Cutes Corporation

CT-2000F Series
AC MOTOR DRIVER

Instruction

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Introduction

Thank you for choosing the CT-2000 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.

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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℃ to 55℃. The surrounding air must be free of corrosive contaminants.
   B. Installation place:
   Places where the peripheral temperature is from -10℃ to 40℃, 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.
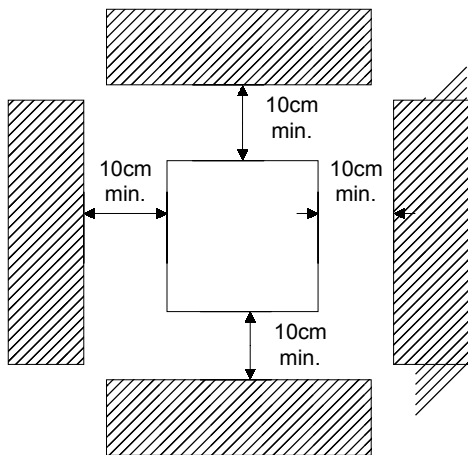
3. Application notes

    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	CT-2002-A75	6A	2~5.5
	CT-2002-1A5	10A	2~5.5
	CT-2002-2A2	15A	3.5~5.5
	CT-2002-3A7	20A	5.5
	CT-2002-5A5	30A	5.5~8
	CT-2002-7A5	40A	5.5~8
	CT-2002-011	60A	22
	CT-2002-015	80A	30
	CT-2002-022	120A	38
	CT-2002-030	150A	38~100
	CT-2002-037	200A	38~100
	CT-2002-045	250A	60~100
	CT-2002-055	300A	100
	CT-2002-075	400A	100~200
	CT-2002-093	500A	100~200
380 | 440	CT-2004-A75	5A	2~5.5
	CT-2004-1A5	5A	2~5.5
	CT-2004-2A2	7.5A	2~5.5
	CT-2004-3A7	10A	3.5~5.5
	CT-2004-5A5	15A	3.5~5.5
	CT-2004-7A5	20A	5.5
	CT-2004-011	30A	8~14
	CT-2004-015	40A	8~14
	CT-2004-022	60A	22
	CT-2004-030	80A	22
	CT-2004-037	100A	30
	CT-2004-045	120A	50
	CT-2004-055	150A	38~100
	CT-2004-075	200A	38~100
	CT-2004-093	250A	60~100
	CT-2004-112	300A	100

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	CT-2002-A75	6A	1.8mH
	CT-2002-1A5	10A	1.1mH
	CT-2002-2A2	15A	0.71mH
	CT-2002-3A7	20A	0.53mH
	CT-2002-5A5	30A	0.35mH
	CT-2002-7A5	40A	0.26mH
	CT-2002-011	60A	0.18mH
	CT-2002-015	80A	0.13mH
	CT-2002-022	120A	0.09mH
	CT-2002-030	150A	70uH
	CT-2002-037	200A	50uH
	CT-2002-045	250A	44uH
	CT-2002-055	300A	35uH
	CT-2002-075	400A	27uH
	CT-2002-093	500A	21uH
380 | 440	CT-2004-A75	5A	4.2mH
	CT-2004-1A5	5A	4.2mH
	CT-2004-2A2	7.5A	3.6mH
	CT-2004-3A7	10A	2.2mH
	CT-2004-5A5	15A	1.42mH
	CT-2004-7A5	20A	1.0mH
	CT-2004-011	30A	0.7mH
	CT-2004-015	40A	0.53mH
	CT-2004-022	60A	0.36mH
	CT-2004-030	80A	0.26mH
	CT-2004-037	100A	0.21mH
	CT-2004-045	120A	0.18mH
	CT-2004-055	150A	0.14mH
	CT-2004-075	200A	0.11mH
	CT-2004-093	250A	0.10mH
	CT-2004-112	300	70uH

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

E. Standard External Connection Diagram
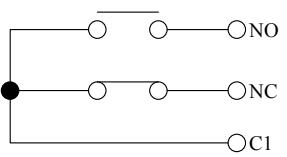
（Note: While external is required for DBR, disconnect inter DBR first

F. Control circuit

C1	NO1	NC1	C2	NO2	NC2

No.1
Multifunctional
relay output
terminal

No.2
Multifunctional
relay output
terminal

Vout	IN1	IN2	IN3	VC	CC

1/2W
5K ohm

4-20mA
Current
Set

Accessory
Voltage
Set

0-10V
DC
Voltage
Output

Main Voltage Set

1/2W
5K ohm

	AC2	DC2	3DF	JOG	2DF	RST			
COM	1	2	3	4	5	6	RR	FR	COM

Multi-
functional
input
terminal

Multi-
functional
input
terminal

Multi-
functional
input
terminal

Reverse
operation

Forward
operation

G. Terminal Specifications

Main Circuit	R.S.T	AC power input terminal	3Φ AC power 200-230V/50,60Hz 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 5
	IN2	Voltage speed input setting	DC 0-10V/5KΩVR, CD01=1,4,3 or 6
	IN3	Voltage speed input setting	DC 0-10V/5KΩVR, CD01=3 or 6
	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	2nd acceleration input terminal (AC2)	Select 2nd acceleration time mode by shorting 1-COM, set CD10
	DI2	2nd deceleration input terminal (DC2)	Select 2nd deceleration time mode by shorting 2-COM, set CD11
	DI3	3rd speed input terminal (3DF)	Select 3rd operation speed by shorting 3-COM, frequency is set by CD13
	DI4	Jogging operation or 5th speed (JOG/5DF)	Shorting 4-COM, JOG/5DF is set by CD59
	DI5	2nd speed input terminal (2DF)	Select 2nd operation speed by shorting 5-COM, frequency is by CD12
	DI6	Free-run operation or alarm reset (MBS/RST)	Shorting 6-COM, MBS/RST is set by CD59
	C1, NC1, NO1, C2, NC2, NO2	Control output terminal	Multifunctional relay output terminal Connector capacity AC 220V, 0.1A While normal C-X closed and NC-X Closed While operating C-X open and NO-X closed Functions of C1, NC1, NO1 are set by CD47 Functions of C2, NC2, NO2 are set by CD48
	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

PANEL INPUT

CT2000

M
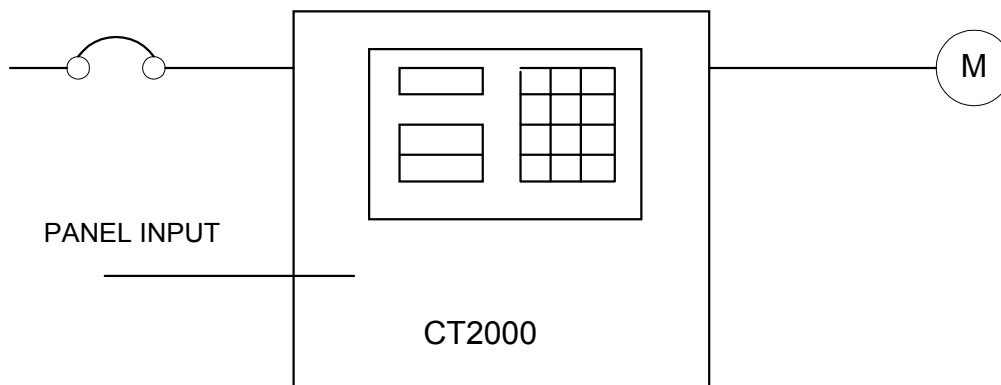
(2) External signal operation

MCB

SWITCH CONTROL

CT2000

M

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

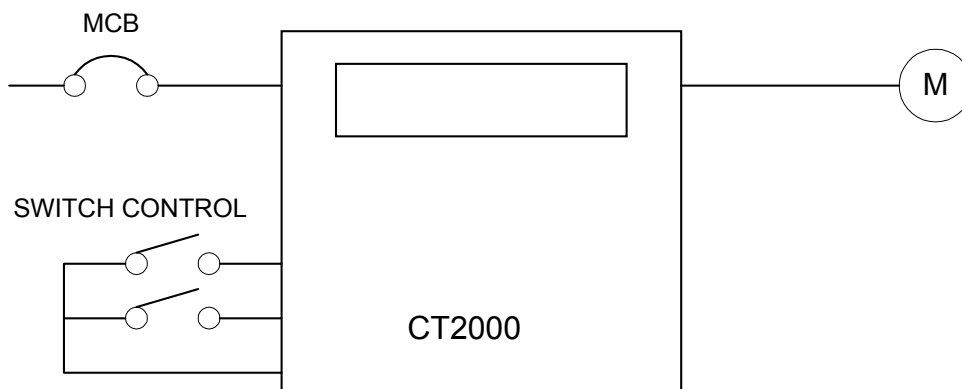   III. Press either FWD or REV key, motor starts running. It will stop accelerating after reaching set frequency

    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.   STOP display, with reciprocal glittering indicated HZ LED and factory setting 10.00HZ.

    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

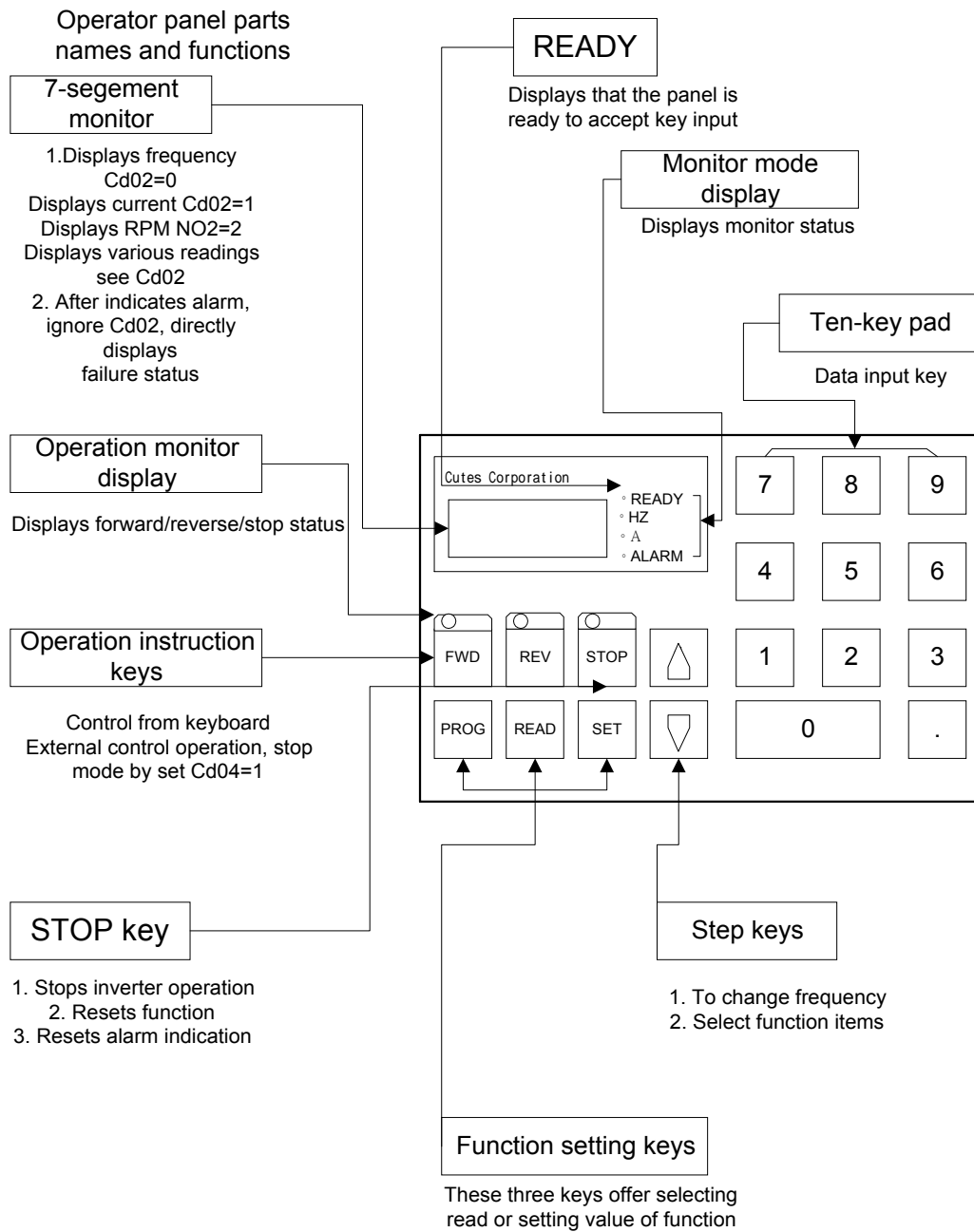   I.   The same as the above basic test of I, II

    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

Operator panel parts
names and functions

**7-segement
monitor**

1.Displays frequency
Cd02=0
Displays current Cd02=1
Displays RPM NO2=2
Displays various readings
see Cd02
2. After indicates alarm,
ignore Cd02, directly
displays
failure status

READY

Displays that the panel is
ready to accept key input

**Monitor mode
display**

Displays monitor status

Ten-key pad

Data input key

**Operation monitor
display**

Displays forward/reverse/stop status

Cutes Corporation

∘ READY
∘ HZ
∘ A
∘ ALARM

| 7 | 8 | 9 |
| 4 | 5 | 6 |

**Operation instruction
keys**

Control from keyboard
External control operation, stop
mode by set Cd04=1

| FWD | REV | STOP | △ | 1 | 2 | 3 |
| PROG | READ | SET | ▽ | 0 | | . |

STOP key

1. Stops inverter operation
2. Resets function
3. Resets alarm indication

Step keys

1. To change frequency
2. Select function items

Function setting keys

These three keys offer selecting
read or setting value of function

B. Display specification

LED	Display specification
READY	READY LED means the Keyboard working normally.
HZ	Hz LED means of recent revolution frequency.
A	A LED means of recent revolution current.
FWD	FWD LED means motor operate at forward direction.
REV	REV LED means motor operate at reverse direction.
STOP	STOP LED means motor operate at stop.

C. Keyboard specification

Bottom	Function	Bottom specification
FWD	MOTOR RUN	Push keypad to control forward of motor, and screen display main display content (Cd02 setting).
REV	MOTOR RUN	Push keypad to control reverse of motor, and screen display main display content (Cd02 setting).
STOP	STOP	Stop motor revolution when push STOP key, and on the mean time screen flashing with commanding instruction.
	RESET	While failure occurred, press STOP key to re-start inverter and save failure in failure memory.
PROG	SELECT FUNCTION	In display mode, press PROG key and screen shows Cd00 (General parameter input area). Press PROG/SET key again and screen shows CE-00 (failure and engineering mode). If pressed PROG/SET key now, screen would return to display mode.
READ	READ	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.
	CANCEL	Press READ at parameter input mode can escape from parameter input mode and not save new parameter.
SET	SET and SAVE	In parameter input mode, press SET key will save new parameter just input.

	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.
0 9 ·	Input a number	Input a number

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.   Use ▼、▲ key to input data (Cd01=0)

    D.   Use Multi-Step function to setting (Refer to function CE05 to CE55.)

    E.   Set external voltage

    F.   Set external current

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)
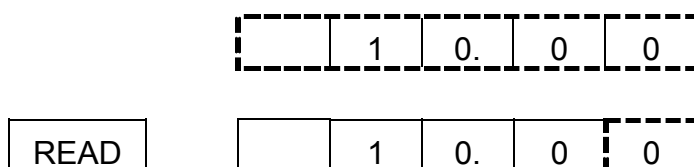
	1	0.	0	0

READ		1	0.	0	0

Key	Display
3					3
0				3	0
SET		3	0.	0	0
	C	d	−	0	0
		3	0.	0	0
READ		3	0.	0	0

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

Key	Display
		1	0.	0	0
PROG	C	0	−	0	0
READ		1	0	0	0
3					3
0				3	0
SET		3	0.	0	0
	C	0	−	0	0
		3	0.	0	0
READ		3	0.	0	0

Note： [ ], Indicate 7 Segment LED flash.

§Cd01   Setting procedure of frequency   (Selective range 0-7)

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/5KΩVR

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

Cd01=3   Set frequency by terminal In2+IN3 DC 0-10V/5KΩVR

Cd01=4   Setting from terminal In2, input DC0～10V/VR 5KΩ hysteresis

Cd01=5   Setting from terminal In1, input DC4～20mA hysteresis

Cd01=6   Setting from terminal In2+IN3, input DC0～10V/VR 5KΩ hysteresis

Cd01=7   Set frequency by Multi-step function mode

§Cd02   Select Main monitor display   (Selective range 0-15)

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 I active

Cd02=2   Display Ultimate speed, Hz and I 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, I 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 average speed of multi-step function (rpm)

Cd02=9   Display current step of multi-step function (step)

Cd02=10   Display current time of multi-step function (minutes)

Cd02=11   Display Yards counter value

Cd02=12   Display power factor (cos Θ)

Cd02=13   Display transient power (Kw)

Cd02=14   Display Kw-h

Cd02=15   Display Mw-h

§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, Maximum boost is 1.5 * Cd07 setting value. Start boost while operation frequency greater than 3 Hz.

Cd03=2   Initial Torque boost active, Maximum boost is 1.5 * Cd07 setting value. Start boost while operation frequency greater than 1.5 Hz.

§Cd04 Operation command mode (Selective range 0,1)
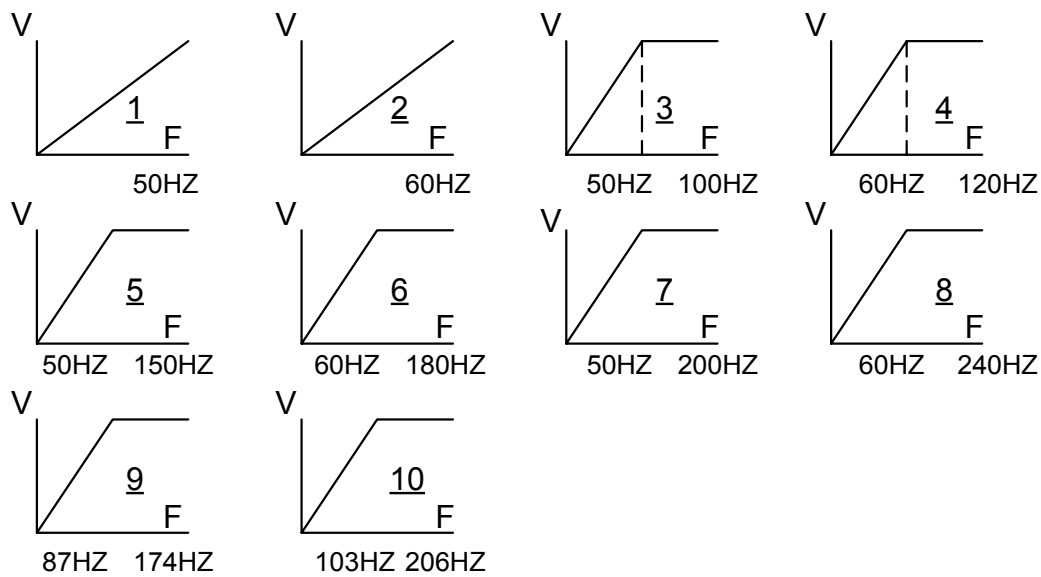
The function cannot be modified during revolution.

Cd04=0 Operation on operation panel

Cd04=1 Operation by external terminal, including FR, RR, terminal (1, 2, 3, 4, 5, 6)

§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:
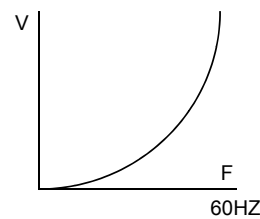

When Cd05=11, V/F slope is determined by Cd57, Cd58.

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:

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

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

Inverter rated current = 17.4A
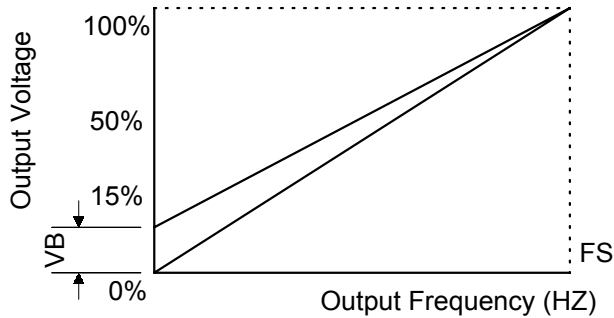
Motor rated current = 8A

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

Set Value $(T) = (50 - 0) / \triangle F \times T1$

T1: time needed for accelerate / decelerate

$\triangle F$: frequency changed

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

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.

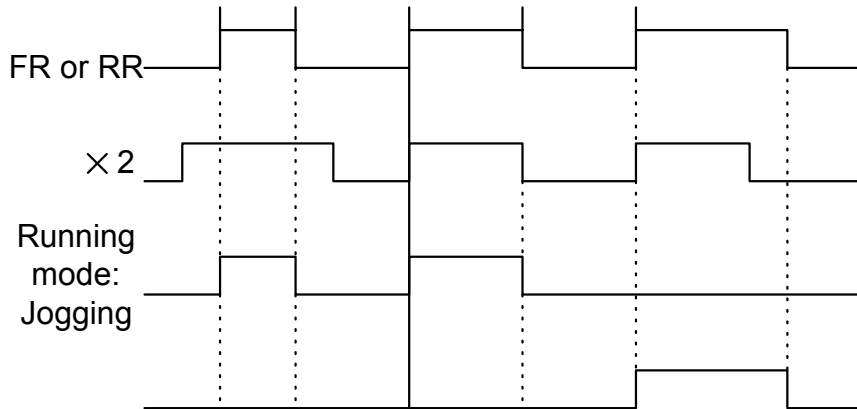Cd12 = 2nd speed setting

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 4-FR or 4-RR with COM shorted.

　　Set running direction

FR or RR

×2

Running
mode:
Jogging

　Forward(Reverse)

　　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 4, and then FR (or RR).

　　　　2.　Put in 4 and FR (or RR) simultaneously.

　　　　Be sure always to put in 4 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.

Frequency

Start
Frequency

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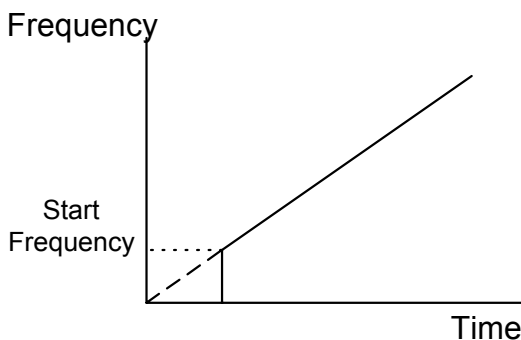
　　Note: The most appropriate range for start frequency is 0.5Hz to 10Hz.

§ 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
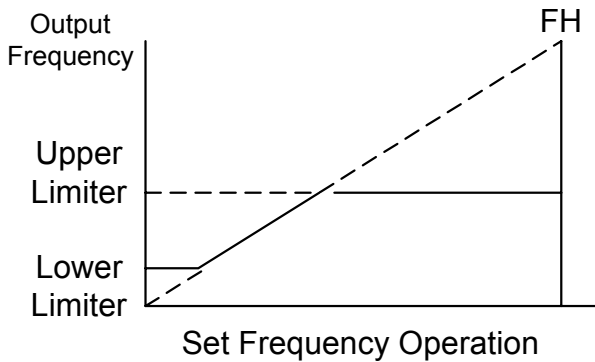
§Cd19   Acceleration / deceleration time of jogging   (Setting range 0.10-30.00)

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

Set Value (T) = (50 - 0) / $\triangle$F $\times$T1

T1: Time needed for acceleration/deceleration

$\triangle$F: Frequency changed

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

This function is to avoid mechanical resonance frequency

Frequency operation automatically jumps to point $+/-$ 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.
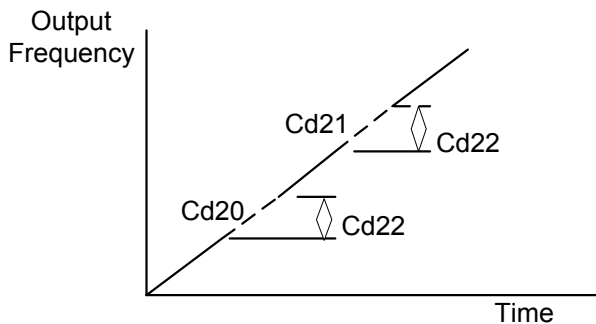
§Cd22   Jump frequency width   (Settable range 0-6)

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

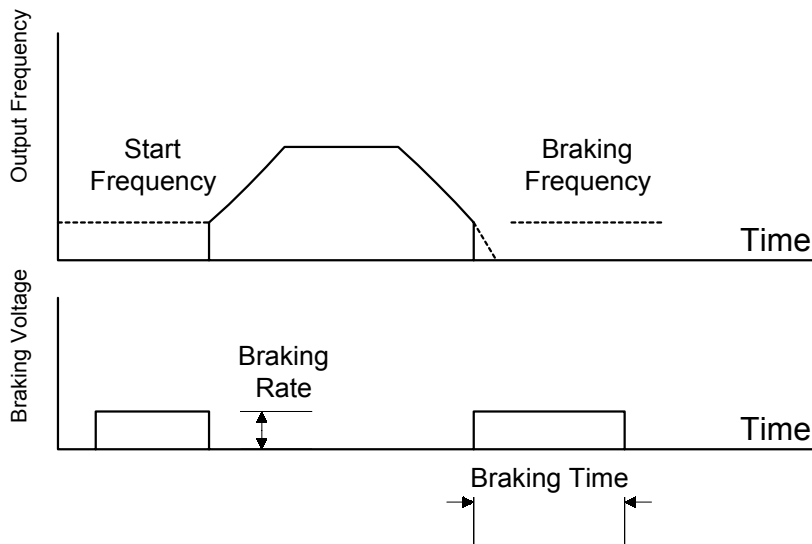When DC brake is active, monitor displays "dCbr"

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 revise 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.
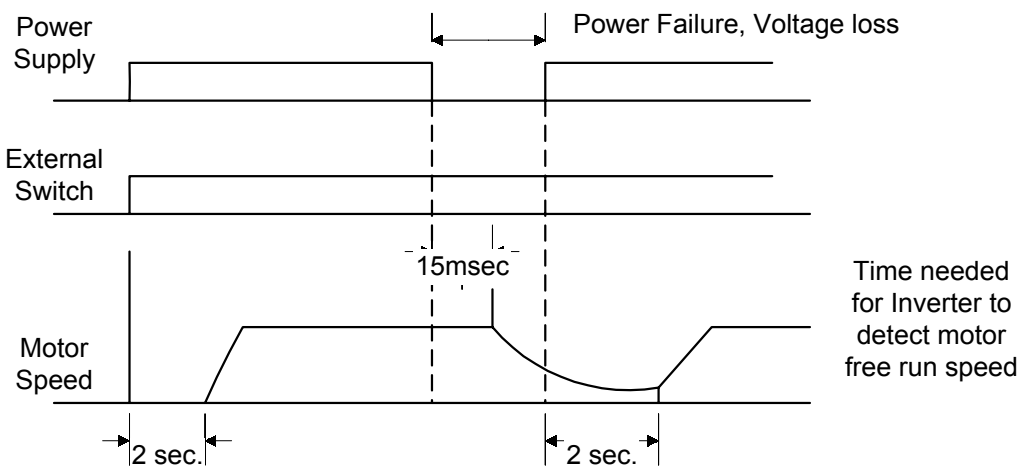
Note:

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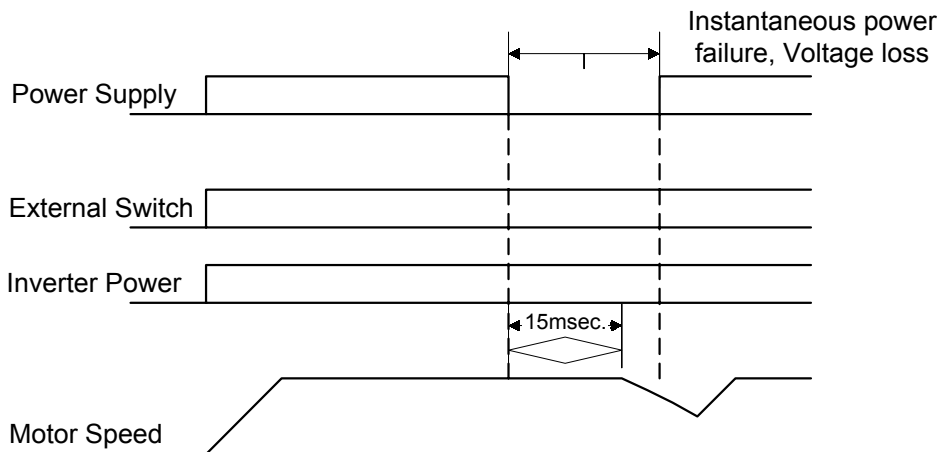
Note: The inverter will be de-active when control voltage is less than 5V.
      Apply with free run restart function when it is required.

§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".

§ Cd34   Dead Time compensation delay angle   （Settable range 0~80）

Default setting. Can't be adjustable

Adjust angle of DEATIME compensation in accordance with current feedback
waveform.

§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.

Output Frequency = Set Value $\times$Frequency Gain $\times$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:

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

If change frequency gain to 150%, then

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

Analog Setting Signal
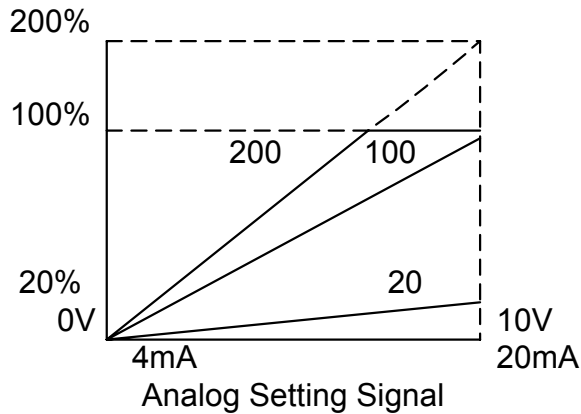
Note: If the maximum frequency (FH) exceeds more than 120Hz, gain setting of larger than 100% is ignored and fixed at 100% and input data of Code 37 will not be changed.

§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

§Code No.39   Frequency command bias   (Settable range 0-250)

   External analog frequency command bias setting
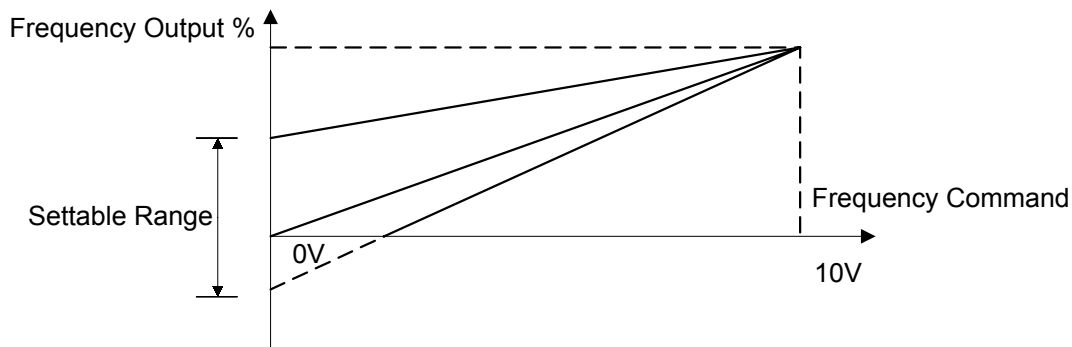
§Cd40, 41, 42, 43   Multi-speed setting   (Settable range 0.5-240)

   This function has 8 kinds of speed operation
   Use external terminal FR (or RR) accommodate 3, 4, 5 to select different
   speeds. Refer to the following table:
      Cd40=   5th speed setting
      Cd41=   6th speed setting
      Cd42=   7th speed setting
      Cd43=   8th speed setting

Note: Apply to multi-speed setting external control is required for operation control mode (e.g. Cd04=1), and it is also required to set Cd59 for activating common terminal 4.

External terminal Name	Selective speed						
	2	3	4	5	6	7	8
Terminal 5	○		○		○		○
Terminal 3		○	○			○	○
Terminal 4				○	○	○	○

○: stands for external terminal to put in.

§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.

HZ OUTPUT

CD45

TIME

FA-FC

OPEN

CLOSE

TIME
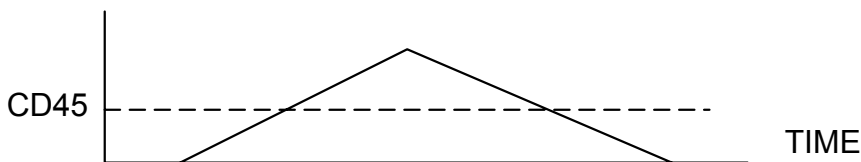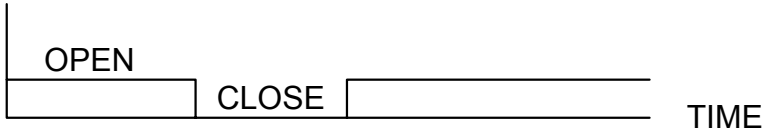
§ <u>Cd46   Speed multiplier   (Settable range 0.01-500)</u>

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".

§<u>Cd47   Relay 1 output select   (Settable range 0-6)</u>

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

§<u>Cd48   Relay 1 output select   (Settable range 0-6)</u>

The function sets the mode of relay2 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

§<u>Cd49   Function to lock data   (Settable range 0, 1)</u>

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

B.   380V Series: Value of Cd51 = Motor rated voltage / 1.73

C.   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.
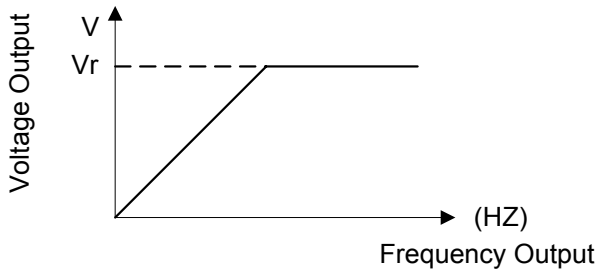
1.   Vin ＞Vrate   when Fr ＜Fb   Vout = Fr / Fb ×Vrate

　　　　　　　　when Fr ＞Fb   Vout = Vrate

2.   Vin ＜Vrate   when Vout ＜Vin   Vout = Fr / Fb ×Vrate

　　　　　　　　when Vout ＞Vin   Vout = Vin

Vin: Power supply voltage

Vout: Inverter output voltage

Vrate: Motor rated voltage

Fr: Inverter revolution frequency

Fb: base frequency

§Cd52   Motor no-load current setting   (Settable range 5-60)

This function cannot be modified during revolution.

The function is to compensate motor vibration during a light-load and fixed speed revolution. This function must accommodate the content of Cd06.

Ex. Motor: 60Hz, 4-pole, 1 horsepower, 220V, no-load current 1.2Arms

Inverter: 1 horsepower, 220V, rated current 4.2Arms, Cd06=100

Cd52 = Motor no-load current / (Inverter rated current ×Motor rated current ratio Cd06) ×100%

= 1.2 / (4.2 ×100%) ×100%

= 28.5%

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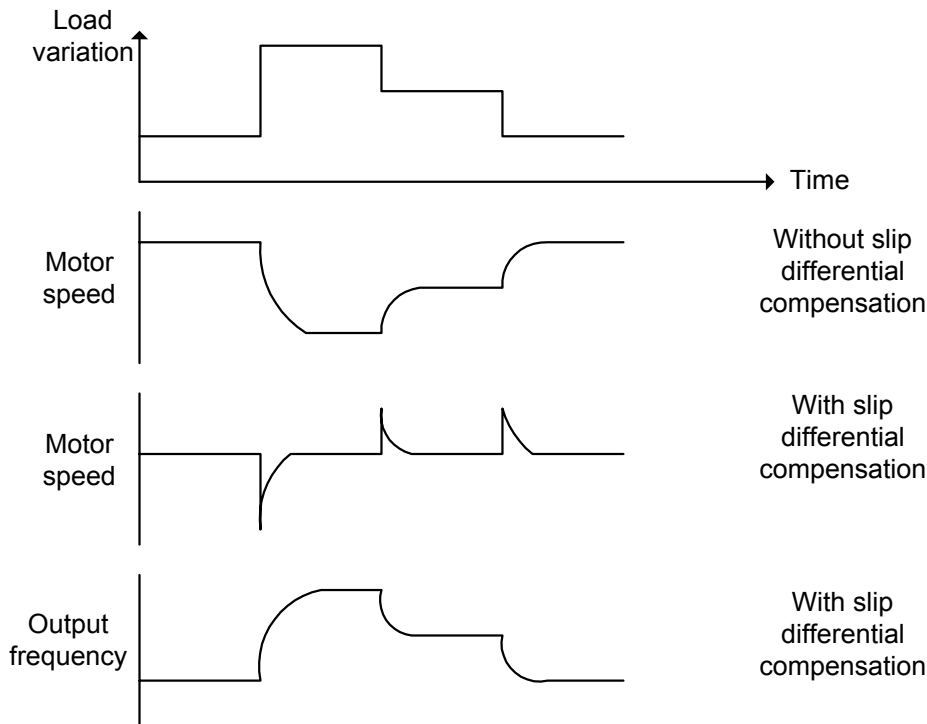
§ Cd54   External analog output selection   （Set range 0～1）

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

Cd54=0   Indicate output frequency.

Cd54=1   Indicate output current

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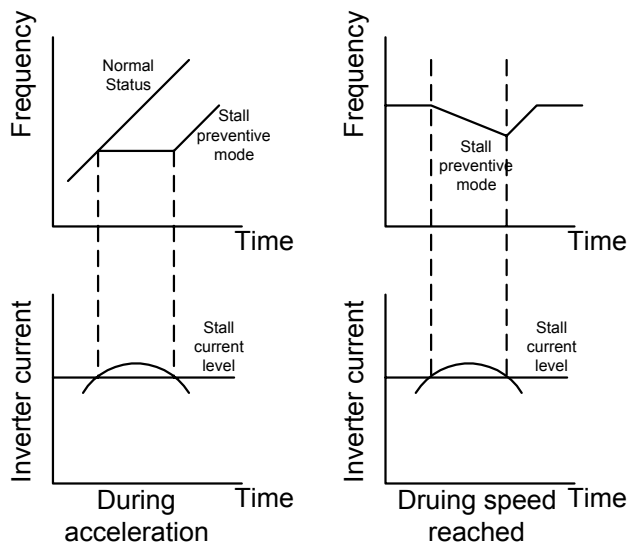
§Cd57   Maximum frequency setting FH   (Settable range 10-240)

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.

§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 ≦FH)

Please refer to function code table.

§Cd59   External terminal 4/6,3/5 function selection (Setting range 0-7)

This function is to select setting common terminal 3,4,5 and 6.

CD59	Common input terminal setting			
	DI4	DI6	DI3	DI5
0	JOG	MBS	3DF	2DF
1	JOG/ Yards counter	RST	3DF/ Down speed %	2DF/ UP speed %
2	5DF	MBS	3DF	2DF
3	5DF	RST	3DF	2DF
4	JOG	MBS	DOWN	UP
5	JOG	RST	DOWN	UP
6	5DF	MBS	DOWN	UP
7	5DF	RST	DOWN	UP

Terminal specification:
   JOG: Jogging operation, accommodating with Cd15.
   5DF: Multi-speed, accommodating with Cd4041, 42, 43 speed setting.
   MBS: Free run stop, operates both panel key and external signal.
   RST: Reset, operates both panel key and external signal
   2DF: Second term operation, accommodating with Cd12 speed setting.
   3DF: Third term operation, accommodating with Cd13 speed setting.
   UP: Using external terminal control on frequency increasing. Max. frequency is
       setting of Cd00
   DOWN: Using external terminal control on frequency decreasing. Min. frequency is
         setting of Cd16

Note: when use multi-steps function, and Cd59=1, functions of external terminal 3,4,5
      are listed as below：

      Terminal 3: "Down Speed %", means the speed will be decreased, according to
                  function CE37~CE45.
      Terminal 4: Yards counter
      Terminal 5: "Up Speed %", means the speed will be decreased, according to
                  function CE37~CE45.

§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)
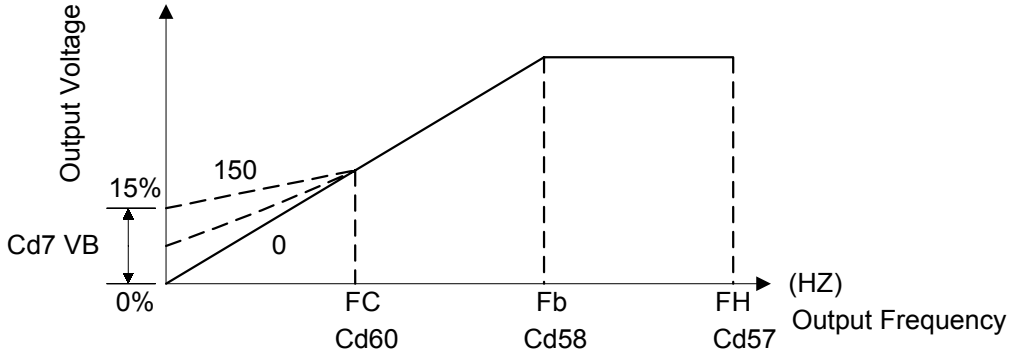
§Cd61   PWN frequency   (Settable range 0-4)

This function cannot be modified during revolution.
This function is to set PWM frequency.
The higher pitch of PWM & the lower noise of motor, however motor might be shave.
The lower pitch of PWM & the higher noise of motor, however motor should be more stable.

Cd61	PWM Frequency
0	Setting by Cd62 (1.5 – 4.0 Hz)
1	4 KHZ
2	6 KHZ
3	8 KHZ
4	10 KHZ

§Cd62   PWM Frequency (Settable range 15-40)

This function cannot be adjusted during operation.
Ex: Cd62 = 15, PWM Frequency = 1.5KHz
Ex: Cd62 = 30, PWM Frequency = 3.0KHz

§Cd63 Switch point for 3rd phase PWM and 2nd phase PWM(Settable range 5-17)

This function is adjustable during revolution
Ex. Cd63 = 5 when output voltage of inverter exceed rated voltage 5%+3%=8%, inverter output shift from 3rd phase PWM to 2nd phase PWM. When output voltage lower than 5% of rated voltage, inverter output shift from 2nd phase PWM to 3rd phase PWM.
Ex. Cd63 = 17 when inverter output voltage exceed rated voltage 17%+3% =20%, inverter output shift from 3rd phase PWM to 2nd phase PWM. When output voltage lower than 17% of rated voltage, inverter output shift from 2nd phase PWM to 3rd phase PWM.

Adjust and Function Specification

§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,
>   higher of the field current .

Cd 65	Instant initial field time
1	64 ms
2	128 ms
3	256 ms
4	512 ms
5	1024 ms
6	2048 ms
7	4096 ms
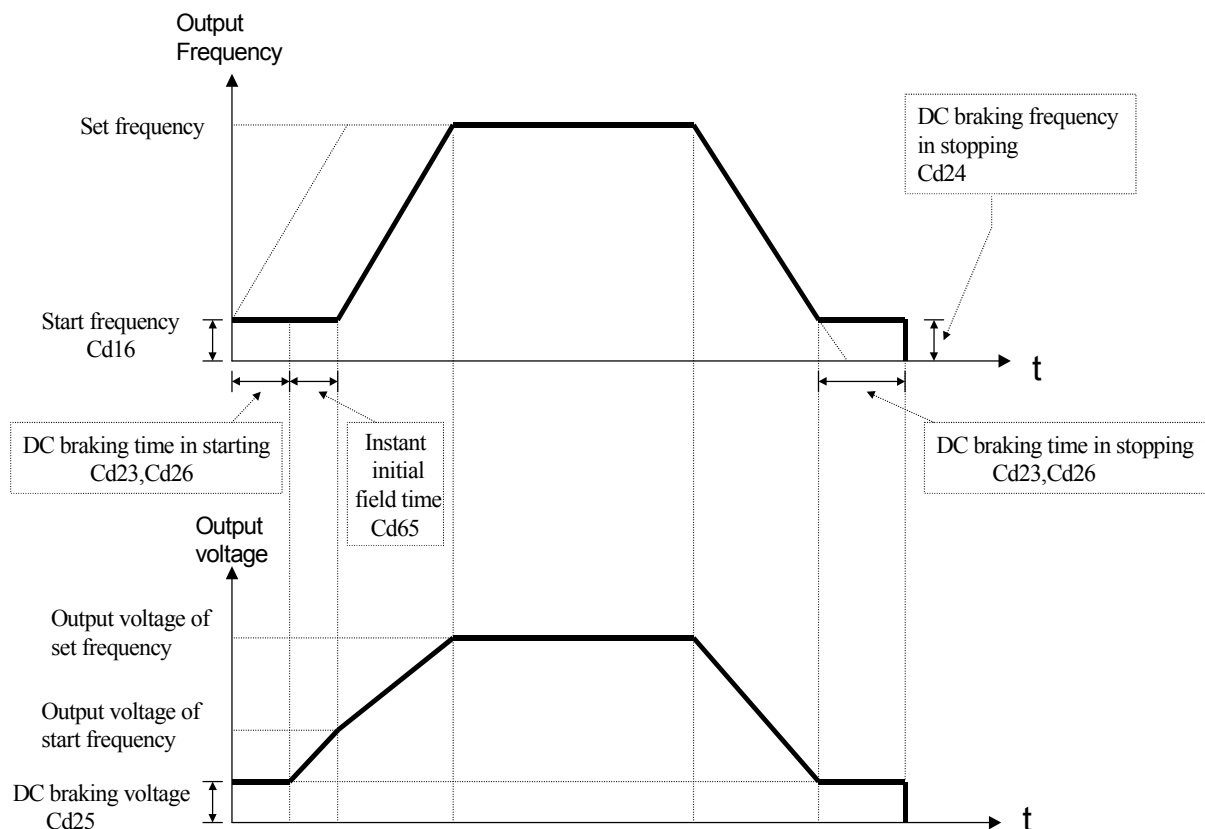
§Cd66 Digital filter function (Settable range 1-6)
  This function is adjustable during revolution
  This is function is active as digital filter while invert with external analogue input.
  Increasing the figure to stabilized frequency while noise of external analogue input is
  higher. Decrease the 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 Dead Time compensation adjustment (Settable range 0-10)
  This function cannot be adjusted during revolution
  This function is to compensate characteristic differential of IC. Therefore, it should be
  adjusted in accordance with individual power IC. Motor would be vibrating if this
  function did not adjust properly. This function has been properly adjusted before
  ex-factory. Recommend customer not to adjust. If adjustment required, start from "5",
  either increase or decrease to a figure that motor operation at the most stable
  operation.

§ 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 $\times$200V $\times$% $\times\sqrt{2}$
  400V series: protection point voltage (VDC)= Cd70 $\times$400V $\times$% $\times\sqrt{2}$

§ Cd71　Over Voltage prevention function active point (Settable range 130~145)
  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 $\times$200V $\times$% $\times\sqrt{2}$
    400Vseries：active voltage (VDC)= setting value $\times$400V $\times$% $\times\sqrt{2}$

§ <u>Cd77   KW-Hour and MW-Hour reset memory   (setting range 0~1)</u>

　When set Cd79=1, KW-Hour and MW-Hour will be recorded automatically when the power off. When set up successfully, "CLr" will showed, and the record will be cleared to zero.

§ <u>Cd79 auto saving function setting (setting range 0~1)</u>
　<u>This function can't be modified during revolution.</u>
　　Cd79=0　Disable auto saving
　　Cd79=1　Enable auto saving. When power off KW-Hour, MW-Hour, Hanks counter, Current time of PLC and current step PLC will be recorded automatically.

§ <u>Cd80   Modbus Protocol and communication mode setting (settable range 0-6)</u>
　<u>This function can't be modified during revolution.</u>
　Selection of operation method on RS485 communication port. Supporting Modbus Protocol.
　Cd80=0　RS485 shut down communication interface.
　Cd80=1　Active RTU Mode. Parameter change is not allowed.
　Cd80=2　Active RTU Mode. Allow changes on general parameter.
　Cd80=3　Active RTU Mode. Allow changes on operation instruction and general parameter.
　Cd80=4　active ASCII Mode. Parameter change is not allowed.）
　Cd80=5　active ASCII Mode. Allow changes on general parameter.）
　Cd80=6　active ASCII Mode. Allow changes on operation instruction and general parameter.）

§ <u>Cd81   RS485 communication address setting (settable range 1-240)</u>
　<u>This function can not be modified during revolution</u>
　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.

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

§ <u>Cd83   Series communication response time setting（settable range 0-15）</u>
　<u>This function can't be modified during revolution.</u>
　Setting waiting time for response when inverter receive correction data.
　MODBUS RESPONE TIME=(0 ~ 8ms) + (8ms * CD83)

§ <u>Cd84　Series communication broadcasting function setting　（settable range 0-3）</u>
<u>This function can't be modified during revolution</u>

When setting communication, wither active group broadcasting (MODBUS Function 241~255) or global broadcasting (MODBUS Function 0) function.
Cd84=0　Active both group and global broadcasting.
Cd84=1　De-active group broadcasting, active global broadcasting.
Cd84=2　Active group broadcasting, de-active global broadcasting.
Cd84=3　De-active both group and global broadcasting.

§ <u>Cd86　RS485 port utility setting (setting range 0-1)</u>
<u>The function cannot be modified during revolution</u>

Selection of utility of 2 sets RS485 series communication interface.
Cd86=0　Only use RS422 or A set RS485 (Modbus protocol).
Cd86=1　Use A set for Remote Keypad, B set RS485 (Modbus protocol).
Cd86=2　Only use A set for Remote Keypad.

Caution:
1. When using B set RS485 series communication interface, J13 at PCB C16D115 must be shorted and adjust J11 to proper position.
2. When using B set RS485, Vout terminal will be disable.
3. Detail information refers to section at Serial Communications User Manual.

§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.

§ CE11 - CE20   Multi-step function control frequency setting（settable range 0.5-240HZ）

Maximum 10 steps.

CE11 1st step speed setting
CE12 2nd step speed setting
CE13 3rd step speed setting
CE14 4th step speed setting
CE15 5th step speed setting
CE16 6th step speed setting
CE17 7th step speed setting
CE18 8th step speed setting
CE19 9th step speed setting
CE20 10th step speed setting

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

Maximum 10 steps. End of entire procedure if time setting = 0.

CE21 1st step time setting
CE22 2nd step time setting
CE23 3rd step time setting
CE24 4th step time setting
CE25 5th step time setting
CE26 6th step time setting
CE27 7th step time setting
CE28 8th step time setting
CE29 9th step time setting
CE30 10th step time setting

§ CE37   1st frequency increase setting (setting range 0.0~10.0%)

(1st Bob up speed %)

Set the 1st frequency increase percentage. The setting is related with current working speed of inverter.

When Inverter working under multi-step function mode(Cd01=7), and CE47=2, or 3, Cd59=1, short terminal 5(UP) and COM, then the speed will be

Operation frequency = current steps' frequency + (current steps' frequency $\times$CE37)

§ <u>CE38　2nd frequency increase setting (setting range 0.0~10.0%)</u>

(2nd Bob up speed %)

Set the 2nd frequency increase percentage.

§ <u>CE39　3rd frequency increase setting (setting range 0.0~10.0%)</u>

(3rd Bob up speed %)

Set the 3rd frequency increase percentage.

§ <u>CE40　Setting Times of 1st frequency increase (setting range0～200min)</u>

(1st Bob up speed % time)

Set the time of 1st frequency increase percentage.

When multi-step operation time shorter than CE40, CE37 will be the current frequency increase order. If CE40=0 it will use CE37 as frequency increase order, no matter what is the perform time in multi-step function.

§ <u>CE41　Setting Times of 2nd frequency increase (setting range0～200min)</u>

(2nd Bob up speed % time)

Set the time of 2nd frequency increase percentage.
When multi-step function operation time longer than CE40 and shorter than CE41, the frequency will increased as CE38. If CE41=0 it will use CE38 as frequency increase order, no matter what is the perform time in multi-step function.

When multi-step operation time is longer or equal to CE41, it will use CE39 as current frequency increase order.

§ <u>CE42　1st frequency decrease setting (Setting range 0.0~10.0%)</u>

(1st Bob down speed %)

Set the 1st frequency decrease percentage. The setting is related with current working speed of inverter. When inverter working under multi-steps function mode(Cd01=7), and CE47=2, or 3、Cd59=1, short external terminal 3(DOWN) and COM, then the speed will be

　Operation frequency = current steps' frequency – (current steps' frequency $\times$ CE42)

§ <u>CE43　2nd frequency decrease setting (Setting range 0.0~10.0%)</u>

(2nd Bob down speed %)

Set the second frequency decrease percentage.

§ <u>CE44　3rd frequency decrease setting (Setting range 0.0~10.0%)</u>

(3rd Bob down speed %)

Set the third step frequency decrease percentage.

§ <u>CE45　Setting Times of 1st frequency decrease (setting range 0~200min)</u>

<u>(1st Bob down speed % time)</u>

Set the time of 1st frequency decrease percentage.
When multi-steps operation time shorter than CE45, CE42 will be the current frequency decrease order.

If CE45=0 it will use CE42 as frequency decrease order, no matter what is the time of the perform time in multi-step function.

§ <u>CE46　Setting Times of 2nd frequency decrease (setting range 0~200min)</u>

<u>(2nd Bob down speed % time)</u>

Set the time of 2nd frequency decrease percentage.
When multi-steps operation time longer than CE45 and shorter than CE46, the frequency will decrease as CE43.

If CE46=0 it will use CE43 as frequency decrease order, no matter what is the perform time in multi-step function. When multi- steps operation time longer or equal to CE46, it will use CE44 as current frequency decrease order.

§ <u>CE47　Multi steps function modes selection（settable range0～1）</u>
<u>The function cannot be modified during revolution</u>
Select operation modes on speed variation when process control switch from previous step to next step.
CE47=0 Liner operation
CE47=1 Gradually 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.)

CE47=2 Liner operation use Up/Down Speed % function.

CE47=3 Gradually operation use Up/Down Speed % function. (Perform time can set to zero, when perform time set to 0, acceleration/deceleration time will according to CD08, CD09. If the steps' frequency set to 0, the step will be ended.)

Liner operation	

Gradually operation	
Up/Down Speed % function	
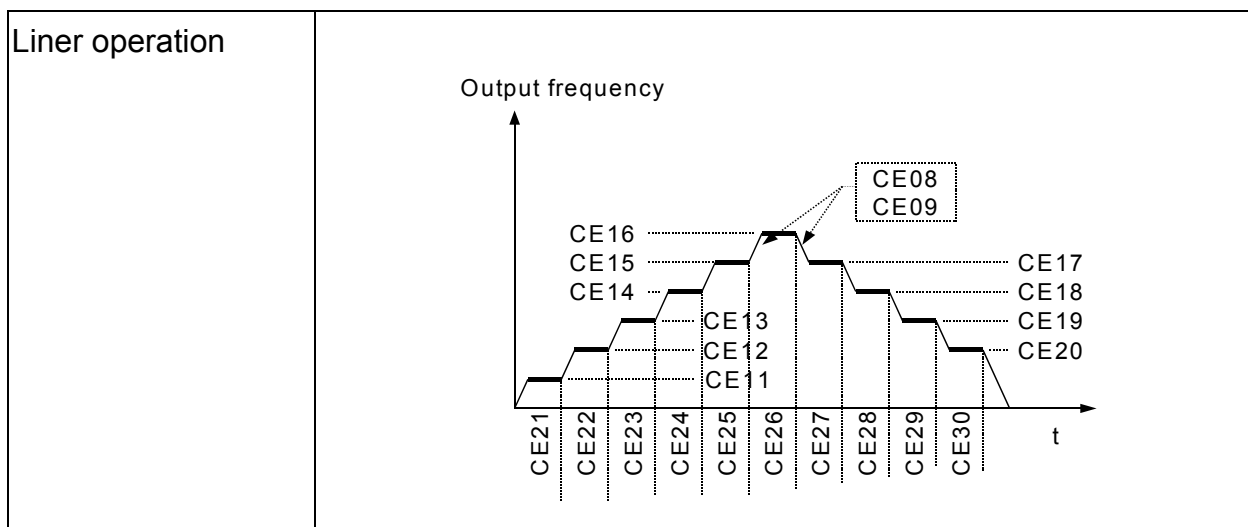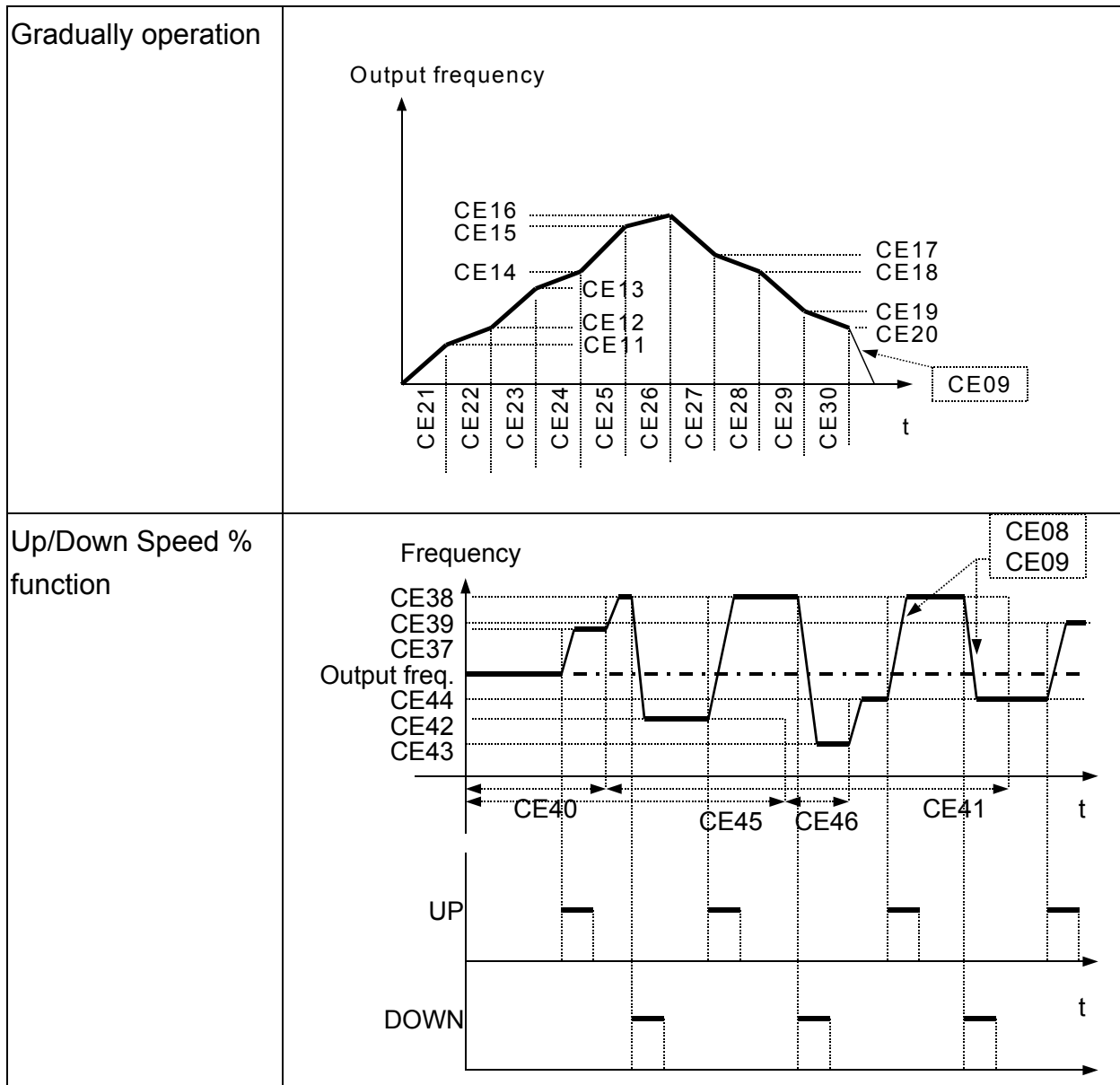
§ <u>CE48   Multi steps function operation reset (settable range0～1)</u>
<u>The function cannot be modified during revolution</u>
Memorized of current operation step and time (in sec) while shut down or power failure.
Step and time reset to 0 when set CE48=1.

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 to1, then change to first step's speed.
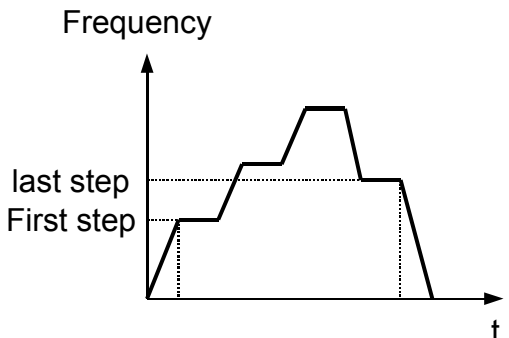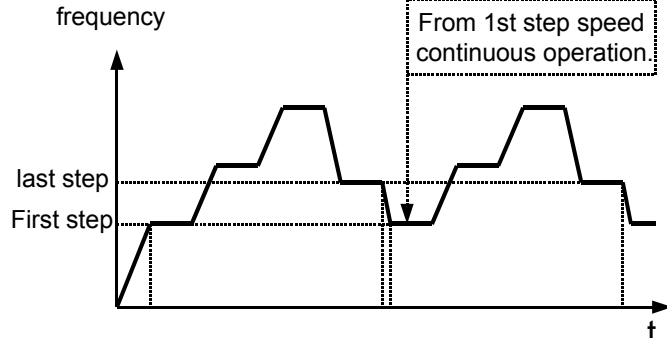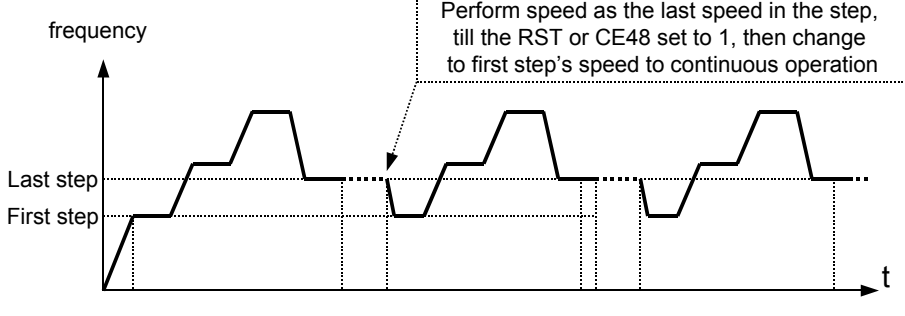
Not continuous operation	
Continuous operation	
Continuous operation, perform speed as the last speed in the step, till the RST or CE48 set to1	

§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~CE46 are stored in the files.

§ <u>CE53   Multi-steps all files set to default (settable range 0~1)</u>

<u>The function cannot be modified during revolution</u>

The setting can not be changed while the machine is working.

CE53=0 Data remain unchanged.

CE53=1 Reset data in files 1-6 to default.

§ <u>CE54   Multi-steps memory duplicate function (settable range 1~6)</u>

<u>The function cannot be modified during revolution</u>

The setting cannot be changed while the machine is working.

Duplicate current using file (CE05~CE46) to CE54 .

§ <u>CE55   Yards counter clear (settable range 0~1)</u>

Set CE55=1 to clear Yards counter.

§ <u>CE61   Input terminal for Set Point and PI feedback (settable range 0~7)</u>

<u>The function cannot be modified during revolution</u>

CE61	Target value	PI feedback terminal
0	De-active PI control	
1	Set by CE67	IN1
2	Set by CE67	IN2
3	Set by CE67	IN3
4	From terminal IN1	IN2
5	From terminal IN1	IN3
6	From terminal IN3	IN1
7	From terminal IN3	IN2

Note:
   1. IN1(4~20mA) scale to 0~100.0 %， IN2、IN3(0~10V) scale to 0~100.0 %
   2. output frequency = PI output frequency + set frequency
   3. Make sure this parameter setting does not conflict with the setting for Cd01 (Set frequency source).
      Ex: If Cd01=1 then the parameter CE61 cann't be modify to 2 ,4 or 7.
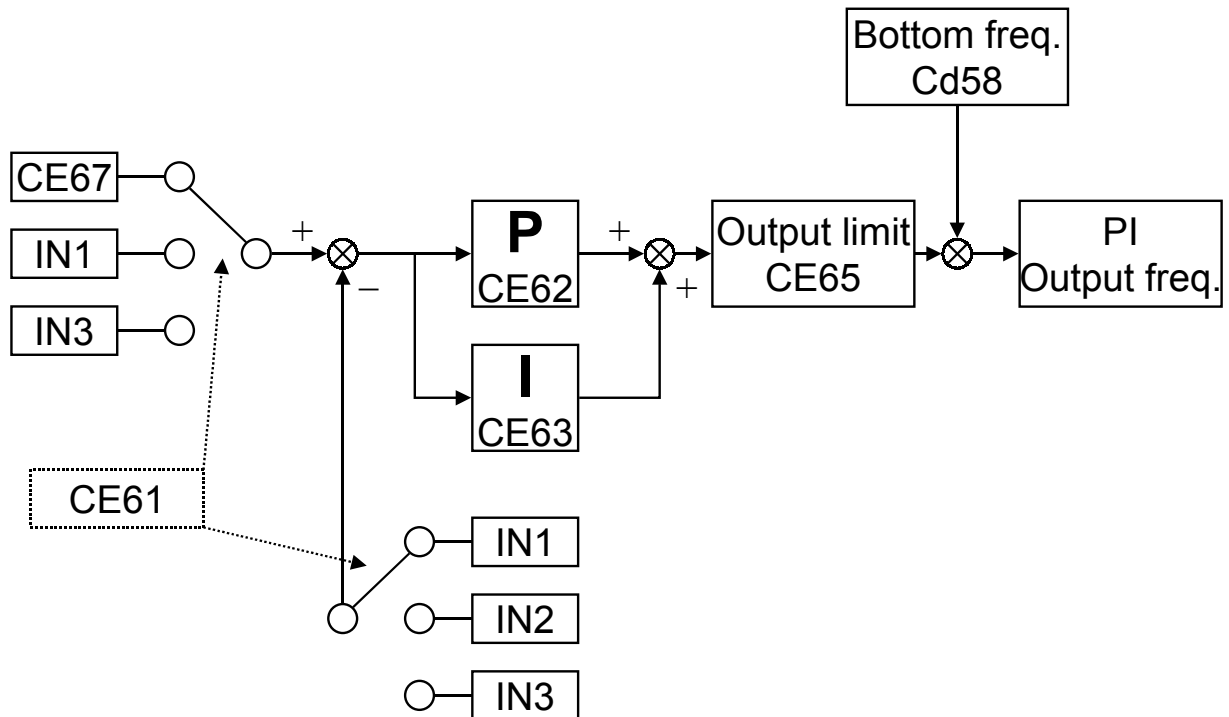
§ <u>CE62   Proportion gain (settable range 0~10.0)</u>

This parameter specifies proportional control and associated gain (P).

§ <u>CE63   Integral gain (settable range 0.2~1000.0 sec)</u>

This parameter specifies integral control (continual sum of the deviation) and associated gain (I).

§ <u> CE65   PI output limit setting (settable 0~100 %)</u>

This parameter defines the percentage of output limit during the PID control.

§ <u>CE67   PI control target value 1 (settable 0~100.0 %)</u>

This parameter defines the percentage of target value.

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

Description of alarm display indications

Error indication	Description of fault operation	Item for inspection	Processing
OH	Overheating of the cooling fan detected	1. Cooling fan stops 2. Ambient temperature too hot 3. Motor being overload	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
ES	Emergency switch active	Check if DI6 and COM are open.	Short DI6 and COM
Fb	Fuse blown	Is the fuse blown	Change a fuse
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. Overload	Reduce the load or increase inverter capacity
	3. Is V/F slope appropriate	Check Code 05 V/F slope is appropriate with motor specification
	4. Is start torque appropriate	Adjust Code 07 torque boost to over come steady friction but not over current trip.
	5. 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
	6. 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

Description of trouble	Possible cause	Solution
"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	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	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

Motor rating (KW)	2.2	3.7	5.5	7.5	11	15	22	30	37	45	55	75	93
Model CT2002F-	2A2	3A7	5A5	7A5	011	015	022	030	037	045	055	075	093
Rated current (A)	11.1	18	23	33	48	61	86	125	150	170	210	278	330
Rated capacity (KVA)	4.4	7.1	9.2	13.1	19.1	24.3	34.3	49	60	68	84	111	131
Power supply	3∮ 200~230V ±10% 50HZ ±5% or 3∮ 200~230V ±10% 60HZ ±5%												
Output voltage	3∮ 200V、220V、230V												
Cooling system	Forced air-cooling												
Outline dimension	Fig1	Fig1	Fig1	Fig2	Fig2	Fig2	Fig2	Fig2	Fig2	Fig2	Fig2	Fig2	Fig2
Weight (Kg)	8	8	9	14	14	20	30	45	60	60	65	70	70

B. 400Vseries

Motor rating (KW)	2.2	3.7	5.5	7.5	11	15	22	30	37	45	55	75	93	112
Model CT2004F-	2A2	3A7	5A5	7A5	011	015	022	030	037	045	055	075	093	112
Rated current (A)	6.2	9	13	17.3	24	31	52	65	71	93	110	156	180	225
Rated capacity (KVA)	4.9	7.1	10.4	13.8	19.1	24.7	41.4	51.8	56.6	74	87.6	124	143	180
Power supply	3∮ 380~460V ±10% 50HZ ±5% or 3∮ 380~460V ±10% 60HZ ±5%													
Output voltage	3∮ 380V、400V、440V、460V													
Cooling system	Forced air-cooling													
Outline dimension	Fig1	Fig1	Fig1	Fig2	Fig2	Fig2	Fig2	Fig2	Fig2	Fig2	Fig2	Fig2	Fig2	Fig2
Weight (Kg)	8	9	9	14	14	18	35	38	40	46	50	65	70	70

C.Standard specification

Control method	Sine P.W.M control
Frequency accuracy	Digital setting: ±0.1%　　Analog setting: ±0.5% (35℃)
Frequency resolution	Digital setting: 0.5～100Hz→0.01Hz　　　100Hz～240Hz→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 boost	0～15.0％ voltage boost, automatic voltage boost
Acceleration / Deceleration time	0.1～6000 sec（linear, two-step setting）
Motor Braking	100% DB. Under 3.7KW Including braking resister.	20% DB. Connect extra braking resister to reach 100% DB.
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 increase/decrease (UP/DOWN) function, BIAS, frequency indicated output (DC0～10V), operation direction setting, forward/reverse prohibit, voltage/current limit, data lock, multi-step function, auto record when power off, 6 memory pattern of multi-step function.
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, fault status, Temperature of PIM module, status of multi-step function, average speed of multi-step function, instant power, power factor, Kwh, Mwh.
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℃～50℃ (Non-condensing and not frozen)
Vibration	Below 0.6G
Humidity	Relative between 45％ to 90% (No condensing)

D. Outline dimension： (unit: mm)

Fig1

Fig2
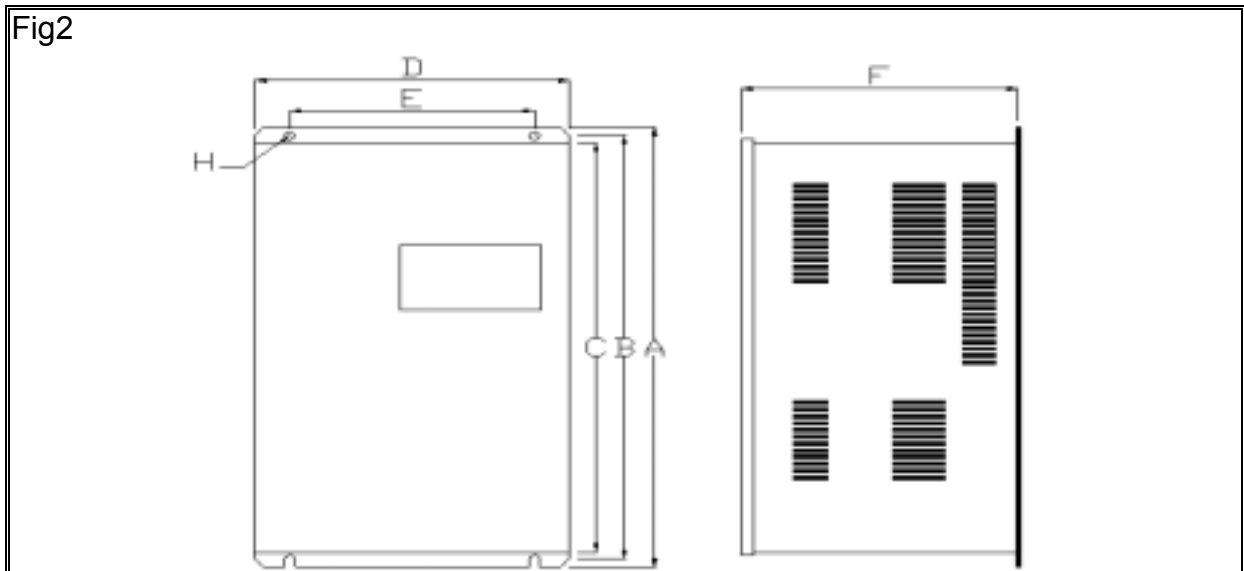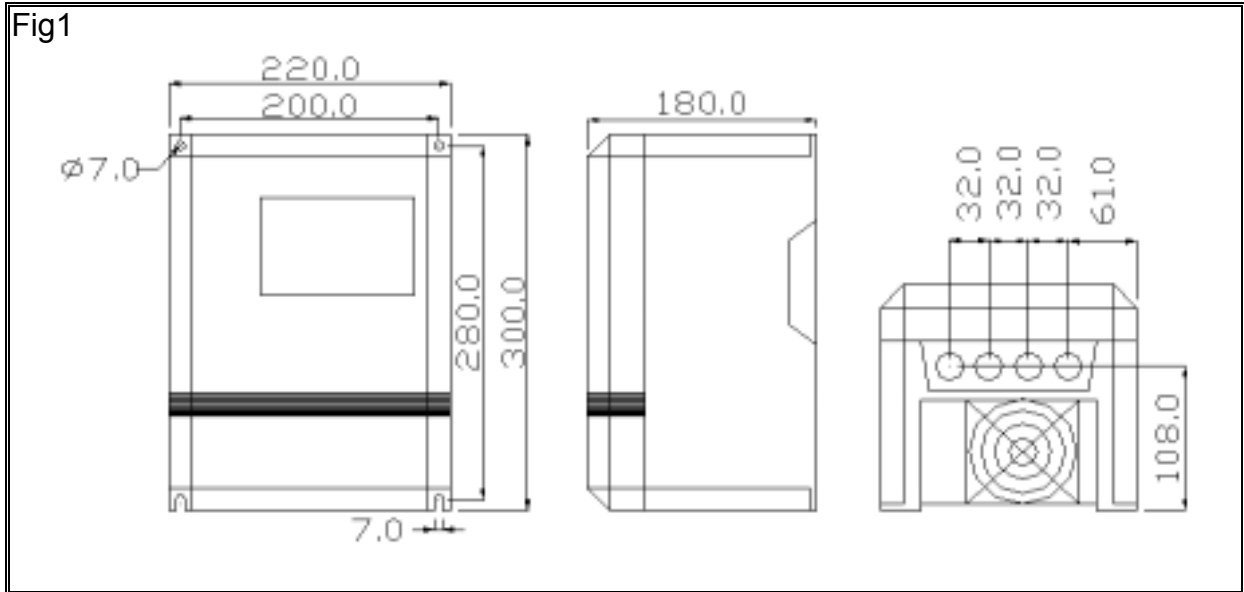
220V Series

KW	A	B	C	D	E	F	G	H
7.5/11	430	414	401	244	190	215	7	Φ7
15/22	492	477	466	283	200	254	7	Φ7
30～45	699	679	668	408	270	314	10	Φ10
55～93	912	892	872	530	350	313	10	Φ10

400V Series

KW	A	B	C	D	E	F	G	H
7.5/15	430	414	401	244	190	215	7	Φ7
22/30	492	477	466	283	200	254	7	Φ7
37～55	699	679	668	408	270	314	10	Φ10
75～112	912	892	872	530	350	313	10	Φ10

11.　Function Code Table

Code No.	Function	Detail of Data	Initial factory setting	MODBUS Address
Cd00	Set frequency	0.5-240Hz	10	128
Cd01	Frequency setting procedure	0: Operation panel Cd00 1: External IN2 (0-10V) 2: External IN1 (4-20mA) 3: External IN2+IN3 (0-10V) 4: External IN2 (0-10V)hysteresis 5: External IN1 (4-20mA)hysteresis 6: External IN2+IN3 (0-10V) 　 hysteresis 7: Multi-steps control	5	129
Cd02	Select monitor display data	0: Frequency (HZ) 1: Current (A) 2: Ultimate speed 3: DC Voltage(d) 4: Output AC Voltage(V) 5: External I/O status(E) 6: Temperature of PIM module(b) 7: operation frequency feedback 8: average speed of multi-step function. 9: current step of multi-step function 10: current time of multi-step function (min) 11: Yards counter 12: power factor 13: transient power (Kw) 14: KWh 15: MWh	0	130
Cd03	Torque mode	0: Without auto boost 1: 3Hz above with auto boost 2: 1.5Hz above with auto boost and frequency compensation 　 3Hz above without frequency compensation	1	131
Cd04	Operation command	0: Operation panel 1: External signal	0	132

Code No.	Function	Detail of Data	Initial factory setting	MODBUS Address
Cd05	V/F pattern	1-10 fixed Modes 11: Set by CD57, CD58 12: 1.5 power curve 13: 1.7 power curve 14: square curve	2	133
Cd06	Motor rated current	25-100%	100	134
Cd07	Torque boost	0-15.0 (0-15.0%)	5	135
Cd08	1st acceleration time	0.1-6000 (S/50HZ)	5	136
Cd09	1st deceleration time	0.1-6000 (S/50HZ)	5	137
Cd10	2nd acceleration time	0.1-6000 (S/50HZ)	10	138
Cd11	2nd deceleration time	0.1-6000 (S/50HZ)	10	139
Cd12	No.2 frequency	HZ	20	140
Cd13	No.3 frequency	HZ	30	141
Cd14	No.4 frequency	HZ	40	142
Cd15	Jogging frequency	0.5HZ-30HZ	5	143
Cd16	Start frequency	0.5HZ-60HZ	1	144
Cd17	Upper limit frequency	10-240HZ	60	145
Cd18	Lower limit frequency	0-100HZ	0	146
Cd19	Jogging acceleration / deceleration time	0.1-10 (S/50HZ)	1	147
Cd20	Jump frequency 1	HZ	0	148
Cd21	Jump frequency 2	HZ	0	149
Cd22	Jump frequency width	0-6HZ	0	150

Code No.	Function	Detail of Data	Initial factory setting	MODBUS Address
Cd23	Braking mode	0: de-active 1: Active when stop 2: Active when start 3: Active both stop and start	0	151
Cd24	DC braking frequency	1-60HZ	1	152
Cd25	DC braking voltage	0-15	5	153
Cd26	DC braking time	1-60 Sec.	1	154
Cd27	Operation direction setting	0: Both forward and reverse 1: Forward only 2: Reverse only	0	155
Cd28	Restart in instantaneous power failure / Free run start	0: Without / Without 1: With / Without 2: Without / With 3: With / With	0	156
Cd29	Time	1-9000 (Sec.)	5	157
Cd30	"Stop" function at panel key under the operation of external sequence	0: Impossible 1: Possible	1	158
Cd31	Initialize data	0: No change 1: Data at the time of shipment	0	
Cd36	Memory clear for fault annunciation	1: Memory clear	0	
Cd37	Frequency gain setting	20-200%	100	165
Cd38	Analog output calibrate	90-110%	100	166
Cd39	Frequency command bias	0-250	125	167
Cd40	No.5 Frequency	HZ	45	168
Cd41	No.6 Frequency	HZ	50	169
Cd42	No.7 Frequency	HZ	55	170
Cd43	No.8 Frequency	HZ	60	171

Code No.	Function	Detail of Data	Initial factory setting	MODBUS Address
Cd44	Stop mode	0: Decelerate stop 1: Free run stop 2: Free run stop after deceleration time is reached	0	172
Cd45	Detect frequency level	0.5-240HZ	0.5	173
Cd46	Speed multiplier	0.01~500	1	174
Cd47	Relay 1 output select	0-6	1	175
Cd48	Relay 2 output select	0-6	1	176
Cd49	Lock data	0: Data change capable 1: Data change not capable	0	177
Cd50	Software version	Read only	x	178
Cd51	Motor rated voltage	10-450 200V Series×1 380V Series×1.73	220	179
Cd52	Motor no-load current	5-60%	30	180
Cd53	Motor slip differential boost	0.0-10.0%	0	181
Cd54	External analog output select	0: Display output frequency 1: Display output current	0	182
Cd55	Field select	0~60%	20	183
Cd56	Current stall preventive	10-200%	180	184
Cd57	Max. frequency FH setting	10-240HZ (FH)	60	185
Cd58	Motor rated frequency Fb	10-240HZ (Fb) FH $\geqq$ Fb	60	186

Code No.	Function	Detail of Data					Initial factory setting	MODBUS Address
Cd59	MBS / RST JOG / 5DF 3DF / DOWN 4DF / UP	Set	DI4	DI6	DI3	DI5	0	187
		0	JOG	MBS	3DF	2DF		
		1	JOG/ yards	RST	3DF/ Down%	2DF/ Up%		
		2	5DF	MBS	3DF	2DF		
		3	5DF	RST	3DF	2DF		
		4	JOG	MBS	DOWN	UP		
		5	JOG	RST	DOWN	UP		
		6	5DF	MBS	DOWN	UP		
		7	5DF	RST	DOWN	UP		
Cd60	V/F Frequency FC	0.5-240HZ					20	188
Cd61	P.W.M. Frequency	1: 4KHZ 2: 6KHZ 3: 8KHZ 4: 10KHZ					2	189
Cd62	PWM Frequency2	15~40					30	190
Cd63	Switch point for 3rd quarter and 2nd quarter	5~17					7	191
Cd64	Dynamic braking mode	0~1					1	192
Cd65	Instant initial field time	1~7					1	193
Cd66	Digital filter function	1~6					5	194
Cd67	Power source positioning accuracy calibration	0~30					0	195
Cd68	Dead Time compensation adjustment	0~10					10	196
Cd69	Reserved							
Cd70	Dynamic Braking active level	120~140%					130	198
Cd71	Over Voltage prevention function active point	130~145%					140	199
Cd72	Reserved							
Cd77	Kwh, Mwh memory clear	1: clear					0	

Code No.	Function	Detail of Data	Initial factory setting	MODBUS Address
Cd79	Auto record when power off	0: de-active 1: active	1	
Cd80	Modbus protocol data frame and Communications mode setting	0: De-active 1: Active with RTU mode, only for monitoring.(8,n,1) 2: Active with RTU mode, change general parameter.(8,n,1) 3: Active with RTU mode, change of general parameter. Operational command by remote control.(8,n,1) 4: Active with ASCII mode, only for monitoring.(7,e,1) 5: Active with ASCII mode, change general parameter.(7,e,1) 6: Active with ASCII mode, change of general parameter. Operational command by remote control.(7,e,1)	3	208
Cd81	RS485 Communication ID Setting	1～240	1	209
Cd82	RS485 Baud rate	0:2400 bps 1:4800 bps 2:9600 bps 3:19200 bps	2	210
Cd83	Series communication response time.	0～15	0	211
Cd84	Series Communication broadcasting function selection	0: Active both group and global broadcasting 1: Active only group broadcasting. 2: Active only global broadcasting 3: De-active both group and global broadcasting.	0	212
Cd85	Reserved			
Cd86	RS485 interface selection	0: Use A+, A- port as RS422/RS485 with modbus protocol 1: Use A+, A- port be de-active 2: only use remote key pad	0	
Cd87	Reserved			

Code No.	Function	Detail of Data	Initial factory setting	MODBUS Address
CE00	Fault annunciation (The last)	OCPA OCPN OCPD	nOnE	228
CE01	Fault annunciation (Before the last)	OCS OC OL	nOnE	229
CE02	Fault annunciation (The 2nd before the last)	OU PLU	nOnE	230
CE03	Fault annunciation (The 3rd before the last)	Erc nonE	nOnE	231
CE04	Reserved		0	
CE11	1st step speed setting	0～240Hz	0	233
CE12	2nd step speed setting	0～240Hz	0	234
CE13	3rd step speed setting	0～240Hz	0	235
CE14	4th step speed setting	0～240Hz	0	236
CE15	5th step speed setting	0～240Hz	0	237
CE16	6th step speed setting	0～240Hz	0	238
CE17	7th step speed setting	0～240Hz	0	239
CE18	8th step speed setting	0～240Hz	0	240
CE19	9th step speed setting	0～240Hz	0	241
CE20	10th step speed setting	0～240Hz	0	242
CE21	1st step time setting	0～100Min	0	249
CE22	2nd step time setting	0～100Min	0	250
CE23	3rd step time setting	0～100Min	0	251
CE24	4th step time setting	0～100Min	0	252
CE25	5th step time setting	0～100Min	0	253
CE26	6th step time setting	0～100Min	0	254

Code No.	Function	Detail of Data			Initial factory setting	MODBUS Address
CE27	7th step time setting	0～100Min			0	255
CE28	8th step time setting	0～100Min			0	256
CE29	9th step time setting	0～100Min			0	257
CE30	10th step time setting	0～100Min			0	258
CE37	1st up Speed %	0~10.0%			0	265
CE38	2nd up Speed %	0~10.0%			0	266
CE39	3rd up Speed %	0~10.0%			0	267
CE40	1st up Speed time	0~200 min			0	268
CE41	2nd up Speed time	0~200 min			0	269
CE42	1st down Speed %	0~10.0%			0	270
CE43	2nd down Speed %	0~10.0%			0	271
CE44	3rd down Speed %	0~10.0%			0	272
CE45	1st down Speed time	0~200 min			0	273
CE46	2nd down Speed time	0~200 min			0	274
CE47	Multi-step function mode selection	0～3			0	275
CE48	Multi-step function reset	0～1			0	
CE49	Multi-step function continuous operation selection	0～2			0	277
CE50	Multi-step function time error adjust	0～256			100	
CE52	File select	1～6			1	
CE53	All Files Restore	0～1			0	
CE54	File copy	1～6			0	
CE55	Yards counter clear	0~1			0	
CE61	PI control Target value/feedback terminal select	Set	Target	Feedback	0	289
		0	De-active			
		1	CE67	IN1		
		2	CE67	IN2		
		3	CE67	IN3		
		4	IN1	IN2		
		5	IN1	IN3		
		6	IN3	IN1		
		7	IN3	IN2		

CE62	P gain	0.0~10.0	0.0	290
CE63	I gain	0.2~1000.0 Sec	1.0	291
CE64	Reserved			
CE65	Output limit	0.0~100.0 %	100.0	293
CE67	Target value setting	0.0~100.0 %	100.0	295

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	Vac=Output voltage /$\sqrt{2}$	0～9999	0.1	332
External terminal mode		0～255		333
Module Temperature		112～1130	0.1℃	234
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	Bit 4,3,2,1,0 = 0:None 4:OCPA 5:OCPd 6:OCPn 8:OV 10:OH 12:OL 14:OC 15:PLU 16:OL2 17:BuOH			337
Power factor		0~100	0.01	338
Instant power		0~65535	0.01KW	339
KW-H		0~9999	0.01KWH	340
MW-H		0~65535	0.1MWH	341
Current time of multi-step function		0~999	1min	342
Yards counter's low 8bits & Current step of multi-step function	0~7 bit: Current step of multi-step function	0～16	1step	343
	8~15 bit : Yards counter's low 8bits	0～255	0.01 yard	
Yards counter's high 16bits		0～65535	2.56 yard	344
Operation frequency		0～24000	0.01HZ	368
IN1(0~20mA)		0~1023		369
IN2(0~10V)		0~1023		370
IN3(0~10V)		0~1023		371

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 J11 and J13.

	J11	J13	Figure
Single RS422	Pin 2-3 short	Open	13-1
Single RS485	Pin 1-2 short	Open	13-2
Remote keyboard & Single RS485	Pin 1-2 short Pin 2-3 short	Short	13-3
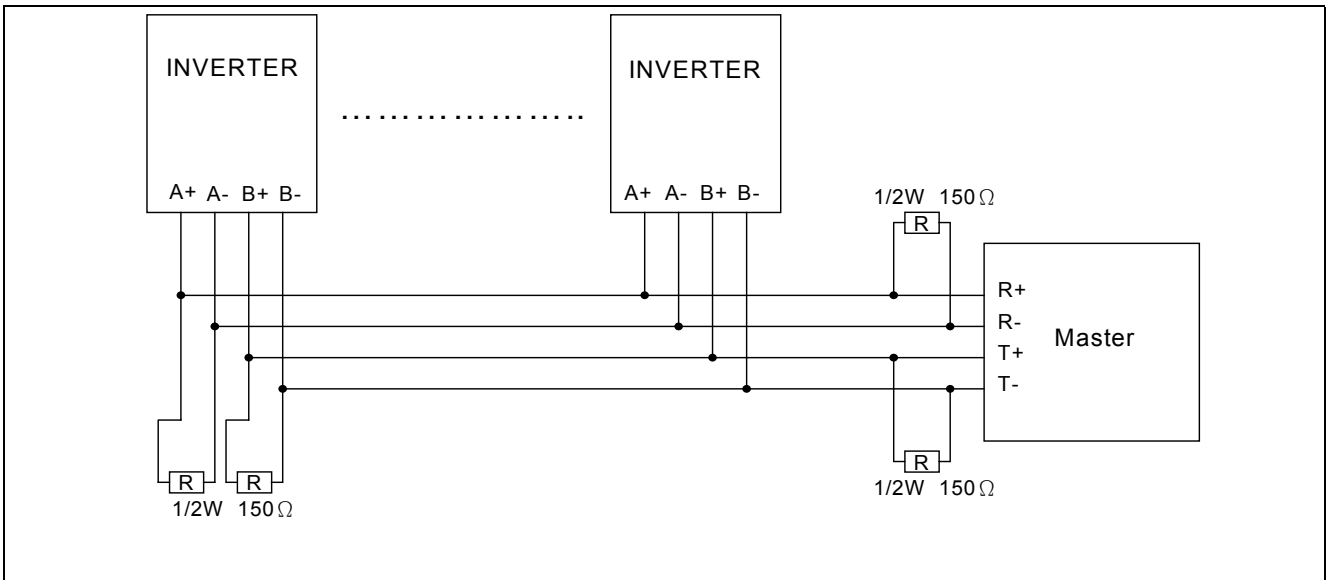
Fig 13-1
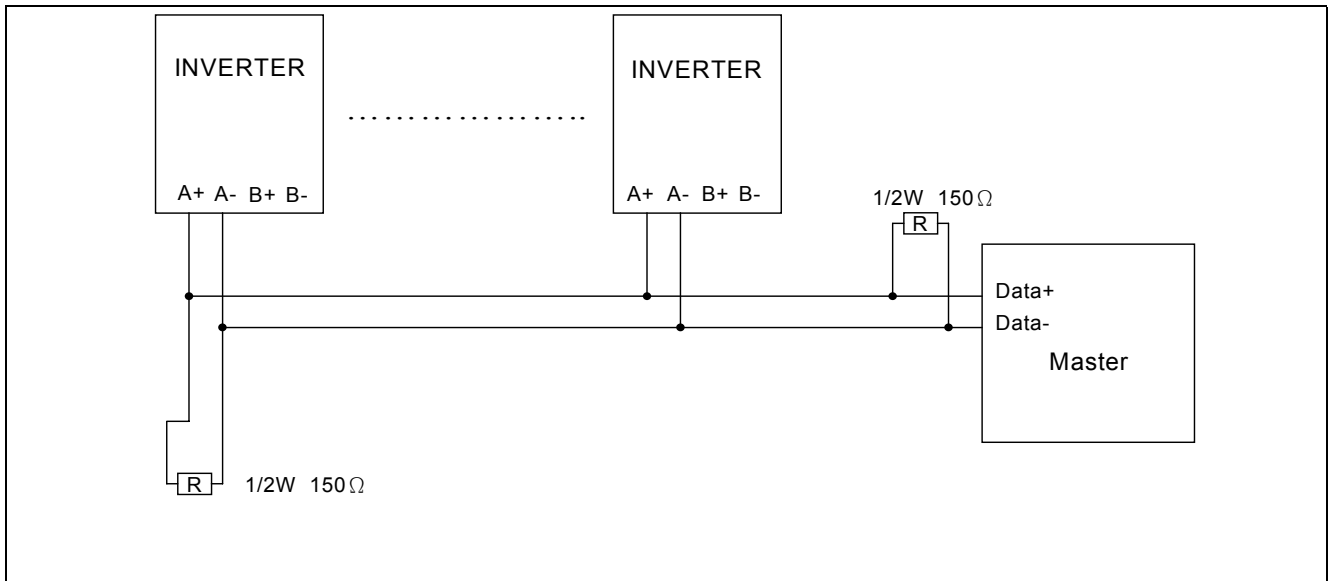
Fig13-2
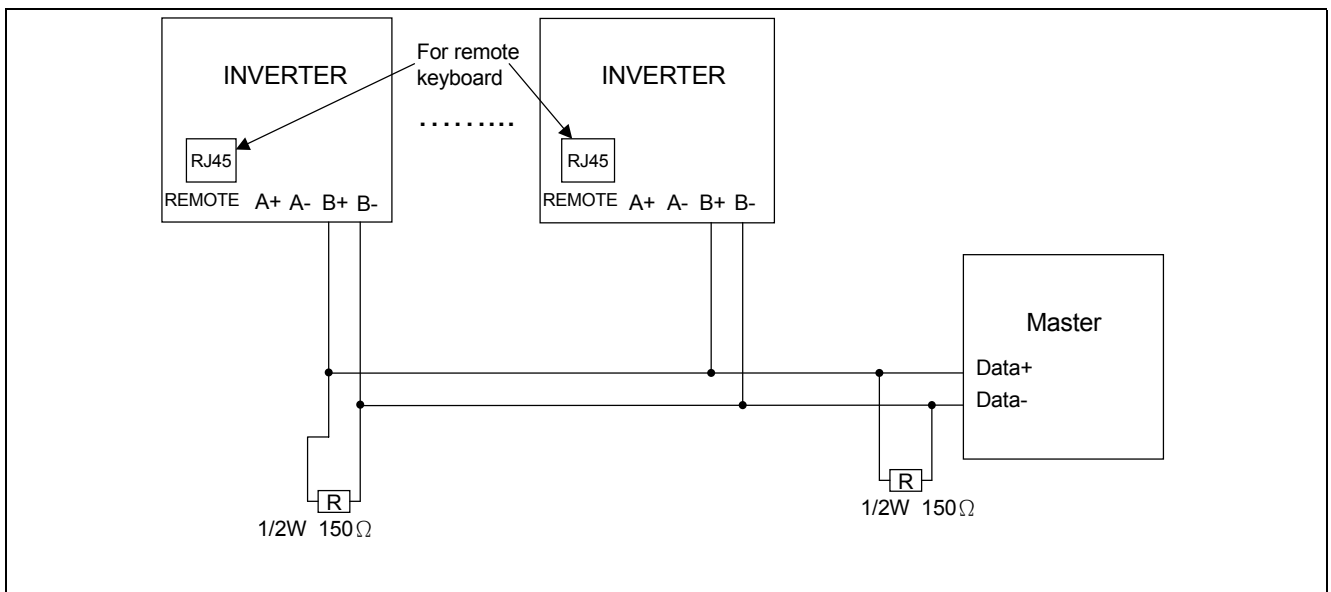
Fig13-3

Note：

 a. When use REMOTE Keyboard and second set RS485 at the same time，please notice that external terminal Vout will be disabled.

 b. When use RS422 (4wires), The 'REMOTE' socket cannot connect to any device.

 c. Single transaction can read up to 10 continuous data from slave device.

 d. It can connect up to 32 devices in single net.

 e. The R in wiring diagram is terminal resister, 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					

C. Function code
    This product support 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
1st Data Hi	03	0 3	0000 0011
1st Data Lo	E8	E 8	1110 1000
2nd Data Hi	00	0 0	0000 0000
2nd Data Lo	07	0 7	0000 0111
3rd Data Hi	00	0 0	0000 0000
3rd 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 */

/* SUBROTINUE OF CRC CACULATE 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 function.
   (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
Group1	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