

Introduction

Thank you for choosing the CT-2000ES inverter unit, this inverter unit is suitable for operating squirrel cage induction motors. Please read this instruction manual carefully before actual usage in order to ensure proper operation and suit your needs.

Table of Contents

| | |
|--|-----------|
| 1. Inspection upon receiving..... | <u>2</u> |
| 2. Installation and Storage..... | <u>2</u> |
| A. Installation | <u>2</u> |
| B. Storage..... | <u>2</u> |
| C. Outline dimension..... | <u>3</u> |
| 3. Application notes..... | <u>4</u> |
| 4. Block diagram and wiring | <u>4</u> |
| A. Wiring of main and control circuit | <u>4</u> |
| B. Signal circuit..... | <u>4</u> |
| C. Connecting the power supply and the AC motor..... | <u>4</u> |
| D. R.S.T. for Power source reactor..... | <u>5</u> |
| E. Brake resistor standard of usage..... | <u>5</u> |
| F. Standard external connection diagram..... | <u>6</u> |
| G. Control circuit specification..... | <u>7</u> |
| H. Terminal specifications..... | <u>8</u> |
| 5. Operation Test..... | <u>9</u> |
| 6. Adjust and Function Specification..... | <u>11</u> |
| A. Keypad operation..... | <u>11</u> |
| B. Display specification..... | <u>11</u> |
| C. Keypad specification..... | <u>11</u> |
| D. Function Code..... | <u>13</u> |
| 7. Description of alarm display indications | <u>41</u> |
| 8. Troubleshooting..... | <u>42</u> |
| 9. Maintenance and Inspection..... | <u>43</u> |
| 10. Standard Specification..... | <u>44</u> |
| A. 200V series 1 phase..... | <u>44</u> |
| B. 200V series 3 phase..... | <u>45</u> |
| C. 400V series 3 phase..... | <u>46</u> |
| 11. Function code Table..... | <u>47</u> |
| 12. Modbus Address of Display Data..... | <u>51</u> |
| 13. Series Communication User Manual..... | <u>52</u> |
| A. The physical link..... | <u>52</u> |
| B. Data structure in communication..... | <u>53</u> |
| C. Function code in Modbus..... | <u>53</u> |
| D. Error check generation..... | <u>56</u> |
| E. Group & global broadcasting..... | <u>57</u> |

1. Inspection upon receiving

- A. Check that the model, the capacity and power voltage specifications are as ordered.
- B. Check that no damage has occurred during transportation.
- C. Check that none of the internal parts have been damaged or have fallen off.
- D. Check that none of the connectors have been damaged or have fallen off.
- E. Check that there is no loosening of the terminals or screws of each of the parts.

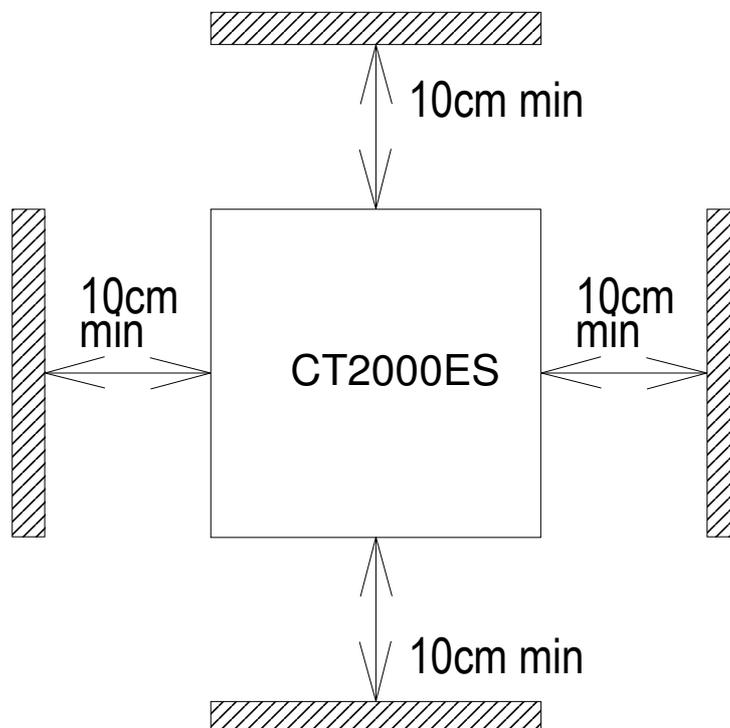
2. Installation and Storage

A. Storage:

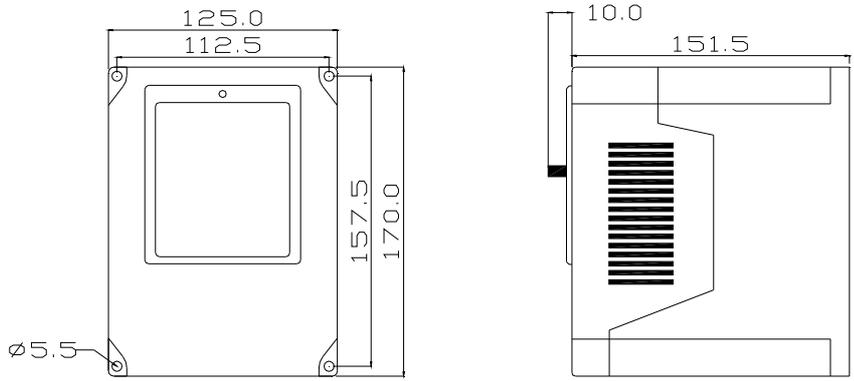
If the equipment is not to be installed immediately, it should be stored in a clean and dry location at ambient temperatures from 20°C to 55°C. The surrounding air must be free of corrosive contaminants.

B. Installation place:

Places where the peripheral temperature is from -10°C to 40°C, and where the relative humidity is 90% or less. Avoid installing at places where there is dust, iron particles, corrosive gas, water spray, direct sunlight or too much vibration. And places where has good ventilation.

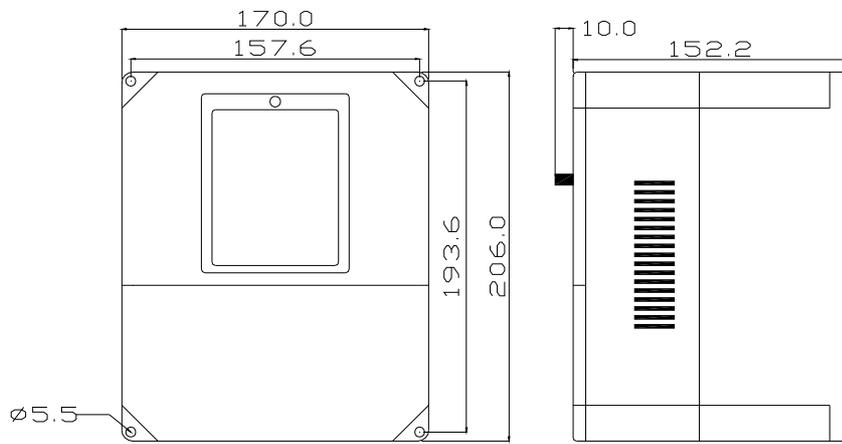


C. Outline Dimension:



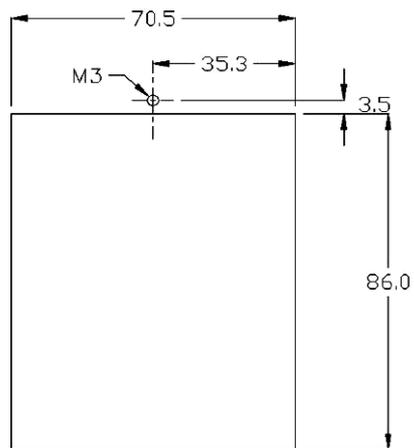
unit:mm

CT2002ES-A75、CT2002ES-1A5、CT2004ES-A75、CT2004ES-1A5



unit:mm

CT2002ES-2A2、CT2002ES-3A7、CT2004ES-2A2、CT2004ES-3A7



KEYBAD screw position

3. Application notes

A. Concerning the inverter unit:

- (1) Do not fit capacitors to the output side of the inverter in order to improve the power ratio.
- (2) In case of fitting MC between inverter and motor to control motor operation, then the capacity of inverter must be 6 times the capacity of motor.
- (3) Run a motor that is within the capacity of the inverter unit, light load current and no-load current will cause the motor to develop ripple current.
- (4) This unit is provided with a current limiting function. The starting torque is assumed to be from 80% to 100%.

B. Concerning the AC motor

- (1) When general-purpose motors are operated at low speeds, there is a reduced cooling effect, please apply the special purpose motor.
- (2) Operation at frequencies exceeding 60 Hz requires caution, as there is the danger of the mechanical strength failure of the motor.
- (3) When motors with brakes are being operated, the power for the brake and inverter should be taken from the same power supply and the brake operation must be in phase when the unit is started and stopped.

4. Block diagram, wiring

A. Wiring of main and control circuit

Wire according to the standard connection diagram. On using the external sequence control, please use small signal relay or double terminal relay to avoid relay terminal malfunction.

B. Signal circuit

The signal circuit uses either shielded pairs or twisted pairs, should be wired either using a wiring duct separated from that for the power circuit, or with the wiring conduit isolated as much as possible.

C. Connecting the power supply and the AC motor

Connect the main circuit, by wiring according to the main circuit terminal connection diagram. Care is required not to make a mistake when connecting the input and output terminals, lest it will cause inverter damage. Specifications of main circuit path and NFB are as follow:

| Voltage (V) | Model | NFB (A) | Wire size for circuit (mm ²) |
|-----------------|--------------|---------|--|
| 220 | CT2002ES-A75 | 10 | 2.0 |
| | CT2002ES-1A5 | 15 | 2.0 |
| | CT2002ES-2A2 | 20 | 2.0 |
| | CT2002ES-3A7 | 30 | 3.5 |
| 380 / 460 | CT2004ES-1A5 | 10 | 2.0 |
| | CT2004ES-2A2 | 10 | 2.0 |
| | CT2004ES-3A7 | 15 | 3.5 |

D. Instantaneous current and to improve power ratio, it should be fitted the A.C.L. to R.S.T. input side under the following circumstance:

- a. Where power supply capacity is larger than 500 KVA.
- b. Using thyrister, phase advance capacitor etc. from the same power supply.

A.C.L. Specifications table:

| Voltage (V) | Model | Current (Ar.m.s) | Induction Value |
|-----------------|--------------|------------------|-----------------|
| 220 | CT2002ES-A75 | 6A | 1.8mH |
| | CT2002ES-1A5 | 10A | 1.1mH |
| | CT2002ES-2A2 | 15A | 0.71mH |
| | CT2002ES-3A7 | 20A | 0.53mH |
| 380 / 460 | CT2004ES-1A5 | 5A | 4.2mH |
| | CT2004ES-2A2 | 7.5A | 3.6mH |
| | CT2004ES-3A7 | 10A | 2.2mH |
| | | | |

Notes: The A.C.L. for 220V and 380V/460V have different induction values, please does not mix up.

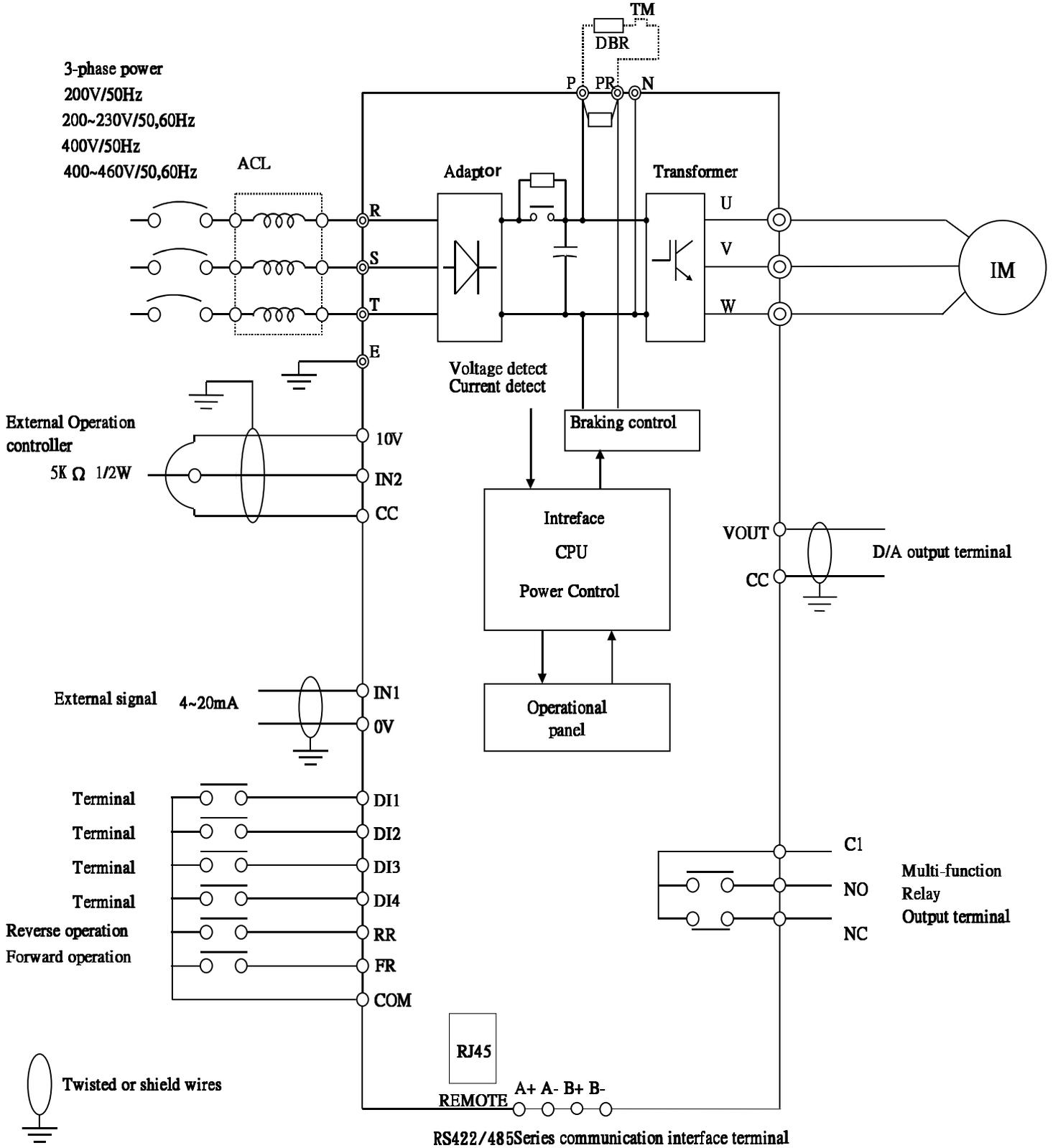
E. Brake resistor standard of usage

CT2000ES series inverter contain brake resistor , P 、 PR terminal can connect external brake resistor. The sizes of brake resistors take the table for reference.
If inertia is too large or cycle of discharge is higher, user can increase wattage of resistor.

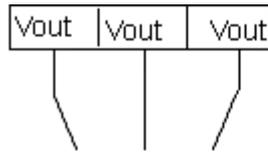
| Voltage (V) | Type | Brake resistor standard | Mark |
|-----------------|--------------|-------------------------|------|
| 220 | CT2002ES-A75 | 120Ω 80W | |
| | CT2002ES-1A5 | 80Ω 160W | |
| | CT2002ES-2A2 | 60Ω 250W | |
| | CT2002ES-3A7 | 36Ω 400W | |
| 380 / 460 | CT2004ES-1A5 | 360Ω 300W | |
| | CT2004ES-2A2 | 250Ω 500W | |
| | CT2004ES-3A7 | 150Ω 800W | |
| | | | |

F. Standard external connection diagram

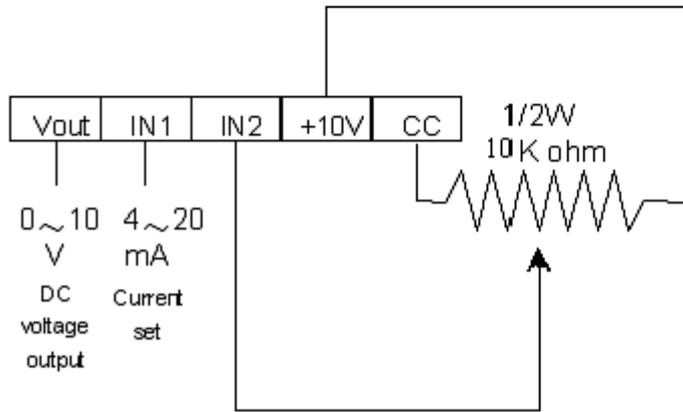
(Note: While external is required for DBR, disconnect inter DBR first)



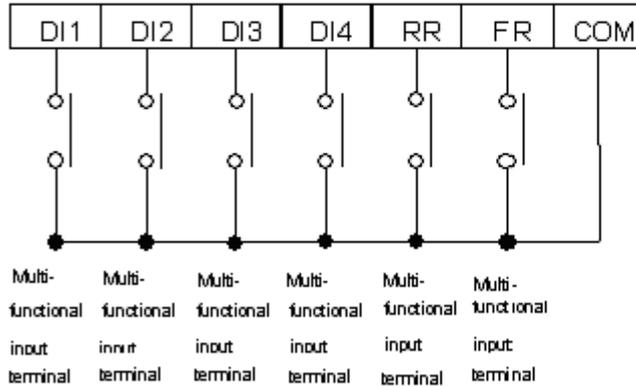
G. Control circuit



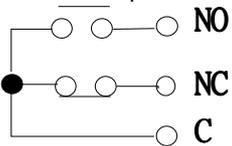
Multifunctional RELAY output terminal



Main voltage set



H. Terminal Specifications

| | | | |
|----------------------|------------------------|--|---|
| Main Circuit | R.S.T | AC power input terminal | Connect 3 ϕ AC with Single ϕ 200-230V/50,60Hz with 3 ϕ 380-460V/50,60Hz |
| | U.V.W | Inverter output terminal | 3-phase induction motor |
| | E | Ground terminal | Ground terminal of inverter chassis |
| | P.PR | Brake resistor connecting terminal | Connected proper brake resistor according to rated ampere |
| Control Terminal (1) | VC | Power speed output setting | DC +10V |
| | IN1 | Current speed input setting | DC 4~20mA, CD01=2 or 4 |
| | IN2 | Voltage speed input setting | DC 0~10V/ 5K Ω VR, CD01=1,3 |
| | VOUT | Operation (Frequency /Current) output indication | Analog Output 0~10V DC, Frequency/Current set by CD54 |
| | CC | Common input control terminal | Ground terminal for speed setting |
| Control Terminal (2) | COM | Sequence control common terminal | Ground terminal for sequence control |
| | FR | Forward operation input terminal | Forward operation by FR-COM shorted |
| | RR | Reverse operation input terminal | Reverse operation by RR-COM shorted |
| | DI1 | 2 nd acceleration input terminal (AC2) | Select 2 nd acceleration time mode by shorting 1-COM, set CD10 |
| | DI2 | 2 nd deceleration input terminal (DC2) | Select 2 nd deceleration time mode by shorting 2-COM, set CD11 |
| | DI3 | JOG | Shorting 3-COM |
| | DI4 | RST | Shorting 4-COM |
| | C1, NC1, NO1 | Control output terminal  | Multifunctional relay output terminal Connector capacity AC 220V, 0.1A While normal C <input type="checkbox"/> closed and NC <input type="checkbox"/> Closed While operating C <input type="checkbox"/> open and NO <input type="checkbox"/> closed Functions of C1, NC1, NO1 are set by CD47 |
| | A+, A- B+, B- SG | Serial communication terminal | Refer to Serial Communications User Manual. SG is 0 volt terminal of the digital signal. |

5. Operational Test

A. Check before test

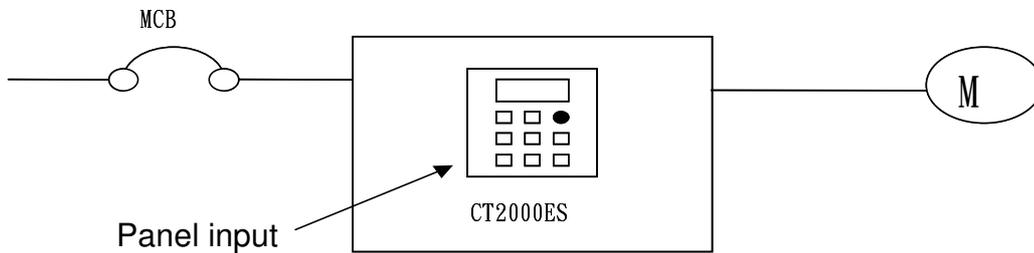
Please check the following:

- (1) Is wiring correct? Check especially the input and output terminals.
- (2) Is there a short-circuit or ground connection on external wiring?
- (3) Make sure there is no loosening of screws.
- (4) Check external sequence control circuit.
- (5) Check voltage of power supply.

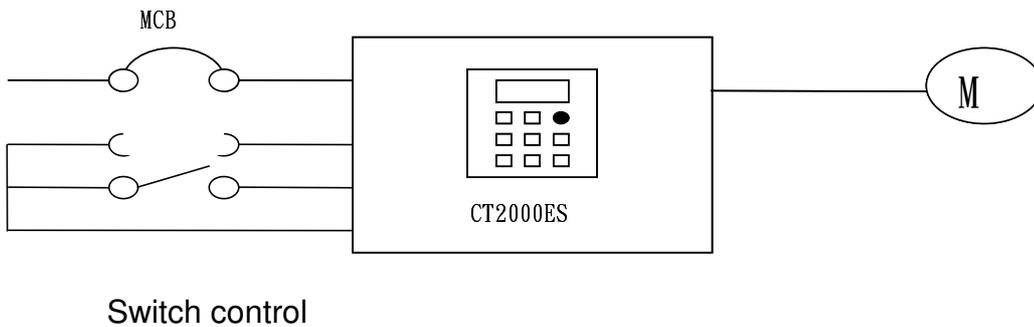
B. Operation Method

CT-2000 series inverter unit has both operator panel and external operation methods.

- (1) Operator panel



- (2) External signal operation



C. Operational test

Test according to the following procedure and be aware of indications.

(1) Basic operational test

-Operational procedure

- I. Connect power supply
- II. Monitor glittering indicates frequency
- III. Press either FWD or REV key, motor starts running. It will stop accelerating after reaching set frequency
- IV. After pressing STOP key, motor stops and indicating frequency steps down. The set frequency starts glittering after the motor stops.
- V. Repeat procedures III and IV to test forward and reverse operations.

-Operation monitor display

- I. With reciprocal glittering indicated HZ LED and factory setting (set VR on the panel)
- II. Hz display, with FWD (or REV) LED lighted up steadily; indication goes up according to frequency until reaching value 10.00 Hz
- III. Indication goes down according to operation frequency, and returns to situation " I " after stop

(2) Frequency change test

- Operational procedure

- I. Exercise the above operation test procedures I, II, III
- II. Adjust VR on the panel to change frequency command
- III. Repeat procedures II to increase or decrease frequency

-Operation monitor display

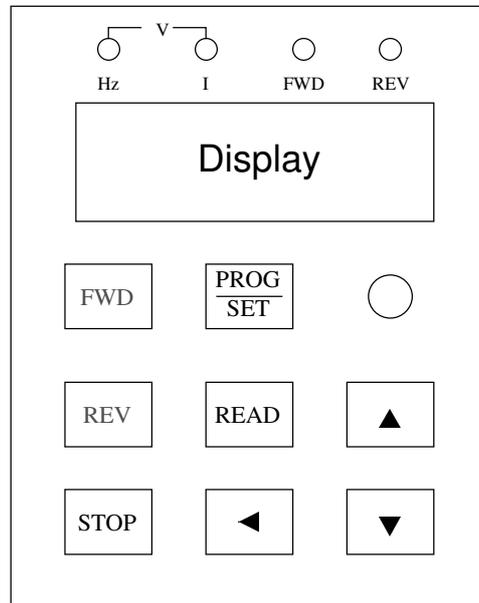
- I. The same as the above basic test of I, II
- II. Monitor display indicates the current new setting value

Note:

1. Is motor operation direction correct? (Changing any two of U.V.W output terminals to change motor operation direction)
2. Is there any noise or vibration on motor?
3. Is it run smoothly during acceleration and deceleration?
4. Is there any power failure?

6. Adjust and Function Specification

A. Keypad operation



(2) Display specification :

- 1.Hz 、 I LED : Hz LED means of recent revolution frequency.
I LED means of recent revolution current.
Hz and I LED mean of recent revolution voltage on the display.
- 2.FWD 、 REV : FWD means motor operate at forward direction.
REV means motor operate at reverse direction.

(3) Keyboard specification :

1. FWD and REV: Push keypad to control reverse of motor, and screen display main display content (Cd02 setting).
Push keypad to control reverse of motor, and screen display main display content (Cd02 setting).
- 2.STOP : STOP function: Stop motor revolution when push STOP key, and on the mean time screen flashing with commanding instruction.
RESET function : While failure occurred, press STOP key to re-start inverter and save failure in failure memory.

3.PROG/SET : FUNC switch: In display mode , PROG/SET key and screen shows Cd00 (General parameter input area). , Press PROG key again and screen shows CE-00 (failure and engineering mode). If pressed PROG key now, screen would return to display mode.

SAVE function: In parameter input mode, press PROG/SET key will save new parameter just input.

4.READ : READ function : When display shows Cd-?? (General parameter Input mode) or CE-?? (Failure display and engineering mode), Press READ to parameter input mode. Screen showing previously parameter setting. Change of parameter can be proceeding.

Back to display function : Press READ at parameter input mode can escape from parameter input mode and not save new parameter.

5. ◀ Key (< as shown): SHIFT function : press < key to swich position of nonius , when the nonius is at left , press <key nonius will be back to right , when accommodate to press ▼ 、 ▲key to modify parameter in this mode.

6.▼ 、 ▲ key: Item of display changing : Press▲, ▼ key at display mode, select required item.

Parameter selection : Press ▲,▼ key to change value when screen shows Cd- (General parameter input area) or CE- (Failure display and engineering mode). Press and hold ▲,▼ key can progressively increase or decrease value.

Parameter modification : Press ▲,▼ key at parameter input mode can change parameter. Using with SET key to modify parameter.

D. Function Code

§ Cd00 Set frequency (Settable range 0.5~240 HZ)

There are 5 methods to change set frequency. Items A~C are methods of panel key operation, items D-E are methods of external terminal input.

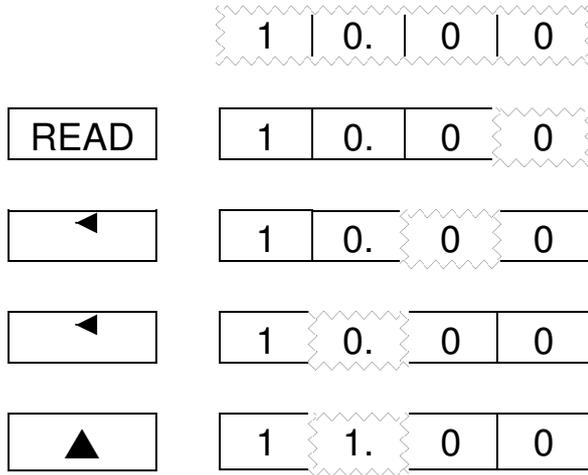
- A. At display function, press READ and setting (Cd01=0)
- B. Use PROG key to input data (Cd01=0)
- C. Set VR on faceplate (Cd01=5)
- D. Set external voltage (Cd01=1 or 3)
- E. Set external voltage (Cd01=2 or 4)

Note:

1. Set value should be in accordance with V/F slope (Cd05) and upper limit frequency (Cd17).

Set by function key

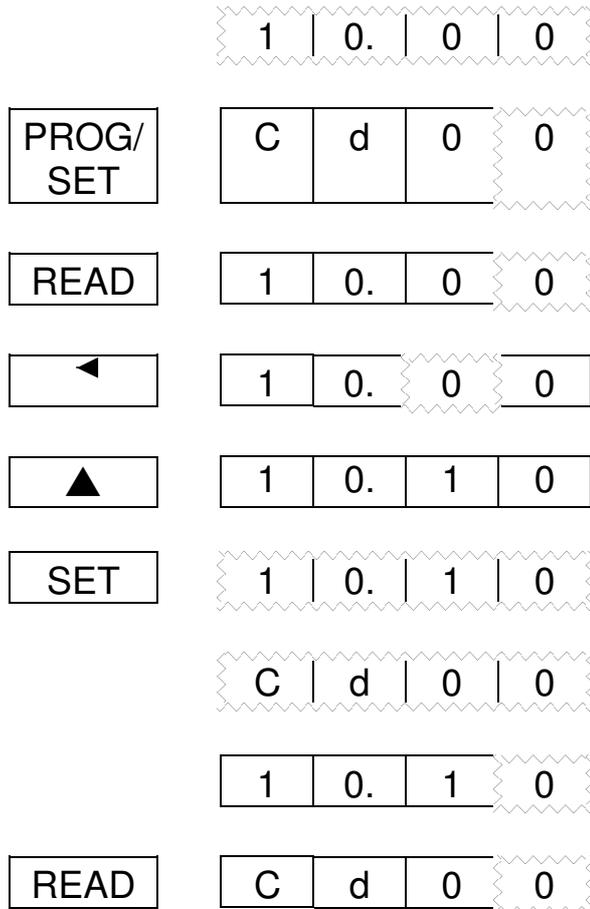
- A. At display function, press READ and setting (Cd01=0)



Meanwhile the operation speed (Cd00) has been changed but not saved yet (power cut off and supply again Cd00 still be 10.00) , press PROG/SET and save data.



B. Use PROG key to input procedure (Cd01=0)



Notice:  Indicate 7- segment LED flash.

§ Cd01 Setting procedure of frequency (Selective range 0~6)

The function cannot be modified during revolution.

Setting procedure of frequency is to select either panel key or external analog signal.

Cd01=0 Set frequency on operation panel, as the above items A-C.

Cd01=1 Set frequency by terminal In2 DC 0~10V/5KΩ VR

Cd01=2 Set frequency by terminal In1 DC 4~20mA

Cd01=3 Set frequency by terminal In2 DC 0~10V/5KΩ VR hysteresis

Cd01=4 Setting from terminal In1, input DC4~20mA hysteresis

Cd01=5 Setting value input by VR of keypad

Cd01=6 Set frequency by Multi-step function mode

§ Cd02 Select Main monitor display (Selective range 0~10)

The monitor is consisted of four 7-segment LEDs, displays frequency, current and various data by digital number and character.

- Cd02=0 Display the frequency, LED HZ active
- Cd02=1 Display the current, LED A active
- Cd02=2 Display Ultimate speed, Hz and A LED de-active.
- Cd02=3 Display DC voltage of DC BUS, showing d in front of value
- Cd02=4 Display rms value of U.V.W. AC output · LED HZ, A active
- Cd02=5 Display external control terminal status, showing E in front of value
- Cd02=6 Display temperature rising of PIM module, showing b in front of value
- Cd02=7 Display speed feedback. Check if MCK circuit working properly, then the restart and free run start function (Cd28) will working normally.
- Cd02=8 Display current step of multi-step function (step)
- Cd02=9 Display current time of multi-step function (minutes)
- Cd02=10 Display motor vibration

§ Cd03 Torque mode (Selective range 0~1)

The function cannot be modified during revolution.

- Cd03=0 Automatic torque compensation de-active, set compensation by Cd07
- Cd03=1 Initial Torque boost active · set compensation by Cd52
Set compensation by Cd63

§ Cd04 Operation command mode (Selective range 0~5)

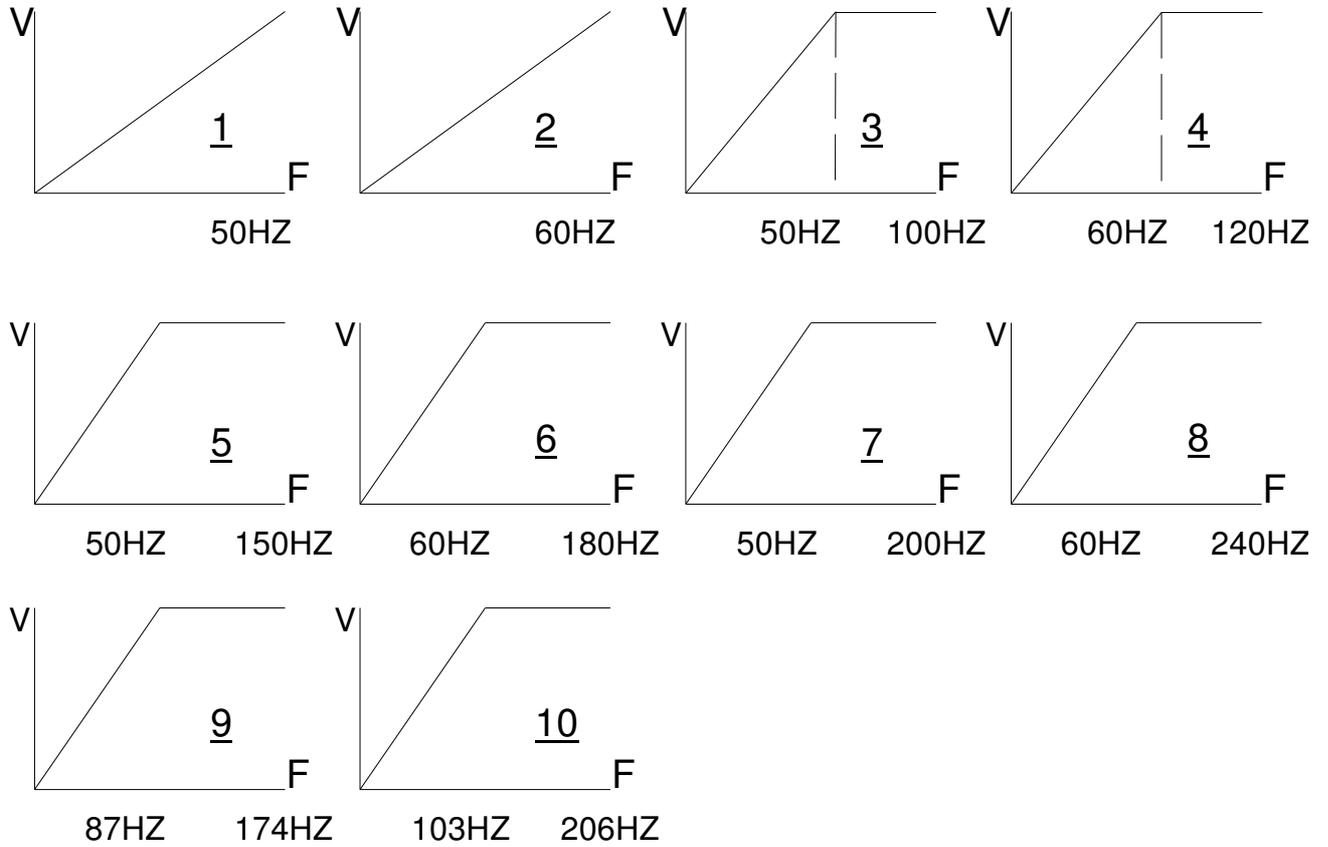
The function cannot be modified during revolution

- Cd04=0 Operation on operation panel 1, press ▲▼key to display the content of Cd02
- Cd04=1 2 wire Operation by external terminal 1, including FR, RR, terminal (1, 2, 3, 4), press ▲▼key to display the content of Cd02
- Cd04=2 Operation on operation panel 2, ▲▼key fine tuning frequency
- Cd04=3 2 wire operation on external terminal 2 · including FR, RR, terminal (1, 2, 3, 4), ▲▼key fine tuning frequency
- Cd04=4 3 wire Operation by external terminal 1, including FR, RR, terminal (1, 2, 3, 4), press ▲▼key to display the content of Cd02
- Cd04=5 3 wire operation on external terminal 2 · including FR, RR, terminal (1, 2, 3, 4), ▲▼key fine tuning frequency

§ Cd05 Set V/F pattern (Selective range 1~14)

The function cannot be modified during revolution

There are 11 patterns of V/F slope, as follow :

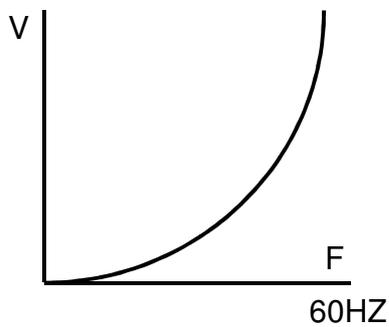


When Cd05=11, V/F slope is determined by Cd57, Cd58

Cd05=12 1.5 power curve

Cd05=13 1.7 power curve

Cd05=14 square curve



§ Cd06 Motor current rate (Settable range 25~100)

Set motor overload protective current, in order to avoid motor failure because of overload. Set value=100, please calculate the following formula:

$$\text{Set Value} = \text{Motor rated current} / \text{Inverter rated current} \times 100$$

Ex. Use inverter with 3.7KW(5HP) to drive motor with 2.2KW(3HP)

Inverter rated current = 17.4A

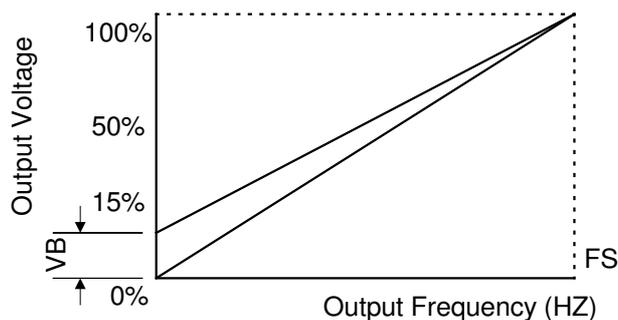
Motor rated current = 8A

$$\text{Set Value} = 8 / 17.4 \times 100 = 46\%$$

§ Cd07 Torque compensation Vb (Settable range 0~150)

The function cannot be modified during revolution.

This function is to raise output voltage to increase torque of motor. It can also be used to increase load slope of low voltage produced by long wiring between inverter and motor, as well as fluid, fan and pump.



§ Cd08, 09, 10, 11 Acceleration / deceleration time (Settable range 0.1~6000)

The time needed for set frequency from 0Hz to 50Hz.

There are 2 selections for each of acceleration time and deceleration time.

To set acceleration/deceleration time

$$\text{Set Value (T)} = (50 - 0) / \Delta F \times T1$$

T1: time needed for accelerate / decelerate

ΔF : frequency changed

Ex.: Frequency from 50Hz down to 30Hz, needed time 1 sec. Then:

$$\text{Set Value (T)} = 50 / 50 - 30 \times 1 = 2.5$$

Cd08 = Acceleration time

Cd09 = Deceleration time

Cd10 = 2nd Acceleration time

Cd11 = 2nd Deceleration time

Note: The 2nd acceleration/ deceleration time only available on external operation mode.
(E.g. Cd04=1)

§ Cd12, 13, 14 Speed setting (Settable range 0.5~240)

This function has 4 kinds of speed setting

The 2nd, 3rd, 4th speeds are set from external terminal FR (or RR) which accommodate terminal 3, 5, the setting value cannot exceed the allowed range.

Cd12 = 2nd speed setting

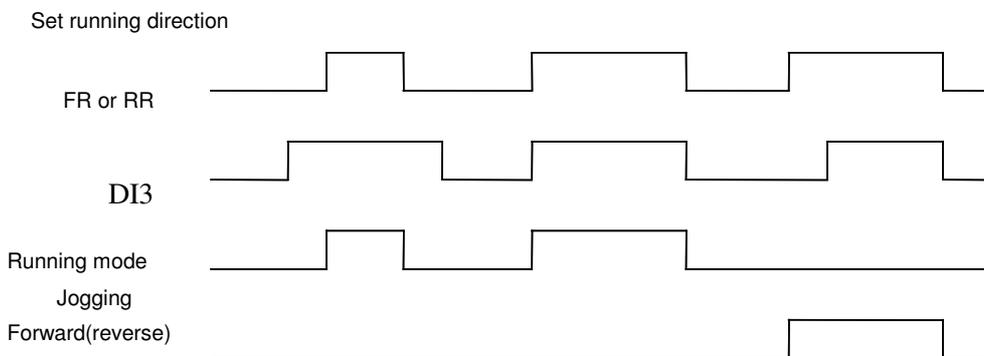
Cd13 = 3rd speed setting

Cd14 = 4th speed setting

Note: When apply to multi-speed setting, use external control (e.g. Cd04=1) to start and use panel to pre-input to set frequency.

§ Cd15 Jogging frequency (Settable range 0.5~30)

To control jogging, use external terminal DI3 accommodate FR or RR with COM shorted.
Set running direction



Note: Jogging operation is valid only when operation command selects the external operation signal mode (e.g. Cd04=1) and Cd59=0 or 1.

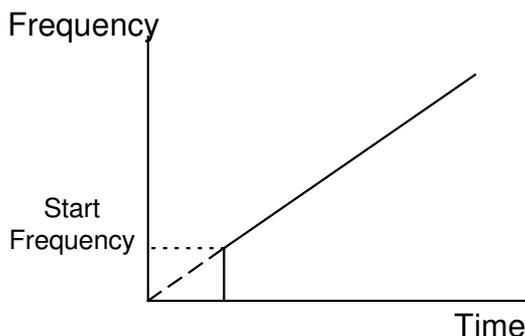
Jogging operation procedures:

1. First put in DI3, and then FR (or RR).
2. Put in DI3 and FR (or RR) simultaneously.
Be sure always to put in DI3 before FR (or RR).

§ Cd16 Start frequency (Settable range 0.5~60)

Set motor start frequency

Settable range of frequency from 0.5Hz to 30Hz, accuracy is 0.01Hz.



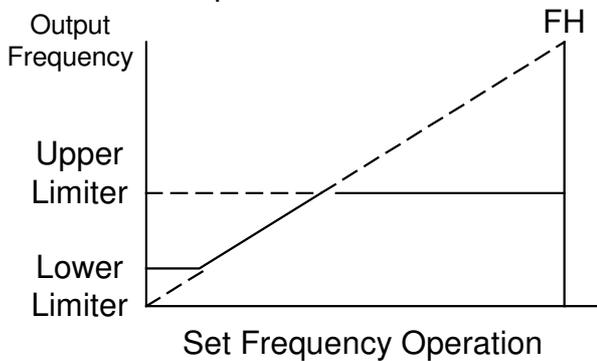
Note: The most appropriate range for start frequency is 0.5Hz to 10Hz.

§ Cd17 Upper limiter of frequency (Selective range 10~240)

This limiter is used to operate within upper limit frequency of motor
 Avoid input errors caused by the panel keys and result in mechanical damage.

§ Cd18 Lower limiter of frequency (Settable range 0.5~100)

This limiter is used to operate within lower limit frequency of motor



§ Cd19 Acceleration / deceleration time of jogging (Settable range 0.10~30.00)

Time needed for set frequency from 0Hz to 50Hz.

$$\text{Set Value (T)} = (50 - 0) / \Delta F \times T1$$

T1: Time needed for acceleration/deceleration

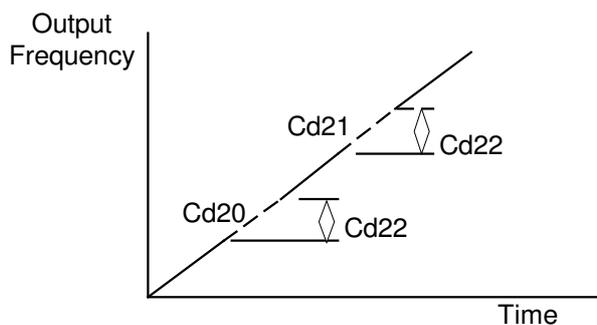
ΔF : Frequency changed

§ Cd20, 21 Jump frequency (Settable range 0~240)

This function is to avoid mechanical resonance frequency

Frequency operation automatically jumps to point \pm jump width (set by Cd22)

This function is only available on constant speed operation, not influence during acceleration/deceleration, it is settable at 2 points.



§ Cd22 Jump frequency width (Settable range 0-6)

This function must accommodate Cd20 and Cd21

§ Cd23 Braking mode (Settable range 0-3)

This function must accommodate Cd24, Cd25, and Cd26.

Cd23=0 No DC braking

Cd23=1 Stop mode

Cd23=2 Start mode

Cd23=3 Stop and start mode

§ Cd24 DC braking frequency (Settable range 1~60)

This function must accommodate Cd23, Cd25, and Cd26.

Set frequency of DC brake starts at the time of inverter deceleration stops, the DC brake is active when operates below the starting frequency.

§ Cd25 DC braking voltage (Settable range 1~15)

This function must accommodate Cd23, Cd24, and Cd26.

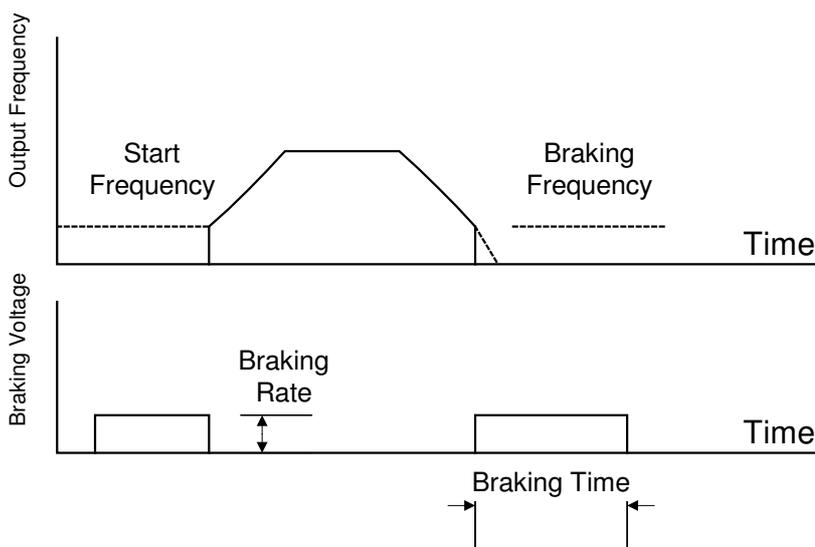
DC braking torque setting

Cd25=1-15, the higher value the higher output brake torque

Note: When DC brake voltage is high, be aware of over current.

§ Cd26 DC braking time (Settable range 1~60)

Adjust DC braking time



Note:

1. DC braking time too long or too many times is possible to cause motor damage because of overheating.
2. Set Cd23=0 when DC braking is not required.

§ Cd27 Motor running direction (Settable range 0~2)

Fix motor running direction to prevent mechanical damage.

Cd27=0 both forward, reverse directions available, stop before changing direction.

Cd27=1 both forward and reverse directions available, No stop required.

Cd27=2 only forward operation is available.

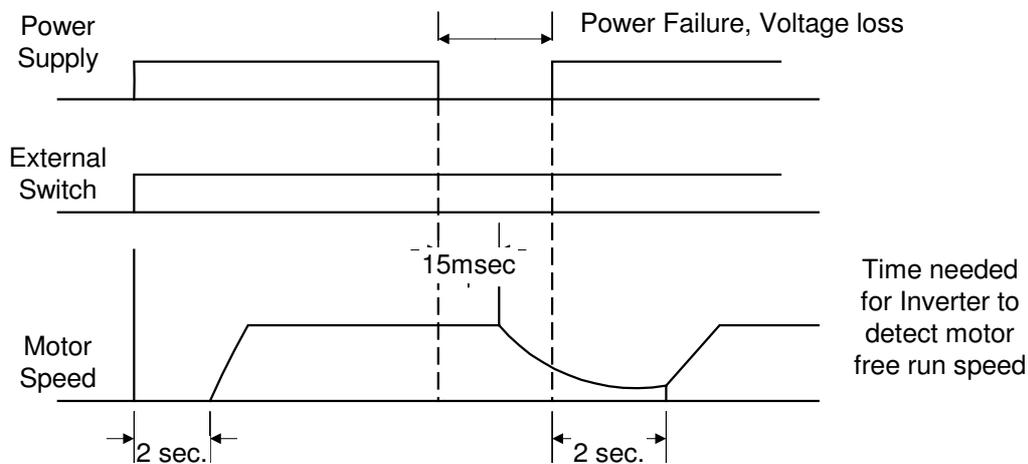
Cd27=3 only reverse operation is available.

§ Cd28 Restart / Free run start (Settable range 0~3)

| Cd28 | Restart | Free run start |
|------|---------------|----------------|
| 0 | No function | No function |
| 1 | With function | No function |
| 2 | No function | With function |
| 3 | With function | With function |

1. Free run restart function:

When power supply failure occurs or voltage loss, there may be a malfunction on PCB control circuit, this function is to return to the original setting of speed and frequency after power recovery.



Note:

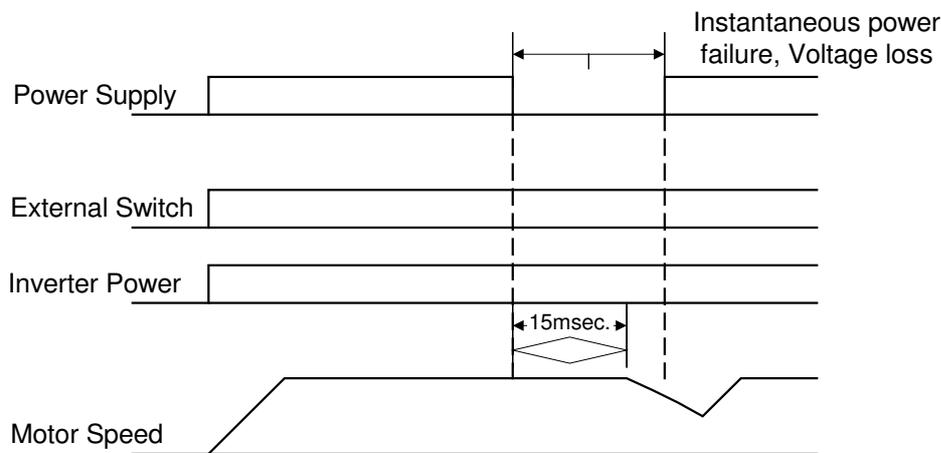
- (1) Free run direction must be the same as setting direction.
- (2) After power recovery, there is about 2 sec. delay time (motor frequency detect) for start.

Restart after power recovery, the inverter will output a frequency signal first to detect if it conforms the frequency of free run, if the two frequencies are equal, the inverter output rated voltage then. The purpose is to prevent over current to happen.

2. Restart after instantaneous power failure

This function is different from free run restart, the inverter control power is maintained above 5V.

| | |
|--|---|
| Restart after instantaneous power failure: no function | When it detects low voltage "PLU", it activates "STOP", "PLU". After recovery of voltage, "PLU" are de-active, "STOP" remains the same, and it will have to switch "ON" again to restart if you select external control, if you select panel control, just press "FWD" or "REW" key to restart. |
| Restart after instantaneous power failure: with function | Restart motor under free run. |



Note: The inverter will be de-active when control voltage is less than 5V.
Apply with free run restart function when it is required.

§ Cd29 Time (Settable range 0~9000)

This function must accommodate Cd47=0 setting.
When motor starts operation, the time counter is active.

§ Cd30 Stop by panel key (Settable range 0~1)

Cd30=0 No function
Cd30=1 with function

Stop function: This function enables the inverter to be stopped by panel key while the inverter is operated by external sequence.

§ Cd31 Initial factory setting (Settable range 0,1)

The function cannot be modified during revolution.

Set data to original factory setting.

Cd31=0 No change

Cd31=1 Initial factory setting, refer to function code table.

Note: After this function is active, content value returns to “0”, readable value is always “0”.

§ Cd32 、 33 、 34 、 35 DI1~DI4 external terminal function setting (Settable range 0~14)

Setting external terminal by operator request, after external terminal put in, according to Cd32 is DI1 function setting 、 Cd33 is DI2 function setting 、 Cd34 is DI3 function setting 、 Cd35 is DI4 function setting.

0: No motion

1: Two kinds of speed order { 2DF }

2: Three kinds of speed order { 3DF }

3: Five kinds of speed order { 5DF }

4: Two kinds of acceleration time { 2AC }

5: Two kinds of deceleration time { 2DC }

6: JOG

7: Inertia stop operation { MBS }

8: Failure clear and Programmable Logic Controller { PLC } time reset { RST }

9: Switch analog input AI1, AI2

10: PID disable

11: PID Error Back

12: PID integral preservation

13: PID integral reset

14: PID soft start

Notice: When setting is 7 { MBS } or 8 { RST } , directly set the external terminal short to act without assume external operation pattern.

§ Cd36 Failure record clear (Settable range 0, 1)

Clear the failure record content of Code 32, 33, 34, and 35.

Cd36=0 No change

Cd36=1 All of the contents of data will be “nOnE”, display of “LoAd” after setting

Note: After this function is active, content value automatically returns to “0”, thus readable value is always “0”.

§ Cd37 Frequency gain setting (Settable range 20~200)

Select ratio of frequency gain

Gain setting for external input signals are available using this function.

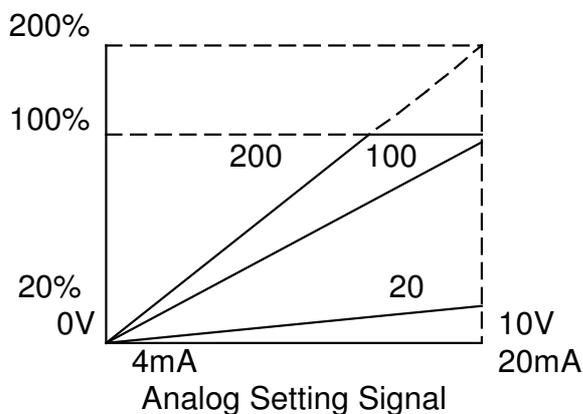
$$\text{Output Frequency} = \text{Set Value} \times \text{Frequency Gain} \times \text{MAX. Frequency}$$

Ex. Under the mode of external voltage (0-10V) frequency setting, frequency gain = 100%, set voltage to 2V, MAX. Frequency (FH) is 120Hz:

$$\text{Output Frequency} = (2\text{V}/10\text{V}) \times 120\text{Hz} \times 100\% = 24\text{Hz}$$

If change frequency gain to 150%, then

$$\text{Output Frequency} = (2\text{V}/10\text{V}) \times 120\text{Hz} \times 150\% = 36\text{Hz}$$



Note: If the maximum frequency (FH) exceeds more than 120Hz, gain setting of larger than 100% is ignored and fixed at 100% and input data of Cd37 will not be changed.

§ Cd38 Analog output calibration (Settable range 90~110)

Set the ratio of frequency graduation calibration then

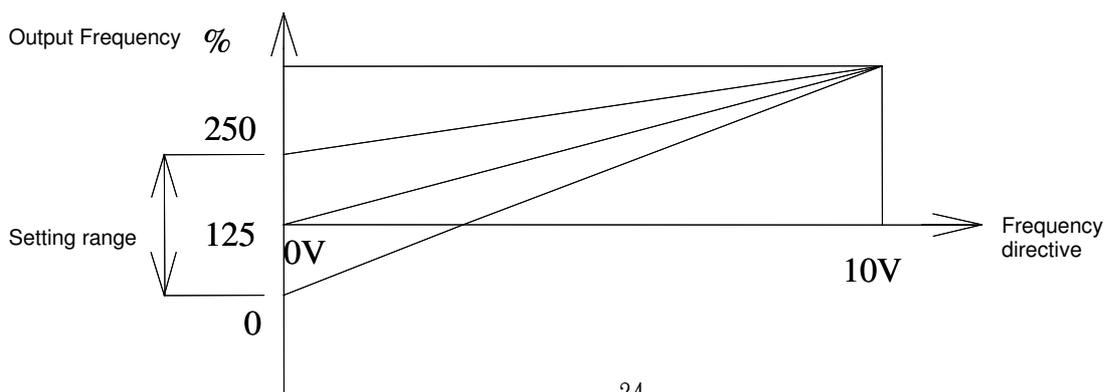
Cd38=99: 99% of initial factory

Cd38=101: 101% of initial factory

Set Cd54 to select analog output

§ Cd39 Frequency command bias (Settable range 0~250)

External analog frequency command bias setting



§ Cd40, 41, 42, 43 Multi-speed setting (Settable range 0.5~240)

This function has 8 kinds of speed operation

Use external terminal FR (or RR) accommodate DI1, DI2, DI3, DI4 to select different speeds. Refer to the following table:

Cd40= 5th step speed setting

Cd41= 6th step speed setting

Cd42= 7th step speed setting

Cd43= 8th step speed setting

Example : DI1 set to be 2DF、DI2 set to be 3DF、DI3 set to be 5DF(DI1 ~ DI4 any three of them, could be set to be 2DF、3DF、5DF)

| External Terminal ame /Setting Function | Selective speed | | | | | | | |
|--|-----------------|---|---|---|---|---|---|--|
| | 2 | 3 | 4 | 5 | 6 | 7 | 8 | |
| DI1/2DF | ○ | | ○ | | ○ | | ○ | |
| DI2/3DF | | ○ | ○ | | | ○ | ○ | |
| DI3/5DF | | | | ○ | ○ | ○ | ○ | |

○ : Stands for external terminal to put in.

Note: Apply to multi-speed setting external control is required for operation control mode (e.g. Cd04=1).

§ Cd44 Stop mode (Settable range 0~2)

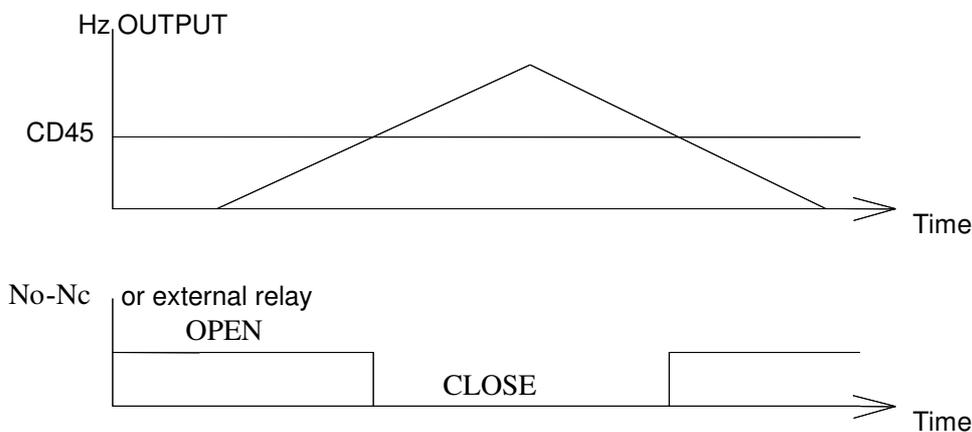
Cd44=0 Deceleration stop

Cd44=1 Free run stop

Cd44=2 Free run stop, but restart after the deceleration time is reached, deceleration time is set by Cd11.

§ Cd45 Frequency detect level (Settable range 0.5~240)

This function is only available when RELAY output terminal Cd47=6 or Cd48=6, and Cd45 is assigned.



§ Cd46 Speed multiplier (Settable range 0.01~500)

The function shows revolution speed multiplied by a scaling factor on the Display.

- Note: 1. HZ and A LED de-active.
 2. RPM = Frequency \times Cd46
 3. If the value overflow, it will show "9999".

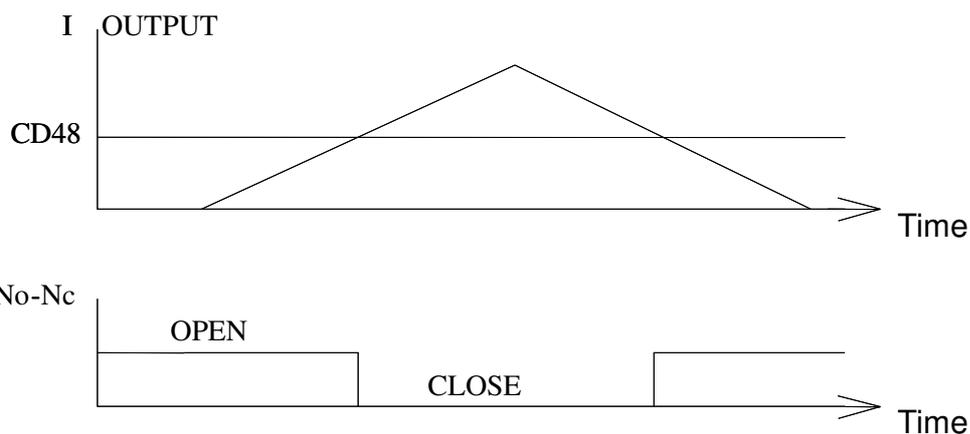
§ Cd47 Relay 1 output select (Settable range 0~6)

The function sets the mode of relay1 to activate.

| Cd47 | Specification | Remark |
|------|-------------------|--|
| 0 | Time counter | Time reached to the content of Cd29 |
| 1 | Fault | |
| 2 | Stop | |
| 3 | Acceleration | |
| 4 | Speed reached | |
| 5 | Deceleration | |
| 6 | Speed pass over | Revolution frequency > content of Cd45 |
| 7 | Current pass over | Current percentage > content of Cd48 |

§ Cd48 Detect current level (Settable range 40~150)

The function is RELAY output terminal function selection Cd47=7, Cd48 allocate motion calibration, Cd59 set reset.



§ Cd49 Function to lock data (Settable range 0, 1)

- To lock data, prevent errors by none operator.
 Cd49=0 Data change capable
 Cd49=1 Data change not capable

§ Cd50 Software version (Read only)

This function is to record software version, read only.

§ Cd51 Motor rated voltage setting Vr (Settable range 10~450)

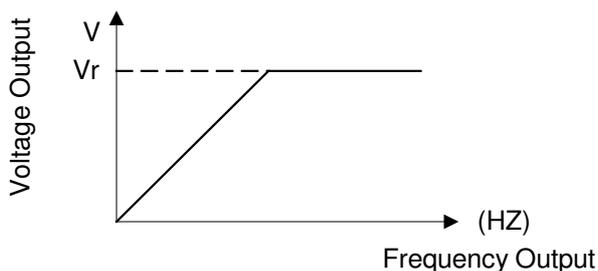
This function cannot be modified during revolution.

RMS Setting

- A. 220V Series: Value of Cd51 = Motor rated voltage / 1
- A. 380V Series: Value of Cd51 = Motor rated voltage / 1.73
- B. 460V Series: Value of Cd51 = Motor rated voltage / 2

Ex.

- a. If the motor rated voltage 220Vrms. Power supply voltage 220Vrms, then setting Cd51=220/1=220, then the inverter output Vrate=220Vrms.
- b. If the motor rated voltage 380Vrms. Power supply voltage 380Vrms, then setting Cd51=380/1.73=220, then the inverter output Vrate=380Vrms.
- c. If the motor rated voltage 460Vrms. Power supply voltage 460Vrms, then setting Cd51=460/2=230, then the inverter output Vrate=460Vrms.



- 1. $V_{in} > V_{rate}$ when $F_r < F_b$ $V_{out} = F_r / F_b \times V_{rate}$
when $F_r > F_b$ $V_{out} = V_{rate}$
- 2. $V_{in} < V_{rate}$ when $V_{out} < V_{in}$ $V_{out} = F_r / F_b \times V_{rate}$
when $V_{out} > V_{in}$ $V_{out} = V_{in}$

V_{in} : Power supply voltage

V_{out} : Inverter output voltage

V_{rate} : Motor rated voltage

F_r : Inverter revolution frequency

F_b : base frequency

§ Cd52 Auto voltage compensation (settable range 0.5%~15.0%)

The function cannot be modified during revolution.

The function is to compensate torque of motor in low r.p.m. Auto voltage compensation parameter is to increase torque to increase output voltage

This function must accommodate the content of Cd03、Cd63

§ Cd53 Motor slip differential compensation (Settable range 0~100)

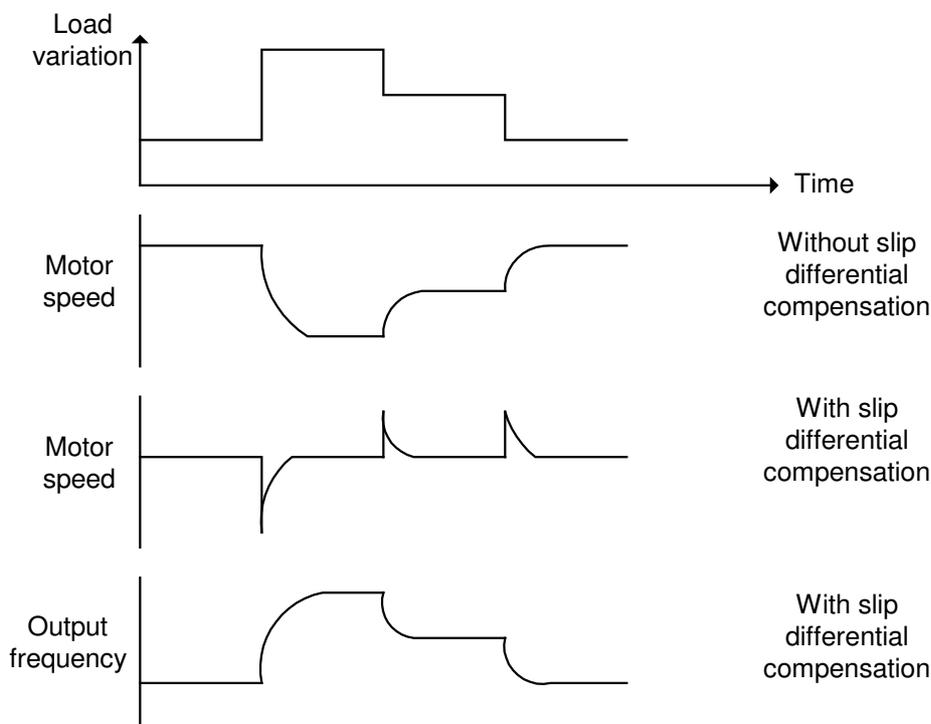
This function is to compensate speed variation produced by load variation.
This function must accommodate the content of Cd52.

Setting value 0-100 in relative slip differential 0.0-10.0%

Ex. 60HZ, 4-pole 1700 rpm
Synchronous speed = 1800 rpm
Full-load speed = 1700 rpm
Slip differential speed = 1800-1700=100 rpm

Slip differential % = Slip differential speed / Synchronous speed ×100%
= 100 / 1800 ×100%
= 5.5%, Setting Cd52=55

Slip differential compensation



§ Cd54 External analog output selection (Settable range 0~1)

Indicate analog output Vout terminal (0~10V) Physical definition of output single.

Cd54=0 Indicate output frequency.

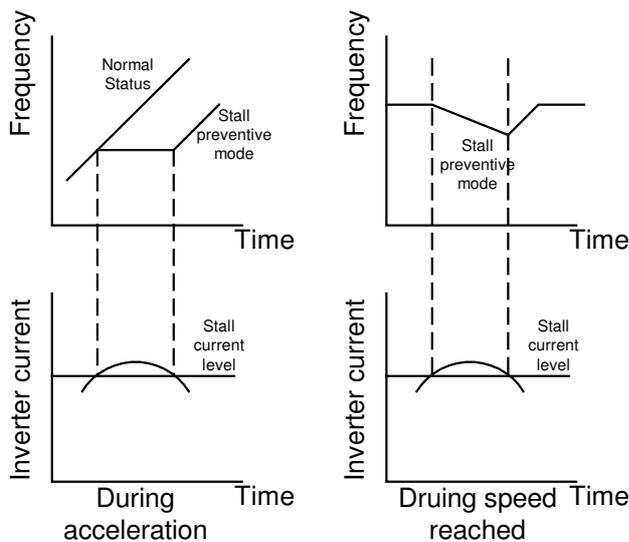
Cd54=1 Indicate output current

§ Cd55 External analog input selection (Settable range 0~1)

| Setting value | IN1 、 IN2 |
|---------------|--|
| 0 | 0V indicate 0HZ , 10V indicate operation highest frequency ◦ |
| 1 | 0V indicate operation highest frequency , 10V indicate 0HZ ◦ |

§ Cd56 Over current stall preventive mode (Settable range 10~200%)

This function is to prevent when motor current exceeds stall current from stall. There are 2 kinds of acceleration time slopes when motor acceleration current exceeding stall current occurs:
 Instantaneous load increase during steady operation and current exceeding over current stall, revolution frequency will drop till current dropped to within stall current level.



§ Cd57 Maximum frequency setting FH (Settable range 10~240)

This function cannot be modified during revolution.

When Cd05=11, the maximum frequency V/F slope FH
 Settable range 10Hz-240Hz
 Please refer to function code table Cd60.

§ Cd58 Base frequency setting Fb (Settable range 10~240)

This function cannot be modified during revolution.

When Cd05=11, the base frequency V/F slope Fb
 Settable range 10Hz-240Hz ($Fb \leq FH$). Please refer to function code table Cd60.

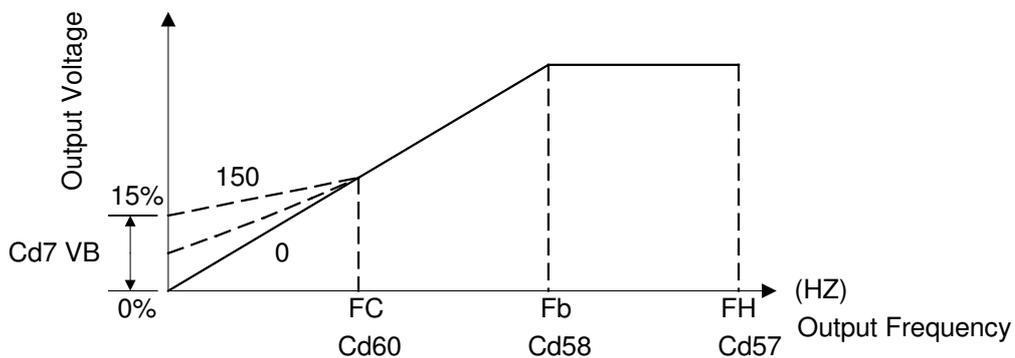
§ Cd59 Stagnancy of current detected (2~10%)

This function accommodate the content of Cd47、Cd48
 When Cd47=7，Detect current level over Cd48，input RELAY，but current must be decreased to equal to the value of C48 minus the value of Cd59，RELAY will be opened.

§ Cd60 V / F frequency FC (Settable range 0.5~240)

This function cannot be modified during revolution.

To set V/F slope frequency FC when Cd05=11.
 Settable range 10Hz-240Hz ($FC \leq Fb$)



§ Cd61 PWN frequency (Settable range 0~7)

This function cannot be modified during revolution.

This function is to set PWM frequency.

| Cd61 | PWM Frequency |
|------|-----------------------------|
| 0 | Setting by Cd62 (1.5-4.0Hz) |
| 1 | 4 KHZ |
| 2 | 5 KHZ |
| 3 | 6 KHZ |
| 4 | 7 KHZ |
| 5 | 8 KHZ |
| 6 | 9 KHZ |
| 7 | 10 KHZ |

Note: When exceed 10kHz, please set=0, maxima 16khz by Cd62

§ Cd62 PWM Frequency (Settable range 15~160)

This function cannot be adjusted during operation.

This function is to set PWM frequency. Frequency (KHZ)= settable value/ 10

Ex: Cd62 = 15, PWM Frequency = 1.5KHz

Ex: Cd62 = 30, PWM Frequency = 3.0KHz

§ Cd63 Start frequency of auto voltage compensation (Settable range 3.0~20.0HZ)
The function cannot be modified during revolution.

This function is the point of motion to assume auto compensation voltage start frequency.

This function accommodate the content of Cd03 、 Cd52

§ Cd64 Dynamic braking range (Settable range 0-1)
This function cannot be adjusted during revolution.

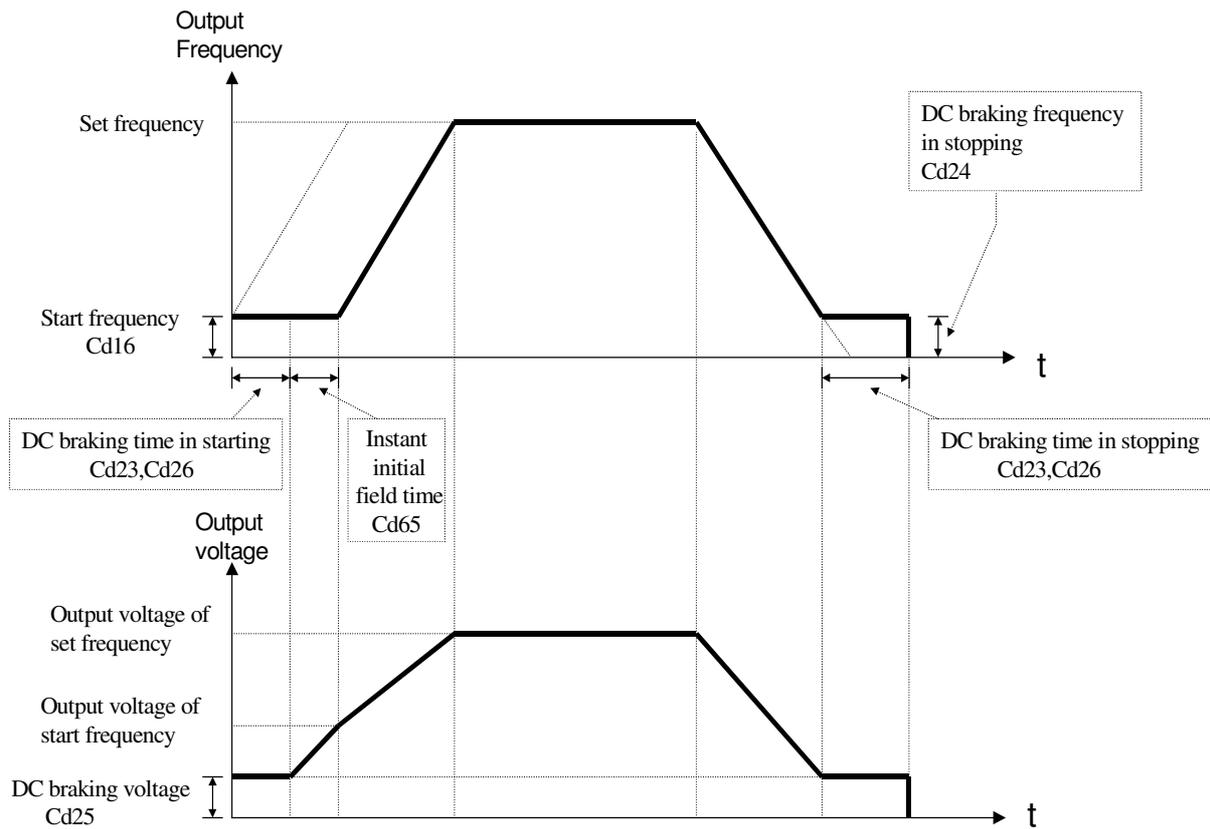
Cd64 = 0 Dynamic braking can be active during acceleration, deceleration and constant speed.

Cd64 = 1 Dynamic braking can be active during acceleration and deceleration, but not active during constant speed operation.

§ Cd65 Instant initial field time (Settable range 1-7)
This function cannot be adjusted during revolution

This function is to adjust instant initial field current of motor. Shorter of the time is higher of the field current.

| Cd65 | Instant initial field time |
|------|----------------------------|
| 1 | 64mS |
| 2 | 128mS |
| 3 | 256mS |
| 4 | 512mS |
| 5 | 1024mS |
| 6 | 2048mS |
| 7 | 4096mS |



§ Cd66 Digital filter function (Settable range 1-6)

This function is adjustable during revolution

This function is active as digital filter while invert with external analogue input. Increasing the figure to stabilized frequency while noise of external analogue input is higher. Decrease the figure when inverter required to response faster.

| Cd 66 | Digital filter time |
|-------|---------------------|
| 1 | 4 ms |
| 2 | 8 ms |
| 3 | 16 ms |
| 4 | 32 ms |
| 5 | 64 ms |
| 6 | 128 ms |

§ Cd67 Power source positioning accuracy calibration (Settable range 0-20)

This function is adjustable during revolution

This function is to adjust the calibration of voltage positioning on DC BUS between detected and actual position. The display value of Cd02=3 will be lower when Cd67 set at bigger figure. Cd02=3 display will be higher when Cd67 setting at smaller figure.

- § Cd68 Motor vibration compensation (Settable range 100~500)
The function cannot be modified during revolution.

This function is being modified vibration when the motor spin out, set Cd03=0
When the motor vibrates and know the value of vibration by Cd02=10
E.g.: cause Cd02=10 indicate 160 ~ 210 , assume Cd68 = 200

- § Cd69 Motor speed search time (Settable range 0~15)
The function cannot be modified during revolution.

Adding Function CD28

- § Cd70 Dynamic Braking active level (Settable range 120~140)
This function cannot be modified during revolution

This function is to adjust active point of dynamic braking.

Note:

220V series: protection point voltage (VDC)= Cd70 x200V x% x $\sqrt{2}$

400V series: protection point voltage (VDC)= Cd70 x400V x% x $\sqrt{2}$

- § Cd71 Over Voltage prevention function active point (Settable range 130~150)
This function cannot be modified during revolution

This is to adjust the over voltage protection active point when over voltage occurred.

Note :

220Vseries : active voltage (VDC)= setting value x200V x% x $\sqrt{2}$

400Vseries : active voltage (VDC)= setting value x400V x% x $\sqrt{2}$

- § Cd79 Auto saving function setting (setting range 0~1)
This function can't be modified during revolution.

Whether select to use memory function of power failure or not.

Cd79=0 Disable auto saving

Cd79=1 Enable auto saving. When power off and current step PLC will be recorded automatically.

- § Cd80 Modbus Protocol and communication mode setting (settable range 0-6)
This function can't be modified during revolution.

Selection of operation method on RS485 communication port. Supporting Modbus Protocol.

Cd80=0 RS485 shut down communication interface.
Cd80=1 Active RTU Mode(8,n,1). Parameter change is not allowed.
Cd80=2 Active RTU Mode(8,n,1). Allow changes on general parameter.
Cd80=3 Active RTU Mode(8,n,1). Allow changes on operation instruction and general parameter.

§ Cd81 RS485 communication address setting (settable range 1-240)
This function cannot be modified during revolution

Corresponding communication address should be set in advance when active RS485 communication function. Inverter is at slave side.
Note: Communication function refers to manuals of interface.

§ Cd82 Series communication baud rate setting(settable range 0-3)
This function can't be modified during revolution.

Setting of Baud rate during communication

Cd82=0 2400 bps
Cd82=1 4800 bps
Cd82=2 9600 bps
Cd82=3 19200 bps

Note: Re-start inverter after setting Baud rate.

§ Cd83 Series communication response time setting (settable range 0-15)
This function can't be modified during revolution.

Setting waiting time for response when inverter receive correction data.
MODBUS RESPONE TIME=4ms * CD83

§ Cd90 Series communication parameter store eeprom (settable range 0~1)

Cd90=0 unstore
Cd90=1 store one data and reset 0

§ CE00,01,02,03 Failure record

Record cause of failure, in order to solve failure.

- Note:
1. Cannot record failure Err, Ero, Erc.
 2. Only memorize 4 records.
 3. Cannot record inverter stopped by low voltage.
 4. Read only Cd00,01,02,03 or delete all (Code 36), cannot put in failure record by operator.

§ CE05 ~ CE20 Multi-step function control frequency setting (settable range 0.5~240HZ)

Maximum 16 steps.

| | |
|------|-------------------------------------|
| CE05 | 1 st step speed setting |
| CE06 | 2 nd step speed setting |
| CE07 | 3 rd step speed setting |
| CE08 | 4 th step speed setting |
| CE09 | 5 th step speed setting |
| CE10 | 6 th step speed setting |
| CE11 | 7 th step speed setting |
| CE12 | 8 th step speed setting |
| CE13 | 9 th step speed setting |
| CE14 | 10 th step speed setting |
| CE15 | 11 th step speed setting |
| CE16 | 12 th step speed setting |
| CE17 | 13 th step speed setting |
| CE18 | 14 th step speed setting |
| CE19 | 15 th step speed setting |
| CE20 | 16 th step speed setting |

§ CE21 ~ CE36 Multi-step process control time setting (settable range 0 - 100Min)

Maximum 16 steps. End of entire procedure if time setting = 0.

| | |
|------|------------------------------------|
| CE21 | 1 st step time setting |
| CE22 | 2 nd step time setting |
| CE23 | 3 rd step time setting |
| CE24 | 4 th step time setting |
| CE25 | 5 th step time setting |
| CE26 | 6 th step time setting |
| CE27 | 7 th step time setting |
| CE28 | 8 th step time setting |
| CE29 | 9 th step time setting |
| CE30 | 10 th step time setting |
| CE31 | 11 th step time setting |
| CE32 | 12 th step time setting |
| CE33 | 13 th step time setting |
| CE34 | 14 th step time setting |
| CE35 | 15 th step time setting |
| CE36 | 16 th step time setting |

§ CE47 Multi steps function modes selection (settable range0~1)

The function cannot be modified during revolution

Select operation modes on speed variation when process control switch from previous step to next step.

CE47=0 Liner operation

CE47=1 Gragually operation. (Perform time can set to zero, when perform time set to 0, perform time will according to CD08, CD09 increase or decrease. If the step frequency set to 0, the step will be ended.)

| | |
|----------------------------|--|
| <p>Liner operation</p> | <p>Output Frequency</p> <p>Time</p> <p>CE21 CE22 CE23 CE24 CE25 CE26 CE27 CE28 CE29 CE30</p> <p>CE10 CE09 CE08</p> <p>CE07 CE06 CE05</p> <p>CD08 CE09</p> <p>CE11 CE12 CE13 CE14</p> |
| <p>Gragually operation</p> | <p>Operation frequency</p> <p>Time</p> <p>CE21 CE22 CE23 CE24 CE25 CE26 CE27 CE28 CE29 CE30</p> <p>CE10 CE09 CE08</p> <p>CE07 CE06 CE05</p> <p>CE11 CE12 CE13 CE14</p> <p>CD09</p> |

§ CE48 Multi steps function operation reset (settable range0~1)

The function cannot be modified during revolution

Memorized of current operation step and time (in sec) while shut down or power failure. Step and time reset to 0 when set CE48=1.

Note: External terminal 6 set to RST function, when RST connect with COM, it will reset the records and steps time to 0.

§ CE49 Multi steps process control continuous operation (settable range0~1)

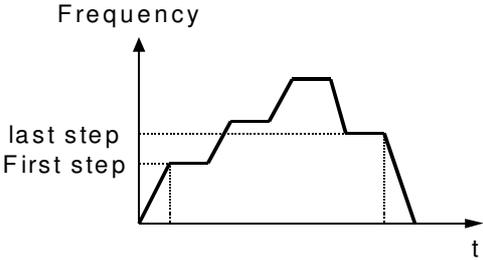
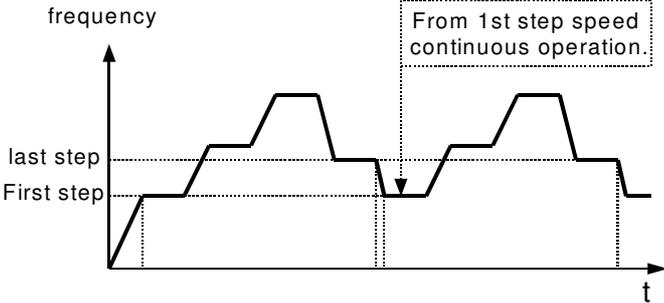
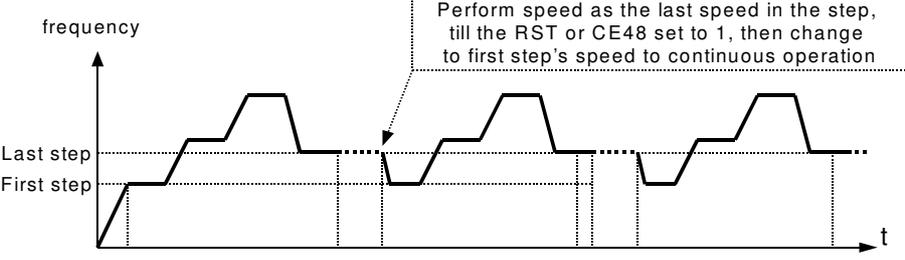
The function cannot be modified during revolution

Selection of shut down or start from 1st step while entire operation procedure finished.

CE49=0 Not continuous operation.

CE49=1 Continuous operation. From 1st steps' speed continuous operation.

CE49=2 Continuous operation, perform speed as the last speed in the step, till the RST or CE48 set to 1, then change to first step's speed.

| | |
|---|--|
| <p>Not continuous operation</p> |  |
| <p>Continuous operation</p> |  |
| <p>Continuous operation, perform speed as the last speed in the step, till the RST or CE48 set to 1</p> |  |

§ CE52 Choice of multi-speed record file (settable range 1~6)
The function cannot be modified during revolution

The setting cannot be changed while the machine is working.
 According to the needs of the user, choose different file for the current step, the data CE05~CE36 are stored in the files.

§ CE53 Multi-steps all files set to default (settable range 0~1)
The function cannot be modified during revolution

The setting cannot be changed while the machine is working.
 CE53=0 Data remain unchanged.
 CE53=1 Reset data in files 1-2 to default.

§ CE54 Multi-steps memory duplicate function (settable range 1~6)
The function cannot be modified during revolution

The setting cannot be changed while the machine is working.
 Duplicate current using file (CE05~CE36) to CE54 .

§ CE61 Input terminal for Set Point and PI feedback (settable range 0~5)
The function cannot be modified during revolution

| CE61 | Target value | PI feedback terminal |
|------|--------------|----------------------|
| 0 | Cd00 | IN1 |
| 1 | Cd00 | IN2 |
| 2 | CE67 | IN1 |
| 3 | CE67 | IN2 |
| 4 | IN1 | IN2 |
| 5 | IN2 | IN1 |

Note:

1. IN1(4~20mA) scale to 0~100.0 % , IN2、IN3(0~10V) scale to 0~100.0 %
2. Make sure this parameter setting does not conflict with the setting for Cd01 (Set frequency source).
 Ex: If Cd01=1 then the parameter CE61 can't be modify to 1, 3 or 4.

§ CE62 Proportion gain (settable range 0~25.0)

PID control and associated gain (P).

§ CE63 Integral gain (settable range 0.0~360.0 sec)

PID control and associated gain (I).

§ CE64 Differential gain (settable range 0.0~10.0 sec)

PID control and associated gain (D).

§ CE65 Integral output limit (settable range 0~100 %)

Set % a unit as output limit of the Integral control. 100% is maximum frequency output.

§ CE66 PID output limit (settable range 0~100 %)

Set % a unit as output limit of the PID control. 100% is maximum frequency output.

§ CE67 PID control target value 1 (settable range 0~100.0 %)

This parameter defines the percentage of target value when PID control.

§ CE68 PID output delay time (settable range 0~10 sec)

Set PID output delay time.

§ CE69 PID offset adjust (settable range 0~200%)

Set % a unit as PID output offset. 100% is central point.

§ CE70 PID output gain (settable range 0~25)

Set enlarge magnification of PID output.

§ CE74 P control status selection (settable range 0~1)

P、I、D controller is individual controller separately when setting value is 0.

P controller is in front of I, D controller when setting value is 1 (an error passes through P controller then enter into I, D controller).

§ CE78 PID output characteristic selection (settable range 0~1)

Set PID output inverse function, inverting when set 1.

§ CE79 PID control selection (settable range 0~4)

0 : PID disable

1 : PID output is inverter frequency output, D control error.

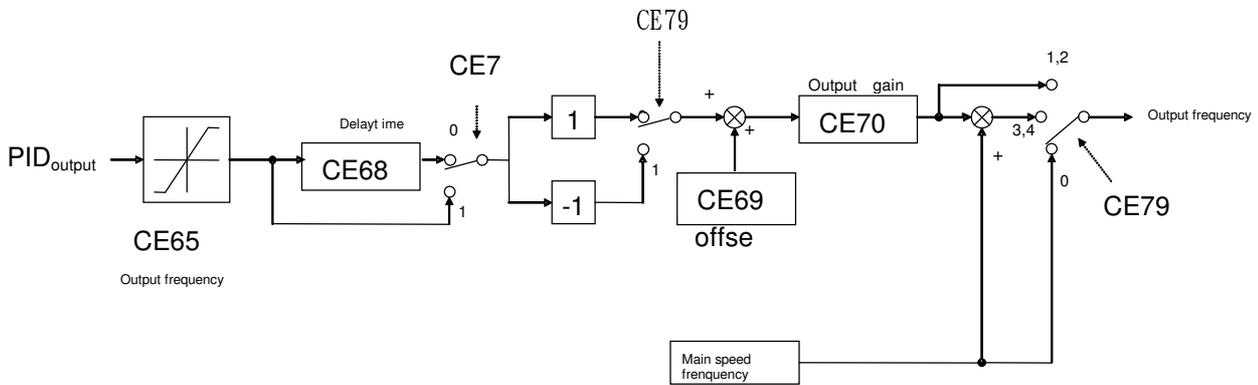
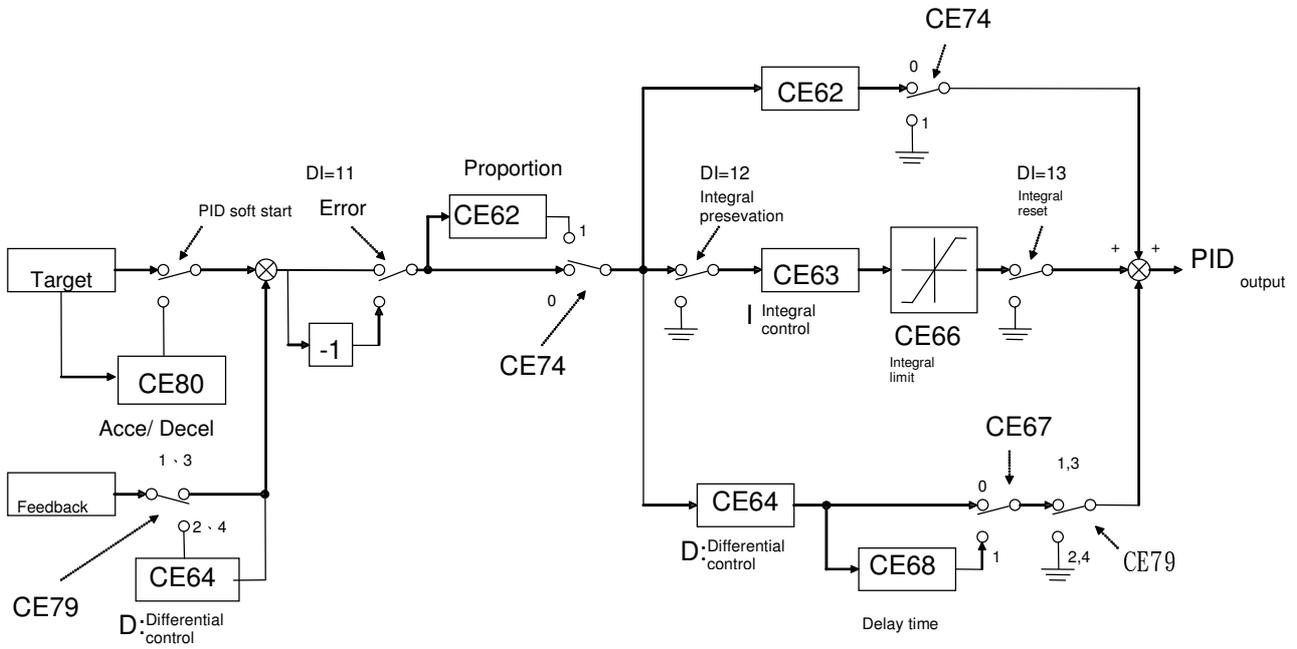
2 : PID output is inverter frequency output, D control feedback.

3 : PID output is corrective value of inverter frequency output (accede main frequency), D control error.

4 : PID output is corrective value of inverter frequency output (accede main frequency), D control feedback ◦

§ CE80 PID target acceleration/ deceleration time (settable range 0~25.5)

Set PID target acceleration/ deceleration time, setting way is to accelerate 0 to 100%.
When PID target is needed to be smoothly curve not pulse wave.



7. Description of alarm display indications

| Error indication | Description of fault operation | Item for inspection | Processing |
|------------------|---|---|---|
| Err | Operation error | Was the unit operated as indicated in the manual | Use the correct procedure |
| ErO | Operation error of internal ROM, RAM | Switch off the power and then apply again | Replace the unit |
| ErC | Error of internal CPU | Is there a large amount of external noise | Check the contact absorber. Install a noise filter |
| OCPA | Over current (180% rated current) | Was there rapid acceleration | Lengthen the acceleration time |
| OCPd | Over current (180% rated current) | Was there rapid deceleration | Lengthen the deceleration time |
| OCPn | Over current (180% rated current) | Was there any variation in the load | Lengthen the time for the load variations |
| OC | Over current (200% rated current) | Was there rapid acceleration / deceleration and variation in the load | Lengthen the acceleration and deceleration time and reduce the load |
| OCS | Output short circuit or ground detected | Is there a short circuit for the output or grounding for the motor | Perform a megger check for the motor |
| OU | DC link over voltage | Was there fast deceleration, or fast voltage | Lengthen the deceleration time. Investigate the use of the optional DBR |
| LU | Insufficient voltage detected due to power failure or instantaneous power loss. | Is there a low voltage at power, or internal inverter wiring error | Improve the voltage condition and confirm inverter model |
| LU A | Insufficient voltage detected due to power failure or instantaneous power loss. And the auto save function is working | Is there a low voltage at power, or internal inverter wiring error | Improve the voltage condition and confirm inverter model |
| OH | Overheating of the cooling fan detected | <ol style="list-style-type: none"> 1. Cooling fan stops 2. Ambient temperature too hot 3. Motor being overload | <ol style="list-style-type: none"> 1. Exchange the cooling fan 2. Lower the ambient temperature 3. Check the load conditions |
| OL | Overload detected for more than one minute | Is the motor being overloaded | Increase the capacity of the inverter and motor |
| OL A | Overload warning, the motor is nearly 1min, 150% overload. | Is the motor being overloaded | Increase the capacity of the inverter and motor |
| bUOH | DBR overheat detected | Is the braking ratio appropriate | Reduce GD^2 of load or lengthen deceleration time |
| PLU | Power voltage too low | Is power voltage too low | Improve power supply condition |

8. Troubleshooting

| Description of trouble | Possible cause | Solution |
|--|--|--|
| The motor does not run at all | 1. Wiring error | Refer to the wiring diagram 1. Check the power input wiring 2. Is there a voltage for U.V.W output |
| | 2. Wrong settings at operator panel | The function code No.04 is as follows 0: Panel key operation 1: External signals |
| | 3. Inverter displays fault indication | Refer to "Protect Function" |
| | 4. Motor cannot start due to overload | Exchange a higher capacity one |
| | 5. Motor breaks down | Repair motor |
| | 6. Inverter breaks down | Please contact us |
| "OCPA" is indicated as soon as the motor is started. (Overcurrent protects operation during acceleration.) | 1. Motor wiring error | Refer to the wiring diagram |
| | 2. Terminals of inverter and motor (U.V.W.) circuit shorted or ground connection | Banish circuit shorted or ground connection |
| | 3. Overload | Reduce the load or increase inverter capacity |
| | 4. Is V/F slope appropriate | Check Code 05 V/F slope is appropriate with motor specification |
| | 5. Is start torque appropriate | Adjust Code 07 torque boost to over come steady friction but not over current trip. |
| | 6. Is the acceleration time too short when compared to load GD^2 | Lengthen acceleration time by apply Code 08 and Code 10 or increase inverter capacity |
| | 7. The inverter is starting during motor free-run | Refers to Code 28, change the value from 0 to 1 |
| "OCPd" is indicated as the motor is decelerating. (Over current protects operation during deceleration). | 1. Deceleration time too short, unable to be loaded | Apply Code 09 and Code 11 to lengthen deceleration time or increase inverter capacity |
| "OC" or "OCS" is indicated during operation. (Over current) | 1. Short circuit on U.V.W or grounding for motor | Exclude short circuit or grounding |
| | 2. Instantaneously mechanical load on motor | Reduce load or increase inverter capacity |
| | 3. Motor breaks down | Repair motor |
| | 4. Inverter breaks down | Please contact us |
| "OU" is displayed during inverter operation | 1. Is power voltage with the specification | Improve power voltage condition |
| | 2. Braking resistor not applied | Apply braking resistor, increase braking ratio |
| | 3. Deceleration time too short, unable to be loaded | Apply Code 09 and Code 11 to lengthen deceleration time |
| "PLU" is displayed during inverter operation | 1. Is power voltage with the specification | Improve power voltage condition |
| | 2. Instantaneous power voltage failure | Check the capacity of the power facilities |
| | 3. Power dropped and the protector function has operated | Check the capacity of the power facilities |
| "OL" is displayed during inverter operation | 1. Overload | Reduce load or increase inverter capacity |
| | 2. Is inverter over current limiter appropriate | Apply Code 06 to re-set motor rated current |
| "OH" is displayed during inverter operation | 1. Check if the cooling fan is still working | Change cooling fan and clean dirt |
| | 2. Is ambient temperature too hot | Improve ambient temperature condition |
| No any indication, the output frequency displayed "0" | 1. Power failure | Check the capacity of the power facilities |
| | 2. Is there loosen part on external control terminal | Check external control terminal |

9. Maintenance and Inspection

Maintenance and inspection must be taken under power off.

Cautions on maintenance and inspection:

- (1) Capacitor is charged at high voltage for a while after turning off the power.
(Accordingly, start the inspection work at least 5 minutes after turning off the power)
- (2) Do the work with operator.

Inspection items:

- (1) Please check the following items
 - A. Motor runs as expected.
 - B. Avoid installing on circumstances like acid, alkaloid.
 - C. No trouble is recognized in the cooling system and irregular vibration or noise.
 - D. No parts is overheated or burned.
- (2) Periodic inspection

| Interval | Inspection item |
|-----------------|---|
| Every 6 months | <ol style="list-style-type: none">1. Terminal plates and mounting bolts.2. Corrosion and breaks in the terminal clips for the wiring.3. Condition for the connector fixing. |
| Once a year | <ol style="list-style-type: none">1. Use clean, dry air to remove dust buildup from the guards, the stack and the cooling fan.2. Check for parts burns or damage and make any exchanges necessary. |

10. STANDARD SPECIFICATION

A. 200Vseries 1 phase

| | | | | | |
|------------------------------------|--|--------|---------|--------|---------|
| Motor rating (KW) | 0.375* | 0.75 | 0.75* | 1.5 | 1.5* |
| Model CT2001 | ES-A37 | ES-A75 | ESe-A75 | ES-1A5 | ESe-1A5 |
| Rated current (A) | 2.4 | 4.2 | 4.2 | 6.2 | 6.2 |
| Rated capacity (KVA) | 0.96 | 1.8 | 1.8 | 2.9 | 2.9 |
| Power supply | 1 ϕ 200~230V \pm 10% 50HZ \pm 5% or 1 ϕ 200~230V \pm 10% 60HZ \pm 5% | | | | |
| Output voltage | 3 ϕ 200V · 220V · 230V | | | | |
| Control method | Sine P.W.M. Control | | | | |
| Frequency accuracy | Digital setting: \pm 0.1% Analog setting: \pm 0.5% (35 $^{\circ}$ C) | | | | |
| Frequency resolution | Digital setting: 0.5~100Hz \rightarrow 0.01Hz 100Hz~240Hz \rightarrow 0.1Hz Analog setting: (setting value/ 1000) Hz | | | | |
| Frequency range | 0.5~240HZ (Initial frequency 0.5~30Hz) | | | | |
| V/F ratio | 10 patterns, or any V/F patterns | | | | |
| Torque compensation | 0~15.0% voltage compensation, automatic voltage compensation | | | | |
| Acceleration/ Deceleration time | 0.1~6000 sec (linear, two-step setting) | | | | |
| Motor Braking | No DB Transistor | | | | |
| DC Braking | DC Injection Braking (Setting mode, torque, time, active frequency) | | | | |
| Standard feature | Free run restart, jogging speed, upper/lower frequency limit setting, jump frequency setting, 8-step speed setting, frequency indicated output (DC0~10V), operation direction setting, forward/reverse prohibit, voltage/current limit, data lock, EMI (with CT2000ESe only) | | | | |
| Relay Output | Arrival with timer, failure, stop, acceleration, frequency equal, deceleration, over frequency | | | | |
| Frequency setting | Digital setting by keypad, or external analog signal (DC0~10V · DC4~20mA) | | | | |
| Display | 7-segment LED display: Frequency, current, voltage, setting value, function, failure status, Temperature of PIM module | | | | |
| Protection | Low voltage, over voltage, instantaneous power failure, over voltage stall, overload, over current stall, instantaneous over current, acceleration over current, deceleration over current, over heat. | | | | |
| Overload capacity | 150% for 1 min, anti-time limit function, adjustable (25~100%) | | | | |
| Altitude | Altitude 1,000m or lower, keep from corrosive gasses, liquid and dust | | | | |
| Ambient Temperature | -10 $^{\circ}$ C ~50 $^{\circ}$ C (Non-condensing and not frozen) | | | | |
| Storage Temperature | -20 $^{\circ}$ C ~60 $^{\circ}$ C | | | | |
| Humidity | Relative between 45% to 90% (No condensing) | | | | |
| Cooling system | Forced air-cooling | | | | |
| Weight (Kgs) | 1.6* | 1.6 | 1.6* | 2.5 | 2.5* |

Note 1: Braking resistor specification refer to page 6

*: Under development

B. 200Vseries 3 phase

| | | | | | | | | | |
|------------------------------------|--|--------|---------|--------|---------|--------|---------|--------|---------|
| Motor rating (KW) | 0.375* | 0.75 | 0.75* | 1.5 | 1.5* | 2.2 | 2.2* | 3.7 | 3.7* |
| Model CT2002 | ES-A37 | ES-A75 | ESe-A75 | ES-1A5 | ESe-1A5 | ES-2A2 | ESe-2A2 | ES-3A7 | ESe-3A7 |
| Rated current (A) | 2.4 | 4.2 | 4.2 | 7.4 | 7.4 | 11.1 | 11.1 | 18 | 18 |
| Rated capacity (KVA) | 0.96 | 1.8 | 1.8 | 2.9 | 2.9 | 4.4 | 4.4 | 7.1 | 7.1 |
| Power supply | 3 ϕ 200~230V \pm 10% 50HZ \pm 5% or 3 ϕ 200~230V \pm 10% 60HZ \pm 5% | | | | | | | | |
| Output voltage | 3 ϕ 200V、220V、230V | | | | | | | | |
| Control method | Sine P.W.M. Control | | | | | | | | |
| Frequency accuracy | Digital setting: \pm 0.1% Analog setting: \pm 0.5% (35 $^{\circ}$ C) | | | | | | | | |
| Frequency resolution | Digital setting: 0.5~100Hz \rightarrow 0.01Hz 100Hz~240Hz \rightarrow 0.1Hz Analog setting: (setting value/1000)Hz | | | | | | | | |
| Frequency range | 0.5~240HZ (Initial frequency 0.5~30Hz) | | | | | | | | |
| V/F ratio | 10 patterns, or any V/F patterns | | | | | | | | |
| Torque compensation | 0~15.0% voltage compensation, automatic voltage compensation | | | | | | | | |
| Acceleration/ Deceleration time | 0.1~6000 sec (linear, two-step setting) | | | | | | | | |
| Motor Braking | DB Transistor built-in, connect braking resistor to reach 100% regeneration braking (Note 2) | | | | | | | | |
| DC Braking | DC Injection Braking (Setting mode, torque, time, active frequency) | | | | | | | | |
| Standard feature | Free run restart, jogging speed, upper/lower frequency limit setting, jump frequency setting, 8-step speed setting, frequency indicated output (DC0~10V), operation direction setting, forward/reverse prohibit, voltage/current limit, data lock, EMI (with CT2000ESe only) | | | | | | | | |
| Relay Output | Arrival with timer, failure, stop, acceleration, frequency equal, deceleration, over frequency | | | | | | | | |
| Frequency setting | Digital setting by keypad, or external analog signal (DC0~10V、DC4~20mA) | | | | | | | | |
| Display | 7-segment LED display: Frequency, current, voltage, setting value, function, failure status, Temperature of PIM module | | | | | | | | |
| Protection | Low voltage, over voltage, instantaneous power failure, over voltage stall, overload, over current stall, instantaneous over current, acceleration over current, deceleration over current, over heat. | | | | | | | | |
| Overload capacity | 150% for 1 min, anti-time limit function, adjustable (25~100%) | | | | | | | | |
| Altitude | Altitude 1,000m or lower, keep from corrosive gasses, liquid and dust | | | | | | | | |
| Ambient Temperature | -10 $^{\circ}$ C~50 $^{\circ}$ C (Non-condensing and not frozen) | | | | | | | | |
| Storage Temperature | -20 $^{\circ}$ C~60 $^{\circ}$ C | | | | | | | | |
| Humidity | Relative between 45% to 90% (No condensing) | | | | | | | | |
| Cooling system | Forced air-cooling | | | | | | | | |
| Weight (Kg) | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 2.5 | 2.5 | 2.5 | 2.5 |

Note 2: Braking resistor specification refer to page 6

* : Under development

C. 400Vseries 3 phase

| | | | | | | | | |
|------------------------------------|--|---------|--------|---------|--------|---------|--------|---------|
| Motor rating (KW) | 0.75 | 0.75 | 1.5 | 1.5 | 2.2 | 2.2 | 3.7 | 3.7* |
| Model CT2004 | ES-A75 | ESe-A75 | ES-1A5 | ESe-1A5 | ES-2A2 | ESe-2A2 | ES-3A7 | ESe-3A7 |
| Rated current (A) | 2.2 | 2.2 | 4.0 | 4.0 | 6.2 | 6.2 | 9 | 9 |
| Rated capacity (KVA) | 1.7 | 1.7 | 3.2 | 3.2 | 4.9 | 4.9 | 7.1 | 7.1 |
| Power supply | 3 ϕ 380~460V \pm 10% 50HZ \pm 5% or 3 ϕ 380V-460V \pm 10% 60HZ \pm 5% | | | | | | | |
| Output voltage | 3 ϕ 380V、400V、415V、440V、460V | | | | | | | |
| Control method | Sine P.W.M. Control | | | | | | | |
| Frequency accuracy | Digital setting: \pm 0.1% Analog setting: \pm 0.5% (35 $^{\circ}$ C) | | | | | | | |
| Frequency resolution | Digital setting: 0.5~100Hz \rightarrow 0.01Hz 100Hz~240Hz \rightarrow 0.1Hz Analog setting: (setting value/1000)Hz | | | | | | | |
| Frequency range | 0.5~240HZ (Initial frequency 0.5~30Hz) | | | | | | | |
| V/F ratio | 10 pattern, or any V/F pattern | | | | | | | |
| Torque compensation | 0~15.0% voltage compensation, automatic voltage compensation | | | | | | | |
| Acceleration/ Deceleration time | 0.1~6000 sec (linear, two-step setting) | | | | | | | |
| Motor Braking | DB built-in, connect extra braking resistor to reach 100% braking (Note 3) | | | | | | | |
| DC Braking | DC Injection Braking (Setting mode, torque, time, active frequency) | | | | | | | |
| Standard feature | Free run restart, jogging speed, upper/lower frequency limit setting, jump frequency setting, 8-step speed setting, frequency indicated output (DC0~10V), operation direction setting, forward/reverse prohibit, voltage/current limit, data lock, EMI (with CT2000ESe only) | | | | | | | |
| Relay Output | Arrival with timer, failure, stop, acceleration, frequency equal, deceleration, over frequency | | | | | | | |
| Frequency setting | Digital setting by keypad, or external analog signal (DC0~10V、DC4~20mA), frequency setting knob | | | | | | | |
| Display | 7-segment LED display: Frequency, current, voltage, setting value, function, failure status, Temperature of PIM module | | | | | | | |
| Protection | Low voltage, over voltage, instantaneous power failure, over voltage stall, overload, over current stall, instantaneous over current, acceleration over current, deceleration over current, over heat. | | | | | | | |
| Overload capacity | 150% for 1 min, anti-time limit function, adjustable (25~100%) | | | | | | | |
| Altitude | Altitude 1,000m or lower, keep from corrosive gasses, liquid and dust | | | | | | | |
| Ambient Temperature | -10 $^{\circ}$ C ~50 $^{\circ}$ C (Non-condensing and not frozen) | | | | | | | |
| Storage Temperature | -20 $^{\circ}$ C ~60 $^{\circ}$ C | | | | | | | |
| Humidity | Relative between 45% to 90% (No condensing) | | | | | | | |
| Cooling system | Forced air-cooling | | | | | | | |
| Weight (Kg) | 1.6 | 1.6 | 1.6 | 1.6 | 2.5 | 2.5 | 2.5 | 2.5 |

Note 3: Braking resistor specification refer to page 5

* : Under development

11. Function Code Table

| NO | Function | Detail of Data | Initial factory setting | MODBUS Address |
|----|--|--|-------------------------|----------------|
| 0 | Set frequency | 0~240Hz | 10 | 128 |
| 1 | Frequency setting procedure | 0: Operation panel Cd00 1: External IN2 (0-10V) 2: External IN1 (4-20mA) 3: External IN2 (0-10V) hysteresis 4: External IN1 (4-20mA) hysteresis 5: Keypad VR 6: Multi-steps control | 5 | 129 |
| 2 | Select monitor display data | 0: Frequency (HZ) 1: Current (I) 2: RPM 3: DC Voltage (d) 4: Output AC Voltage (V) 5: External I/O status (E) 6: Temperature of PIM module (b) 7: MCK operation frequency feedback 8: Current step of multi-step function 9: Current time of multi-step function (min) 10: Motor vibration | 0 | 130 |
| 3 | Torque mode | 0: Without auto boost 1: Auto boost | 0 | 131 |
| 4 | Operation command | 0: Operation panel 1 3: 2 wire Operation 2 1: 2 wire Operation 1 4: 3 wire Operation 1 2: Operation panel 2 5: 3 wire Operation 2 | 0 | 132 |
| 5 | V/F pattern | 1-10 fixed Modes 11: Set by Cd57, Cd58 12: V/F 1.5 power curve 13: V/F 1.7 power curve 14: V/F square curve | 2 | 133 |
| 6 | Motor rated current | 25~100% | 100 | 134 |
| 7 | Torque boost | 0.0~15.0% | 2 | 135 |
| 8 | 1 st acceleration time | 0.1~6000 (S/50HZ) | 5 | 136 |
| 9 | 1 st deceleration time | 0.1~6000 (S/50HZ) | 5 | 137 |
| 10 | 2 nd acceleration time | 0.1~6000 (S/50HZ) | 10 | 138 |
| 11 | 2 nd deceleration time | 0.1~6000 (S/50HZ) | 10 | 139 |
| 12 | No.2 frequency | HZ | 20 | 140 |
| 13 | No.3 frequency | HZ | 30 | 141 |
| 14 | No.4 frequency | HZ | 40 | 142 |
| 15 | Jogging frequency | 0.5HZ~30HZ | 5 | 143 |
| 16 | Start frequency | 0.5HZ~60HZ | 1 | 144 |
| 17 | Upper limit frequency | 10~240HZ | 60 | 145 |
| 18 | Lower limit frequency | 0.5~100HZ | 0 | 146 |
| 19 | Jogging acceleration / deceleration time | 0.1~10 (S/50HZ) | 1 | 147 |
| 20 | Jump frequency 1 | HZ | 0 | 148 |
| 21 | Jump frequency 2 | HZ | 0 | 149 |
| 22 | Jump frequency width | 0~6HZ | 0 | 150 |
| 23 | Braking mode | 0: de-active 1: Active when stop 2: Active when start 3: Active both stop and start | 0 | 151 |
| 24 | DC braking frequency | 1~60HZ | 1 | 152 |
| 25 | DC braking voltage | 0~15 | 5 | 153 |

| | Function | Detail of Data | Initial factory setting | MODBUS Address |
|----|---|--|-------------------------|----------------|
| 26 | DC braking time | 1~60S | 1 | 154 |
| 27 | Operation direction setting | 0: Both forward and reverse, stop before changing direction 1: Both forward and reverse, no stop required 2: Forward only 3: Reverse only | 0 | 155 |
| 28 | Restart in instantaneous power failure / Free run start | 0: Without / Without 1: With / Without 2: Without / With 3: With / With | 0 | 156 |
| 29 | Time | 1~9000(sec) | 5 | 157 |
| 30 | "Stop" function at panel key under the operation of external sequence | 0: Impossible 1: Possible | 1 | 158 |
| 31 | Initialize data | 0: No change 1: Data at the time of shipment | 0 | 159 |
| 32 | DI1 External terminal setting | 0: No motion | 1 | 160 |
| 33 | DI2 External terminal setting | 1: 2DF 5 : 2DC 9: analog switch | 2 | 161 |
| 34 | DI31 External terminal setting | 2: 3DF 6 : JOG 10: PID disable | 3 | 162 |
| 35 | DI4 External terminal setting | 3: 5DF 7 : MBS 11: PID inverting 4: 2AC 8 : RST | 4 | 163 |
| 36 | Memory clear for fault annunciation | 1: Memory clear | 0 | 164 |
| 37 | Frequency gain setting | 20~200% | 100 | 165 |
| 38 | Analog output calibrate | 90~110% | 100 | 166 |
| 39 | Frequency command bias | 0~250 | 125 | 167 |
| 40 | No.5 Frequency | HZ | 45 | 168 |
| 41 | No.6 Frequency | HZ | 50 | 169 |
| 42 | No.7 Frequency | HZ | 55 | 170 |
| 43 | No.8 Frequency | HZ | 60 | 171 |
| 44 | Stop mode | 0: Decelerate stop 1: Free run stop 2: Free run stop after deceleration time is reached | 0 | 172 |
| 45 | Detect frequency level | 0.5~240HZ | 0.5 | 173 |
| 46 | Speed multiplier | 0.01~500 | 1 | 174 |
| 47 | Relay 1 output select | 0-7 | 1 | 175 |
| 48 | Detec current level | 40~150% | 100 | 176 |
| 49 | Lock data | 0: Data change capable 1: Data change not capable | 0 | 177 |
| 50 | Software version | Read only | X | 178 |
| 51 | Motor rated voltage | 10-450 200V Series = 1 380V Series = 1.73 400V Series = 2 | 220 | 179 |
| 52 | Auto voltage compensation | 0.5%~15.0% | 50 | 180 |
| 53 | Motor slip differential boost | 0.0~10.0% | 0 | 181 |
| 54 | External analog output select | 0: Display output frequency 1: Display output current | 0 | 182 |
| 55 | External analog input select | 0: 0~10V normal pattern 1: 10~0V reverse pattern | 0 | 183 |
| 56 | Current stall preventive | 10~200% | 150 | 184 |
| 57 | Max. Frequency FH setting | 10~240HZ (FH) | 60 | 185 |

| NO | Function | Detail of Data | Initial factory setting | MODBUS Address |
|----|--|---|-------------------------|----------------|
| 58 | Motor rated frequency Fb | 10~240HZ (Fb) FH ≥ Fb | 60 | 186 |
| 59 | Stagnancy of current detected | 2~10% | 2 | 187 |
| 60 | V/F Frequency FC | 0.5~240HZ | 20 | 188 |
| 61 | P.W.M. Frequency 1 | 0: P.W.M. Frequency set by Cd62 1: 4KHZ 2: 5KHZ 3: 6KHZ 4: 7KHZ 5: 8KHZ 6: 9KHZ 7: 10KHZ | 2 | 189 |
| 62 | P.W.M. Frequency 2 | 15~160 | 30 | 190 |
| 63 | Start frequency of auto voltage compensation | 3.0~20.0HZ | 10 | 191 |
| 64 | Dynamic braking mode | 0~1 | 1 | 192 |
| 65 | Instant initial field time | 1~7 | 1 | 193 |
| 66 | Digital filter function | 1~6 | 5 | 194 |
| 67 | Power source positioning accuracy calibration | 0~30 | 0 | 195 |
| 68 | Motor vibration compensation | 100~500 | 200 | 196 |
| 69 | Motor speed search time | 0~15 | 15 | 197 |
| 70 | Dynamic braking active level | 120~140% | 130 | 198 |
| 71 | Over Voltage prevention function active point | 130~150% | 140 | 199 |
| 79 | Auto record when power off | 0: unuse 1: use | 1 | 207 |
| 80 | Modbus protocol data frame and Communications mode setting | | 0 | 208 |
| 81 | RS485 Communication ID Setting | 1~240 | 240 | 209 |
| 82 | RS485 Baud rate | 0 : 2400 bps 1 : 4800 bps 2 : 9600 bps 3 : 19200 bps | 2 | 210 |
| 83 | Series communication response time. | 5~15 | 5 | 211 |
| 90 | Series communication Parameter store eeprom | Cd90=0 unstore Cd90=1 store one data and reset 0 | 0 | 218 |

| NO | Function | Detail of Data | | | Initial factory setting | MODBUS Address |
|------|--|----------------|--------|----------|-------------------------|----------------|
| CE00 | Fault annunciation (The last) | | | | None | 228 |
| CE01 | Fault annunciation (Before the last) | | | | None | 229 |
| CE02 | Fault annunciation (The 2 nd before the last) | | | | None | 230 |
| CE03 | Fault annunciation (The 3 rd before the last) | | | | None | 231 |
| CE04 | Input code | | | | 0 | 232 |
| CE05 | 1 st step speed setting | 0~240Hz | | | 0 | 233 |
| CE06 | 2 nd step speed setting | 0~240Hz | | | 0 | 234 |
| CE07 | 3 rd step speed setting | 0~240Hz | | | 0 | 235 |
| CE08 | 4 th step speed setting | 0~240Hz | | | 0 | 236 |
| CE09 | 5 th step speed setting | 0~240Hz | | | 0 | 237 |
| CE10 | 6 th step speed setting | 0~240Hz | | | 0 | 238 |
| CE11 | 7 th step speed setting | 0~240Hz | | | 0 | 239 |
| CE12 | 8 th step speed setting | 0~240Hz | | | 0 | 240 |
| CE13 | 9 th step speed setting | 0~240Hz | | | 0 | 241 |
| CE14 | 10 th step speed setting | 0~240Hz | | | 0 | 242 |
| CE15 | 11 th step speed setting | 0~240Hz | | | 0 | 243 |
| CE16 | 12 th step speed setting | 0~240Hz | | | 0 | 244 |
| CE17 | 13 th step speed setting | 0~240Hz | | | 0 | 245 |
| CE18 | 14 th step speed setting | 0~240Hz | | | 0 | 246 |
| CE19 | 15 th step speed setting | 0~240Hz | | | 0 | 247 |
| CE20 | 16 th step speed setting | 0~240Hz | | | 0 | 248 |
| CE21 | 1 st step time setting | 0~100Min | | | 0 | 249 |
| CE22 | 2 nd step time setting | 0~100Min | | | 0 | 250 |
| CE23 | 3 rd step time setting | 0~100Min | | | 0 | 251 |
| CE24 | 4 th step time setting | 0~100Min | | | 0 | 252 |
| CE25 | 5 th step time setting | 0~100Min | | | 0 | 253 |
| CE26 | 6 th step time setting | 0~100Min | | | 0 | 254 |
| CE27 | 7 th step time setting | 0~100Min | | | 0 | 255 |
| CE28 | 8 th step time setting | 0~100Min | | | 0 | 256 |
| CE29 | 9 th step time setting | 0~100Min | | | 0 | 257 |
| CE30 | 10 th step time setting | 0~100Min | | | 0 | 258 |
| CE31 | 11 th step time setting | 0~100Min | | | 0 | 259 |
| CE32 | 12 th step time setting | 0~100Min | | | 0 | 260 |
| CE33 | 13 th step time setting | 0~100Min | | | 0 | 261 |
| CE34 | 14 th step time setting | 0~100Min | | | 0 | 262 |
| CE35 | 15 th step time setting | 0~100Min | | | 0 | 263 |
| CE36 | 16 th step time setting | 0~100Min | | | 0 | 264 |
| CE47 | Multi-step function mode selection | 0~1 | | | 0 | 275 |
| CE48 | Multi-step function reset | 0~1 | | | 0 | 276 |
| CE49 | Multi-step function continuous operation selection | 0~2 | | | 0 | 277 |
| CE52 | Multi-step function time error adjust | 1~2 | | | 1 | 280 |
| CE53 | All Files Restore | 0~1 | | | 0 | 281 |
| CE54 | File copy | 0~2 | | | 0 | 282 |
| CE61 | PI control Target value/feedback terminal select | Set | Target | Feedback | 0 | 288 |
| | | 0 | CD00 | IN1 | | |
| | | 1 | CD00 | IN2 | | |
| | | 2 | CE67 | IN1 | | |

| | | 3 | CE67 | IN2 | | |
|------|-------------------------------------|-----------------|------|-----|-----|-----|
| | | 4 | IN1 | IN2 | | |
| | | 5 | IN2 | IN1 | | |
| CE62 | P gain | 0~10.0 | | | 0 | 289 |
| CE63 | I gain | 0.2~1000.0 sec. | | | 1 | 290 |
| CE64 | Reserved | | | | | 291 |
| CE65 | Output limit | 0~100.0 % | | | 100 | 292 |
| CE66 | PID output limit | | | | | 293 |
| CE67 | PI target value Setting | 0~100.0 % | | | 100 | 294 |
| CE68 | PID delay time | 0~10 | | | 0 | 295 |
| CE69 | PID offset adjust | 0~200 | | | 100 | 296 |
| CE70 | PID output gain | 0~25 | | | 1 | 297 |
| CE74 | P control status selection | 0~1 | | | 0 | 301 |
| CE77 | PID delay status selection | 0~1 | | | 0 | 302 |
| CE78 | PID output characteristic selection | 0~1 | | | 1 | 303 |
| CE79 | PID status selection | 0~4 | | | 0 | 304 |
| CE80 | PID target acceleration time | 0~25.5 | | | 0 | 305 |

12. Modbus Address of Display Data

| Description | Notes | Range | Unit | MODBUS Address |
|--|---|----------|--------|----------------|
| Operation frequency | | 0~24000 | 0.01HZ | 328 |
| Current feedback | | 0~9999 | 0.1A | 329 |
| Operation command | | 0~24000 | 0.01HZ | 330 |
| DC voltage | | 0~9999 | 0.1V | 331 |
| Output voltage | $V_{ac} = \text{Output voltage} / \sqrt{2}$ | 0~9999 | 0.1 | 332 |
| External terminal mode | | 0~255 | | 333 |
| Module Temperature | | 112~1130 | 0.1℃ | 334 |
| Operation status | Bit2: 0=Stop, 1=RUN Bit14: 0=FR, 1=RR | | | 335 |
| Operation command | MASTER changes: Bit0: FWD command Bit1: REV command Clear Bit0 Bit1: Stop command Bit2: Reset after failure command | | | 336 |
| Failure | Bit4, 3, 2, 1, 0= 0:None 4:OCPA 5:OCPd 6:OCPn 8:OV 10:OH 12:OL 14:OC 15:PLU 16:OL2 17:BuOH | | | 337 |
| IN 1(0~20mA) | | 0~1023 | | 369 |
| IN 2(0~10V) | | 0~1023 | | 370 |
| KEYPAD (0~10V) | | 0~1023 | | |
| Automatic procedure control operation time | | 0~999 | 1min | 342 |

13. Serial Communications User Manual

This product built in with standard RS422/RS485 communicate port, support international standard MODBUS protocol, user can monitor single or many inverters by using PLC, PC, industrial computer or other equipment which support MODBUS protocol

A. The physical link

The wiring of this product can use either RS422 (4 wires) or RS485 (2wires), by jumper.

| | JP4 | Figure |
|--------------|---------------|--------|
| Single RS422 | Pin 1-2 short | 13-1 |
| Single RS485 | Pin 2-3 short | 13-2 |

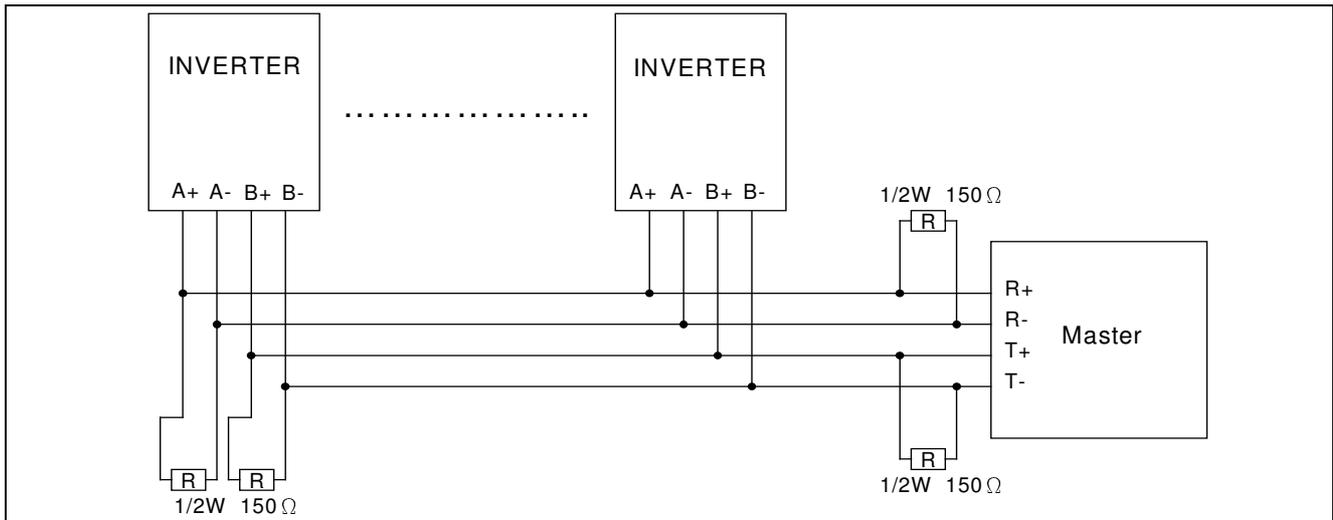


Fig.13-1

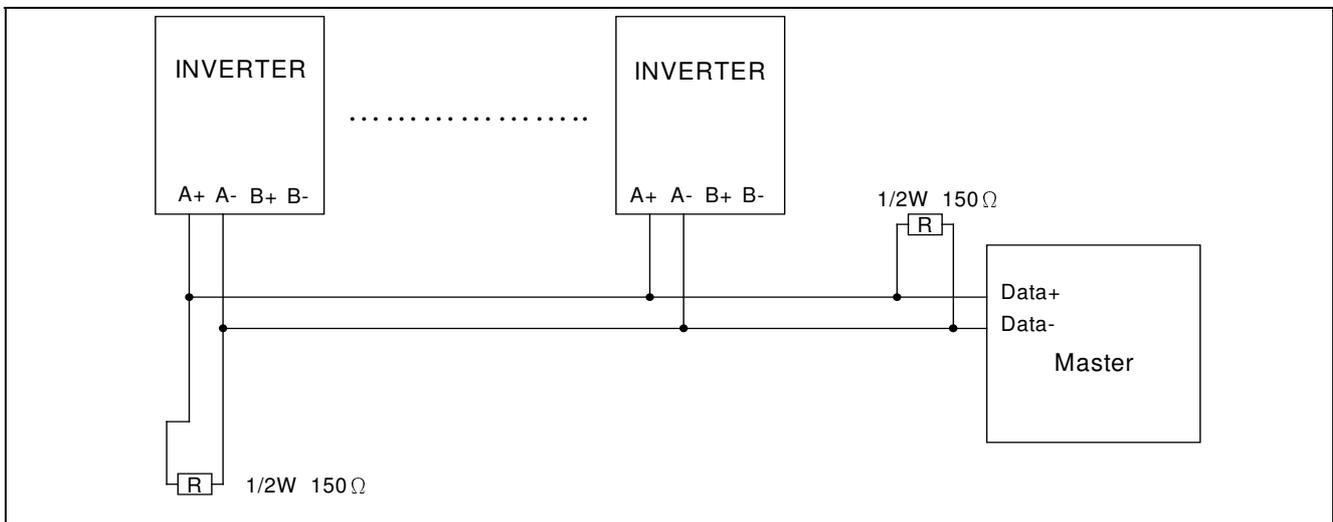


Fig.13-2

- Note :
- a. When use RS422 (4wires), The 'REMOTE' socket cannot connect to any device.
 - b. Single transaction can read up to 10 continuous data from slave device.
 - c. It can connect up to 32 devices in single net.
 - d. The R in wiring diagram is terminal resistor, only used on the device in the end of communication line.

B. Data structure in communication

This product support MODBUS RTU and MODBUS ASCII protocol.
In ASCII mode, every byte of the data will transfer to two ASCII code.
Ex. If byte data is 63H, it will be 36H, 33H in ASCII code.

(1) Hex to ASCII code transfer table

| | | | | | | | | |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|
| Char | '0' | '1' | '2' | '3' | '4' | '5' | '6' | '7' |
| ASCII code | 30H | 31H | 32H | 33H | 34H | 35H | 36H | 37H |

| | | | | | | | | |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|
| Char | '8' | '9' | 'A' | 'B' | 'C' | 'D' | 'E' | 'F' |
| ASCII code | 38H | 39H | 41H | 42H | 43H | 44H | 45H | 46H |

| | | | | | | | | |
|------------|-----|-----|-----|--|--|--|--|--|
| Char | ':' | CR | LF | | | | | |
| ASCII code | 3AH | 0DH | 0AH | | | | | |

(2) The data frame format explain

| Field Name | Explain |
|------------------|---------------------------------------|
| Header | Data frame initial character |
| Slave Address | Inverter communication address |
| Function | Function code |
| Start Address | Enquiry feedback data initial address |
| No. of Register | Enquiry feedback data (word) |
| Byte Count | Feedback data(byte) |
| Data | Feedback data |
| Register Address | Enquiry modified data address |
| Preset Data | Modified data |
| Error Check | Checksum |
| Trailer | Data frame stop character |

C. Function code in Modbus

This product supports Function code 03H and 06H in MODBUS protocol.

(1) Function 03H : Read holding register

Read the binary contents of holding registers (4 x references) in the slave. Broadcast is not supported. The maximum parameters supported by various controller models are listed on page.

Ex: Read data from 3 continuous addresses in register. The beginning address is 0080H, the data frame are listed as follow.

Query

| Field Name | Example (hex) | ASCII code | RTU 8-Bit Field |
|--------------------|---------------|---------------|-----------------|
| Header | | ':' (Colon) | None |
| Slave Address | F0 | F 0 | 1111 0110 |
| Function | 03 | 0 3 | 0000 0011 |
| Start Address Hi | 00 | 0 0 | 0000 0000 |
| Start Address Lo | 80 | 8 0 | 1000 0000 |
| No. of Register Hi | 00 | 0 0 | 0000 0000 |
| No. of Register Lo | 03 | 0 3 | 0000 0011 |
| Error Check | | LRC (2 chars) | CRC (16 bits) |
| Trailer | | CR LF | None |
| Total Bytes | | 17 | 8 |

Response

| Field Name | Example (hex) | ASCII code | RTU 8-Bit Field |
|-------------------------|---------------|---------------|-----------------|
| Header | | ':' (colon) | None |
| Slave Address | F0 | F 0 | 1111 0000 |
| Function | 03 | 0 3 | 0000 0011 |
| Byte Count | 06 | 0 6 | 0000 0110 |
| 1 st Data Hi | 03 | 0 3 | 0000 0011 |
| 1 st Data Lo | E8 | E 8 | 1110 1000 |
| 2 nd Data Hi | 00 | 0 0 | 0000 0000 |
| 2 nd Data Lo | 07 | 0 7 | 0000 0111 |
| 3 rd Data Hi | 00 | 0 0 | 0000 0000 |
| 3 rd Data Lo | 00 | 0 0 | 0000 0000 |
| Error Check | | LRC (2 chars) | CRC (16 bits) |
| Trailer | | CR LF | None |
| Total Bytes | | 23 | 11 |

(2)Function 06H : preset signal register

Presets a value into a single holding register (4 x reference). When broadcast, the function presets the same register reference in all attached slaves. The maximum parameters supported by various controller models are listed on page.

Ex. To inverter in F0H address protocol, pre set data 6000(1770H) into 0080H register, the protocol frame will listed as below.

Query

| Field Name | Example (hex) | ASCII code | RTU 8-Bit Field |
|---------------------|---------------|---------------|-----------------|
| Header | | ' :' (colon) | None |
| Slave Address | F0 | F 0 | 1111 0110 |
| Function | 06 | 0 6 | 0000 0110 |
| Register Address Hi | 00 | 0 0 | 0000 0000 |
| Register Address Lo | 80 | 8 0 | 1000 0000 |
| Preset Data Hi | 17 | 1 7 | 0001 0111 |
| Preset Data Lo | 70 | 7 0 | 0777 0000 |
| Error Check | | LRC (2 chars) | CRC (16 bits) |
| Trailer | | CR LF | None |
| Total Bytes | | 17 | 8 |

Response

| Field Name | Example (hex) | ASCII code | RTU 8-Bit Field |
|---------------------|---------------|---------------|-----------------|
| Header | | ' :' (colon) | None |
| Slave Address | F0 | F 0 | 1111 0110 |
| Function | 06 | 0 6 | 0000 0110 |
| Register Address Hi | 00 | 0 0 | 0000 0000 |
| Register Address Lo | 80 | 8 0 | 1000 0000 |
| Preset Data Hi | 17 | 1 7 | 0001 0111 |
| Preset Data Lo | 70 | 7 0 | 0777 0000 |
| Error Check | | LRC (2 chars) | CRC (16 bits) |
| Trailer | | CR LF | None |
| Total Bytes | | 17 | 8 |

D. Error check Generation

(1) LRC Generation

Add all bytes in the message, excluding the starting colon and ending CRLF. Add them into an eight-bit field, so that carries will be discarded.

Subtract the final field value from FF hex (all 1's), to produce the ones complement.

Add 1 to produce the two's-complement. Ex. The query data is F0H + 06H + 00H + 80H + 17H + 70H = FDH, the two's complement is 03H. The '0' & '3' will be the LRC.

(2) CRC Generation

Generating a CRC

Step 1 Load a 16-bit register with FFFF hex (all 1's). Call this the CRC register.

Step 2 Exclusive OR the first eight-bit byte of the message with the low order byte of the 16-bit CRC register, putting the result in the CRC register.

Step 3 Shift the CRC register one bit to the right (toward the LSB), zero filling the MSB. Extract and examine the LSB.

Step 4 If the LSB is 0, repeat Step 3 (another shift). If the LSB is 1, Exclusive OR the CRC register with the polynomial value A001 hex (1010 0000 0000 0001).

Step 5 Repeat Steps 3 and 4 until eight shifts have been performed. When this is done, a complete eight-bit byte will have been processed.

Step 6 Repeat Steps 2 ... 5 for the next eight-bit byte of the message. Continue doing this until all bytes have been processed.

The final contents of the CRC register is the CRC value.

Step 7 When the CRC is placed into the message, its upper and lower bytes must be swapped as described below.

Pseudo code for generating a CRC-16 :

```
CONST ARRAY BUFFER          /* data, ex: F0h, 06h, 00h, 80h, 17h, 70h */
CONST WORD POLYNOMIAL = 0A001h /* X16 = X15 + X2 + X1 */
/* SUBROUTINE OF CRC CALCULATE START */
CRC_CAL(LENGTH)
VAR INTEGER LENGTH;
{
  VAR WORD CRC16 = 0FFFFH; /* CRC16 initial */
  VAR INTEGER = i,j; /* LOOP COUNTER */
  VAR BYTE DATA; /* DATA BUFFER */
  FOR (i=1;i=LENGTH;i++) /* BYTE LOOP */
  {
    DATA == BUFFER[i];
    CRC16 == CRC16 XOR DATA
    FOR (j=1;j=8;j++) /* BIT LOOP */
    {
      IF (CRC16 AND 0001H) = 1 THEN
        CRC16 == (CRC16 SHR 1) XOR POLYNOMIAL;
      ELSE
        CRC16 == CRC16 SHR 1;
        DATA == DATA SHR 1;
    };
  };
};
RETURN(CRC16);
};
```

E. Group and Global Broadcast

(1) Group Broadcast

User can use this function to control certain group of inverter at the same time. When master send out group address data, the slave inverters will react when receive order, but will not send any signal back to master.

(2) Global Broadcast

User can use this function to control all inverters at the same time. When master global broadcast, all slaves inverters will react after receive order, but will not send any signal back to master.

Group and Global broadcast address should be recognized refer to table as below, when the group and global broadcast address is in use.

There are 240 addresses in total for inverter setting, which means it can connect up to 240 inverters at the same time, and provide 1 Global Broadcast address 15-group address. Each group address can control up to 16 inverters, and user can set it.

| Group | Individual Address | Group address | Global address |
|----------|--------------------|---------------|----------------|
| Group 1 | 1...16 | 241 | 0 |
| Group 2 | 17...32 | 242 | 0 |
| Group 3 | 33...48 | 243 | 0 |
| Group 4 | 49...64 | 244 | 0 |
| Group 5 | 65...80 | 245 | 0 |
| Group 6 | 81...96 | 246 | 0 |
| Group 7 | 97...112 | 247 | 0 |
| Group 8 | 113...128 | 248 | 0 |
| Group 9 | 129...144 | 249 | 0 |
| Group 10 | 145...160 | 250 | 0 |
| Group 11 | 161...176 | 251 | 0 |
| Group 12 | 177...192 | 252 | 0 |
| Group 13 | 193...208 | 253 | 0 |
| Group 14 | 209...224 | 254 | 0 |
| Group 15 | 225...240 | 255 | 0 |