathrm{S}_{1}$ | $\wedge$ | $\mathrm{S}_{2}$ | $=0$ |

4. \&: Logical "AND" operation
5. |: Logical "OR" operation
6. ^: Logical "XOR" operation
7. When $\mathrm{X} 0=\mathrm{On}$ and the result of logical AND operation of C 0 and $\mathrm{C} 10 \neq 0, \mathrm{Y} 10=$ On.
8. When $\mathrm{X} 1=\mathrm{Off}$ and the result of logical OR operation of D 10 and $\mathrm{D} 0 \neq 0$ and $\mathrm{X} 1=$ On, Y11 = On will be retained.
9. When $\mathrm{X} 2=$ On and the result of logical XOR operation of 32-bit register D200 (D201) and 32-bit register D100 (D101) $=0$ or M3 $=$ On, M50 $=$ On.



10. $\mathbf{S}_{1}$ : Data source device $1 \quad \mathbf{S}_{2}$ : Data source device 2
11. This instruction compares the content in $S_{1}$ and $S_{2}$. If the result is not " 0 ", the continuity of the instruction is enabled. If the result is " 0 ", the continuity of the instruction is disabled.
12. OR\# (\#: \& $\mid,,^{\wedge}$ ) is an operation instruction used on parallel contacts.

| API No. | 16 -bit <br> instruction | 32 -bit <br> instruction | Continuity condition | No-continuity <br> condition |  |  |  |  |  |  |
| :---: | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 221 | OR\& | DOR\& | $\mathbf{S}_{1}$ | $\&$ | $\mathbf{S}_{2}$ | $\neq 0$ | $\mathbf{S}_{1}$ | $\&$ | $\mathbf{S}_{2}$ | $=0$ |
| 222 | OR $\mid$ | DOR $\mid$ | $\mathbf{S}_{1}$ | $\mid$ | $\mathbf{S}_{2}$ | $\neq 0$ | $\mathbf{S}_{1}$ | । | $\mathbf{S}_{2}$ | $=0$ |
| 223 | OR $^{\wedge}$ | DOR^ $^{\wedge}$ | $\mathbf{S}_{1}$ | $\wedge$ | $\mathbf{S}_{2}$ | $\neq 0$ | $\mathbf{S}_{1}$ | $\wedge$ | $\mathbf{S}_{2}$ | $=0$ |

4. \&: Logical "AND" operation
5. |: Logical "OR" operation
6. ^: Logical "XOR" operation

When $\mathrm{X1}=\mathrm{On}$ and the result of logical AND operation of C 0 and $\mathrm{C} 10 \neq 0, \mathrm{Y} 10=\mathrm{On}$.

1. M60 will be On, if X 2 and M 30 are On with one of the following two conditions: 1. The OR operation result of 32-bit register D10 (D11) and 32-bit register D20(D21) does not equal to 0 . 2. The XOR operation result of 32-bit counter C235 and 32bits register D200 (D201) does not equal 0.




Explanation

1. $\mathbf{S}_{1}$ : Data source device $1 \quad \mathbf{S}_{2}$ : Data source device 2
2. This instruction compares the content in $\mathbf{S}_{1}$ and $\mathbf{S}_{2}$. Take API224 (LD=) for example, if the result is " $=$ ", the continuity of the instruction is enabled. If the result is " $\neq$ ", the continuity of the instruction is disabled.
3. LD $(\ldots:=,>,<,<>, \leq, \geq)$ instruction is used for direct connection with BUS.

| API No. | 16 -bit <br> instruction | 32 -bit <br> instruction | Continuity <br> condition | No-continuity <br> condition |
| :---: | :--- | :--- | :---: | :---: |
| 224 | $\mathrm{LD}=$ | $\mathrm{DLD}=$ | $\mathbf{S}_{\mathbf{1}}=\mathbf{S}_{\mathbf{2}}$ | $\mathbf{S}_{\mathbf{1}} \neq \mathbf{S}_{\mathbf{2}}$ |
| 225 | $\mathrm{LD}>$ | $\mathrm{DLD}>$ | $\mathbf{S}_{\mathbf{1}}>\mathbf{S}_{\mathbf{2}}$ | $\mathbf{S}_{\mathbf{1}} \leqq \mathbf{S}_{\mathbf{2}}$ |
| 226 | $\mathrm{LD}<$ | $\mathrm{DLD}<$ | $\mathbf{S}_{\mathbf{1}}<\mathbf{S}_{\mathbf{2}}$ | $\mathbf{S}_{\mathbf{1}} \geqq \mathbf{S}_{\mathbf{2}}$ |
| 228 | $\mathrm{LD}<>$ | $\mathrm{DLD}<>$ | $\mathbf{S}_{\mathbf{1}} \neq \mathbf{S}_{\mathbf{2}}$ | $\mathbf{S}_{\mathbf{1}}=\mathbf{S}_{\mathbf{2}}$ |
| 229 | $\mathrm{LD}<=$ | $\mathrm{DLD}<=$ | $\mathbf{S}_{\mathbf{1}} \leqq \mathbf{S}_{\mathbf{2}}$ | $\mathbf{S}_{\mathbf{1}}>\mathbf{S}_{\mathbf{2}}$ |
| 230 | $\mathrm{LD}>=$ | $\mathrm{DLD}>=$ | $\mathbf{S}_{\mathbf{1}} \geqq \mathbf{S}_{\mathbf{2}}$ | $\mathbf{S}_{\mathbf{1}}<\mathbf{S}_{\mathbf{2}}$ |

Example

1. When the content in $\mathrm{C} 10=\mathrm{K} 200, \mathrm{Y} 10=\mathrm{On}$.
2. When the content in $\mathrm{D} 200>\mathrm{K}-30$ and $\mathrm{X} 1=\mathrm{On}, \mathrm{Y} 11=$ On will be retained.


| API |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| $232 \sim$ <br> 238 | D | AND $\%$ | S1 (S2 | AND Compare $\%$ |


|  | Bit Devices |  |  | Word devices |  |  |  |  |  |  |  | $\begin{aligned} & 16-\text { bit command (5 STEPS) } \\ & \text { AND } \% \end{aligned}$ |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | X | Y | M | K | H | KnX KnY KnM |  |  | T | C | D |  |  |  |  |
| $\mathrm{S}_{1}$ |  |  |  | * | * | * | * | * | * | * | * |  |  |  |  |
| $\mathrm{S}_{2}$ |  |  |  | * | * | * | * | * | * | * | * | B2-bit command (9 STEPS) |  |  |  |
| Operands: $\nVdash:=,>,<,<>, \leqq, \geqq$ <br> Please refer to the specifications of each model for the range of operands. |  |  |  |  |  |  |  |  |  |  |  | Flag sign | -- |  |  |

Explanation

1. $\begin{array}{lll}\mathbf{S}_{1} \text { : Data source device } 1 & \mathbf{S}_{2} \text { : Data source device } 2\end{array}$
2. This instruction compares the content in $\mathbf{S}_{\mathbf{1}}$ and $\mathbf{S}_{\mathbf{2}}$. Take API232 (AND=) for example, if the result is " $=$ ", the continuity of the instruction is enabled. If the result is " $\neq$ ", the continuity of the instruction is disabled.
3. AND ( $※:=,>,<,<>, \leq, \geq$ ) is a comparison instruction is used on series contacts

| API No. | $16-$ bit <br> instruction | $32-$ bit <br> instruction | Continuity <br> condition | No-continuity <br> condition |
| :---: | :--- | :--- | :---: | :---: |
| 232 | AND $=$ | DAND $=$ | $\mathbf{S}_{\mathbf{1}}=\mathbf{S}_{\mathbf{2}}$ | $\mathbf{S}_{\mathbf{1}} \neq \mathbf{S}_{\mathbf{2}}$ |
| 233 | AND $>$ | DAND $>$ | $\mathbf{S}_{\mathbf{1}}>\mathbf{S}_{\mathbf{2}}$ | $\mathbf{S}_{\mathbf{1}} \leqq \mathbf{S}_{\mathbf{2}}$ |
| 234 | AND $<$ | DAND $<$ | $\mathbf{S}_{\mathbf{1}}<\mathbf{S}_{\mathbf{2}}$ | $\mathbf{S}_{\mathbf{1}} \geqq \mathbf{S}_{\mathbf{2}}$ |
| 236 | AND $<>$ | DAND $<>$ | $\mathbf{S}_{\mathbf{1}} \neq \mathbf{S}_{\mathbf{2}}$ | $\mathbf{S}_{\mathbf{1}}=\mathbf{S}_{\mathbf{2}}$ |
| 237 | AND $<=$ | DAND $<=$ | $\mathbf{S}_{\mathbf{1}} \leqq \mathbf{S}_{\mathbf{2}}$ | $\mathbf{S}_{\mathbf{1}}>\mathbf{S}_{\mathbf{2}}$ |
| 238 | AND $>=$ | DAND $>=$ | $\mathbf{S}_{\mathbf{1}} \geqq \mathbf{S}_{\mathbf{2}}$ | $\mathbf{S}_{\mathbf{1}}<\mathbf{S}_{\mathbf{2}}$ |

Example

1. When $\mathrm{X} 0=\mathrm{On}$ and the content in $\mathrm{C} 10=\mathrm{K} 200, \mathrm{Y} 10=\mathrm{On}$.
2. When $\mathrm{X} 1=\mathrm{Off}$ and the content in $\mathrm{D} 0 \neq \mathrm{K}-10, \mathrm{Y} 11=\mathrm{On}$ will be retained.
3. When $\mathrm{X} 2=\mathrm{On}$ and the content in 32-bit register D 0 (D11) $<678,493$ or $\mathrm{M} 3=$ On, M50 = On.




Explanation

1. $\begin{array}{lll}\mathbf{S}_{1} \text { : Data source device } 1 & \mathbf{S}_{2} \text { : Data source device } 2\end{array}$
2. This instruction compares the content in $\mathbf{S}_{\mathbf{1}}$ and $\mathbf{S}_{\mathbf{2}}$. Take API240 (OR=) for example, if the result is " $=$ ", the continuity of the instruction is enabled. If the result is " $\neq$ ", the continuity of the instruction is disabled.
3. OR $\because(※:=,>,<,<>, \leq, \geq)$ is an comparison instruction used on parallel contacts.

| API No. | 16 -bit <br> instruction | 32 -bit <br> instruction | Continuity <br> condition | No-continuity <br> condition |
| :---: | :--- | :--- | :---: | :---: |
| 232 | AND $=$ | DAND $=$ | $\mathbf{S}_{\mathbf{1}}=\mathbf{S}_{\mathbf{2}}$ | $\mathbf{S}_{\mathbf{1}} \neq \mathbf{S}_{\mathbf{2}}$ |
| 233 | AND $>$ | DAND $>$ | $\mathbf{S}_{\mathbf{1}}>\mathbf{S}_{\mathbf{2}}$ | $\mathbf{S}_{\mathbf{1}} \leqq \mathbf{S}_{\mathbf{2}}$ |
| 234 | AND $<$ | DAND $<$ | $\mathbf{S}_{\mathbf{1}}<\mathbf{S}_{\mathbf{2}}$ | $\mathbf{S}_{\mathbf{1}} \geqq \mathbf{S}_{\mathbf{2}}$ |
| 236 | AND $<>$ | DAND $<>$ | $\mathbf{S}_{\mathbf{1}} \neq \mathbf{S}_{\mathbf{2}}$ | $\mathbf{S}_{\mathbf{1}}=\mathbf{S}_{\mathbf{2}}$ |
| 237 | AND $<=$ | DAND $<=$ | $\mathbf{S}_{\mathbf{1}} \leqq \mathbf{S}_{\mathbf{2}}$ | $\mathbf{S}_{\mathbf{1}}>\mathbf{S}_{\mathbf{2}}$ |
| 238 | AND $>=$ | DAND $>=$ | $\mathbf{S}_{\mathbf{1}} \geqq \mathbf{S}_{\mathbf{2}}$ | $\mathbf{S}_{\mathbf{1}}<\mathbf{S}_{\mathbf{2}}$ |

Example

1. When $\mathrm{X} 1=\mathrm{On}$ and the present value of $\mathrm{C} 10=\mathrm{K} 200, \mathrm{Y} 0=\mathrm{On}$.
2. When $\mathrm{X} 1=$ Off and the content in $\mathrm{D} 0 \neq \mathrm{K}-10, \mathrm{Y} 11=$ On will be retained.
3. M50 will be On when X2=On and the content of 32-bit register D0(D11) <678,493 or M3= On.


| API |  |  |  |  |  | TCMP |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| $\mathbf{P}$ | S1 | S2 | S3 | S | Time Compare |  |  |
| 160 |  |  |  |  |  |  |  |


|  | Bit Devices |  |  | Word Devices |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | X | Y | S | K | H | KnX | KnY | KnM | T | C | D |
| $\mathrm{S}_{1}$ |  |  |  | * | * | * | * | * | * | * | * |
| $\mathrm{S}_{2}$ |  |  |  | * | * | * | * | * | * | * | * |
| $\mathrm{S}_{3}$ |  |  |  | * | * | * | * | * | * | * | * |
| S |  |  |  |  |  |  |  |  | * | * | * |
| D |  | * | * |  |  |  |  |  |  |  |  |

Operands: $\mathbf{S}_{\mathbf{1}}, \mathbf{S}_{\mathbf{2}}, \mathbf{S}_{\mathbf{3}}$; Range: $\mathbf{S}_{\mathbf{1}}=\mathrm{K} 0 \sim \mathrm{~K} 23, \mathbf{S}_{\mathbf{2}}=\mathrm{S} 3=\mathrm{K} 0 \sim \mathrm{~K} 59$
S will occupy 3 consecutive devices;
D will occupy 3 consecutive points
Please refer to the specifications of each model for the range of operands

| 16-bit command (11 STEP) |  |  |
| :---: | :---: | :---: |
| TCMP | TCMP |  |
|  | P |  |
| 32-bit command |  |  |
| - | - | - |

Flag signal: None

1. $\mathbf{S}_{1}$ : "Hour" for comparison (K0~K23). $\mathbf{S}_{2}$ : "Minute" for comparison (K0~K59). $\mathbf{S}_{3}$ : "Second" for comparison (K0~K59). S: current time of RTC. D: Comparison result.
2. $\mathbf{S}_{1}, \mathbf{S}_{\mathbf{2}}$ and $\mathbf{S}_{\mathbf{3}}$ are compared with the present values of "hour", "minute" and "second" starting from $\mathbf{S}$. The comparison result is stored in $\mathbf{D}$.
3. $S$ is the "hour" of the current time ( $\mathrm{KO} \sim \mathrm{K} 23$ ) in RTC; $\mathrm{S}+1$ is the "minute" ( $\mathrm{KO} \sim$ K59) and $S+2$ is the "second" (K0 ~K59).
4. $S$ is read by TRD instruction and the comparison is started by TCMP instruction. If $S$ exceeds the range, the program will regard this as an operation error and the instruction will not be executed, M1068 = On
5. When $\mathrm{X} 10=\mathrm{On}$, the instruction will compare the current time in RTC (D20 ~ D22) with the set value 12:20:45 and display the result in M10 ~ M12. When X10 goes from On to Off, the instruction will not be executed, but the On/Off stauts prior to M10 ~ M12 will remain.
6. Connect $\mathrm{M} 10 \sim \mathrm{M} 12$ in series or in parallel to obtain the result of $\geqq$, $\leqq$, and $\neq$.


| API | TZCP |  | (S1) S2 S D | Time Zone Compare |
| :---: | :---: | :---: | :---: | :---: |
| 161 |  | P |  |  |


| Bit Devices |  |  |  |  |  |  |  |  |  | Word Devices |  |  |  |  |  |  |  |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | X | Y | M | K | H | KnX | KnY | KnM | T | C | D |  |  |  |  |  |  |
| $\mathbf{S}_{1}$ |  |  |  |  |  |  |  |  | $*$ | $*$ | $*$ |  |  |  |  |  |  |
| $\mathbf{S}_{2}$ |  |  |  |  |  |  |  |  | $*$ | $*$ | $*$ |  |  |  |  |  |  |
| S |  |  |  |  |  |  |  |  | $*$ | $*$ | $*$ |  |  |  |  |  |  |
| D |  | $*$ | $*$ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

Operands: $\mathbf{S}_{1}, \mathbf{S}_{2}$, Swill occupy 3 consecutive devices.
The content in $\mathbf{S}_{1}$ must be less than the content in $\mathbf{S}_{\mathbf{2}}$.
D will occupy 3 consecutive points.
Please refer to the specifications of each model for the range of operands

| 16-bit command (9 STEP) |  |
| :--- | :--- |
| TZCP | TZCPP |
| 32-bit command |  |
| $-\quad-\quad-$ |  |

Flag signal: None

## Explanation

1. $\mathbf{S}_{\mathbf{1}}$ : Lower bound of the time for comparison; $\mathbf{S}_{\mathbf{2}}$ : Upper bound of the time for comparison S: Current time of RTC;

D: Comparison result
2. $\mathbf{S}$ is compared with $\mathbf{S}_{1}$ and $\mathbf{S}_{\mathbf{2}}$. The comparsion result is stored in $\mathbf{D}$.
3. $\mathbf{S}_{1}, \mathbf{S}_{1}+1, \mathbf{S}_{1}+2$ : The "hour", "minute" and "second" of the lower bound of the time for comparison.
4. $\mathbf{S}, \mathbf{S}+1, \mathbf{S}+2$ : The "hour", "minute" and "second" of the current time of RTC.
5. D0 designated by S is read by TRD instruction and the comparison is started by TZCP instruction. If $\mathbf{S}_{1}, \mathbf{S}_{\mathbf{2}}$, and $\mathbf{S}$ exceed their ranges, the program will regard this as an operation error and the instruction will not be executed, M1068 $=$ On.
6. When $\mathbf{S}<\mathbf{S}_{1}$ and $\mathbf{S}<\mathbf{S}_{2}$, D will be On. When $\mathbf{S}>\mathbf{S}_{1}$ and $\mathbf{S}>\mathbf{S}_{2}, \mathbf{D}+2$ will be On. In other occasions, $\mathbf{D}+1$ will be On.

When X10= On, TZCP instruction will be executed and one of M10 ~ M12 will be On. When X10 = Off, TZCP instruction will not be executed and the status of M10 ~ M12 prior to $\mathrm{X} 10=$ Off will remain unchanged.


| API | TADD | (S1) (S2) (D) | Time Addition |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 162 | PA | $\mathbf{P}$ |  |


| Bit Devices |  |  |  |  |  |  |  |  |  | Word Devices |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | X | Y | M | K | H | KnX | KnY | KnM | T | C | D |  |  |  |  |  |
| $\mathrm{S}_{1}$ |  |  |  |  |  |  |  |  | $*$ | $*$ | $*$ |  |  |  |  |  |
| $\mathrm{~S}_{2}$ |  |  |  |  |  |  |  |  | $*$ | $*$ | $*$ |  |  |  |  |  |
| D |  |  |  |  |  |  |  |  | $*$ | $*$ | $*$ |  |  |  |  |  |

Operands: $\mathbf{S}_{1}, \mathbf{S}_{2}$, and D will occupy 3 consecutive devices. Please refer to the specifications of each model for the range of operands

| 16-bit command (7 STEPS) |  |
| :--- | :--- |
| TADD TADDP |  |
| $-\quad-\quad-\quad-$ |  |

Flag Signal: M1020 Zero flag M1022 Carry flag

Explanation

1. $S_{1}$ : Time summand $S_{2}$ : Time addend $D$ : Time sum
2. $\mathbf{S}_{1}+\mathbf{S}_{2}=\mathbf{D}$. The hour, minute, and second of the RTC designated in $\mathbf{S}_{1}$ plus the hour, minute, and second designated in $\mathbf{S}_{2}$. The result is stored in the hour, minute, and second of the register designated in $\mathbf{D}$.
3. If $\mathbf{S}_{1}$ and $\mathbf{S}_{\mathbf{2}}$ exceed their ranges, the program will regard this as an operation error and the instruction will not be executed, M1068 = On.
4. If the sum is larger than 24 hours, the carry flag M1022 will be On and the value in $\mathbf{D}$ will be the result of "sum minuses 24 hours".
5. If the sum equals 0 (00:00:00), the zero flag M1020 will be On.

Example

1. When $\mathrm{X} 10=\mathrm{On}, \mathrm{TADD}$ instruction will be executed and the hour, minute and second in RTC designated in D0 ~ D2 will plus the hour, minute and second in RTC designated in D10 ~ D12. The sum is stored in the hour, minute and second of the register designated in D20 ~ D22.

2. If the sum is larger than 24 hours, M1022 will be On.


| API |  |  |  |  | TSUB |
| :--- | :--- | :--- | :--- | :--- | :--- |
| 163 |  | S1 | S2 | D | Time Subtraction |


| Bit Devices |  |  |  |  |  |  |  |  |  | Word Devices |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | X | Y | M | K | H | KnX | KnY | KnM | T | C | D |  |  |  |  |  |
| $\mathrm{S}_{1}$ |  |  |  |  |  |  |  |  | $*$ | $*$ | $*$ |  |  |  |  |  |
| $\mathrm{~S}_{2}$ |  |  |  |  |  |  |  |  | $*$ | $*$ | $*$ |  |  |  |  |  |
| D |  |  |  |  |  |  |  |  | $*$ | $*$ | $*$ |  |  |  |  |  |

Operands: $\mathbf{S}_{\mathbf{1}}, \mathbf{S}_{\mathbf{2}}$, and $\mathbf{D}$ will occupy 3 consecutive devices. Please refer to the specifications of each model for the range of operands

| 16 -bit command (7 STEP) |  |
| :---: | :---: |
| TSUB | TSUB |
|  | $P$ |

## 32-bit command

Flag signal: M1020 Zero flag M1021 Barrow flag

Explanation

1. $\mathbf{S}_{1}$ : Time minuend $\mathbf{S}_{2}$ : Time subtrahend D: Time remainder
2. $\mathbf{S}_{\mathbf{1}}-\mathbf{S}_{\mathbf{2}}=\mathbf{D}$. The hour, minute, and second of the RTC designated in $\mathbf{S}_{1}$ minus the hour, minute, and second designated in $\mathbf{S}_{\mathbf{2}}$. The result is stored in the hour, minute, and second of the register designated in $\mathbf{D}$.
3. If $\mathbf{S}_{1}$ and $\mathbf{S}_{2}$ exceed their ranges, the program will regard this as an operation error and the instruction will not be executed. M1068 will be On.
4. If the remainder is a negative value, the borrow flag M1021 will be On. The value in $\mathbf{D}$ will be the result of "the negative value pluses 24 hours".
5. If the remainder equals 0 (00:00:00), the zero flag M1020 will be On.
6. When $\mathrm{X} 10=\mathrm{On}$, TADD instruction will be executed and the hour, minute and second in RTC designated in D0~ D2 will minus the hour, minute and second in RTC designated in D10 ~ D12. The remainder is stored in the hour, minute and second of the register designated in D20 ~ D22.


| D0 20 (hours) |  | D10 14(hours) | $\longrightarrow$ | D20 5 (hours) |
| :---: | :---: | :---: | :---: | :---: |
| D1 20 (mins) |  | D11 30 (mins) |  | D21 49 (mins) |
| D2 5 (secs) |  | D12 8 (secs) |  | D22 57 (secs) |
| 20:20:05 |  | 14:30:08 |  |  |

2. If the subtraction result is a negative value, M1021 will be On.



| API |  | TRD |  | D | Time Read |
| :--- | :--- | :--- | :--- | :--- | :--- |
|  |  |  |  |  |  |


| Bit Devices | Word Devices |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | X | Y | M | K | H | KnX | KnY | KnM | T | C | D |
| $\mathbf{D}$ |  |  |  |  |  |  |  |  | $*$ | $*$ | $*$ |

Operand: D will occupy 7 consecutive devices.
Please refer to the specifications of each model for the range of operands

## 16-bit command (3 STEP) <br> TRD TRDP

## 32-bit command

Flag signal: None

Example

1. D: The device for storing the current time read in RTC
2. The built-in RTC in EH/EH2/SV/SA/SX/SC series MPU offers 7 data (year, week, month, day, hour, minute, second) stored in D1063 ~ D1069. TRD instruction is for program designers to read the current data in RTC and store the data to the 7 registers designated.
3. When $\mathrm{XO}=\mathrm{On}$, the instruction will read the current time in RTC to the designated registers D0 ~ D6.
4. The content of D1318: $1=$ Monday; $2=$ Tuesday $. .7=$ Sunday


| $\begin{gathered} \text { Special } \\ \text { D } \end{gathered}$ | Item | Content | $\rightarrow$ | General <br> D | Item |
| :---: | :---: | :---: | :---: | :---: | :---: |
| D1063 | Year (A.D.) | 00~99 |  | D0 | Year (A.D.) |
| D1064 | $\begin{gathered} \text { Day } \\ \text { (Mon~Sun) } \end{gathered}$ | 1~7 | $\rightarrow$ | D1 | $\begin{gathered} \text { Day } \\ \text { (Mon~Sun) } \end{gathered}$ |
| D1065 | Month | 1~12 | $\rightarrow$ | D2 | Month |
| D1066 | Day | 1~31 | $\rightarrow$ | D3 | Day |
| D1067 | Hour | 0~23 | $\rightarrow$ | D4 | Hour |
| D1068 | Minute | 0~59 | $\rightarrow$ | D5 | Minute |
| D1069 | Second | 0~59 | $\rightarrow$ | D6 | Second |

3. How to use RTC:

The RTC function of CP2000 is provided by its digital keypad, so KPC-CC01 is required to execute RTC function.
4. How to correct RTC:

It can be corrected by user using the digital keypad.

### 17.5.5 Description to drive's special commands

| API |  | RPR |  | S1 |
| :--- | :--- | :--- | :--- | :--- |
| 139 | S2 | Read the AC motor drive's parameters |  |  |



| API | - WPR |  | (S1) S2) | Write the AC motor drive's parameters |
| :--- | :--- | :--- | :--- | :--- |
| $\mathbf{1 4 0}$ |  |  |  |  |



Explanation $\mathbf{S}_{1}$ : The data for writing. $\mathbf{S}_{2}$ : The parameters address for the write data.

## Example

1. It will read the data in parameter H 2100 of the CP2000 and write into D0; the data in parameter H 2101 is read and write into D1.
2. When M0=On, data in D10 will be written into Pr. H2001 of CP2000.
3. When $\mathrm{M} 1=\mathrm{ON}$, data in H 2 will be written into Pr. H 2001 of CP2000, which is to activate the AC motor drive.
4. When $\mathrm{M} 2=\mathrm{ON}$, data in H 1 will be written into H 2000 of CP 2000 , which is to stop the AC motor drive.
5. When data writing successfully, M1017 will be on.


| API | - FPID |  | S1 S2 S3 (S4 | PID control for the AC motor drive |
| :--- | :--- | :--- | :--- | :--- | :--- |
| 141 |  | $\mathbf{P}$ |  |  |


| Bit Devices |  |  |  | Word devices |  |  |  |  |  |  |  | 16-bit command (9 STEPS) |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | X | Y | M | K | H | KnX | KnY | KnM | T | C | D | FPID | FPIDP |  |
| $\mathrm{S}_{1}$ |  |  |  | * | * |  |  |  |  |  | * |  |  |  |
| $\mathrm{S}_{2}$ |  |  |  | * | * |  |  |  |  |  | * | 32-bit command |  |  |
| $\mathrm{S}_{3}$ |  |  |  | * | * |  |  |  |  |  | * | - | - |  |
| $\mathrm{S}_{4}$ |  |  |  | * | * |  |  |  |  |  | * | Flag signal: None |  |  |
| Operands: None |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

Explanation 1. $\quad \mathbf{S}_{1}$ : PID Set Point Selection(0-4), $\mathbf{S}_{2}$ : Proportional gain P (0-100), $\mathbf{S}_{3}$ : Integral Time I (0-10000), $\mathrm{S}_{4}$ : Derivative control D (0-100)
2. This command FPID can control the PID parameters of the AC motor drive directly, including Pr.08.00 PID set point selection, Pr.08.01 Proportional gain (P), Pr.08.02 Integral time (I) and Pr. 08.03 Derivative control (D)

1. Assume that when $\mathrm{MO}=\mathrm{ON}, \mathbf{S}_{1}$ is set to 0 (PID function is disabled), $\mathbf{S}_{2}=0, \mathbf{S}_{3}=1$ (unit: 0.01 seconds) and $\mathbf{S}_{4}=1$ (unit: 0.01 seconds).
2. Assume that when $\mathrm{M} 1=\mathrm{ON}, \mathbf{S}_{1}$ is set to 0 (PID function is disabled), $\mathbf{S}_{\mathbf{2}}=1$ (unit: $0.01), \mathbf{S}_{3}=0$ and $\mathbf{S}_{4}=0$.
3. Assume that when $\mathrm{M} 2=\mathrm{ON}, \mathbf{S}_{1}$ is set to 1 (frequency is inputted by digital keypad), $\mathbf{S}_{2}=1$ (unit: 0.01), $\mathbf{S}_{3}=0$ and $\mathbf{S}_{4}=0$.
4. D1027: frequency command after PID calculation.


| API |  | FREQ |  | S1 S2 S3 | Operation control of the AC motor drive |
| :--- | :--- | :--- | :--- | :--- | :--- |
| 142 | $\mathbf{P}$ |  |  |  |  |


| Bit Devices |  |  |  | Word devices |  |  |  |  |  |  |  | 16-bit command ( 7 STEPS) |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | X | Y | M | K | H | KnX | KnY | KnM | T | C | D | FREQ | EQP |  |
| $\mathrm{S}_{1}$ |  |  |  | * | * |  |  |  |  |  | * | 32-bit command |  |  |
| $\mathrm{S}_{2}$ |  |  |  | * | * |  |  |  |  |  | * | - | - |  |
| $\mathrm{S}_{3}$ |  |  |  | * | * |  |  |  |  |  | * |  |  |  |
|  | ran | ds: | ne |  |  |  |  |  |  |  |  | Flag signal: M1028 |  |  |

Explanation 1. $\mathbf{S}_{\mathbf{1}}$ : frequency command, $\mathbf{S}_{\mathbf{2}}$ : acceleration time, $\mathbf{S}_{\mathbf{3}}$ : deceleration time
2. This command can control frequency command, acceleration time and deceleration time of the AC motor drive. Special register control is shown as following:

M1025: controls RUN (On)/STOP (Off) of the drive. (Run is valid when Servo is On (M1040 On).)
M1026: Operation directions FWD (On)/REV (Off) of the drive.
M1040: controls Servo On (On)/ Servo Off (Off).
M1042: enable quick stop(ON)/ disable quick stop(Off)
M1044: enable Stop (On)/ disable stop(Off)
M1052: frequency locked (On)/ disable frequency locked(Off)
Example 1. M1025: controls RUN (On)/STOP (Off) of the drive. M1026: operation direction FWD (On)/REV (Off) of the drive. M1015: frequency attained.
2. When $\mathrm{M} 10=\mathrm{ON}$, setting frequency command of the AC motor drive to $\mathrm{K} 300(3.00 \mathrm{~Hz})$ and acceleration/deceleration time is 0 .
3. When $\mathrm{M} 11=\mathrm{ON}$, setting frequency command of the AC motor drive to $\mathrm{K} 3000(30.00 \mathrm{~Hz})$, acceleration time is 50 and deceleration time is 60 .


| API | CANRX |  | S1 S2 S3 | D | Read CANopen slave data |
| :--- | :--- | :--- | :--- | :--- | :--- |
| 261 |  |  |  |  |  |


| Bit Devices |  |  |  | Word devices |  |  |  |  |  |  |  | 16-bit command (7 STEPS) |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | X | Y | M | K | H | KnX | KnY | KnM | T | C | D |  |  |  |
| $\mathrm{S}_{1}$ |  |  |  | * | * |  |  |  |  |  |  | 32-bitcommand |  |  |
| $\mathrm{S}_{2}$ |  |  |  | * | * |  |  |  |  |  |  | 32-bit command | - |  |
| $\mathrm{S}_{3}$ |  |  |  | * | * |  |  |  |  |  |  |  |  |  |
| D |  |  |  |  |  |  |  |  | * | * | * | Flag signal: M1028 |  |  |

Explanation 1. $\mathbf{S}_{\mathbf{1}}$ : Slave station number, $\mathbf{S}_{\mathbf{2}}$ : main index, $\mathbf{S}_{\mathbf{3}}$ : sub-index + bit length, $\mathbf{D}$ : save address
2. Command CANRX can read the corresponding slave. Index. When executing this command, it will send SDO message to the slave. At this time, M1066 and M1067 are 0 but when reading is complete M1066 will set to 1 . If the slave replied an accurate response, the value will be written to the designated register and M1067 is now set to 1 . However, if the slave replied an inaccurate response, this error message will be recorded in D1076~D1079.

Example M1002: touch once to activate PLC and change K4M400=K1. After the change, different message will be displayed when M1066 is set to 1 .


| API |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- |
| 264 | CANTX | $\mathbf{P}$ |  |  |


|  | Bit Devices |  |  | Word devices |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | X | Y | M | K | H | KnX | KnY | KnM | T | C | D | $\frac{16 \text {-bit command }}{\text { FREQ }}$ | FREQP |  |
| $\mathrm{S}_{1}$ |  |  |  | * | * |  |  |  |  |  |  | FREQ | FREQP |  |
| $\mathrm{S}_{2}$ |  |  |  | * | * |  |  |  | * | * | * | 32 -bit command |  |  |
| $\mathrm{S}_{3}$ |  |  |  | * | * |  |  |  |  |  |  | - - | - | - |
| $\mathrm{S}_{4}$ |  |  |  | * | * |  |  |  |  |  |  | Flag signal: M1028 |  |  |
| Operands: None |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

Explanation 1. $\mathbf{S}_{1}$ : slave station number, $\mathbf{S}_{\mathbf{2}}$ : the address to write, $\mathbf{S}_{3}$ : main index, $\mathbf{S}_{4}$ : sub-index+ bit length.
2. Command CANTX can read the corresponding index of the slave. When executing this command, it will send SDO message to the slave. At this time, M1066 and M1067 are 0 but when reading is complete M1066 will set to 1 . If the slave replied an accurate response, the value will be written to the designated register and M1067 is now set to 1 . However, if the slave replied an inaccurate response, this error message will be recorded in D1076~D1079.

| API | CANFLS | P | Update the mapping special D of CANopen |
| :--- | :--- | :--- | :--- |
| 265 |  |  |  |


| Bit Devices |  |  |  | Word devices |  |  |  |  |  |  |  | $\begin{aligned} & 16 \text {-bit command (7 STEPS) } \\ & \text { FREQ } \end{aligned}$ |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | X | Y | M | K | H | KnX | KnY | KnM | T | C | D |  |  |  |
| D |  |  |  | * | * |  |  |  |  |  |  | 32-bit command |  |  |
| Operands: None |  |  |  |  |  |  |  |  |  |  |  | 32-bit command | - | - |
|  |  |  |  |  |  |  |  |  |  |  |  | Flag signal: M1028 |  |  |

Explanation 1. D: the special D for update.
2. CANFLS can update the Special D command. When it executes in read only mode, it sends equivalent message as CANRX to the slave and saves the slave response to this particular Special D. When it executes in read/write mode, it sends equivalent message as CANTX to the slave and saves this special D value to the corresponding slave.
3. M1066 and M1067 are both 0 . When reading is complete, M1066 will be 1 and this value will write to the designated register if the slave replies an accurate response. When slave replies a fault response then M1067 will be 0 and this error message will be recorded to D1076~D1079.

### 17.6 Error and Troubleshoot

| Fault | ID | Fault Descript | Corrective Action |
| :---: | :---: | :--- | :--- |
| PLod | 50 | Data write error | Check if there is error in the program and <br> download the program again. |
| PLSv | 51 | Data write error when executing | Re-apply the power and download the <br> program again. |
| PLdA | 52 | Program upload error | Upload again. If error occurs continuously, <br> please return to the factory. |
| PLFn | 53 | Command error when download <br> program | Check if there is error in the program and <br> download the program again. |
| PLor | 54 | Program capacity exceeds memory <br> capacity | Re-apply the power and download the <br> program again. |
| PLFF | 55 | Command error when executing | Check if there is error in the program and <br> download the program again. |
| PLSn | 56 | Check sum error | Check if there is error in the program and <br> download the program again. |
| PLEd | 57 | There is no "END" command in the <br> program | Check if there is error in the program and <br> download the program again. |
| PLCr | 58 | The command MC is continuous <br> used more than 9 times | Check if there is error in the program and <br> download the program again. |
| PLdF | 59 | Download program error | Check if there is error in the program and <br> download the program again. |
| PLSF | 60 | PLC scan time over-time | Check if the program code is inaccurately <br> written and download the program again. |

### 17.7 CANopen Master Application

Simple control of multiple-axes for certain application can be done by CP2000 if the device supports CANopen protocol. One of the CP2000 could acts as Master to perform simple synchronous control, e.g. position, speed, zero return, and torque control. The setup can be done in 7 steps:

## Step 1: Activate CANopen Master

1. Set Pr.09-45 to 1. (To activate Master function, turn off the power after setting and reboot. The digital keypadKPC-CC01 status will display "CAN Master".)
2. Set Pr.00-02 to 6 for PLC reset. (Note: This action will erase the program and PLC register and will be set to factory setting.)
3. Turn off the power and reboot.
4. Set PLC control to"PLC Stop mode" by digital keypad KPC-CC01. (If the digital keypad is KPC-CE01 series, set PLC control to"PLC 2". If the drive just came out of the factory, since PLC program is not yet installed, the digital keypad will show PLFF warning code.)

## Step 2: Configuration of the Special D in Master

Each slave occupies 100 of Special D space and is numbered 1 to 8 . There are in total of 8 stations. Please refer to 4-3 Special Register in this chapter for Special D register definition.

## Slave No.

| Slave No. 1 | D2000 | Station number |
| :---: | :---: | :---: |
|  | D2001 | Factory code(L) |
|  | ~ | ~ |
|  | D2099 | The mapping address $4(\mathrm{H})$ of receiving station 4 |
| Slave No. 2 | D2100 | Station number |
|  | D2101 | Factory code(L) |
|  | ~ | ~ |
|  | D2199 | The mapping address 4 (H)of receiving station 4 |
| Slave No. 3 | D2200 | Station number |
|  | D2201 | Factory code(L) |
|  | ~ | ~ |
|  | D2299 | The mapping address 4 (H)of receiving station 4 |
| Slave No. 8 | D2700 | Station number |
|  | D2701 | Factory code(L) |
|  | ~ | ~ |
|  | D2799 | The mapping address $4(\mathrm{H})$ of receiving station 4 |

1. When communication cable 485 is connected, set PLC status to "stop" by WPL soft. (If PLC had already switched to "PLC Stop" mode then PLC status should be "stop" already.)
2. To control the slave address and corresponding station. For example, control 2 stations of the slave (max. 8 stations synchronous control), if the station number is 21 and 22 , set D2000 and D2100 to 20 and 21 and then set D2200, D2300, D2400, D2500, D2600 and D2700 to 0 . The setting can be done via PLC software editor WPL, follow the steps shown:

- Open WPL Editor > communication> Edit Register Memory(T C D)


■ When the "Register" window appears, click "Transmit".


- When transmission window appear, select "read" and input the range D2000~D2799 then press enter. The value in D2000~D2799 will be read. If communication failed, check the communication format (pre-defined PLC station is 2, 9600, 7N2, ASCII).
- Insert the slave station for control. Set D2000 and D2100 to 20 and 21 then set D2200, D2300, D2400, D2500, D2600 and D2700 to 0.
- Click"Transmit" again. When transmission window appears, input the range D2000~D2799 and enter. The value in D2000~D2799 will be write (If communication error occur and display failed, it means PLC is not in "stop" status. The value can only
be write in "stop" status, pleas switch PLC to "stop".)
- Another method is by setting D1091. Set the corresponding bit of the excluding slave to 0 (slave station range from No.1~8). For example, if the user wants to exclude slave No. 2, 6 and 7, please set D1091 = 003B by following steps: WPL Editor > communication> Edit Register Memory(T C D)

3. Setup the communication setting. If following conditions apply to you then no additional setting needs to be done:
■ If the only control in this application is the speed mode of AC motor drive. (For other control such as position and torque control, D2000~D2799 should be set. Please refer to synchronous control on position, torque and zero return for more set up detail.

To perform synchronous control on position for the slave, please enable the corresponding function PDO 3. ( P to P function is not yet supported by CP2000.)

- To activate PDO 3 TX (Master sending command to Slave), please set up bit 8~11 of the PLC address D2034+n*100. This special D register is defined as below:

|  | PDO4 |  | PDO3 |  | PDO2 |  | PDO1 |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Torque |  | Position |  | Remote I/O |  | Speed |  |
| Bit | 15 | $14 \sim 12$ | 11 | $10 \sim 8$ | 7 | $6 \sim 4$ | 3 |  |
| $2 \sim 0$ |  |  |  |  |  |  |  |  |
| Definition | En | Number | En | Number | En | Number | En |  |
| Number |  |  |  |  |  |  |  |  |

The pre-defined setting of PDO 3 TX has corresponded to CANopen control word "Index 6040"and CANopen target position" Index 607A". If position control is the only control in this application then simply set Special $D$ register value to 0x0A00.

■ To activate PDO 3 RX (Slave response with the status to Master), please set up bit 8~11 of the PLC address D2067+n*100. This special D register is defined as below:

|  | PDO4 | PDO3 |  | PDO2 |  | PDO1 |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Torque |  | Position |  | Remote I/O |  | Speed |  |
| Bit | 15 | $14 \sim 12$ | 11 | $10 \sim 8$ | 7 | $6 \sim 4$ | 3 |  |
| Definition | En | Number | En | Number | En | Number | En |  |
| Number |  |  |  |  |  |  |  |  |

The pre-defined setting of PDO 3 TX has corresponded to CANopen control word "Index 6041"and CANopen actual position" Index 6064". If position control is the only control in this application then simply set Special $D$ register value to $0 \times 0 A 00$.

In same theory, to perform torque control, please enable the mapping function PDO4.

The speed for 1 corresponding cycle is 8 ms . (When shorten the cycle time to $<8 \mathrm{~ms}$, make sure the time is enough for the data to be transmitted.

User should calculate the corresponding PDO quantity before setting the cycle. The PDO quantity should not be greater than the N . The quantity can be calculated by the following formula.
$\mathrm{N}=(1$ cycle $(\mathrm{ms})$ * rate (kbs) )/250
Example: 1 cycle is 2 ms , speed= 1000 k , max PDO value is $2 \star 1000 / 250=8$. If user wants to set the cycle time to 2 ms , turns off 4 of the C type AC motor drive slave stations must be turned off (since the pre-defined setting is 8 slaves, half of the slave station would be 4). The slave station can be turned off by setting the D2000+n*100 of the unused slaves to 0 .
v
Number of control station $\leq 8$.
Controlling 8 slave stations at once can only be done by asynchronous control where to Read/Write the slave is done by CANRX and CANTX command. This is similar to the Read/Write action of Modbus protocol.
$\square$ The slave complies with DS402 standard.
■ Does not control Slave IO terminal.
■ If above conditions do not apply, please set up the slave corresponding addresses manually by open WPL editor > communication> Edit Register Memory (T C D).

Step 3: Set up Master station number and communication speed.
■ Set up the station number for the Master (the default setting of Pr.09-46=100). Do not to set the same station number as the Slave.
■ Set up CANopen communication parameter Pr.09-37. It does not matter if the drive is defined as a Master or a Slave, communication speed is set by Pr.09-37 in both case.

## Step 4: Coding

Real-time corresponding action: the data can be Read/Write directly to the corresponding special "D" register.
Non Real-time corresponding action:
Read: Reading is made by CANRX command. When reading process is complete, M1066=1. If reading succeeded, M1067 =1; if reading failed, M1067= 0 .
Write: Writing is made by CANTX command. When writing process is complete, M1066 $=1$. If writing succeeded, M1067=1; if reading failed, M1067 $=0$.
Update: Updating the data is made by CANFLS command. (If special D register is defined as RW type, Master will write the value into the slave. If special $D$ register is defined as RO type, then the data in the Slave will be read and write into the Master.) When updating process is complete, M1066 will be 1. If updating succeeded, M1067=1; if updating failed, M1067=0.

## $\square$ NOTE

When executing CANRX, CANTX and CANFLS commands, the device will wait till M1066 is completed before the next CANRX, CANT or CANFLS begins. When the commands completed, download the program to the drive. (Note: The factory setting of PLC communication protocol is ASCII 7N2 9600 and station number is 2. Please change WPL Editor setting at Setting> Communication Setting)

Step 5: Setting the Slave station number, communication speed, operation source and command source

CANopen communication is supported by Delta CP2000 series and EC series AC motor drive.
The corresponding slave and CANopen speed are shown as below:

|  | Corresponding Parameter of Drive |  | Value | Definition |
| :---: | :---: | :---: | :---: | :---: |
|  | CP2000 | E-C |  |  |
| Slave address | 09-36 | 09-20 | 0 | Disable CANopen Hardware Interface |
|  |  |  | 1~127 | CANopen communication address |
| CANopen speed | 09-37 | 09-21 | 0 | 1M |
|  |  |  | 1 | 500K |
|  |  |  | 2 | 250K |
|  |  |  | 3 | 125K |
|  |  |  | 4 | 100K |
|  |  |  | 5 | 50K |
| Source of operation command | 00-21 |  | 3 |  |
|  |  | 02-01 | 5 |  |
| Source of frequency command | 00-20 |  | 6 |  |
|  |  | 02-00 | 5 |  |
| Torque command | 11-34 |  | 3 |  |
|  | , | $2$ |  |  |

The only servo motor and drive that supports CANopen communication interface is A2 series.
The corresponding slave station number and communication speed are shown as below:

|  | Corresponding <br> Parameter of Drive | Value | Definition |
| :--- | :---: | :---: | :--- |

## Step 6: Hardware connection

The terminating resistor must be installed at the two farthest ends as shown in the figure below:


## Step 7: Activate PLC Control Function

Download the program after coding is complete and switch PLC mode to Run status. Then reboots the power for Slave and Master. Please refer to CANMaster Test 1 vs. 2 driver.dvp.

## > Example:

CP2000 AC motor drive (1 master vs. 2 slave control)
Step 1: Activate CANopen Master
■ Set Pr.09-45 to 1. (To activate Master function, turn off the power after setting and reboot. The digital keypadKPC-CC01 status will display "CAN Master".)
$\rrbracket \quad$ Set Pr.00-02 to 6 for PLC reset. (Note: This action will erase the program and PLC register and will be set to factory setting.)
$\square$ Turn off the power and reboot.
■ Set PLC control to"PLC Stop mode" by digital keypad KPC-CC01. (If the digital keypad is KPC-CE01 series, set PLC control to"PLC 2". If the drive just came out of the factory, since PLC program is not yet installed, the digital keypad will show PLFF warning code.)
Step 2: Configuration of the Special D in Master
■ Open WPL editor

- Set PLC mode to PLC Stop (PLC2) via the keypad

■ WPL editor read D1070~D1099 and D2000~D2799

- Set D2000=10 and D2100=11

■ Set D2100, 2200, 2300 240025002600 2700=0
■ Download D2000~D2799 setting
Step 3: Set up Master station number and communication speed

■ Set up the station number for the Master (the default setting of Pr.09-46=100). Do not to set the same station number as the Slave.
■ Set up CANopen communication speed to 1 M (parameter Pr.09-37= 0). It does not matter if the drive is defined as a Master or a Slave, communication speed is set by Pr.09-37 in both case.

Step 4: Coding
Real-time corresponding action: the data can be Read/Write directly to the corresponding special "D" register.
Non Real-time corresponding action:
Read: Reading is made by CANRX command. When reading process is complete, M1066=1. If reading succeeded, M1067 =1; if reading failed, M1067= 0 .
Write: Writing is made by CANTX command. When writing process is complete, M1066 $=1$. If writing succeeded, M1067=1; if reading failed, M1067 $=0$.
Update: Updating the data is made by CANFLS command. (If special D register is defined as RW type, Master will write the value into the slave. If special D register is defined as RO type, then the data in the Slave will be read and write into the Master.) When updating process is complete, M1066 will be 1. If updating succeeded, M1067=1; if updating failed, M1067=0.

## $\square$ NOTE

When executing CANRX, CANTX and CANFLS commands, the device will wait till M1066 is completed before the next CANRX, CANT or CANFLS begins. When the commands completed, download the program to the drive. (Note: The factory setting of PLC communication protocol is ASCII 7N2 9600 and station number is 2. Please change WPL setting at setting> communication setting)
Step 5: Set Slave station number and communication speed.
Slave No.1: Pr.09-37 = 0(speed 1M), Pr.09-36=10 (station number 10)
Slave No.2: Pr. 09-37 = 0(speed 1M), Pr.09-36=10 (station number 11)

## Step 6: Hardware connection

The terminating resistor must be installed at the two farthest ends as shown in the figure below:


## Step 7: Activate PLC Control Function

Download the program after coding is complete and switch PLC mode to Run status. Then reboots the power for Slave and Master. Please refer to CAN Master Test 1 vs. 2 driver.dvp.

## 18 Introduction to BACnet

## 1. About BACnet:

BACnet is an ASHRAE communication protocol for building automation and control networks. (ASHRAE: American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.). CP2000's BACnet is based on version 20004.

BACnet's regulations are related to several kind of physical layers' interfaces. The physical layers built inside CP200 are achieved via MS/TP interface.

The BACnet of CP2000 supports a device type called B-ASC. B-ASC supports five types of services such as DS-RP-B, DS-WP-B, DM-DDB-B, DM-DOB and DM-DCC-B.

## 2. Definition of BACnet's ICS:

## CP2000-Object:

| Property Type | Object Type supported |  |  |
| :---: | :---: | :---: | :---: |
|  | Device | Analog Value | Binary Value |
|  | Supported | Supported | Supported |
| Object Identifier ; | V | V | V |
| Object Name | V | V | V |
| Object Type | V | V | V |
| System Status | V |  |  |
| Vendor Name | V |  |  |
| Vendor Identifier | V |  |  |
| Model Name | V |  |  |
| Firmware Revision | V |  |  |
| Appl Software revision | V |  |  |
| Protocol Version | V |  |  |
| Protocol Revision | V |  |  |
| Services Supported | V |  |  |
| Object Types supported | V |  |  |
| Object List | V |  |  |
| Max APDU Length | V |  |  |
| Segmentation Support | V |  |  |


| APDU Timeout | V |  |  |
| :---: | :---: | :---: | :---: |
| Number ADPU Retries | V |  |  |
| Device Address Binding | V |  |  |
| Database Revision | V | V | V |
| Preset Value |  | V | V |
| Status Flags |  | V | V |
| Event State |  | V | V |
| Out-of-Service |  | V | V |
| Units |  | $\mathrm{V} *$ | $\mathrm{~V}^{*}$ |
| Priority Array |  |  | V |
| Relinquish Default |  |  | V |
| Active Text |  |  |  |
| Inactive Text |  |  |  |

## Analog Values

## Control of Analog Values

| Address | Property | Unit | bit | limit | Value | Note |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  | Speed mode | Torque mode |
| AV0 | C | NO_UNITS | 1~0 |  | 00 | 0 : No function | $0:$ No function |
|  |  |  |  |  | 01 | 1 : Stop | 1 : Stop |
|  |  |  |  |  | 10 | 2 : Enable | 2 : Enable |
|  |  |  |  |  | 11 | 3 : No function | 3 : No function |
|  |  |  | 3~2 |  |  | No function | No function |
|  |  |  | 5~4 |  | 00 | No function |  |
|  |  |  |  |  | 01 | Fwd command |  |
|  |  |  |  |  | 10 | Reverse command |  |
|  |  |  |  |  | 11 | Direction changing command |  |
|  |  |  | 15~6 |  |  | Reserved |  |
| AV1 | C | HERTZ |  |  |  | Frequency Command |  |
| AV2 | C | NO_UNITS | 0 |  | 0 | E.F. ON |  |
|  |  |  |  |  | 1 | E.F. OFF |  |
|  |  |  | 1 |  | Pulse 1 | Reset command |  |
|  |  |  | 2 |  | 0 | External interrupt ( B.B ) OFF |  |
|  |  |  |  |  | 1 | External interrupt ( B.B ) ON |  |
|  |  |  | 15~3 |  |  | Reserved |  |


| BACnet |  | Unit | bit | Limit | Value | Note |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Address | $\begin{array}{\|c} \text { Pro-p } \\ \text { erty } \end{array}$ |  |  |  |  | Speed mode | Torque mode |
| AV 30 | C | NO_UNITS | 0 | 4 | 0 | fcmd $=0$ |  |
|  |  |  |  |  | 1 | fcmd $=$ Fset(Fpid) |  |
|  |  |  | 1 | 4 | 0 | Fwd command |  |
|  |  |  |  |  | 1 | Reverse command |  |
|  |  |  | 2 |  |  | No function | No function |
|  |  |  | 3 | 3 | 0 | Continue running to target speed | Free(Continue running to target torque) |
|  |  |  |  |  | 1 | Follow deceleration setting, stop temporary | Torque stops at current speed |
|  |  |  | 4 | 4 | 0 | Continue running to target speed |  |
|  |  |  |  |  | 1 | Frequency stops at current frequency |  |
|  |  |  | 5 | 4 |  | No function | No function |
|  |  |  | 6 | 2 | 0 | None | None |
|  |  |  |  |  | 1 | Quick Stop | Quick Stop |
|  |  |  | 7 | 1 | 0 | Servo OFF | Servo OFF |
|  |  |  |  |  | 1 | Servo ON | Servo ON |
|  |  |  | 14~8 |  |  | No function | No function |
|  |  |  | 15 | 4 | Pulse 1 | Clear error code | Clear error code |
| AV 31 | C | NO_UNITS |  |  |  |  |  |
| AV 32 | C | HERTZ |  |  |  | Speed command (unsigned numbers) | Profile velocity(unsigned numbers) |
| AV 33 | C | NO_UNITS |  |  |  |  |  |
| AV 34 | C | NO_UNITS |  |  |  |  |  |
| AV 35 | C | NO_UNITS |  |  |  |  |  |
| AV 36 | C | NO_UNITS |  |  |  |  | Torque command (signed numbers) |
| AV 37 | C | NO_UNITS |  |  |  |  | Speed limit |

*Property C means Commandable which has properties such as priority array and relinquish default.

## Display of Analog Values

| Address | Property | Unit | bit | Value | Note |
| :---: | :---: | :---: | :---: | :---: | :---: |
| AV 100 | R | NO_UNITS |  |  | Error code |
| AV101 | R | NO_UNITS | 1~0 | 00 | Drive stops. |
|  |  |  |  | 01 | Drive decelerates |
|  |  |  |  | 10 | Drive standby |
|  |  |  |  | 11 | Drive in operation |
|  |  |  | 2 | 0 | Jog command OFF |
|  |  |  |  | 1 | Jog command ON |
|  |  |  | 4~3 | 00 | Drive forward |
|  |  |  |  | 01 | From reverse to forward |
|  |  |  |  | 10 | From forward to reverse |
|  |  |  |  | 11 | Drive reverse |
|  |  |  | 7 ~ 5 |  | Reserved |
|  |  |  | 8 | 1 | Source of main frequency communication interface |
|  |  |  | 9 | 1 | Input main frequency from analog/external terminal signal |
|  |  |  | 10 | 1 | Operation command from communication interface |
|  |  |  | $15 \sim 11$ |  | Reserved |
| AV102 | R | HERTZ |  |  | Frequency command (F) |
| AV103 | R | HERTZ |  |  | Output frequency (H) |
| AV104 | R | AMPERE |  |  | Output current ( AXXX.X) |
| AV105 | R | VOLTS |  |  | DC-BUS voltage (UXXX.X) |
| AV106 | R | VOLTS |  |  | Output voltage (EXXX.X) |
| AV107 | R | HERTZ |  |  | Current running speed of the multi-speed command |
| AV108 | R | NO_UNITS |  |  |  |
| AV109 | R | NO_UNITS |  |  | Attribute value |
| AV110 | R | DEGREES ANGULAR |  |  | Power factor angle |
| AV111 | R | NO_UNITS |  |  | Output torque |
| AV112 | R | NO_UNITS |  |  | Output rotational speed (rpm) |
| AV113 | R | NO_UNITS |  |  | Reserved |
| AV114 | R | NO_UNITS |  |  | Reserved |
| AV115 | R | $\begin{gathered} \text { KILOWAT } \\ \mathrm{T} \\ \hline \end{gathered}$ |  |  | Output power |
| AV116 | R | NO_UNITS |  |  | User defined value |
| AV117 | R | NO_UNITS |  |  | User defined page |
| $\begin{gathered} \hline \text { AV118~1 } \\ 19 \\ \hline \end{gathered}$ | R | NO_UNITS |  |  | Reserved |


| Address | $\begin{gathered} \text { Pro- } \\ \text { perty } \end{gathered}$ | Unit | bit | Value |  | Note |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| AV130 | R | NO_UNITS | 0 | 0 | Frequency command not reached | Torque command not reached |
|  |  |  |  | 1 | Frequency command reached | Torque command reached |
|  |  |  | 1 | 0 | Forward | Forward |
|  |  |  |  | 1 | Reverse | Reverse |
|  |  |  | 2 | 0 | No warning | No warning |
|  |  |  |  | 1 | Warning | Warning |
|  |  |  | 3 | 0 | No error | No error |
|  |  |  |  | 1 | Error | Error |
|  |  |  | 5 | 0 | None | None |
|  |  |  |  | 1 | On JOG | On JOG |
|  |  |  | 6 | 0 | None | None |
|  |  |  |  | 1 | On Quick Stop | On Quick Stop |
|  |  |  | 7 | 0 | PWM OFF | PWM OFF |
|  |  |  |  | 1 | PWM ON | PWM ON |
|  |  |  | 15~8 | - | - | - |
| AV131 | R | NO_UNITS |  | - | - | - |
| AV132 | R | HERTZ |  |  | Actual output frequency | Actual output frequency |
| AV133 | R | NO_UNITS |  | - | - | - |
| AV134 | R | NO_UNITS |  |  |  |  |
| AV135 | R | NO_UNITS |  |  | Reserved |  |
| AV136 | R | NO_UNITS |  |  | Actual torque | Actual torque |
| $\begin{gathered} \hline \text { AV137~1 } \\ 39 \\ \hline \end{gathered}$ | R | NO_UNITS |  |  | Reserved |  |
| AV145 | R | NO_UNITS |  |  | ID code of the AC motor drive |  |


| BACnet |  | Modbus | Unit | Value | Note |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Address | Property | Address |  |  |  |
| AV150 | R | 2200H | AMPERES |  | Display output from drive to motors |
| AV151 | R | 2201H | NO_UNITS |  | Display attribute value at TRG terminal |
| AV152 | R | 2202H | HERTZ |  | Display actual output frequency |
| AV153 | R | 2203H | VOLTS |  | Display the DC voltage value detected in the drive |
| AV154 | R | 2204H | VOLTS |  | Display output value of $\mathrm{U}, \mathrm{V}, \mathrm{W}$ of this drive |
| AV155 | R | 2205H | NO_UNITS |  | Display power factor angles of U,V,W |
| AV156 | R | 2206H | KILOWATTS |  | Display output power of U,V,W (kW) |
| AV157 | R | 2207H | REVOLUTIONS PER_MINUTE |  | Display estimated (r 00: fwd rotational speed ; - 00: reverse rotational speed) |


| AV158 | R | 2208H | NEWTON METER | Display estimated <br> N-m (t 0.0: fwd torque ; - 0.0 : reverse torque ) |
| :---: | :---: | :---: | :---: | :---: |
| AV159 | R | 2209H | NO_UNITS |  |
| AV160 | R | 220AH | PERCENT | When PID function is enabled, display PID feedback value in \%. |
| AV161 | R | 220BH | PERCENT | Display AVI1 analog input terminal signal, $0 \sim 10 \mathrm{~V}$ and 0~100\% |
| AV162 | R | 220CH | PERCENT | Display ACI analog input terminal signal, , 4~20mA/0~10V and 0~100\% |
| AV163 | R | 220DH | PERCENT | Display AVI2 analog input terminal signal, , 0V 10 V and 0 $100 \%$ |
| AV164 | R | 220EH | $\begin{aligned} & \hline \text { DEGREES } \\ & \text { CELSIUS } \end{aligned}$ | Display IGBT's temperature in ${ }^{\circ} \mathrm{C}$ |
| AV165 | R | 220FH | $\begin{aligned} & \hline \text { DEGREES } \\ & \text { CELSIUS } \end{aligned}$ | Display capatcitor's temperature in ${ }^{\circ} \mathrm{C}$ |
| AV166 | R | 2210H | NO_UNITS | Digital input, ON/OFF status, see Pr02-10 |
| AV167 | R | 2211H | NO_UNITS | Digital output ON/OFF status, see 02-15 |
| AV168 | R | 2212H | NO_UNITS | Display current speed of the multi-speed |
| AV169 | R | 2213H | NO_UNITS | Corresponding CPU Pin status to digital input |
| AV170 | R | 2214H | NO_UNITS | Corresponding CPU Pin status to digital output |
| AV171 | R | 2215H | NO_UNITS |  |
| AV172 | R | 2216H | NO_UNITS |  |
| AV173 | R | 2217H | NO_UNITS |  |
| AV174 | R | 2218H | NO_UNITS |  |
| AV175 | R | 2219H | NO_UNITS | Display number of times of over load. (0.) |
| AV176 | R | 221AH | PERCENT | Display GFF's value in \% ( G. ) |
| AV177 | R | 221BH | NO_UNITS |  |
| AV178 | R | 221CH | NO_UNITS | Display value of D1043, the register of PLC (C) |
| AV179 | R | 221DH | NO_UNITS |  |
| AV180 | R | 221 EH | NO_UNITS | User's physical output |
| AV181 | R | 221FH | NO_UNITS | Output value of Pr00-05 |

Analog Values' Parameter Setting

| BACnet |  |  | BACnet |  | Preset |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :--- |
| Address | Pro- <br> perty | Preset value | Note |  |  |  |
|  |  | Address | Pro- <br> perty |  |  |
| AV 200 | W | NULL | AV 300 | C | ---- | no-corresponding terms |
| AV 201 | W | NULL | AV 301 | C | ---- | no-corresponding terms |
| AV 202 | W | NULL | AV 302 | C | ---- | no-corresponding terms |
| AV 203 | W | NULL | AV 303 | C | ---- | no-corresponding terms |
| AV 204 | W | NULL | AV 304 | C | ---- | no-corresponding terms |
| AV 205 | W | NULL | AV 305 | C | ---- | no-corresponding terms |
| AV 206 | W | NULL | AV 306 | C | ---- | no-corresponding terms |


| AV 207 | W | NULL | AV 307 | C | ---- | no-corresponding terms |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| AV 208 | W | NULL | AV 308 | C | ---- | no-corresponding terms |
| AV 209 | W | NULL | AV 309 | C | ---- | no-corresponding terms |
| AV 210 | W | NULL | AV 310 | C | ---- | no-corresponding terms |
| AV 211 | W | NULL | AV 311 | C | ---- | no-corresponding terms |
| AV 212 | W | NULL | AV 312 | C | ---- | no-corresponding terms |
| AV 213 | W | NULL | AV 313 | C | ---- | no-corresponding terms |
| AV 214 | W | NULL | AV 314 | C | ---- | no-corresponding terms |
| AV 215 | W | NULL | AV 315 | C | ---- | no-corresponding terms |
| AV 216 | W | NULL | AV 316 | C | ---- | no-corresponding terms |
| AV 217 | W | NULL | AV 317 | C | ---- | no-corresponding terms |
| AV 218 | W | NULL | AV 318 | C | ---- | no-corresponding terms |
| AV 219 | W | NULL | AV 319 | C | ---- | no-corresponding terms |

## Binary Values :

For Present Value Access Types, R = Read-only, W = Writable, C = Commandable. Commandable values support priority arrays and relinquish defaults.

## 3.Steps to set up BACnet in CP2000

1. Set Pr09-31 =1 so the COM1 protocol becomes BACnet.(Note that RJ45 and RS485 shares the same PIN, so when BACnet is enabled, Modbus, PLC upload/download functions, VFDSoft and VFD Explorer will be disabled.). When that is set, the COM1 Communication Protocol stays at 8N1 (See Pr.09-04 = 6).
2. Set $\operatorname{Pr} 00-20=1$, Source of the master frequency command $=$ RS485 serial communication.
3. Set $\operatorname{Pr} 00-21=2$, RS485 serial communication.
4. Set PR09-50, BACnet's MS/TP station number 0~127
5. Set Pr09-51, BACnet baud rate, 9600, 19200 or 38400.
6. Set device instance, setting range $0 \sim 4194303$. It is a combination of Pr09-52 and Pr09-53, for example, $\operatorname{Pr} 09-53=78$ and $\operatorname{Pr} 09-52=1234$, then the device instance's value $=781234$.
7. When you need to set up main station, use Pr09-55 to search for range of station number.
8. If you need to set up a password, use Pr09-56 to set it up. If set up is successful, keypad will display 8888.
9. Then connect a communication cable as shown in the diaram below.

10. At Pr09-30, choose a communication decoding method, 20XX or 60XX.

20XX decoding method: to control AV100 ~ AV102
60XX decoding method: to control AV150 to AV157
11. When the 10 points above are done, you now just need to control corresponding Analog Value.

## 4. Description of the Analog Value

| BACnet |  | Modbus | bit | Limit | Value | Note |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Address | Property | Address |  |  |  | Speed mode | Torque mode |
| AV0 | C | 2000H | 1~0 |  | 00 | 0 : No function | 0 : No function |
|  |  |  |  |  | 01 | 1: Stop | 1 : Stop |
|  |  |  |  |  | 10 | 2 : Enable | 2 : Enable |
|  |  |  |  |  | 11 | 3 : No function | 3 : No function |
|  |  |  | 3~2 |  |  | No function | No function |
|  |  |  | 5~4 |  | 00 | No function |  |
|  |  |  |  |  | 01 | Fwd command |  |
|  |  |  |  |  | 10 | Reverse command |  |
|  |  |  |  |  | 11 | Direction changing command |  |
|  |  |  | 15~6 |  |  | Reserved |  |
| AV1 | C | 2001H |  |  |  | Frequency Command |  |
| AV2 | C | 2002H | 0 |  | 0 | E.F. ON |  |
|  |  |  |  |  | 1 | E.F. OFF |  |
|  |  |  | 1 |  | Pulse 1 | Reset command |  |
|  |  |  | 2 |  | 0 | External interrupt( B.B ) OFF |  |
|  |  |  |  |  | 1 | External interrupt ( B.B ) ON |  |
|  |  |  | 15~3 |  |  | Reserved |  |

*Property C means Commandable which has properties such as priority array and relinquish default

| BACnet |  | Modbus | bit | Limi | Value | Note |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Address | Property | Address |  |  |  | Speed mode | Torque mode |
| AV30 | C | 6000h | 0 | 4 | 0 | fcmd =0 |  |
|  |  |  |  |  | 1 | fcmd = Fset(Fpid) |  |
|  |  |  | 1 | 4 | 0 | Fwd command |  |
|  |  |  |  |  | 1 | Reverse command |  |
|  |  |  | 2 |  |  | No function | No function |
|  |  |  | 3 | 3 | 0 | Continue running to target speed | Continue running to target speed |
|  |  |  |  |  | 1 | Follow deceleration setting, stop temporary | Follow deceleration setting, stop temporary |
|  |  |  | 4 | 4 | 0 | Continue running to target speed |  |
|  |  |  |  |  | 1 | Continue running to target speed |  |
|  |  |  | 5 | 4 |  | No function | No function |
|  |  |  | 6 | 2 | 0 | None | None |
|  |  |  |  |  | 1 | Quick Stop | Quick Stop |


|  |  |  | 7 | 1 | 0 | Servo OFF | Servo OFF |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  | 1 | Servo ON | Servo ON |
|  |  |  | 14~8 |  |  | No function | No function |
|  |  |  | 15 | 4 | Pulse 1 | Clear error code | Clear error code |
| AV31 | C | 6001h |  |  |  |  |  |
| AV32 | C | 6002h |  |  |  | Speed command (unsigned numbers) | Profile velocity((unsigned numbers)) |
| AV33 | C | 6003h |  |  |  |  |  |
| AV34 | C | 6004h |  |  |  |  |  |
| AV35 | C | 6005h |  |  |  |  |  |
| AV36 | C | 6006h |  |  |  |  | Torque command (signed numbers) |
| AV37 | C | 6007h |  |  |  |  | Speed limit |

*Property C means Commandable which has properties such as priority array and relinquish default

## Display of the Analog Value

| BACnet |  | Modbus | bit | Value | Note |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Address | Property | Address |  |  |  |
| AV100 | R | 2100H |  |  | Error code |
| AV101 | R | 2101H | 1~0 | 00 | Drive stops. |
|  |  |  |  | 01 | Drive decelerates |
|  |  |  |  | 10 | Drive standby |
|  |  |  |  | 11 | Drive in operation |
|  |  |  | 2 | 0 | Jog command OFF |
|  |  |  |  | 1 | Jog command ON |
|  |  |  | 4~3 | 00 | Drive forward |
|  |  |  |  | 01 | From reverse to forward |
|  |  |  |  | 10 | From forward to reverse |
|  |  |  |  | 11 | Drive reverse |
|  |  |  | 7~5 |  | Reserved |
|  |  |  | 8 | 1 | Source of main frequency communication interface |
|  |  |  | 9 | 1 | Input main frequency from analog/external terminal signal |
|  |  |  | 10 | 1 | Operation command from communication interface |
|  |  |  | 15~11 |  | Reserved |
| AV102 | R | 2102H |  |  | Frequency command (F) |
| AV103 | R | 2103H |  |  | Output frequency (H) |
| AV104 | R | 2104H |  |  | Output current ( AXXX.X) |
| AV105 | R | 2105H |  |  | DC-BUS voltage (UXXX.X) |
| AV106 | R | 2106H |  |  | Output voltage (EXXX.X) |
| AV107 | R | 2107H |  |  | Current running speed of the multi-speed command |


| AV108 | R | 2108 H |  |  |  |
| :---: | :---: | :---: | :--- | :--- | :--- |
| AV109 | R | 2109 H |  |  | Attribute value |
| AV110 | R | 210 AH |  |  | Power factor angle |
| AV111 | R | 210 BH |  |  | Output torque |
| AV112 | R | 210 CH |  |  | Output rotational speed (rpm) |
| AV113 | R | 210 DH |  |  | Reserved |
| AV114 | R | 210 EH |  |  | Reserved |
| AV115 | R | 210 FH |  |  | Output power |
| AV116 | R | 2116 H |  |  | User defined value |
| AV117 | R | 211 BH |  |  | User defined page |
| AV118~AV119 | R | --- |  |  | Reserved |


| BACnet |  | Modbus | bit | Value | Note |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Address | Pro perty | Address |  |  | Speed | Torque |
| AV130 | R | 6100h | 0 | 0 | Frequency command not reached | Torque command not reached |
|  |  |  |  | 1 | Frequency command reached | Torque command reached |
|  |  |  | 1 | 0 | Forward | Forward |
|  |  |  |  | 1 | Reverse | Reverse |
|  |  |  | 2 | 0 | No warning | No warning |
|  |  |  |  | 1 | Warning | Warning |
|  |  |  | 3 | 0 | No error | No error |
|  |  |  |  | 1 | Error | Error |
|  |  |  | 5 | 0 | None | None |
|  |  |  |  | 1 | On JOG | On JOG |
|  |  |  | 6 | 0 | None | None |
|  |  |  |  | 1 | On Quick Stop | On Quick Stop |
|  |  |  | 7 | 0 | PWM OFF | PWM OFF |
|  |  |  |  |  | PWM ON | PWM ON |
|  |  |  | 15~8 |  | - | - |
| AV131 | R | 6101h |  |  | - | - |
| AV132 | R | 6102h |  |  | Actual output frequency | Actual output frequency |
| AV133 | R | 6103h |  |  | - | - |
| AV134 | R | $\begin{array}{\|c} \hline 6105 \mathrm{~h} / 61 \\ 04 \mathrm{~h} \end{array}$ |  |  |  |  |
| AV135 | R | ---- |  |  | Reserved |  |
| AV136 | R | 6106h |  |  | Actual torque | Actual torque |
| AV137~139 | R | ---- |  |  | Reserved |  |
| Av145 | R | 0000h |  |  | ID code of the AC motor drive |  |


| BACnet |  | Modbus | Value | Note |
| :---: | :---: | :---: | :---: | :---: |
| Address | Property | Address |  |  |
| AV150 | R | 2200H |  | Display output from drive to motors |
| AV151 | R | 2201H |  | Display attribute value at TRG terminal |
| AV152 | R | 2202H |  | Display actual output frequency |
| AV153 | R | 2203H |  | Display the DC voltage value detected in the drive |
| AV154 | R | 2204H |  | Display output value of $\mathrm{U}, \mathrm{V}, \mathrm{W}$ of this drive |
| AV155 | R | 2205H |  | Display power factor angles of U,V,W |
| AV156 | R | 2206H |  | Display output power of U,V,W (kW) |
| AV157 | R | 2207H |  | Display estimated (r 00: fwd rotational speed ; - 00: reverse rotational speed) |
| AV158 | R | 2208H |  | Display estimated <br> $\mathrm{N}-\mathrm{m}$ (t 0.0: fwd torque ; - 0.0 : reverse torque ) |
| AV159 | R | 2209H |  |  |
| AV160 | R | 220AH |  | When PID function is enabled, display PID feedback value in \%. |
| AV161 | R | 220BH |  | Display AVI1 analog input terminal signal, $0 \sim 10 \mathrm{~V}$ and 0~100\% |
| AV162 | R | 220CH |  | Display ACI analog input terminal signal, , 4~20mA/0~10V and 0~100\% |
| AV163 | R | 220DH |  | Display AVI2 analog input terminal signal, , 0V 10 V and 0~100\% |
| AV164 | R | 220EH |  | Display IGBT's temperature in ${ }^{\circ} \mathrm{C}$ |
| AV165 | R | 220FH |  | Display capatcitor's temperature in ${ }^{\circ} \mathrm{C}$ |
| AV166 | R | 2210 H |  | Digital input, ON/OFF status, see Pr02-10 |
| AV167 | R | 2211H |  | Digital output ON/OFF status, see 02-15 |
| AV168 | R | 2212H |  | Display current speed of the multi-speed |
| AV169 | R | 2213H |  | Corresponding CPU Pin status to digital input |
| AV170 | R | 2214H |  | Corresponding CPU Pin status to digital output |
| AV171 | R | 2215H |  |  |
| AV172 | R | 2216H |  |  |
| AV173 | R | 2217H |  |  |
| AV174 | R | 2218 H |  |  |
| AV175 | R | 2219H |  | Display number of times of over load. (0.) |
| AV176 | R | 221AH |  | Display GFF's value in \% (G. ) |
| AV177 | R | 221BH |  |  |
| AV178 | R | 221 CH |  | Display value of D1043, the register of PLC (C) |
| AV179 | R | 221DH |  |  |
| AV180 | R | 221EH |  | User's physical output |
| AV181 | R | 221FH |  | Output value of Pr00-05 |

模擬値的參數設定

| BACnet |  | Preset | BACnet |  | Preset | Note |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Address | Property |  | Address | Property |  |  |
| AV 200 | W | NULL | AV 220 | C | －－－－ | no－corresponding terms |
| AV 201 | W | NULL | AV 221 | C | －－－－ | no－corresponding terms |
| AV 202 | W | NULL | AV 222 | C | －－－－ | no－corresponding terms |
| AV 203 | W | NULL | AV 223 | C | －－－－ | no－corresponding terms |
| AV 204 | W | NULL | AV 224 | C | －－－－ | no－corresponding terms |
| AV 205 | W | NULL | AV 225 | C | －－－－ | no－corresponding terms |
| AV 206 | W | NULL | AV 226 | C | －－ | no－corresponding terms |
| AV 207 | W | NULL | AV 227 | C | －－－－ | no－corresponding terms |
| AV 208 | W | NULL | AV 228 | C | －－－－ | no－corresponding terms |
| AV 209 | W | NULL | AV 229 | C | －－－－ | no－corresponding terms |

## 19. PT100 Thermistor Operation Guide

1. At Group 3 Analog Input, select $\operatorname{Pr} 03-00=11$ or $\operatorname{Pr} 03-02=11$ for PT100 input. You also can select Pr03-01=11, but you need to set Pr03-29=1 and switch ACI selection (SW4) as $0 \sim 10 \mathrm{~V}$ on the control terminal.
2. At Pr03-23, AFM2, select 23 for AFM2 Constant Current Output and switch AFM2 selection (SW2) as $0 \sim 20 \mathrm{~mA}$ on the control terminal. Set AFM2 constant current output as 9 mA ( $\operatorname{Pr03-33=45\% )~}$
3. The wiring diagram of PT100 is as below.

4. There are two kinds of action level at PT100. The diagram of PT100 protecting action is shown as below.

Level $2=\operatorname{Pr} 06-57$

| Setting range $0.000 \sim 10.000 \mathrm{~V}$ |
| :--- |
| Factory setting 7.000 V |
| Frequency |
|  |
|  |  |
|  |

5. When Pr06-58 $=0 \mathrm{~Hz}$, PT100 function is disabled.

When connecting RTD signal (PT100) to VFD-CP2000, the parameter setting of the auto-frequency decreasing function while the temperature is too high is shown as below

When the temperature of RTD is higher than $135^{\circ} \mathrm{C}\left(275^{\circ} \mathrm{F}\right)$, VFD will decrease automatically the frequency to selected frequency. It stays at that selected frequency until the temperature goes lower than $135^{\circ} \mathrm{C}\left(275^{\circ} \mathrm{F}\right)$. If the temperature is higher than $150^{\circ} \mathrm{C}\left(302^{\circ} \mathrm{F}\right)$, VFD will decrease the output and decelerating to stop. The error message ( OH 3 ) will also be recorded.

The PT100 detection level of Pr06-56 is set at 1.37.



[^0]:    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

[^1]:    D1* : Flange mounting

[^2]:    D1* : Flange mounting

[^3]:    * NOTE: Wire size of analog control signals: 18 AWG ( $0.75 \mathrm{~mm}^{2}$ ) with shielded wire

