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Chapter 1 Operation

⚠ WARNING

• Be sure not to touch the main terminal or to check the signal or put on/off wire and/or connector.
Otherwise, there is a danger of electric shock.

• Be sure to turn on the input power supply after closing from cover.
While being energized, be sure not to open the front cover.
Otherwise, there is a danger of electric shock.

• Be sure not to operate the switches with wet hands.
Otherwise, there is a danger of electric shock.

• While the inverter is energized, be sure not to touch the inverter terminals even during stoppage.
Otherwise, there is a danger of electric shock.

• If the retry mode is selected, it may suddenly restart during the trip stop. Be sure not to approach the machine.
(Be sure to design the machger of ine so that personnel safety will be secured even if it restarts.)
Otherwise, there is a daninjury.

• Be sure not to select retry mode for up and down equipment or traveling equipment, because there is output free-running mode in term of retry.
Otherwise, there is a danger of injury and/or machine breakage

• Even if the power supply is cut for a short period of time, it may restart operation after the power supply is recovered if the operation command is given. If it may incur danger to personnel, be sure to make a circuit so that it will not restart after power recovery.
Otherwise, there is a danger of injury.

• The stop key is effective only when the function is set. Be sure to prepare the key separately from the emergency stop.
Otherwise, there is a danger of injury.

• After the operation command is given, if the alarm reset is conducted, it will restart suddenly. Be sure to set the alarm reset after checking the operation command is off.
Otherwise, there is a danger of injury.

• Be sure not to touch the inside of the energized inverter or to put a bar into it.
Otherwise, there is a danger of electric shock and/or fire.

⚠ CAUTION

• Cooling fin will have high temperature. Be sure not to touch them.
Otherwise, there is a danger of getting burned.

• Low to high speed operation of the inverter can be easily set. Be sure to operate it after checking the tolerance of the motor and machine.
Otherwise, there is a danger of injury.

• Install external break system if needed.
Otherwise, there is a danger of injury.

• If a motor is operated at a frequency higher than standard setting value(50Hz / 60Hz), be sure to check the speeds of the motor and the machine with each manufacturer, and after getting their consent, operate them.
Otherwise, there is a danger of machine breakage.

• Check the following before and during the test run.
Otherwise, there is a danger of machine breakage.
Was the direction of motor correct?
Was the inverter tripped during acceleration or deceleration?
Were the rpm and frequency meter correct?
Were there any abnormal motor vibrations or noise?

1.1 Operation

This inverter requires two different signals in order for the Inverter to operate correctly. The Inverter requires both an operation setting and a frequency setting.

The following indicates the details of each method of operation and the necessary instructions for operation.

(1) Operation setting and a frequency setting by the terminal control.

This is the method by connecting signals from the outside (the frequency setting, the starting switch etc.) with the control circuit terminals.

The operation is started when the operation setting (FWD, REV) is turned ON while the input power is turned ON.

NOTE: The methods of the setting frequency with terminal are the voltage setting and the electric setting. And they are selective by each system. The control circuit terminal list shows this in detail.

(Necessary things for operation)

[1] The operation setting: switch, relay etc.

[2] The frequency setting: signals from volume or outside (DCO-10V, DC-10-10V, 4-20mA etc.)

(2) Operation setting and frequency setting with the digital operator.

This is the method for operation from the digital operator, which comes equipped with the inverter as standard, or the remote operator keypad.

When the digital operator sets the operation, the terminals (FWD, REV) don't need to be linked.

And it is possible to select frequency from the digital operator as a method of the frequency setting too.

(Necessary things for operation)

[1] Remote Operator (It's unnecessary in case of digital operator operation)

(3) Operation setting and frequency setting from both digital operator and terminal operator

This is the method of inverter operating from both of the above two operating methods

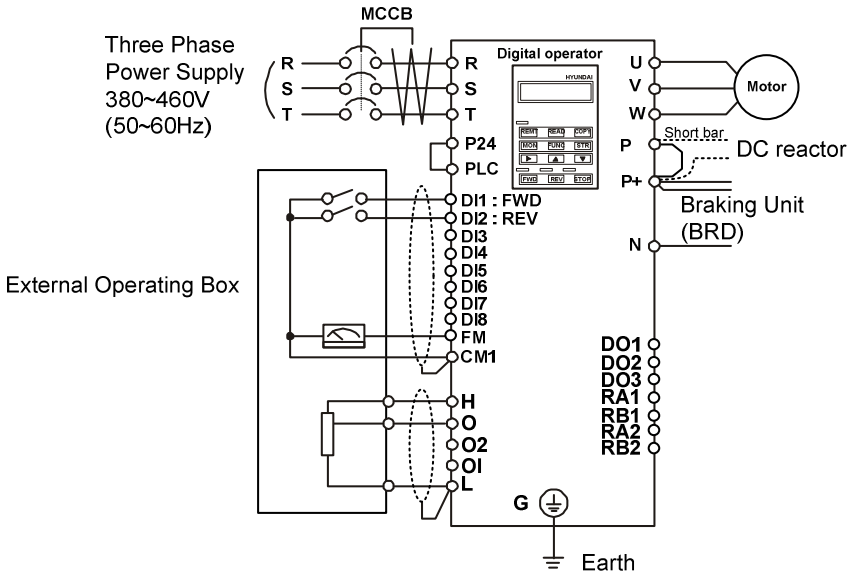
It is possible that the operation setting and the frequency setting can be selected for both the digital operator and the terminal operator each separately.

1.2 Test Run

This is the common connection example.

Please refer to 4.1 Digital Operator, for the detailed use of the digital operator (NOP500).

(1) To input the operation setting and the frequency setting from terminal control.



[Arrangements]

① Please make sure that the connections are correctly secure.

② Turn the MCCB ON to supply power to the inverter.

(The Yellow LED “POWER” on the digital operator should illuminate.)

③ Set terminal with the frequency setting selection[A01].

- Set A01 as indication code, press the ▶ key key once.
- Set 01(TM) with the ▲ key or the ▼ key, press the STR key once to set the frequency setting for terminal.

(Indication code turns back to A001.)

④ Set terminal with the operation setting selection[A02].

- Set A002 as indication code, press the ▶ key once.
- Set 01(TM) with the ▲ key or the ▼ key; press the STR key once to set the operation setting for terminal.

(Indication code turns back to A002.)

⑤ Set monitor mode.

When monitoring the output frequency, set indication code to d01.

Or when monitoring the operating direction, set indication code to d04.

⑥ Input starting operation setting.

- Turn ON between [FWD] and [CM1] of terminal.
- Impress voltage between [O] and [L] of terminal to start operation.

⑦ Input ending operation setting.

- Turn OFF between [FWD] and [CM] to stop slowly down.

Chapter 2 Explanation of Function

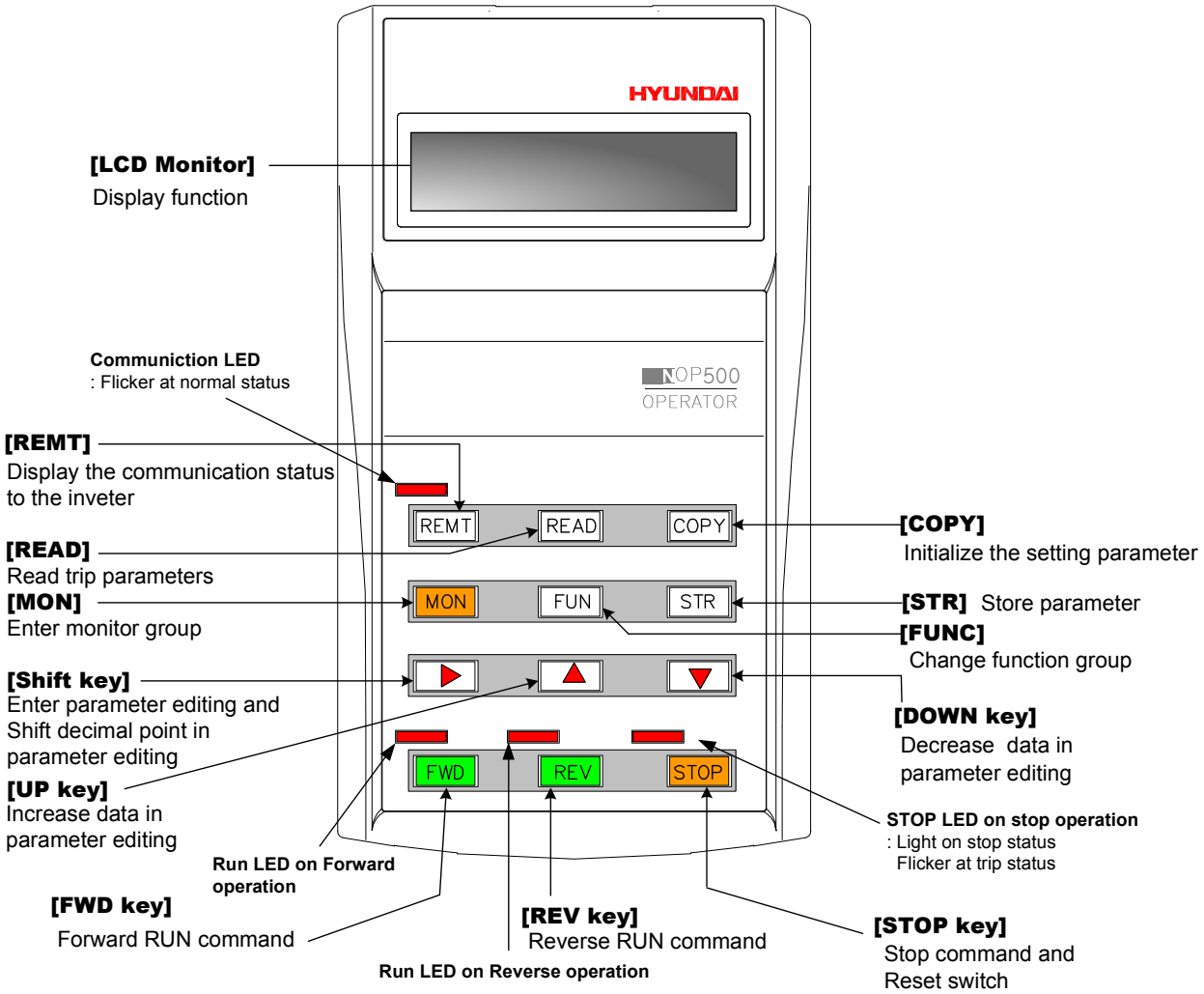
2.1 About Digital Operator

Explanation of operating the digital operator (NOP500) ;

N500 series operates by using the digital operator, which is fitted as standard.

◇ **Name and contents of each part of the digital operator**

- NOP500 does operational command and has copy function so it can memorize the data of inverter at built-in memory chip.
- And, it has [16 characters X 2 lines] LCD Screen.

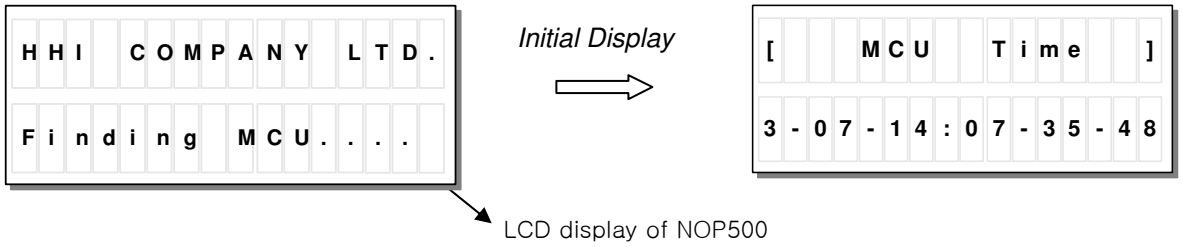


2.2 Setting operation mode

2.2.1 LCD Screen composition

• **Initial Display**

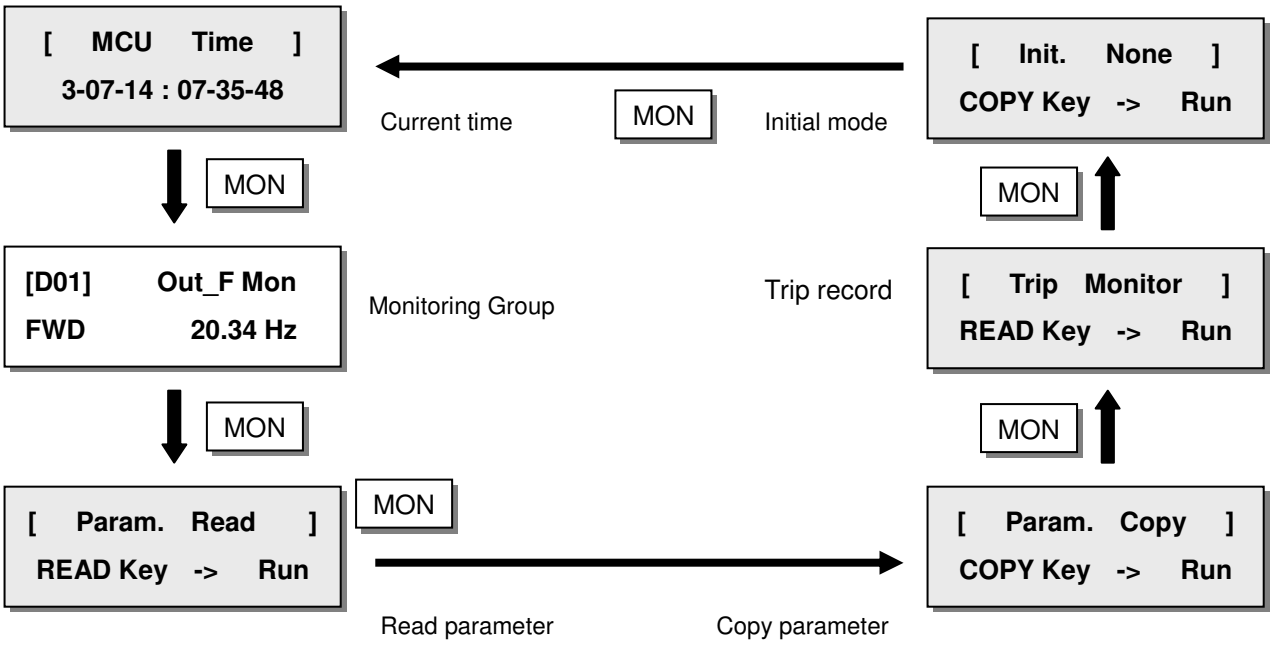
When NOP is turned on, the initial display is as follows and transform monitor mode.



2.2.2 Display method of Monitor mode

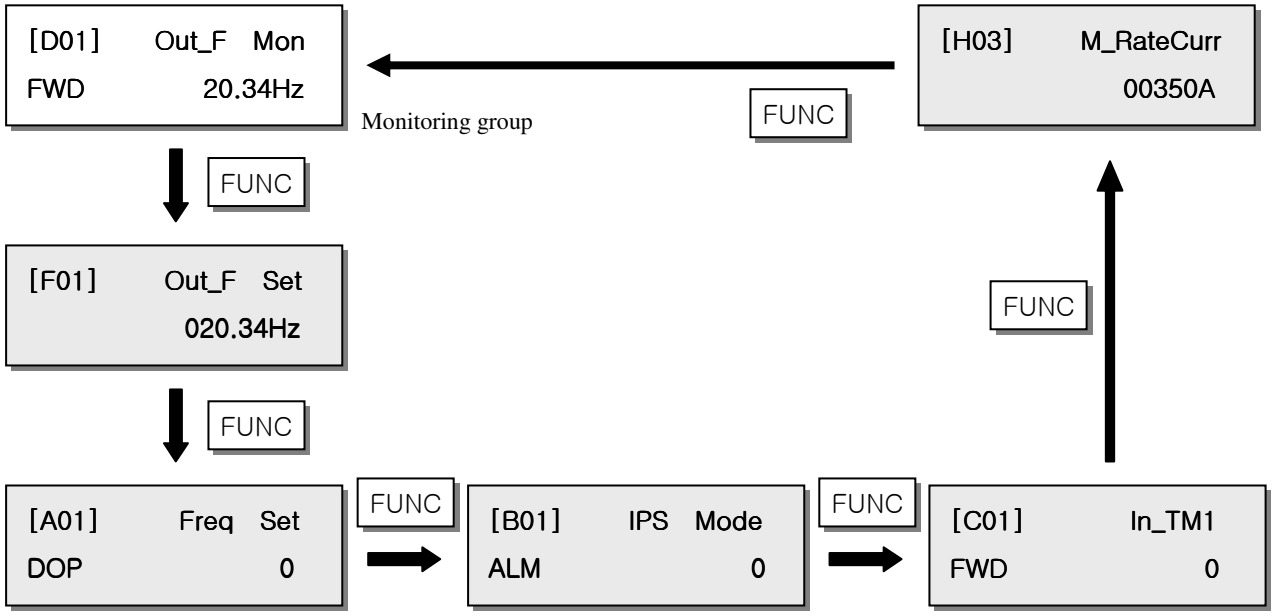
Monitor mode consists of 6 mode. Each mode is explained at function code table.

To change monitor mode of the standard operator is by **MON** key.



2.2.3 Changing method between parameter groups

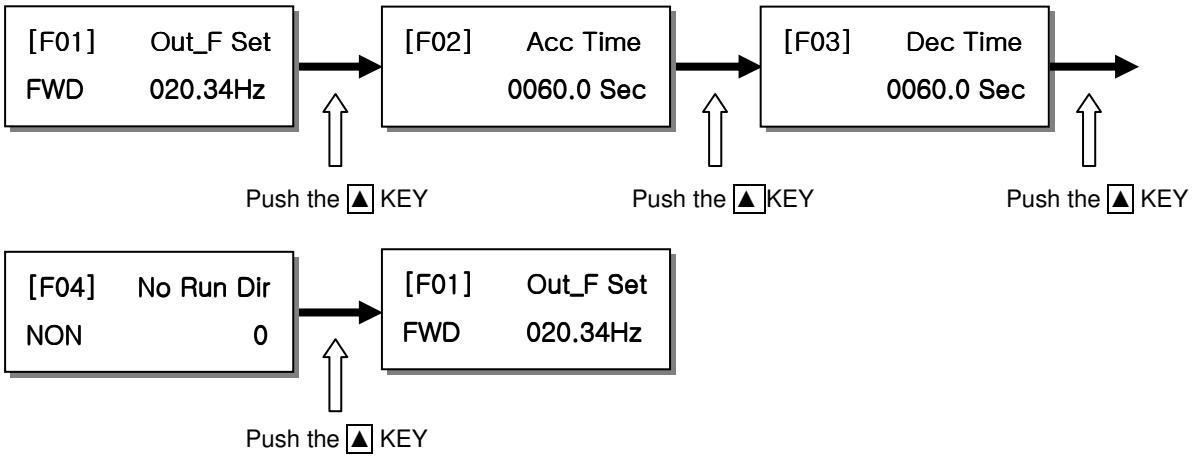
It is possible to shift to other extension function modes from D-Group by FUNC KEY.



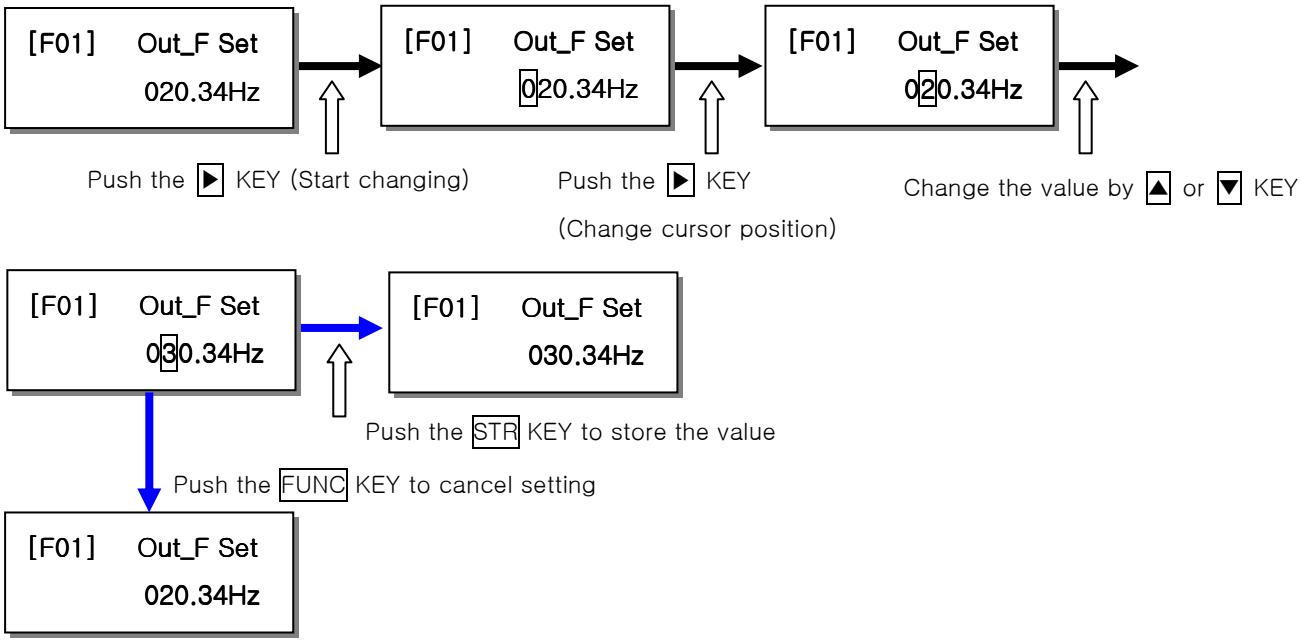
2.2.4 **Changing and setting method of function**

▲ ▼(UP/DOWN) KEY: The keys to change extension function mode, function mode and set value.

1) Change of parameters in each group (Example: F-Group)

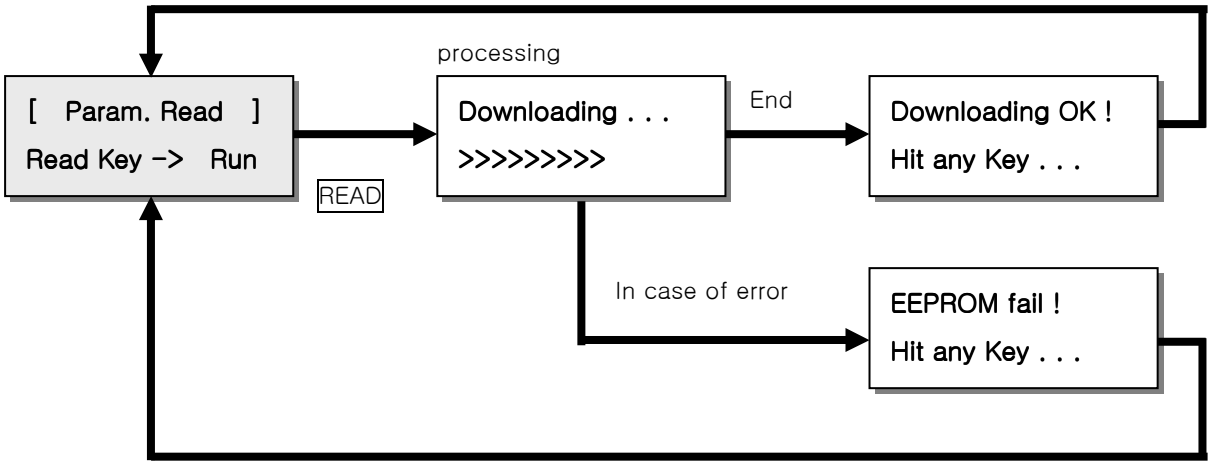


2) Setting method of parameter value (Example: Change of frequency parameter)



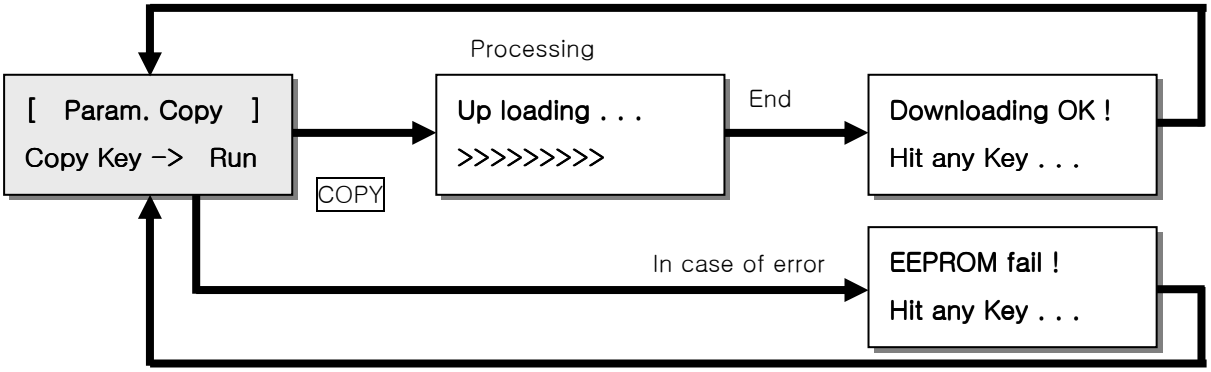
Note) Although pushing the **STR** KEY, the store function will be canceled and the parameter value will be back to the previous value when changing mode which is unchangeable on run and setting value exceed the range..

2.2.5 Reading all parameter values from inverter



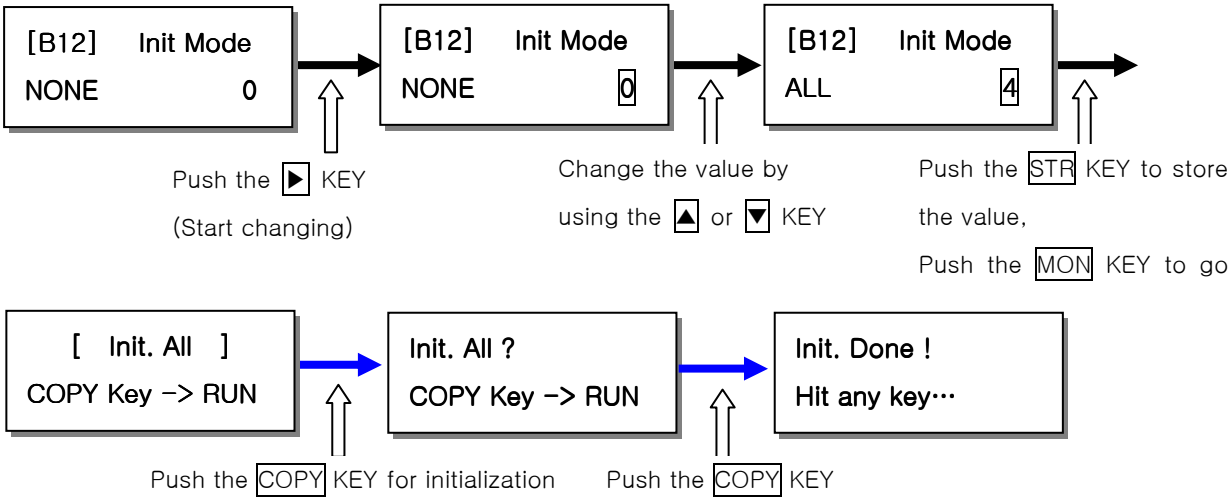
Note) It is impossible to read parameter values on run.

2.2.6 Coping all parameter values from inverter

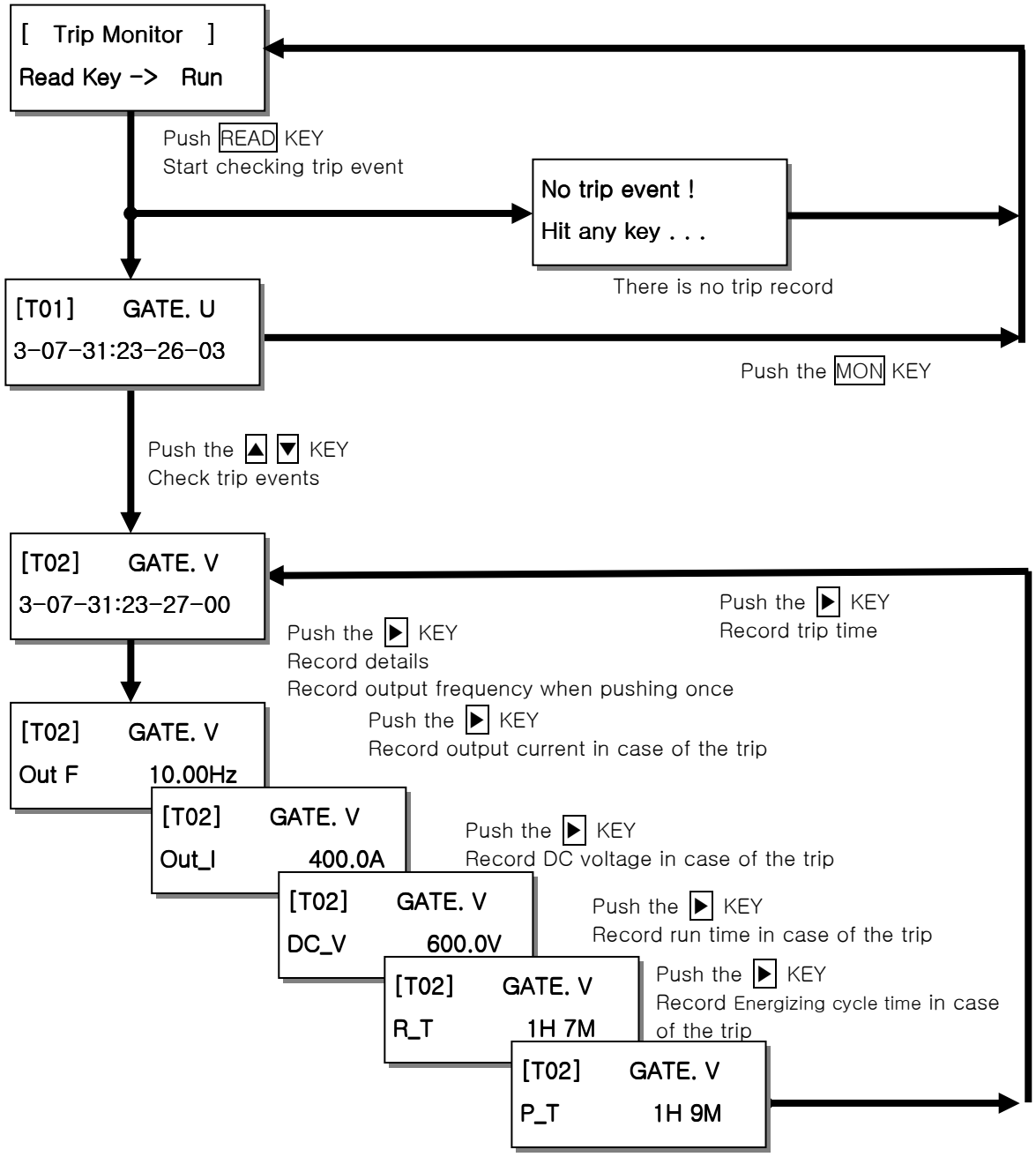


Note) It is impossible to copy parameter values on run.

2.2.7 Initialization of parameter values



2.2.8 Checking the Trip Event



2.2.9 Changing time

Make the same progress as chapter 4.2.4(Setting parameter values) to change time.

Only, press the MON Key (not FUNC Key) to cancel set time.

2.3 Code List

Monitor Mode (D-Group)

Display code		Function name	Monitor range	Initial data	Setting on running	Read/ Copy	Page
Monitor function	D01	Output frequency monitor Out_F Mon	0.00~400.00Hz	0.00Hz	X	X	2-15
	D02	Output current monitor Out_I Mon	0.0~ 6553.5A	0.0A	X	X	2-15
	D03	Output voltage monitor Out_V Mon	0.0~ 6553.5V	0.0V	X	X	2-15
	D04	DC rink voltage DC_V Mon	0.0~ 6553.5V	0.0V	X	X	2-15
	D05	Direction/ Motor rotational speed Speed Mon	0.0~ 6553.5RPM	0.0RPM	X	X	2-15
	D06	PID feedback monitor PID FB Mon	0.0~ 250.0%	0.0%	X	X	2-15
	D07	Intelligent input terminal monitor I_87654421	00000000~11111111	00000000	X	X	2-15
	D08	Intelligent output terminal monitor O_87654421	00000000~11111111	00100000	X	X	2-16
	D09	Power dissipation monitor IPower Mon	0.0~ 6553.5kW	0.0KW	X	X	2-16
	D10	Accumulated time monitor on RUN Run Time	00000~ 65535H 00~ 59M	0H 0M	X	X	2-16
	D11	Power ON time monitor P_On Time	00000~ 65535H 00~ 59M	0H 0M	X	X	2-16

Basic Function Mode (F-Group)

Function code		Function name	Data range	Initial data	Setting on running	Read/ Copy	Page
Main setting	F01	Output frequency setting Out_F Set	B10(Min_F_Set) ~ A04(Max_F_Set)	000.00Hz	O	O	2-17
	F02	1st acceleration time Acc Time	0.01 ~ 3600Sec	0060.0Sec	O	O	2-17
	F03	1st deceleration time Dec Time	0.01 ~ 3600Sec	0060.0Sec	O	O	2-17
	F04	Operation direction selection No Run Dir	0~2 (NON,FWD,REV)	0	X	O	2-17

Expanded Function Mode of A Group (A-Group) : Basic function

Function code		Function name	Setting range	Initial data	Setting on run	read/ code	Page
Base setting	A01	Frequency setting selection	0~3 (DOP, TM, REM, UDT)	0	X	O	2-18
	A02	Operation setting selection	0~2 (DOP, TM, REM)	0	X	O	2-18
	A03	Base Frequecy	30.00~A04(MAX_F_Set)Hz	060.00Hz	X	O	2-19
	A04	Maximum Frequecy	30.00~400.00Hz	060.00Hz	X	O	2-20
Analog Input Setting	A05	External frequency input selection O/OI/O2	0~2 (O, OI, O2)	0	X	O	2-21
	A06	External frequency setting start Ex_Start_F	B10(Min_F_Set) ~ A07(Ex_End_F)	000.50Hz	X	O	2-21
	A07	External frequency setting end Ex_End_F	A06(Ex_Start_F)~ 400.00Hz	060.00Hz	X	O	2-21
	A08	External frequency start rate setting Ex_Start_%	0.0~100.0%	0000.0%	X	O	2-21
	A09	External frequency end tate setting Ex_End_%	0.0~100.0%	0100.0%	X	O	2-21
	A10	External frequency end rate setting Ex_St Sel	0~1 (A_Code,0Hz)	0	X	O	2-21
	A11	External frequency start pattern setting Ex_F Samp	1~1000	00100	X	O	2-22
Multistage speed Jogging frequency setting	A12	Multi-speed 1 Multi_1S	B10(Min_F_Set) ~ A04(Max_F_Set)Hz	000.50Hz	O	O	2-23
	A13	Multi-speed 2 Multi_2S	B10(Min_F_Set) ~ A04(Max_F_Set)Hz	000.50Hz	O	O	2-23
	A14	Multi-speed 3 Multi_3S	B10(Min_F_Set) ~ A04(Max_F_Set)Hz	000.50Hz	O	O	2-23
	A15	Multi-speed 4 Multi_4S	B10(Min_F_Set) ~ A04(Max_F_Set)Hz	000.50Hz	O	O	2-23
	A16	Multi-speed 5 Multi_5S	B10(Min_F_Set) ~ A04(Max_F_Set)Hz	000.50Hz	O	O	2-23
	A17	Multi-speed 6 Multi_6S	B10(Min_F_Set) ~ A04(Max_F_Set)Hz	000.50Hz	O	O	2-23
	A18	Multi-speed 7 Multi_7S	B10(Min_F_Set) ~ A04(Max_F_Set)Hz	000.50Hz	O	O	2-23
	A19	Multi-speed 8 Multi_8S	B10(Min_F_Set) ~ A04(Max_F_Set)Hz	000.50Hz	O	O	2-23
	A20	Multi-speed 9 Multi_9S	B10(Min_F_Set) ~ A04(Max_F_Set)Hz	000.50Hz	O	O	2-23
	A21	Multi-speed 10 Multi_10S	B10(Min_F_Set) ~ A04(Max_F_Set)Hz	000.50Hz	O	O	2-23
	A22	Multi-speed 11 Multi_11S	B10(Min_F_Set) ~ A04(Max_F_Set)Hz	000.50Hz	O	O	2-23
	A23	Multi-speed 12 Multi_12S	B10(Min_F_Set) ~ A04(Max_F_Set)Hz	000.50Hz	O	O	2-23
	A24	Multi-speed 13 Multi_13S	B10(Min_F_Set) ~ A04(Max_F_Set)Hz	000.50Hz	O	O	2-23
	A25	Multi-speed 14 Multi_14S	B10(Min_F_Set) ~ A04(Max_F_Set)Hz	000.50Hz	O	O	2-23
	A26	Multi-speed 15 Multi_15S	B10(Min_F_Set) ~ A04(Max_F_Set)Hz	000.50Hz	O	O	2-23

	A27	Jogging frequency setting Jog_F Set	B10(Min_F_Set) ~ 10.00Hz	001.00Hz	O	O	2-24
	A28	Jogging selection Jog_Stop	0~2 (FRE, DEC, DCB)	0	X	O	2-24

Function code		Function name	Setting range	Initial data	Setting on run	Read/ Copy	Page
V/F Characteristics	A29	Torque boost mode selection Boost Mode	0~1(Man, Auto)	0	X	O	2-25
	A30	Manual torque boost voltage setting T_Boost_V	0.0~20.0%	0001.0%	O	O	2-25
	A31	Manual torque boost frequency setting T_Boost_F	0.0~50.0%	0005.0%	O	O	2-25
	A32	V/F Characteristic curve selection V/F Mode	0~3 (VC, VP1.7, VP2.0, FVF)	0	X	O	2-26
	A33	V/F gain setting V/F Gain	20.0~100.0%	0100.0%	O	O	2-28
DC Braking Settings	A34	DC braking function selection DCB Mode	0~1 (OFF, ON)	0	X	O	2-28
	A35	DC braking frequency setting DCB_F Set	0.0~60Hz	000.50Hz	X	O	2-28
	A36	DC braking output delay time setting DCB Wait_T	0.0~5.0sec	0000.0sec	X	O	2-28
	A37	DC braking force setting DCB Force	0.0~100.0%	0000.0%	X	O	2-28
	A38	DC braking time setting DCB Time	0.0~10.0sec	0000.0sec	X	O	2-28
Upper and lower limiter	A39	Frequency upper limit setting Limit H_F	A40(Limit_L_F) ~ A04(Max_F_Set)Hz	000.00Hz	X	O	2-29
	A40	Frequecy lower limit setting Limit L_F	B10(Min_F_Set) ~ A39(Limit_H_F)Hz	000.00Hz	X	O	2-29
Jump frequency	A41	Jump frequency 1 Jump_Freq1	0.00~400Hz	000.00Hz	X	O	2-30
	A42	Jump frequency width 1 Jump_Wdth1	0.00~10.00Hz	000.00Hz	X	O	2-30
	A44	Jump frequency 2 Jump_Freq2	0.00~400Hz	000.00Hz	X	O	2-30
	A44	Jump frequency width 2 Jump_Wdth2	0.00~10.00Hz	000.00Hz	X	O	2-30
	A45	Jump frequency 3 Jump_Freq3	0.00~400Hz	000.00Hz	X	O	2-30
	A46	Jump frequency width 3 Jump_Wdth3	0.00~10.00Hz	000.00Hz	X	O	2-30
PID control	A47	PID Function selection PID Mode	0~1 (OFF, ON)	0	X	O	2-31
	A48	PID P gain setting PID P_Gain	0.1~5.0	0001.0	O	O	2-31
	A49	PID I gain setting PID I_Gain	0.0~3600.0sec	0001.0sec	O	O	2-31
	A50	PID D D gain setting PID D_Gain	0.0~100.0sec	0000.0sec	O	O	2-31
	A51	PID scale factor setting PID Scale	0.01~200.00%	001.00%	X	O	2-31
	A52	PID Feedback method setting PID Source	0~1 (O, OI)	0	X	O	2-31
AVR	A53	AVR Function selection AVR Mode	0~2 (All_On, All_Off, Dec-Off)	0	X	O	2-33

	A54	Motor input voltage setting AVR_V Sel	0~5 (380V, 400V, 415V, 440V, 460V, 480V)	3	X	O	2-33

Function code		Function name	Setting range	Initial data	Setting on rum	Read/ Copy	Page
Second acceleration and deceleration function	A55	2nd acceleration setting Acc Time2	0.1~3600.0Sec	0015.0sec	O	O	2-34
	A56	2nd deceleration time setting Dec Time2	0.1~3600.0Sec	0015.0sec	O	O	2-34
	A57	2nd stage adjustable selection 2nd_F Mode	0~1 (TM,A_Code)	0	X	O	2-34
	A58	2nd Acceleration frequency 2nd Acc_F	0.00~A04 Hz	000.00Hz	X	O	2-34
	A59	2nd deceleration frequency 2nd Dec_F	0.00~A04 Hz	000.00Hz	X	O	2-34
Accel-decel pattern	A60	Acceleration curve selection Acc Curve	0~3 (Line,S_curv,U-curv,RU-curv)	0	X	O	2-35
	A61	Deceleration curve setting Dec Curve	0~3 (Line,S_curv,U-curv,RU-curv)	0	X	O	2-35

Expanded Function mode (B-Group)

Function code		Function name	Setting range	Initial data	Setting on run	Read/ Copy	Page
Restar mode	B01	Selection of restart mode IPS Mode	0~3 (ALM, FTP, RST, ZST)	0	X	O	2-36
	B02	Allow under-voltage power failure time(IPS Time)	0.3~1.0Sec	0001.0sec	X	O	2-36
	B03	Retry wait time IPS Wait	0.3~100.0Sec	0001.0sec	X	O	2-36
Electronic thermal	B04	Electronic thermal level setting E_Thm Set	20.0~120.0%	0100.0%	X	O	2-37
	B05	Electronic thermal characteristic selection (E_Thm Char)	0~1 (CRT, SUB)	0	X	O	2-37
Overload Restriction	B06	Overload restriction selection OLoad Mode	0~2 (All_Off, A/F_On, Fix-On)	0	X	O	2-37
	B07	Overload restriction level OL_Lev Set	50.0~200.0%	0120.0%	X	O	2-37
	B08	Overload restriction constant OL_Val Set	0.1~30.0Sec	0001.0sec	X	O	2-37
Lo ck	B09	Software lock mode selection SLock Mode	0~4 (SFT_All, SFT_Fset, All, Fset, Normal)	4	X	O	2-39
Other Function	B10	Start frequency setting Min_F Set	0.10~10.00Hz	000.50Hz	X	O	2-39
	B11	Carrier frequency setting Cary_F Set	2.0~4.0kHz	0002.0KHz	X	O	2-39
	B12	Initialization mode Init Mode	0~4 (NONE,TRIP, PARAM, TIME, All)	0	X	O	2-40
	B13	Initializatio data selection Init Data	0~3 (2800HF, 3500HF, 3200HFP, 3800HFP)	1	X	O	2-40
	B14	STOP key validity during terminal operation (Stop SW)	0~1 (OFF,ON)	0	X	O	2-40

	B15	Free-run Stop FRS Mode	0~1 (ZST,FST)	0	X	O	2-41
	B81	Digital frequency gain setting FM Gain	0~2000	000.85	X	O	2-40

Function code		Function name	Setting range	Initial data	Setting on run	Read/ Copy	Page
Free V/F setting	B100	Free V/F frequency 1 Free Freq1	0.00~B102	000.00Hz	X	O	2-41
	B101	Free V/F voltage 1 Free Volt1	0.0~800.0V	0000.0V	X	O	2-41
	B102	Free V/F frequency 2 Free Freq2	0.00~B103	000.00Hz	X	O	2-41
	B103	Free V/F voltage 2 Free Volt2	0.0~800.0V	0000.0V	X	O	2-41
	B104	Free V/F frequency 3 Free Freq3	0.00~B104	000.00Hz	X	O	2-41
	B105	Free V/F voltage 3 Free Volt3	0.0~800.0V	0000.0V	X	O	2-41
	B106	Free V/F frequency 4 Free Freq4	0.00~B105	000.00Hz	X	O	2-41
	B107	Free V/F voltage 4 Free Volt4	0.0~800.0V	0000.0V	X	O	2-41
	B108	Free V/F frequency 5 Free Freq5	0.00~B106	000.00Hz	X	O	2-41
	B109	Free V/F voltage 5 Free Volt5	0.0~800.0V	0000.0V	X	O	2-41
	B110	Free V/F frequency 6 Free Freq6	0.00~B107	000.00Hz	X	O	2-41
	B111	Free V/F voltage 6 Free Volt6	0.0~800.0V	0000.0V	X	O	2-41
	B112	Free V/F frequency 7 Free Freq7	0.00~400Hz	000.00Hz	X	O	2-41
	B113	Free V/F voltage 7 Free Volt7	0.0~800.0V	0000.0V	X	O	2-41

Expanded Function Mode (C-Group)

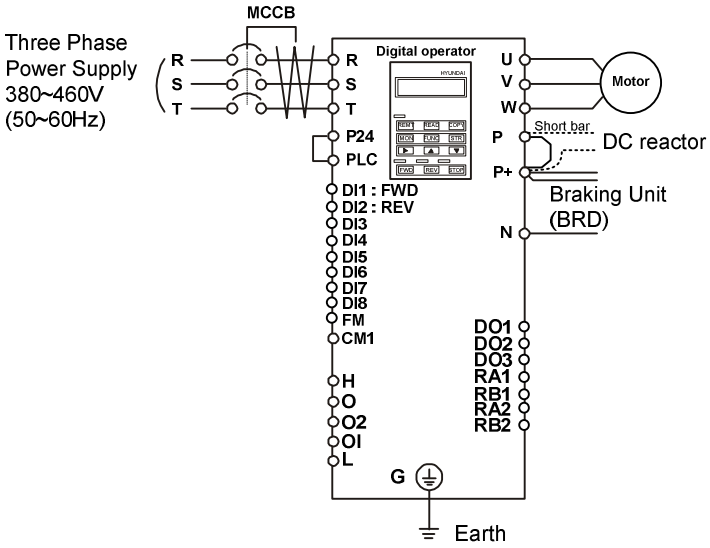
Function code		Function name	setting range	Initial data	Setting on run	Read/ Copy	Page
Input Terminal Function	C01	Intelligent input 1 setting In_TM1	0~20 (0 : FWD, 1 : REV, 2 : CF1, 3 : CF2, 4 : CF3, 5 : CF4, 6 : JOG, 7 : DB, 8 : 2CH, 9 : FRS, 10 : EXT, 11 : USP, 12 : CS, 13 : SFT, 14 : AT, 15 : RS, 16 : PID, 17 : PID_C, 18 : UP, 19 : DOWN, 20 : UDCLR)	0	X	O	2-43
	C02	Intellignet input 1 setting In_TM2		1	X	O	2-43
	C03	Intelligent input 1 setting In_TM3		15	X	O	2-43
	C04	Intelligent input 1 setting In_TM4		14	X	O	2-43
	C05	Intelligent input 1 setting In_TM5		6	X	O	2-43
	C06	Intelligent input 1 setting In_TM6		9	X	O	2-43
	C07	Intelligent input 1 setting In_TM7		10	X	O	2-43
	C08	Intelligent input 1 setting In_TM8		13	X	O	2-43
	C09	Intelligent input 1 a/b In_TM o/c1	0~1 (NO, NC)	0	X	O	2-44
	C10	Intelligent input 2 a/b In_TM o/c2	0~1 (NO, NC)	0	X	O	2-44
	C11	Intelligent input 3 a/b In_TM o/c3	0~1 (NO, NC)	0	X	O	2-44
	C12	Intelligent input 4 a/b In_TM o/c4	0~1 (NO, NC)	0	X	O	2-44
	C13	Intelligent input 5 a/b In_TM o/c5	0~1 (NO, NC)	0	X	O	2-44
	C14	Intelligent input 6 a/b In_TM o/c6	0~1 (NO, NC)	0	X	O	2-44
	C15	Intelligent input 7 a/b In_TM o/c7	0~1 (NO, NC)	0	X	O	2-44
	C16	Intelligent input 8 a/b In_TM o/c8	0~1 (NO, NC)	0	X	O	2-44
Output Terminal function	C17	Intelligent output 1 Out_TM1	0~8 (0:RUN, 1:FA1, 2:FA2, 3:OL, 4:OD, 5:ALM, 6:FA3, 7:IPS, 8:THM)	0	X	O	2-52
	C18	Intelligent output 2 Out_TM2		2	X	O	2-52
	C19	Intelligent output 3 Out_TM3		3	X	O	2-52
	C20	Intelligent output 4 Out_TM4		7	X	O	2-52
	C21	Intelligent output 5 Out_TM5		8	X	O	2-52
Relay output	C22	Intelligent output 6 Out_TM6		9 (Unchangeable)	X	X	MCR (fixed)
	C23	Intelligent output 7 Out_TM7		1	X	O	2-52
	C24	Intelligent output 8 Out_TM8		5	X	O	2-52
Intelligent output contact setting	C25	Output terminal 1 a/b selection (O_TM o/c1)	0~1 (NO, NC)	0	X	O	2-52
	C26	Output terminal 2 a/b selection (O_TM o/c1)	0~1 (NO, NC)	0	X	O	2-52
	C27	Output terminal 3 a/b selection (O_TM o/c1)	0~1 (NO, NC)	0	X	O	2-52
	C28	Output terminal 4 a/b selection (O_TM o/c1)	0~1 (NO, NC)	0	X	O	2-52

Function code		Function name	Setting range	Initial data	Setting on run	Read/ Copy	Page
	C29	Output terminal 5 a/b selection O_TM o/c1	0~1 (NO, NC)	0	X	O	2-52
	C30	Output terminal 5 a/b selection O_TM o/c1	0~1 (NO, NC)	0	X	O	고정
	C31	Output terminal 5 a/b selection O_TM o/c1	0~1 (NO, NC)	0	X	O	2-52
	C32	Output terminal 5 a/b selection O_TM o/c1	0~1 (NO, NC)	0	X	O	2-52
Analog meter setting	C33	FM selection FM_sig Sel	0~5 (OutF,OutC,OutV,OutT,Out F_dig, InPwr)	0	X	O	2-59
	C34	AM selection AM_sig Sel	0~4 (OutF,OutC,OutV,OutT,InPwr)	0	X	O	2-60
	C35	AM2 selection AM2 Sel	0~4 (OutF,OutC,OutV,OutT,InPwr)	0	X	O	2-60
	C36	Analog meter 1 voltage gain adjustment (AMV Gain)	0~10.00	001.00	X	O	2-60
	C37	Analog meter 1 voltage offset adjustment(AMV Off)	0~2000	01000	X	O	2-60
	C38	Analog meter 1 current gain adjustment (AMI Gain)	0~10.00	000.00	X	O	2-60
	C39	Analog meter 1 current offset adjustment (AMI Off)	0~2000	01000	X	O	2-60
	C40	Analog meter 2 voltage gain adjustment (AM2V Gain)	0~10.00	000.00	X	O	2-60
	C41	Analog meter 2 voltage offset adjustment (AM2V Off)	0~2000	01000	X	O	2-60
	C42	Analog meter 2 current gain adjustment (AM2I Gain)	0~10.00	001.00	X	O	2-60
	C43	Analog meter 2 current offset adjustment (AM2I Off)	0~2000	01000	X	O	2-60
External frequency adjustment	C44	External input voltage gain adjustment (Ex_O Gain)	0~10.00	001.00	X	O	2-1
	C45	External input voltage adjustment (Ex_O Adj)	0~2000	01000	X	O	2-1
	C46	External input current gain adjustment (Ex_OI Gain)	0~10.00	000.00	X	O	2-2
	C47	External input current adjustment (Ex_OI Adj)	0~2000	01000	X	O	2-2
	C48	External voltage input frequency selection (Ex_V Sel)	0~1 (10V, 5V)	0	X	O	2-1
Output level setting	C49	Overload advance notice level (OL PreSet)	50.0~200.0%	0050.0%	X	O	2-56
	C50	PID Deviation setting level PID PreSet	0.0~100.0%	0000.0%	X	O	2-57
	C51	Thermal warning level E_Thm Warn	0.0~100.0%	0080.0%	X	O	2-57
	C52	Frequency arrival setting for acceleration (F_Arv Acc)	0.00~400Hz	000.00Hz	X	O	2-54
	C53	Frequency arrival setting for deceleration (F_Arv Dec)	0.00~400Hz	000.00Hz	X	O	2-54
	C54	Setting for arrival frequency signal (Arv OutPTN)	0~2 (FA_Fix, Mt_FA, Eq_FA)	0	X	O	2-54
Communication function	C55	Communicating code Com Node	0~32	00000	X	O	-
	C56	Communicating transmission speed (Com Speed)	0~4 (2400, 4800, 9600, 19200, 38400 BPS)	0	X	O	-
	C57	UD_Store	0~1 (off, on)	0	X	O	2-60

Expanded function mode (H-Group) : Function about motor constant

Function code		Function name	Setting range	Initial data	Setting on run	Read/ Copy	Page
Motor constant	H03	Motor rated current M_RateCurr	0~99999A	00656A	X	O	2-61
	H04	Motor poled selection M_Pole	0~5 (2,4,6,8,10,12)POLE	1	X	O	2-61
	H05	Motor constant Rs M_Cnst Rs	0.0001~6.5535ohm	0.0183ohm	X	O	2-61
	H06	Motor constant Rr M_Cnst Rr	0.0001~6.5535ohm	0.0105ohm	X	O	2-61
	H07	Motor constant Ls M_Cnst Ls	0.001~65.535mH	027.45mH	X	O	2-61
	H08	Motor constant Lr M_Cnst Lr	0.001~65.535mH	027.31mH	X	O	2-61
	H09	Motor constant Lm M_Cnst Lm	0.001~65.535mH	026.93mH	X	O	2-61

(2) Operation setting and the frequency setting from the digital operator



[Arrangements]

① Please make sure that there isn't matter about the connection.

② Turn the MCCB on to supply power to the inverter.

(The YELLOW LED "POWER" on the digital operator should illuminate.)

③ Set standard operator with the frequency setting selection[A01].

• Set A01 as indication code, press the ▶ key once.

• Set 00(DOP) with the ▲ key or the ▼ key, press the STR key once to set the frequency setting for the operator. (Indication code turns back to A01.)

④ Set standard operator with the operation setting selection[A02].

• Set A02 as indication code, press the ▶ key once.

• Set 00(DOP) with the ▲ key or the ▼ key, press the STR key once to set the operation setting for the operator. (Indication code turns back to A002.)

⑤ Set the output frequency

• Set F01 as indication code, as press the ▶ key once.

• Set to the desired output frequency with the ▲ key or the ▼ key, press the STR key once to store it. (Indication code turns back to F01.)

⑥ Set monitor mode.

When monitoring the output frequency, set indication code to d01.

Or when monitoring the operation direction, set indication code to d04.

⑦ Press FWD or REV key to start operating.

• The green LED "RUN" turns on a light, and the indication changes in response to the monitor mode set.

⑧ Press the STOP key t to decelerate to a stop.

• When the frequency turn back to 0, the LED "STOP" light will switch on.)

Note) • Make sure that there is no tripping during the acceleration and deceleration and check that the revolution per minute and the frequency meter are correct.

• When overcurrent tripping or overvoltage tripping occurs during the test run, increase the acceleration time or the deceleration time.

Chapter 2 Explanation of function

2.4 Explanation of function

2.4.1 D-Group (Monitor mode)

Monitor function [D01]~[D11]

Output frequency monitor (D01)

• Indication code D01 displays the frequency the inverter outputs.

Output current monitor (D02)

• Indication code D02 displays the output current value.

Output voltage monitor (D03)

• This inverter displays the output voltage of the inverter converted into the alternating voltage.

DC link voltage monitor (D04)

• This inverter displays the DC link voltage.

Operation direction/Motor Rotational Speed (D05)

• Indication code D05 displays the direction that the inverter output is rotating. Forward, reverse or stop

• This inverter displays the motor rotational speed per minute. (RPM : Rotational speed Per Minute)

PID feedback monitor (D06)

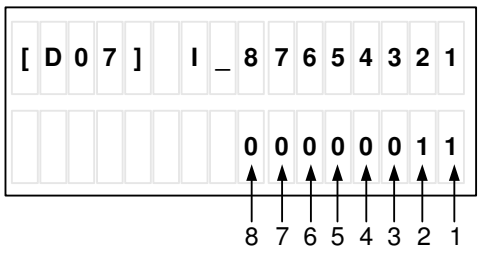
• When you select PID function (01) in A47, the inverter displays the feedback value changed by A51(PID scale).

"Display of monitor part" = Feedback quantity(%) × PID scale

(Frequency command value) (A75)

Intelligent input monitor (D07)

• The LED display will monitor the state of the intellignet inputs as “0” or “1”.

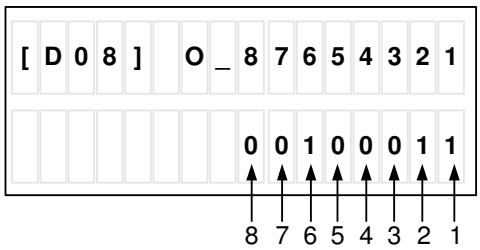


Input intelligent terminal – 0 : OFF

1 : ON

Intelligent output monitor (D08)

• The LED display will monitor the state of the intelligent outputs as “0” or “1”.



Output intelligent terminal – 0 : OFF
1 : ON

Input electric power monitor (D09)

• Display input electric power from inverter.

Accumulated time monitor on RUN (D10)

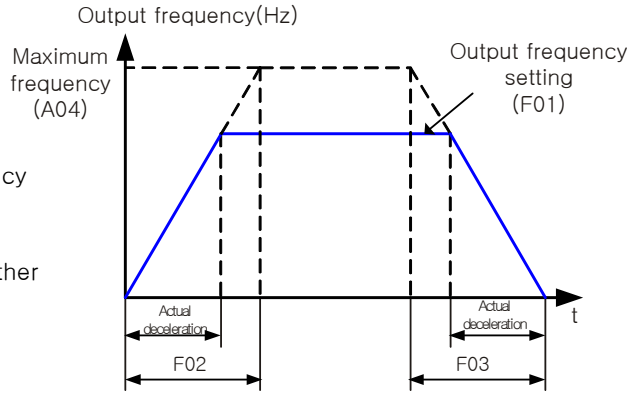
• The operation time of inverter is accumulated and the value is displayed.

Power ON time monitor (D11)

• This accumulates the time running to the inverter and displays the value.

Code	Function name	Setting range	Description	Initial data
D01	Out_F Mon Output frequency monitor	0.00~400.00Hz (STP, FWD, REV)	Unit : Hz, Stop(STP), Forward(FWD), Reverse(REV)	[D01] Out_F Mon STP 000.00Hz
D02	Out_I Mon Output courrent monitor	0.0~6553.5A	Unit : A	[D02] Out_I Mon 0000.0A
D03	Out_V Mon Output voltage monitor	0.0~6553.5V	Unit : V	[D03] Out_V Mon 0000.0V
D04	DC_V Mon DC rink voltage	0.0~6553.5V	Unit : V	[D04] DC_V Mon 0000.0V
D05	Speed Mon Direction/회전수 모니터	0.0~6553.5RPM (STP, FWD, REV)	Unit : RPM(Rotatioal speed Per Minute), Direction(FWD, REV) and Stop(STP)	[D05] Speed Mon STP 0000.0RPM
D06	PID_FB Mon PID feedback monitor	0.0~250.0%	단위 : %	[D06] PID_FB Mon 0000.0%
D07	I_87654321 Intelligent input terminal monitor	00000000~11111111	0 : Off 1 : On	[D07] I_87654321 00000000
D08	O_87654321 Intelligent output terminal monitor	00000000~11111111	0 : Off 1 : On	[D08] O_87654321 0010000
D09	IPower Power dissipation monitor	0.0~6553.3kW	Unit : kW	[D09] IPower 0000.0kW
D10	Run Time Accumulated time monitor on RUN	00000~65535H 00~59M	Unit : H(Hour), M(Minute)	[D10] Run Time 00000~65535H 00~59M
D11	P_On Time Power ON time monitor	00000~65535H 00~59M	Unit : H(Hour), M(Minute)	[D11] P_On 00000~65535H 00~59M

2.4.2 F-Group (Basic function mode)



Output frequency setting (F01)

- Setting the output frequency of the motor
- The output frequency is set by F01, when frequency command select (A01) is set to 0.
  Please frequency command select (A01) about other methods of frequency setting.
- When a frequency is set in F01, the same value is automatically set in 1st mult-stage zero speed.

Code	Function code	Setting range	Description	Initial data
F01	Out_F Set Output frequency setting	0.0, Start frequency setting(B10) ~Maximum frequency (A04)	Unit : Hz	[F01] Out_F Set FWD 000.00Hz

Selection with limits of operation direction (F04)

- The direction of the motor can be restricted.
- This is effective in terminal and operation mode, as well.

Code	Function name	setting range	Description	Initial data
F04	No Run Dir Operation direction selection	0 (NON)	Forward/reverse is effective	[F04] No Run Dir NON 0
		1 (FWD)	Only forward	
		2 (REV)	Only reverse	

Adjustable time (F02/F03)

- The acceleration and deceleration time can be set.
  Set a long time to accelerate or decelerate slowely or set a short time to accelerate or decelerate quickly.
- The time setting is the time it takes to accelerate from zero to the maximum frequency and to decelerate from the maximum frequency to zero.

Code	Function code	Setting range	Description	Initial data
F02	Acc Time Acceleration time	0.01~3600	Unit : Second Setting acceleration time from zero to maximum frequency.	[F02] Acc Time 0060.00Sec
F03	Dec Time Deceleration time	0.01~3600	Unit : Second Setting acceleration time from zero to maximum frequency.	[F03] Dec Time 0060.00Sec

- However short you set the adjustable time, the adjustable time of the actual motor can't be shorter than the shortest adjustable time determined by the inertial Effect J of the mechanical system and motor torque.
- If you set the time shorter than the shortest adjustable time, a protection trip of OC or OV may occur.

Acceleration time t_S : $t_S = \frac{(J_L + J_M) \times N_M}{9.55 \times (T_S - T_L)}$

Deceleration time t_B : $t_B = \frac{(J_L + J_M) \times N_M}{9.55 \times (T_B + T_L)}$

J_L : J of the load converter into motor shaft (kg.m^2)
J_M : J of the motor (kg.m^2)
N_M : Motor revolving (r/min)
T_S : The maximum motor acceleration torque on inverter driving (N.m)
T_B : Needed transit torque (N.m)

2.4.3 A-Group (Expanded Function Mode)

Basic parameter settings [A01]~[A04]

Frequency command selection (A01)

• Select the method of frequency command.

• When 0~10 Vdc is inputted to the frequency command by 02-L terminal, operation direction of motor reverses.

Code	Function name	Setting range	Description	Initial data
A01	Freq Set Frequency command selection	0	DOP : Setting frequency with the potentieter of the digital operator (F01)	[F01] Freq Set DOP 0
		1	TM : Setting frequency with control terminals (Terminals : O-L, OI-L, O2-L)	
		2	REM : Setting frequency with remote operator , RS485 communication	
		3	UDT : Setting frequency with intelligent input terminals (UP/DOWN)	

Operation command selection (A02)

• Select the control of RUN/STOP commands.

• Operation command from the control terminals (Teminal) Start/Stop by ON/OFF of control terminals.

- Function mode(DI1~DI8) of Intelligent input terminal (DI1~DI8) shall be set to 01(FWD) or 02(REV)

Forward : FWD-CM1 terminal

Reverse : REV-CM1 terminal

- When using the FW teminal, it is possible to change the contact from NO to NC by setting a or b (respectively)in C09~C16.

• When forward command and reverse command entered simultaneouly, operation command be comes stop command.

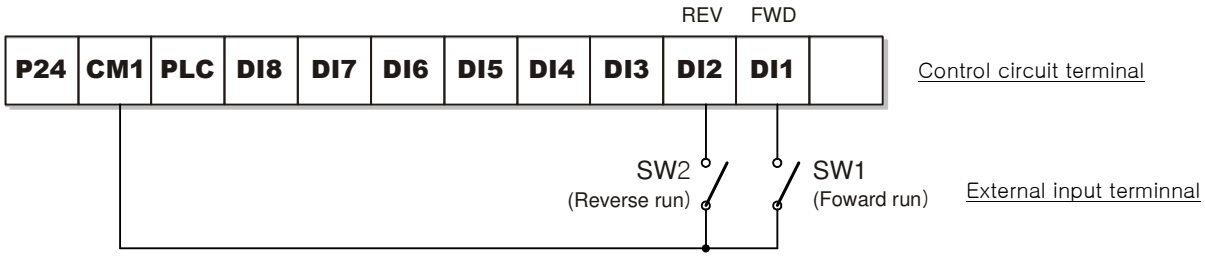
• When operating from the digital operator, set operation in F04.

Or operate start/stop command and reverse command entered simultaneously, operation command be comes stop command.

Code	Function name	Settng range	Description	Initial data
A02	Run Set Operation command selection	0	DOP : Start/stop with digital operator	[A02] Run Set DOP 0
		1	TM : Start/stop with control terminals	
		2	REM : Start/stop with remote operator	
C01~C08	In_TM1~8 Intelligent input terminal	0~20	0 : FWD(Forward) 1 : REV(Reverse)	[C01] In_TM1 0
C09~C16	In_TM o/c1~8 Input terminal a/b(NO/NC) selection	0	a contact (Normally Open : NO)	[C02] In_TM o/c1 0
		1	b contact (Normally Closed : NC)	

예) The method of run commanding in control terminal

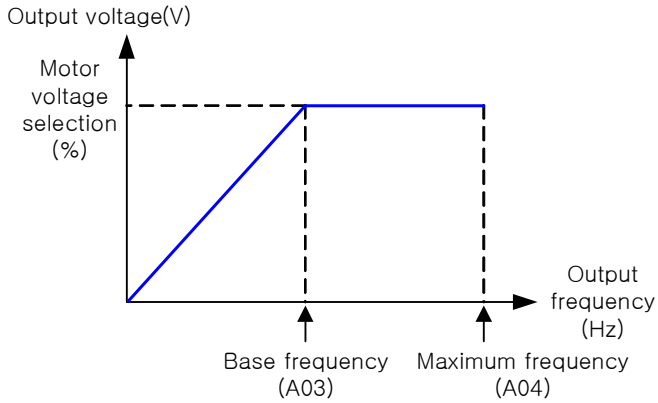
Set A02=1(TM), C01=0(FWD), C02=1(REV)

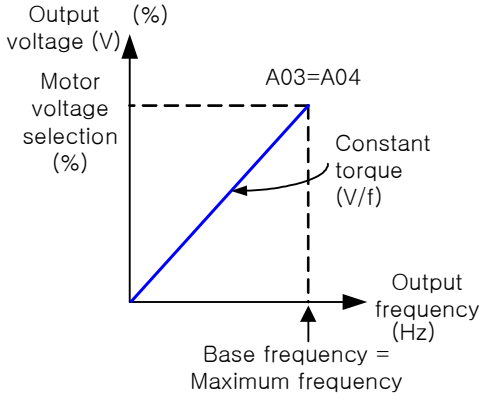


Base frequency (A03)

(1) Base frequency and motor voltage

• On selection of base frequency and motor voltage, set the output of the inverter (frequency voltage) to the motor rating.





• The base frequency is the nominal frequency of the motor, this value can be found on the nameplate of a motor.

When a motor has a base frequency lower than 50Hz, there is risk of damage to the motor.

• If a motor has a base frequency higher than 60Hz, it is considered to be a special motor.

In this situation, it is important to make sure the maximum output current of the inverter is higher than the FLC of the motor.

• It is important to match the Motor Voltage (A082) to this nominal value or there is risk of damage to the motor.

<table>
<tr><th>Code</th><th>Function code</th><th>Setting range</th><th>Description</th><th>Initial data</th></tr>
<tr><td>A03</td><td>Base_F Set
Base frequency setting</td><td>30.00~A04</td><td>Unit : Hz</td><td>[A03] Base_F Set
060.00Hz</td></tr>
<tr><td>A54</td><td>AVR_V Sel
Motor voltage</td><td>0~5</td><td>Setting value of 0~5
<table>
<tr><th>Setting</th><th>Voltage</th><th>Setting</th><th>Voltage</th></tr>
<tr><td>0</td><td>380V</td><td>3</td><td>440V</td></tr>
<tr><td>1</td><td>400V</td><td>4</td><td>460V</td></tr>
<tr><td>2</td><td>415V</td><td>5</td><td>480V</td></tr>
</table></td><td>[A54] AVR_V Sel
440V 3</td></tr>
</table>

(2) AVR Function

• Even if the incoming voltage changes, this function will keep the output voltage and a constant voltage level. The output voltage to the motor in this function references to the voltage selected on motor voltage selection. Select Yes/No of this function on A53 AVR selection.

Code	Function name	Setting range	Description	Initial data
A53	AVR Mode AVR Function selection	0	All_On : This function is effective on acceleration, constant speed, deceleration.	[A53] AVR Mode 0
		1	All_Off : This function is ineffective on acceleration, constant speed, deceleration.	
		2	Dec_Off : This increases a loss of motor and reduces the energy regenerated to inverter on decelerating.	

Maximum frequency (A04)

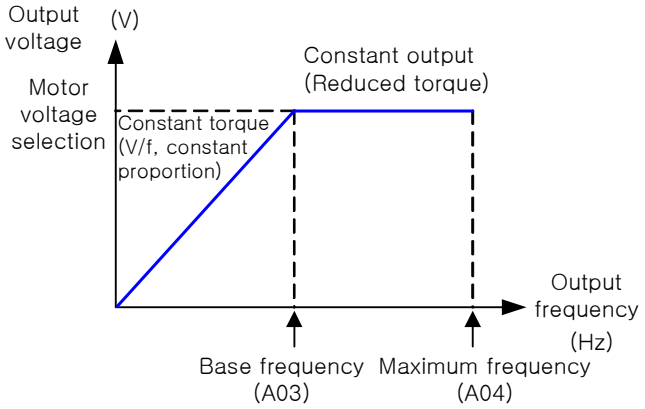
• Set the maximum frequency value of the inverter.

• This set value is the maximum frequncey that the inverter will achieve when It receives top speed reference from the control terminals or the digital operator. (Example: 10V of 0~10V)

• The Inverter output voltage from the base frequencey to the maximum frequency is the same level as the voltage selected on the motor voltage selection(A54).

Code	Function name	Setting range	Description	Initial data
A04	Max_F Set Maximum frequency	30.~400.	Unit : Hz	[A04] Max_F Set 060.00Hz

• The limit from 0 to 100% of basic frequency is the constant characteristic. Motor torque becomes reduced to increase motor speed to be higher than base frequency from the base frequency to the maximum frequency and the output voltage is constant regardless of frequency. Only, the maximum rotational speed of gereral purpose motor is 60~120Hz. When setting over the limit, please contact the manufacture.



• The base frequency (A03) should be same as the maximum frequecy (A04) for constant torque.

Note) The base frequency (A03) is always set to be less than the maximum frequency (A04). (A03 ≤ A04)

Analog input setting function [A05]~[A11]

External frequency input selection (A05)

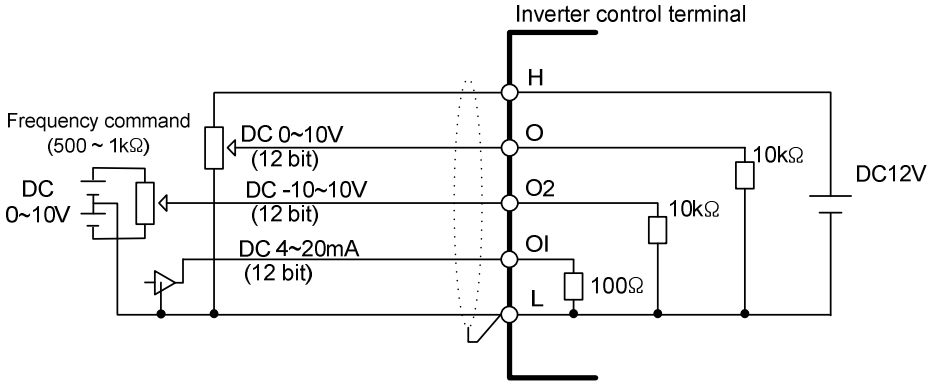
- This inverter has three kinds of external analog ouput terminals.
- The frequency setting is the values from terminals O(0~10V), OI(4~20mA) and O2(-10~10V).

  Only, terminal L is analogue power common.

  O-L terminal : 0~10 V
  OI-L terminal : 4~20 mA
  O2-L terminal : -10~10V

- The setting contents of this function is as follows.

Code	Function name	setting range	Description	Initial data
A05	External frequency input selection	0	O : Voltage input	[A05] O/OI/O2 O 0
		1	OI : Current input	
		2	O2 : ± Voltage input	



Input Frequency Start/End (A06~A10)

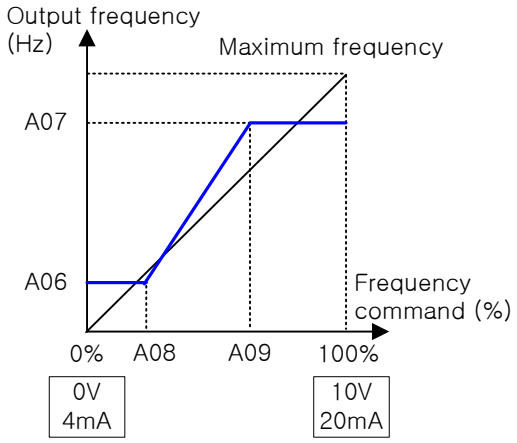
External analog signal from the control terminals (frequency command)

(1) Start, End of O-L terminal, OI-L terminal

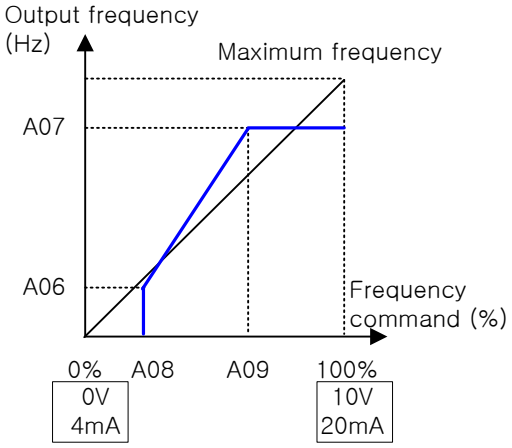
Code	Function name	Setting range	Description	Initial data
A06	Ex_Start_F O/OI Start	B10~400.00	Unit : Hz Set starting frequency	[A06] Ex_Start_F 000.50Hz
A07	Ex_End_F O/OI End	B10~400.00	Unit : Hz Set ending frequency	[A07] Ex_End_F 000.50Hz
A08	Ex_Start_% O/OI Start rate	0.0~100.0	Unit : % Set start rate for output frequency command 0-10V, 4-20mA	[A08] Ex_Start_% 0000.0%
A09	Ex_End_% O/OI End rate	0.0~100.0	Unit : % Set end rate for output frequency command 0-10V, 4-20mA	[A09] Ex_Start_F 0100.0%
A10	Ex_St Sel O/OI Start selection	0	A_Code : External start frequency Output frequency from 0 to A08 outputs the value of A06	[A10] Ex_St Sel A_Code 0
		1	0Hz : Output frequency from 0 to A08 outputs 0Hz	

Note) When inputting the external frequency, refer to appendix A for precise control.

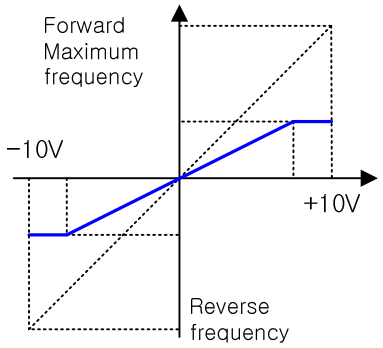
(Example 1) A10 = 0 : External start frequency



(Example 2) A10 = 1 : Start from 0Hz



(2) Start, End of O2-L terminal



External frequency start pattern setting (A11)

- Set the internal filter of the frequency setting signal of voltage or current from the control terminals

It is important to first remove the source of the noise to the system.

- When stable operation can not be achieved due to the effect of electrcal noise, set a larger value.
- The response will be slower by setting a larger value.

code	Function name	Setting range	Description	Initial data
A11	Ex_F Samp External frequency start pattern setting	1~1000	Can set with the 1 unit.	[A11] Ex_F Samp 00100

Multi-speed operation function [A12]~[A26]

Multi-speed operation function 1~15 (A12~A26)

- It is possible to set multi-speed 0 to 15 by selecting 02 to 05 (CF1 to CF4) on the intelligent input terminals.
- Set frequency setting for speed 1 to 15 with A12-A26.
- Set 0 speed with F01 when frequency command is operator.

Or when frequency command is control terminal (Terminal), set with O, OI terminal.

Code	Function name	Setting range	Description	Initial data
A12	Multi_1S Multi-speed 1	B10~A04	Unit : Hz, Setting Multi-speed 1	[A12] Multi_1S 000.50Hz
A13	Multi_2S Multi-speed 2	B10~A04	Unit : Hz, Setting Multi-speed 2	[A13] Multi_2S 000.50Hz
A14	Multi_3S Multi-speed 3	B10~A04	Unit : Hz, Setting Multi-speed 3	[A14] Multi_3S 000.50Hz
A15	Multi_4S Multi-speed 4	B10~A04	Unit : Hz, Setting Multi-speed 4	[A15] Multi_4S 000.50Hz
A16	Multi_5S Multi-speed 5	B10~A04	Unit : Hz, Setting Multi-speed 5	[A16] Multi_5S 000.50Hz
A17	Multi_6S Multi-speed 6	B10~A04	Unit : Hz, Setting Multi-speed 6	[A17] Multi_6S 000.50Hz
A18	Multi_7S Multi-speed 7	B10~A04	Unit : Hz, Setting Multi-speed 7	[A18] Multi_7S 000.50Hz
A19	Multi_8S Multi-speed 8	B10~A04	Unit : Hz, Setting Multi-speed 8	[A19] Multi_8S 000.50Hz
A20	Multi_9S Multi-speed 9	B10~A04	Unit : Hz, Setting Multi-speed 9	[A20] Multi_9S 000.50Hz
A21	Multi_10S Multi-speed 10	B10~A04	Unit : Hz, Setting Multi-speed 10	[A21] Multi_10S 000.50Hz
A22	Multi_11S Multi-speed 11	B10~A04	Unit : Hz, Setting Multi-speed 11	[A22] Multi_11S 000.50Hz
A23	Multi_12S Multi-speed 12	B10~A04	Unit : Hz, Setting Multi-speed 12	[A23] Multi_12S 000.50Hz
A24	Multi_13S Multi-speed 13	B10~A04	Unit : Hz, Setting Multi-speed 13	[A24] Multi_13S 000.50Hz
A25	Multi_14S Multi-speed 14	B10~A04	Unit : Hz, Setting Multi-speed 14	[A25] Multi_14S 000.50Hz
A26	Multi_15S Multi-speed 15	B10~A04	Unit : Hz, Setting Multi-speed 15	[A26] Multi_15S 000.50Hz

Note) Refer to Multi-speed function (CF1~CF4), when you know details

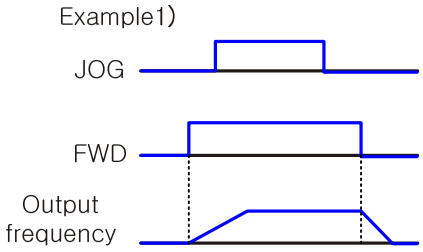
Jogging operation [A27]~[A28]

Jogging frequency setting (A27) and 및 Jogging operation selection (A28)

- This function can be used to rotate the motor in small steps to allow fine-tuning.
- Set an intelligent input terminal to 06(JG).

Code	Function name	Setting range	Description	Initial data
A27	Jog_F Set Jogging frequency selection	B10~10.00	Unit : Hz Jogging frequency setting	[A27] Jog_F Set 001.00Hz
A28	Jog_Stop Jogging stop operation selection	0	FRE : Free-run on jogging stop	[A28] Jog_Stop FRE 0
		1	DEC : Decelerating stop on jogging stop	
		2	DCB : Direct braking on jogging stop	

- The jogging operation does not use acceleration, therefore it would be advisable to set the jogging frequency to limit the starting current to a minimum or tripping may occur. Adjust A27 to the jogging frequency required.



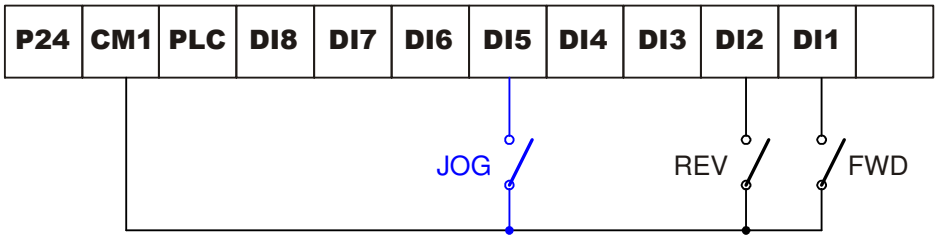
- Jogging operation selection

(Note1) When using the jogging function, turn FW terminal or RV terminal ON after the JG terminal is turned ON. (It is the same when the operation command point is from the operator.)
When setting of A28 is 00,01 or 02 and FW signal is turned ON beforehand, the inverter doesn't operate jogging.

(Note2) In the case that the setting of A039 is 02 or 05, data setting of DB is necessary.

- set 6(JOG) to the intelligent input terminals(C01~C08).

(Initial data: Set C05=6)



Control system (V/F Characteristic) [A29]~[A33]

Torque boost (A29~A31)

• A correctly installed motor and careful attention to voltage drop in the wiring will improve the motor torque at low speed.

• Setting of A29 will select between manual torque boost and automatic torque boost, the level of torque boost corresponds to the set motor capacity selection (H03) and the motor pole selection (H04).

Code	Function name	Setting range	Description	Initial data
A29	Boost Mode Torque boost mode selection	0	Man : Manual torque boost	[A29] Boost Mode Man 0
		1	Auto : Auto torque boost	
A30	T_Boost_V Manual torque boost voltage setting	0.0~20.0	Unit : % Level corresponding to output Voltage (100%)	[A30] T_Boost_V 0001.0%
A31	T_Boost_F Manual torque boost frequency setting	0.0~50.0	Unit : % Level corresponding to base frequency	[A30] T_Boost_F 0005.0%

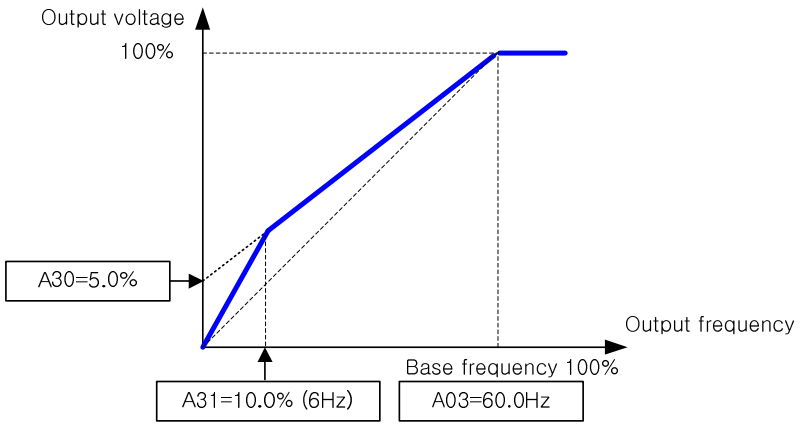
(1) Manual torque boost

• The values set up with A30 and A31 is outputted.

• A30 sets a percentage level where the motor voltage is 100%. p4_27-36

• When using the manual torque boost, it should be noted that overuse will cause saturation of the motor and may cause damage.

• A31 sets a percentage level where the base frequency voltage is 100%.



(2) Automatic torque boost

• The output voltage is adjusted automatically by the condition of the load.

• When using automatic torque boost it is important that the following two parameters are set correctly.

• In case of adding over-current protection at deceleration time, set AVR selection ON all the time.

Code	Function name	Data	Description	Initial data
H03	M_RateCurr Motor capacity selection	0~99999	Unit : A	[H03] M_RateCurr 00656A
H04	M_Pole Motor pole selection	0~5	0 = 2 poles, 1 = 4 poles, 2 = 6 poles, 3 = 8 poles, 4 = 10 poles, 5 = 12 poles	[H04] M_Pole 4 Pol 1

Control system (V/f Characteristic) (A32)

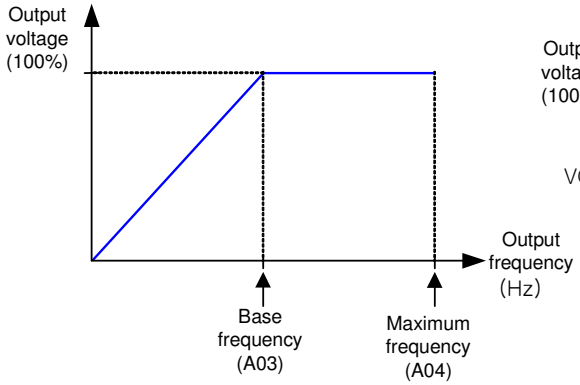
• Set V/f (output voltage/output frequency) characteristic.

Code	Function name	Data	Description	Initial data
A32	V/F Mode V/F Characteristic (Control method)	0	VC : Constant torque characteristic(VC)	[A32] V/F Mode VC 0
		1	VP1.7 : Reduced torque characteristic(VP1.7power)	
		2	VP2.0 : Reduced torque characteristic(VP1.7power)	
		3	FVF : Free setting V/f characteristic	

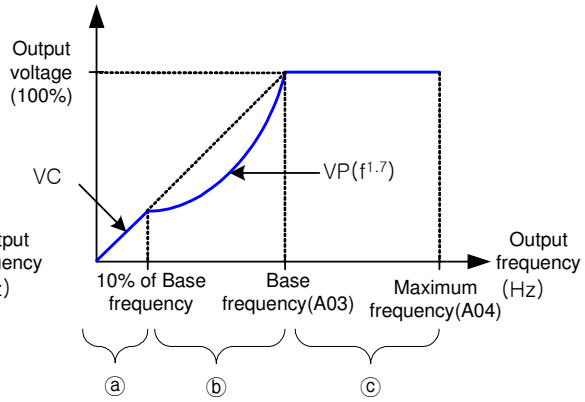
(1) Constant torque characteristic (VC)

• Output voltage outputs proportionally to the output frequency.

Output voltage outputs proportionally from 0 to the base frequency, but the output voltage from the base frequency to the maximum frequency is constant regardless of frequency.



<정토오크 특성>



<Reduced torque characteristic>

(2) Reduced torque characteristic (VP1.7)

• This characteristic can be used when a large starting torque isn't required.

At low speeds, it can cause improvement of efficiency, low noise and low vibration because of lowering the output voltage. V/f characteristic is as follows.

Period ⓐ : The limit from 0 to 10% of basic frequency is the constant characteristic.

(Example) If the base frequency is 60Hz, the limit from 0 to 6Hz is constant characteristic.

Period ⓑ : The limit from 10% of base frequency to base frequency is reduced torque characteristic.

The voltage is output in the curve of 1.7 power for frequency.

Period ⓒ : The voltage is constant from the base frequency to the maximum frequency.

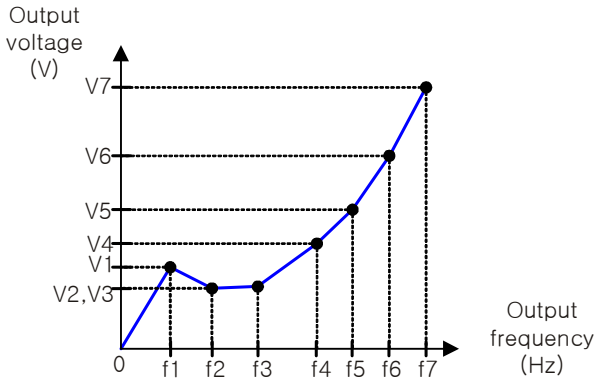
(3) Reduced torque characteristic (VP2.0)

• The voltage is output in the curve of 2.0 power for frequency. VP($f^{2.0}$)

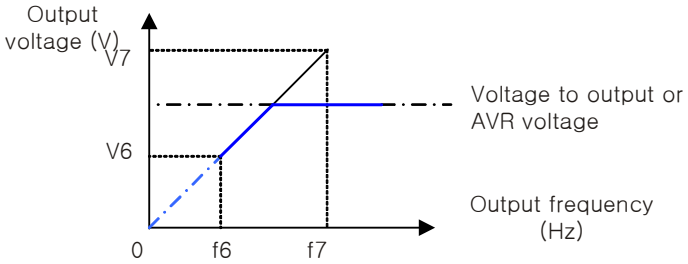
(4) Free V/F setting

- The free V/f setting sets optional V/f characteristics by setting the voltage and frequency in seven parts.(b100-b113)
- The setting of free V/f setting operates always to be $1 \le 2 \le 3 \le 4 \le 5 \le 6 \le 7$.
  Please set first free V/f setting 7 because the initial value is all 0Hz.
- When the free V/f setting is valid, the function of torque boost(A29), basic frequency(A03), maximum frequency(A04) is invalid. (Free V/f frequency 7 is treated as maximum frequency.)

Code	Function name	Setting range	Description	Initial data
B112	Free V/f frequency 7	0.- 400.	Unit : Hz	[B112] Free Freq1 000.00Hz
B110	Free V/f frequency 6	0.- 자유 V/f 주파수7		
B108	Free V/f frequency 5	0.- 자유 V/f 주파수6		
B106	Free V/f frequency 4	0.- 자유 V/f 주파수5		
B104	Free V/f frequency 3	0.- 자유 V/f 주파수4		
B102	Free V/f frequency 2	0.- 자유 V/f 주파수3		
B100	Free V/f frequency 1	0.- 자유 V/f 주파수2		
B113	Free V/f voltage 7	0.0 - 800.0	Unit : V (Note1)	[B113] Free Volt1 0000.0V
B111	Free V/f voltage 6			
B109	Free V/f voltage 5			
B107	Free V/f voltage 4			
B105	Free V/f voltage 3			
B103	Free V/f voltage 2			
B101	Free V/f voltage 1			



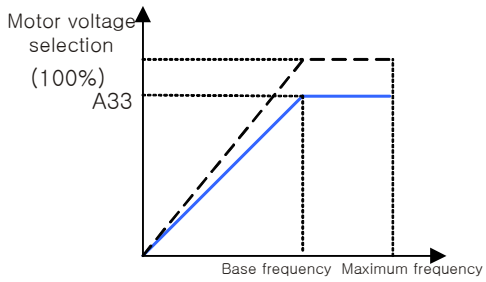
(Note1) Even if you set 800V for free V/f voltage1-7, output of inverter can't be more than the input voltage or the AVR setting voltage.



Output voltage gain (A33)

• Regarding the voltage selected on A082 motor voltage selection as 100 %, set the rate of the voltage which the inverter outputs for the voltage selected.

Code	Function name	Setting range	Description	Initial data
A33	V/F Gain Output voltage gain	20.0~100.0	Unit : %	[A33] V/F Gain 0100.0%



DC braking setting [A34]~[A38]

Direct current braking (DB)

• A dc voltage can be applied to the motor windings in order to lock the motor shaft and avoid overun at low speeds.

• There are two methods of activating the dc braking. Outside which is through the intelligent input terminals and Inside which is automatically started at a specific frequency.

Code	Function name	Setting range	Description	Initial data
A34	DCB Mode DC braking selection	0	Inside DC braking : invalid	[A34] DCB Mode OFF 0
		1	Inside DC braking : valid	
A35	DCB_F Set DC braking frequency	0.50~60.00	Unit : Hz When the output reaches the set frequency and Inside DC braking is valid, DC braking is started..	[A35] DCB_F Set 000.50Hz
A36	DCB Wait_T DC braking delay time	0.0~5.0	Unit : Second After DC braking time is reached, or DB terminal is ON, the late time is a delay before DC braking is started.	[A36] DCB Wait-T 000.00Sec
A37	DCB Force DC braking power /Starting DC braking power	0.0~100.0	Unit : % Weak (Zero current) ~ Strong (Inverter rating fairly 70% the DC current)	[A37] DCB Force 0000.0%
A38	DCB Time DC braking time	0.0~10.0	Unit : second The DC braking is stopped after this time delay has elapsed. The time is tarted when the late time has elapsed.	[A38] DCB Time 0000.0Sec

Frequency limit function [A39]~[A46]

Frequency limiter (A39~A40)

• This function can set a maximum and minimum limit of the output frequency.

• Even if a frequency command exceeds the maximum and minimum limiter the inverter will ignore this value and stop at the values set.

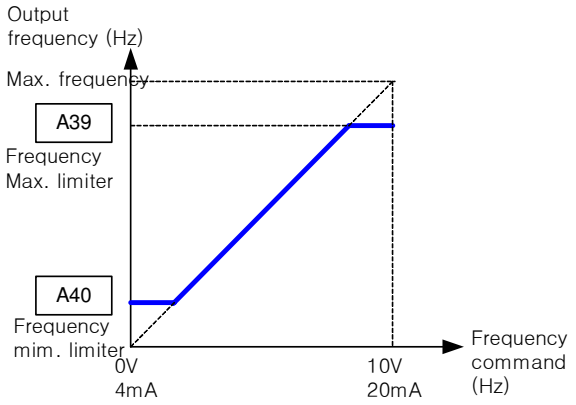
• Set first maximum limiter on setting.

Be sure that the maximum limiter (A39) > minimum limiter (A40).

Code	Function name	Setting range	Description	Initial data
A39	Limit H_F Frequency max. limiter	A40 ~ A04	Unit : Hz Frequency upper limit setting frequency min. limiter – max. limiter frequency	[A39] Limit H_F 000.00Hz
A40	Limit L_F Frequency min. limiter	B10 ~ A39	Unit : Hz Frequecy lower limit setting starting frequency – max. limiter frequency	[A40] Limit L_F 000.00Hz

(1) In use O-L, OI-L case

• When frequency command is control terminal (Terminal), by setting Min. limiter, even if 0V is input, it is not possible to output less than the frequency set with Min. limiter.



(a) When operation command is control terminal (A02:01) (b) When operation command is operator (A002:02)

Terminal	Revolution when O2 is 0V
FWD(ON)	A40 on forward side
REV(ON)	A40 on reverse side

F04	Revolution when O2 is 0V
0	A40 on forward side
1	A40 on reverse side

Frequency Jump Function (A41~A46)

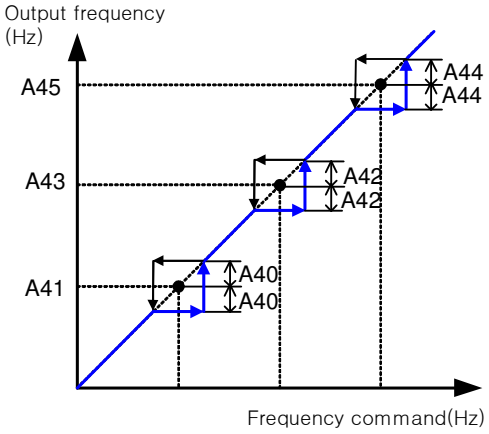
• Frequency jump can be used to avoid resonance points on machinery.

• Frequency jump is to jump the frquency command and avoid usual operation within the limit of the jump f requency.

• Output frequency changes continuously according to adjustable time.

• It is possible three different points are set for the jump frequency.

Code	Function name	Setting range	Description	Initial data
A41/A43/A45	Jump_Freq1/2/3 Jump frequency 1/2/3 setting	0.00~A04	Unit : Hz Set the frequency fj of center to jump.	[A41] Jump_Freq1 000.00Hz
A42/A44/A46	Jump__Wdth1/2/3 Jump width 1/2/3/ setting	0.00~10.00	Unit : Hz Set 1/2 value of frequency band to jump.	[A42] Jump_Wdth1 000.00Hz



PID Control Function [A47]~[A52]

PID Function

• This integrated process control function can be used for controls such as constant flow and control for fan and pump applications.

• When using this function set A47 to 01.

• Turn off the terminal in the case that you validate this function or turn on the terminal in the case that you invalidate this function after assigned 16 (PID valid/invalid) to intelligent input terminal in the case of switching valid/invalid of this function with the outside signal.

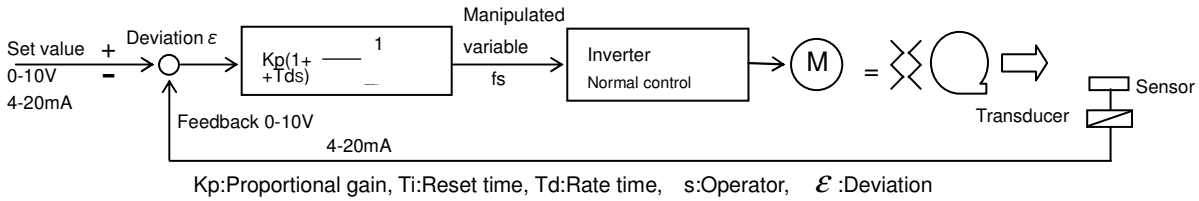
Code	Function name	Setting range	Description	Initial data
A47	PID Mode PID selection	0	OFF : PID Invalid	[A47] PID Mode OFF 0
		1	ON : PID Valid	
A48	PID P_Gain PID P gain setting	0.1~5.0	Proportional gain	[A48] PID P_Gain 0001.0
A49	PID I_Gain PID I gain setting	0.0~3600.0	Unit : Second Integration gain	[A49] PID I_Gain 0001.0Sec
A50	PID D_Gain PID D gaing setting	0.0~100.0	Unit : Second Derivative gain	[A50] PID D_Gain 0000.0Sec
A51	PID Scale PID scale setting	0.01~200.00	Unit : %	[A51] PID Scale 001.00%
A52	PID Source PID feedback selection	0	O-L : 0~10V	[A52] PID Source O 0
		1	OI-L : 4~20mA	
C50	PID PreSet PID deviation level	0.0~100.0	Unit : %	[C30] PID PreSet 0000.0%

(1) Feedback selection

• Select which analogue input terminals will be the feedback reference (A52).

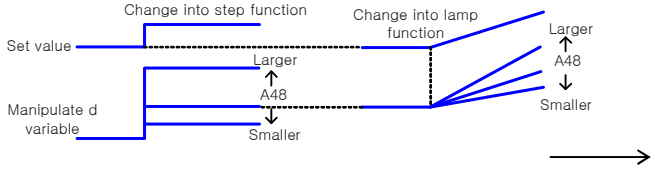
• Set the set frequency command selection with A01. (It should not be the same as the terminals selected with A52).

(2) Basic operation of PID control

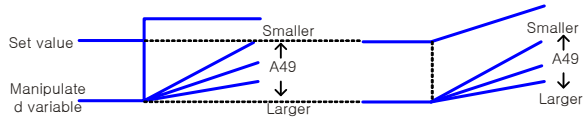


(3) components of PID

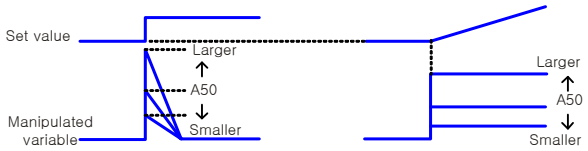
① P action: This is the action that the manipulated variable is in proportion to the command.



② I action: This is the action that the manipulated variable increases with time in a straight line.



③ D action: This is the action that the manipulated variable is in proportion to the changing rate of command.



• PI action combines above ① and ②, PD action does ① and ③, PID action does ①, ② and ③.

(4) The adjustment of gain

Please adjust each gain according to the state as the following, when the response on the functional operation PID is not stable.

• Inspite of changing command, the change of feedback signal is slow. → Raise P gain
• The feedback signal changes instantly but is not stable. → Lower P gain
• The command and feedback signal doesn't coincide instantly. → Lower I gain
• The feedback signal oscillates and is not stable. → Raise I gain
• In spite of raising of P gain, the response is slow. → Raise D gain
• When P gain is raised, the feedback signal oscillates and is not stable. → Lower D gain

(5) The Maximum PID Deviation Level/Output

• It is possible to establish the maximum deviation level C50 on PID control. When the PID deviation amount reaches the set level C50, it is possible to set an intelligent output.
• C50 can be set from 0 to 100 and corresponds with the command; from 0 to maximum.
• Assign 04 (OD) to intelligent output terminal DO1~DO8(C17~C24).

(6) Feedback monitor of PID

• Feedback signal of PID can be monitored.
• The monitor value can be displayed by the product of PID scale A075.
"Monitor display" = "Feedback (%)" x "A075 setting"

(7) PID integral reset

• This is the function to clear integral value of PID action.
• Assign 17(PIDC) to intelligent input terminal.
• It is cleared whenever PIDC is turned ON..

Don't turn absolutely ON PID terminal during PID action, because there is a possibility of overcurrent trip.

Turn ON PIDC terminal after turning OFF PID action.

AVR function [A53]~[A54]

AVR (Automatic Voltage Regulation) function setting(A53)

• Even if the incoming voltage changes, this function will keep the output voltage and a constant voltage level. The output voltage to the motor in this function references to the voltage selected on motor voltage selection.

Code	Function name	Setting range	Description	Initial data
A53	AVR Mode AVR Function selection	0	All_On : Always ON, This function is effective on acceleration, constant speed, deceleration.	[A53] AVR Mode All_On 0
		1	All_Off : Always OFF, This function is ineffective on acceleration, constant speed, deceleration.	
		2	Dec_Off : On decelerating OFF, This increases a loss of motor and reduces the energy regenerated to inverter on decelerating.	

Motor voltage selection (A54)

• The Motor Voltage Selection is the nominal voltage of the motor, this value can be found on the nameplate of the motor. It is important to match the Motor Voltage (A54) to this nominal value or there is risk of damage to the motor.

Code	Function name	Setting range	Description	Initial data
A54	AVR_V Sel Motor voltage selection	0~5	0~5 are displayed as follows.	[A54] AVR_V Sel 440V 3

Setting	Voltage	Setting	Voltage
0	380V	3	440V
1	400V	4	460V
2	415V	5	480V

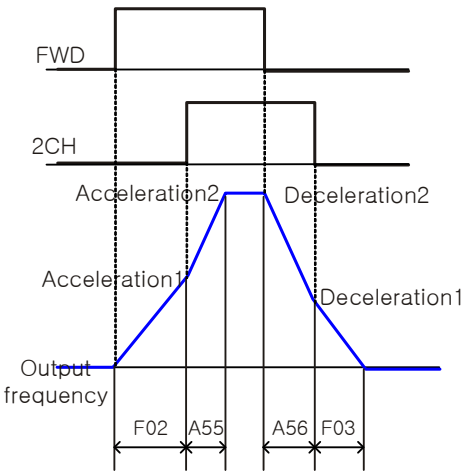
Two-stage Acceleration and Deceleration Function [A55]~[A61]

Second acceleration and deceleration function (A55~A59)

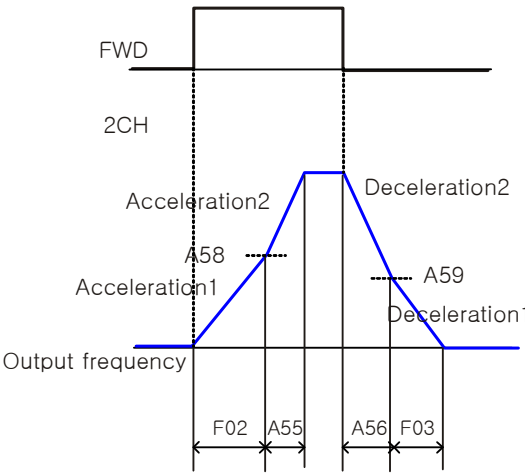
- By setting this function, it is possible to change the rate of acceleration and deceleration.
- As methods to change the rate of acceleration and deceleration, you can select the method of changing by intelligent input terminal and the method of automatic changing by optional frequency.
- In case of changing by intelligent input terminal, assign 08(2CH) to an Intelligent input terminal.

Code	Function name	Data	Description	Initial
A55	Acc Time2 Acceleration time 2	0.1~3600.0	Unit : Second	[A55] Acc Time2 0015.0Sec
A56	Dec Time2 Deceleration time 2	0.1~3600.0	Unit : Second	[A56] Dec Time2 0015.0Sec
A57	2nd_F Mode Two-stage acceleration and deceleration selection	0	Changing by intelligent input terminal 09 (2CH) (Example 1)	[A57] 2nd_F Mode TM 0
		1	Changing by two-stage acceleration and deceleration frequency (A58/A59)(Example 2)	
A58	2nd Acc_F Two-stage acceleration frequency	0.00~A04	Unit : Hz It is valid when two-stage acceleration and deceleration selection (A57) is 01. (Example2)	[A58] 2nd Acc_F 000.00Hz
A59	2nd Dec_F Two-stage deceleration frequency	0.00~A04	Unit : Hz It is valid when two-stage acceleration and deceleration selection (A57) is 01. (Example2)	[A59] 2nd Dec_F 000.00Hz

(Example1) In to set A57 to 00 case



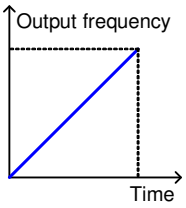
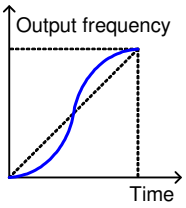
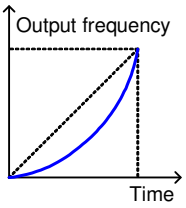
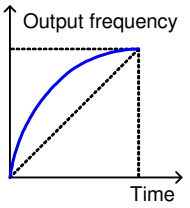
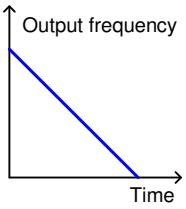
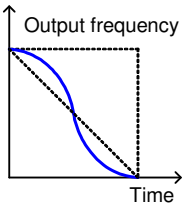
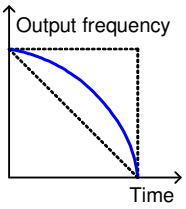
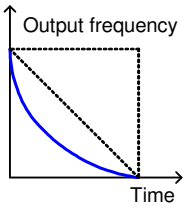
(Example2) In to set A57 to 01 case



Acceleration and deceleration pattern (A60~A61)

(1) Selection of pattern

- Pattern of acceleration and deceleration speed is possible to set up corresponding to each system.
- Select the pattern of acceleration and deceleration with A60 and A61.

Set value	0	1	2	3
Curve	Line	Sigmoid	U-shape	Reverse U-shape
[A60] Acc Curve Acceleration pattern				
[A61] Dcc Curve Deceleration pattern				
Contents	Accelerate and decelerate in line until output frequency set value.	collapsing the cargo such as the going up and down machine, conveyor it uses it for prevention.	Cutting the tension control, rolled book such as the volume collector machine it uses it for prevention.	

2.4.4 B-Group (Expanded Function mode)

Instantaneous power failure / under-voltage (B01~B03)

(1) Instantaneous stop and start

• You can select whether the inverter trips or retries (restart) when an instantaneous power failure/under-voltage occurs.

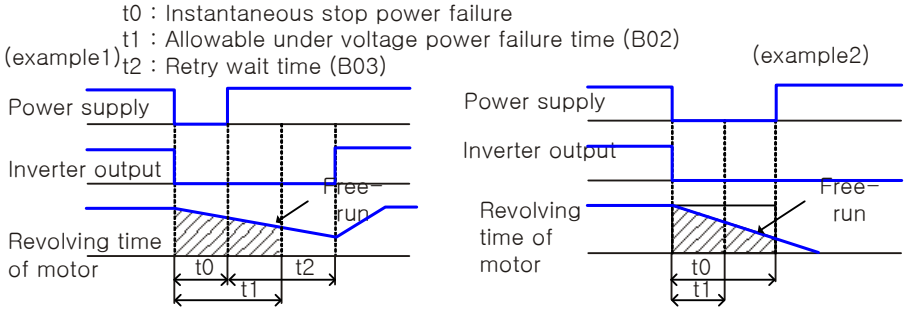
• To select a retry function with b001, set the following retry mode correspondent to each system.

Code	Function name	Setting range	Description	Initial data
B01	IPS Mode Retry selection	0	ALM : Alarm cord output after trip	[B01] IPS Mode ALM 0
		1	FTP : Restart from 0Hz on retry.	
		2	RST : Start equaling frequency on retry.	
		3	ZST : Start f-equaling and stop decelerating on retry. After stop, start trip.	
B02	IPS Time Allowable under-voltage power failure time	0.3~1.0	Unit : Second If the instantaneous power failure time is shorter than the set time, a restart will occur. (example1) If the instantaneous stop time is longer than set time, trip. (example2)	[B02] IPS Time 0001.0Sec
B03	IPS Wait Retry wait time	0.3~100.0	Unit : Second Delay before motor restart time.	[B03] IPS Wait 0001.0Sec

F-equaling start: The inverter reads the motor RPM and direction and restarts the inverter to match these readings.

Note1) When trip of the over voltage or over current etc. occurs in the deceleration midway an instantaneous power failure error <IPL.ER> is displayed and operates free-run. In this case make the deceleration time of long.

• Retry function (b01:02): The timing chart in case of selection is following.



Electrionic thermal function (B04~B05)

- Set the Inverter according to motor rated current to protect the motor from overloading, overheating and damage.
- A warning signal is outputted before tripping on electronic thermal Protection.
- Frequency characteristic is added up to set value of B05.

(1) Electronic thermal level

Code	Function name	Setting range	Description	Initial data
B04	E_Thm Set Electronic thermal level setting	20.0~120.0	Unit : % Rated current×0.2~Rated current×1.2	[B04] E_Thm Set 0100.0%
B05	E_Thm Char Electronic thermal characteistic	0	CRT : Constant torque charcteistic	[B05] E_Thm Char CRT 0
		1	SUB : Reduced torque characteristic	

- When output frequency of general motor decreases, cooling function of self-cooled fan will fall.
- Reduced torque characteristic is calculated according to heat of a general motor.

(2) Thermal warning

- A warning signal is outputted before overheat protection by the electronic thermal protection occurs.

Warning level is set with C061.

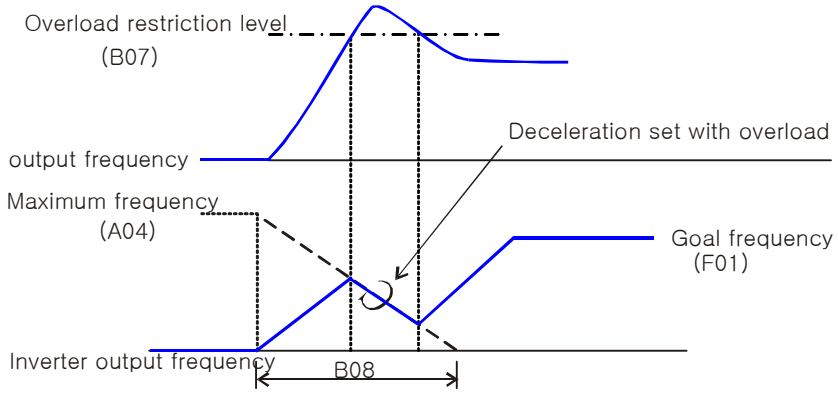
Code	function name	Setting range	Description	Initial data
C51	E_Thm Warn Thermal warning level	0.0~100.0	Unit : %	[C51] E_Thm Warn 0080.0%

Overload restriction/Overload advance notice (B06~B08)

- he Inverter monitors the motor current on acceleration and constant speed, When the inverter reaches the overload restriction level, the Inverter will reduce the output frequency automatically to restrict the overload.
- This function prevents an over-current trip by inertia during acceleration or radical changes in load at constant speed.
- The current value this function operates at is set in overload restriction level.
- The overload restriction constant is the time to decelerate to 0Hz from max frequency.
- As this function operates, the acceleration time is longer than setting time.
- If the overload restriction constant is set too short, in spite of accelerating, an over-voltage trip is caused with regenerative enegy from the motor on automatic deceleration by this function.
- When this function operates in the midst of accelerating, the frequency will not reach the goal frequency, the Inverter will adjust in the following way.

Make acceleration time longer.
Raise torque boost.
Raise overload restriction level.

Set item	function code	Setting range	Description	Initial data
B06	Oload Mode Overload restriction selection	0	All_Off : Invalid	[B06] Oload Mode All_Off 0
		1	A/F_On : Acceleration/valid on constant speed.	
		2	Fix_On : Valid on constant speed.	
B07	OL_Lev Set Overload restriction level	50.0~200.0	Unit : % Rated current x 0.5 ~ Rated current x 2 Current value overloads restriction oerates.	[B07] OL_Lev Set 0150.0%
B08	OL_Val Set Overload restriction constant	0.1~30.0	Unit : Second Deceleration time when overload restriction operates.	[B08] OL_Val Set 0001.0Sec

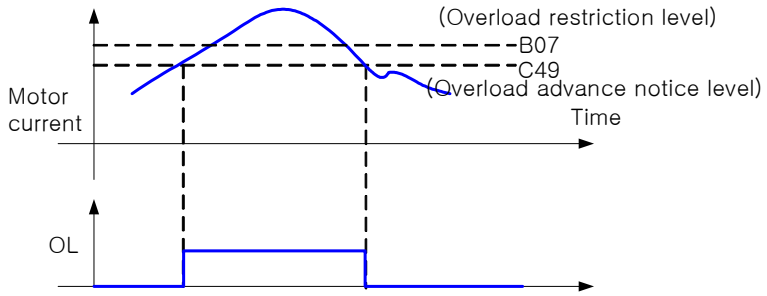


(2) Overload advance notice

• When the load is high, it is possible to adjust the load again by outputting an overload advance notice. It is used to prevent damage to the machine from too much load, i.e. baggage on a conveyor, the Inverter overload protection will operate.

• Assign 03(OL) to an intelligent output terminal 11 – 16 or the alarm relay output terminal.

Code	Function name	Setting range	Description	Initial data
C49	OL PreSet Overload advance notice level	0.0~200.0	Unit : % 0 ~ Rated current x 2 As load reaches overload advance notice level, OL signal is output.	[C49] OL PreSet 0050.0%



Software lock mode selection(SFT) (B09)

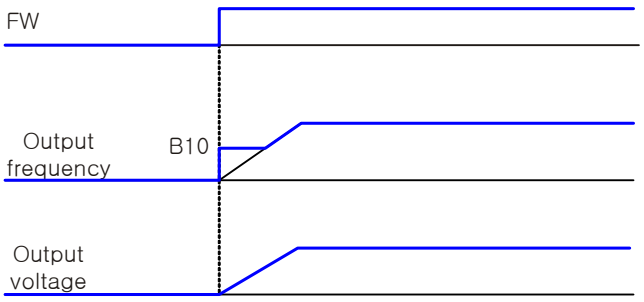
- This function is used to prevent changing data by mistake.
- When you want to use an intellignent input terminal, assign 13(SFT).
- Below is the software lock code selection.

Code	Function name	Data	Description	Initial data
B09	SLock Mode Soft-lock selection	0	SFT_All : Write disable except for b09/write enable SFT	[B09] SLock Mode Normal 4
		1	SFT_Fset : Write disable except for b09 and frequency setting/write enable	
		2	All : Write disable except for b09	
		3	Fset : Write disable except for b09 and frequency setting	
		4	Normal	

Start frequency setting function (B10)

- This frequency is the value the operator must set before the Inverter will give an output.
- Mainly used when an operator adjusts the start torque.
- By setting the start frequency higher, direct starting is caused and the starting current increases. Therefore an overload is within the restriction range and the inverter has a tendency to trip on over-current protection.

Code	function name	Setting range	Descritption	Initial data
B10	Min_F Set Start frequency setting	0.10~10.00	Unit : Hz	[B10] Min_F Set 000.50Hz



Carrier frequency setting function (B11)

- The carrier frequency of the PWM wave-form output from the inverter is adjustable by changing B11.
- If the carrier frequency is set higher, the audible noise from motor will be reduced but the RFI noise and the I eakage current may be increased.
- This function may help to avoid the resonant frequency of the motor or the mechanical system.

Code	Function name	Setting range	Description	Initial data
B11	Cary_F Set Carrier frequency setting	2.0~4.0	Unit :kHz	[B11] Cary_F Set 002.0kHz

Note1) The maximum value of the carrier frequency in order to achieve full output current is different depending on the capacity. When raising the carrier frequency, the rated output current will be reduced.

Initialization setting (B12~13)

- It is possible at any time to reinitialize the Inverter parameters back to their factory default.
- The trip history can also be cleared at any time.
- RUN time, POWER-ON time is not clear.
- Initialization details are as follows.

Code	Function name	Data	Description	Initial data
B12	Init Mode Initialization selection	0	NONE : Default value	[B12] Init Mode NONE 0
		1	TRIP : This clears only trip history	
		2	PARAM : This only initializes setting value. Setting value becomes the state on factory forwarding	
		3	TIME : This clears TIME.	
		4	ALL : This clears trip history and initializes setting.	
B13	Init Data Initial data selection	00	N500-2800HF	[B13] Init Data 3500HF 1
		01	N500-3500HF	
		02	N500-3200HFP	
		03	N500-3800HFP	

Operation command selection (B14)

- Select the control of RUN/STOP commands of an operator from the control terminals.
- Although operation setting selection is 01(Terminal), this can stop with STOP key on the digital operator.
- STOP key works as 'Reset on trip (Clear)' .

Code	Function name	Data	Description	Initial data
B14	Stop SW Selection of stop key during the terminal operation.	0	OFF : STOP key is effective.	[B14] Stop SW OFF 0
		1	ON : STOP key is ineffective.	

FM adjustment (B81)

- This function is used to calibrate a meter connected to the FM terminal.

Code	Function name	Data	Description	Initial data
B81	FM Gain FM adjustment	0~2000	Change one by one.	[B81] FM Gain 000.85

(Calibration methods)

① Connect meter to FM-CM1

② Adjust B81 so that the meter is reading the same as the output frequency on your scaled.

(Example) When output frequency is 60Hz, change the value of B81 so that meter is 60Hz.

Free-run stop (FRS) (B15)

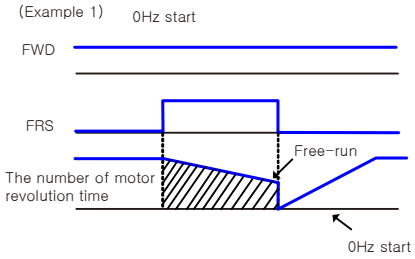
- By operating the free-run stop (FRS) function, the inverter output is cut off. The motor will free wheel under its own momentum.
- This function is used when the motor is to be stopped by the use of a brake, like an electromagnetic brake. If you stop the motor with a machine brake while the inverter is still outputting to the motor an over-current trip may occur.

Relation

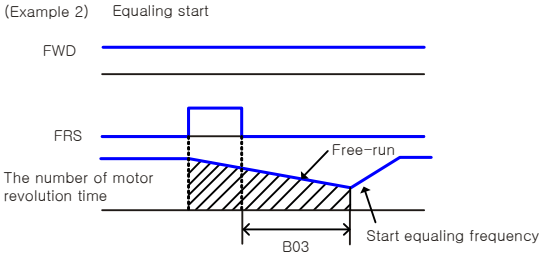
b088 : Free-run stop selection
b003 : Retry wait time
b007 : frequency setting to match

- Assign 11(FRS) to an intelligent input terminal.
- This free-run stop function will operate when the FRS terminal is ON.
- If you turn FRS terminal OFF the inverter will restart after the retry wait time b003 passes. However when the operation command selection A002 is set to control terminal (01), the inverter restarts during free-running. This function will only operate when the FW terminal is ON.
- On restart it is possible to select 0Hz start or matching frequency start as output methods with the free-run stop selection b15.

Code	Function name	Data	Description	Initial data
B15	FRS Mode Free-run stiop selection	0	ZST : 0Hz start	[B15] FRS Mode ZST 0
		1	FST : Equaling frequency start	
B03	IPS Wait Retry wait time	0.3~100.0	Unit : Second Time until restart after FRS terminal is OFF. (This is also used for Instantaneous to item of insufficiency)	[B03] IPS Wait 0001.0Sec



Start 0Hz regardless of the motor speed.
On 0Hz start, the retry wait time is disregarded.
When 0Hz start is used and the motor speed is still high there is the possibility of over-current trips.



After FRS terminal is switched OFF, the Inverter reads the frequency of the motor and when it starts equaling frequency to RUN again.
On frequency matching start if an over-current trip occurs, try extending the retry time.

Free V/f setting 1~7 (B100~B113)

- Please set V/F characteristic selection (A32) to 3(FVF)
- The free V/f setting sets optional V/f characteristics by setting the voltage and frequency in seven parts.(b100-b113)
- Please refer to page 4-27 for details.

2.4.5 C-Group (Input-output terminal function setting)

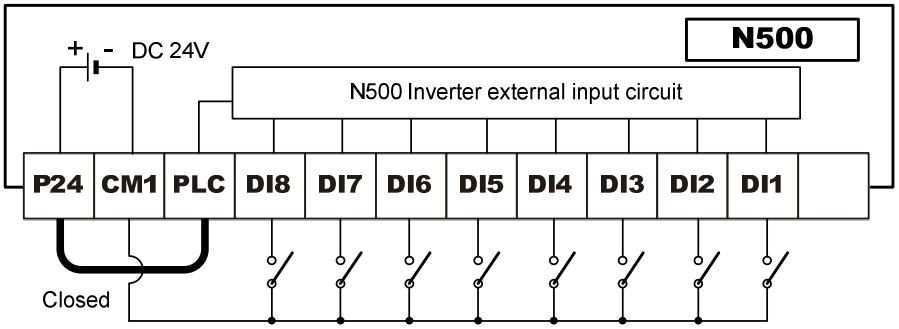
Intelligent input terminal setting

• P24 is DC24V power for connection input signal. When selecting source logic, it's for connection input common. PLC is intelligent power common. So It can change sink type and source type by short bar on control terminals.

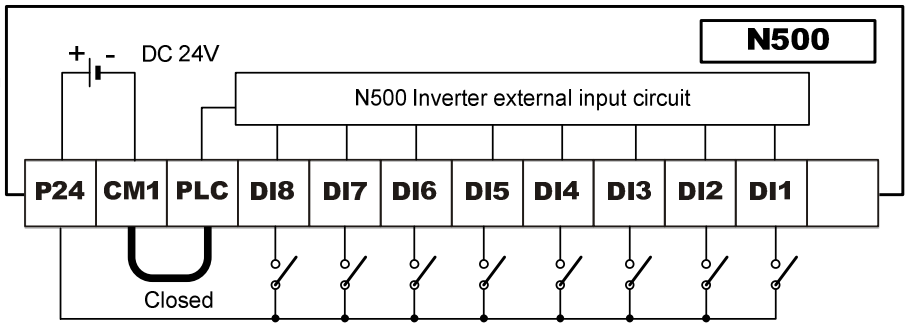
P24-PLC: Sink type, CM1-PLC: Source type.

• In case of using the internal power source of inverter (P24 : DC 24V)

(Sink Type)
: P24-PLC connection

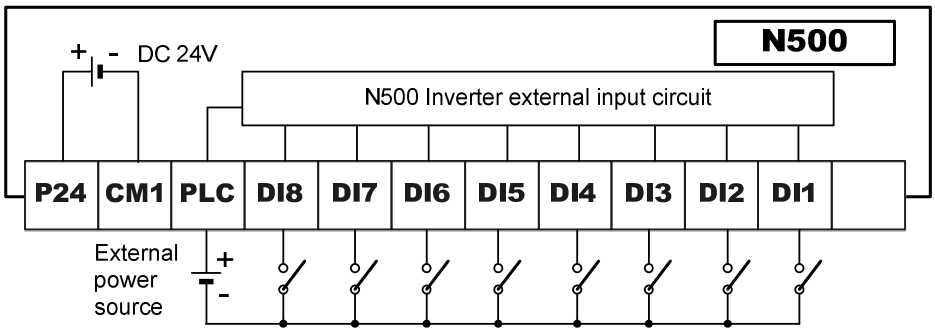


(Source Type)
: PLC-CM1 connection

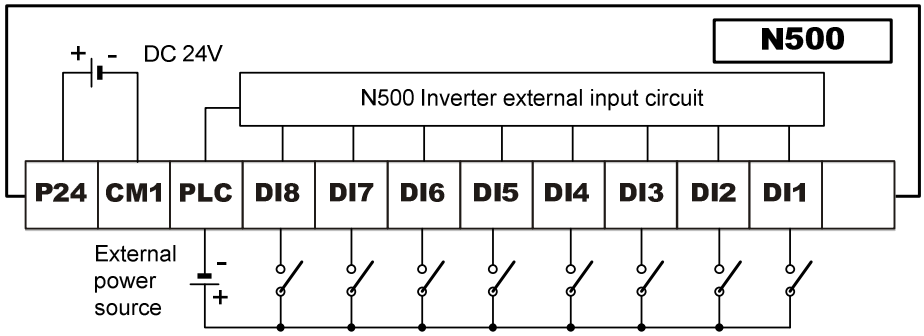


• In case of using the external power source of inverter

(Sink Type)
: Open P24-PLC



(Source Type)
: Open CM1-PLC



Intelligent input terminal setting [C01]~[C08]

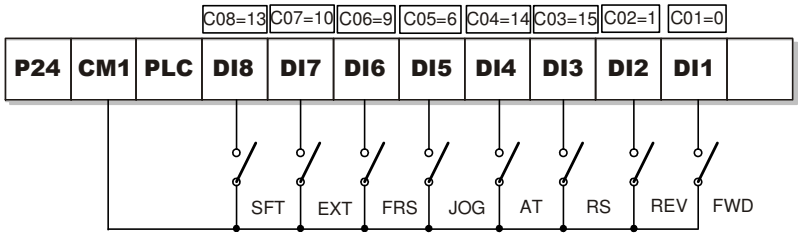
Input terminal function (C01~C08)

• It is possible to operate functions by assigning those functions to the intelligent input terminals 1-8 (C01-C08).

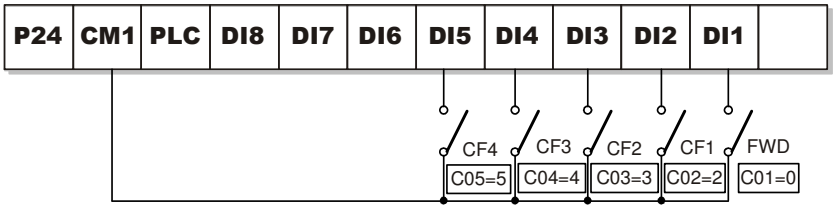
• The intelligent input terminals 1-8 can be selected individually whether the contact input specification is either a NO or a NC contact.

Code	Function name	Setting range			Description	Initial data
C01~C08	In_TM1~In_TM8 Intelligent input terminal DI1~DI8	0	FWD	Forward command	Operation run	[C01] In_TM1 FWD 0
		1	REV	Reverse command		[C02] In_TM2 REV 1
		2	CF1	Multi-speed 1 (binary operation)	Multi-speed operation function	[C03] In_TM3 RS 15
		3	CF2	Multi-speed 2 (binary operation)		[C04] In_TM4 AT 14
		4	CF3	Multi-speed 3 (binary operation)		[C05] In_TM5 JOG 6
		5	CF4	Multi-speed 4 (binary operation)		[C06] In_TM6 FRS 9
		6	JOG	Jogging	Jogging operation	[C06] In_TM7 EXT 10
		7	DB	External DC braking	DC braking(external DC braking)	[C08] In_TM8 SFT 13
		8	2CH	Two-stage adjustable-speed	Two-stage adjustable-speed function	
		9	FRS	Free-run stop	Free-run stop	
		10	EXT	External trip	External trip	
		11	USP	Unattended start protection	Unattended start protection function	
		12	CS	Commercial change	Commercial change	
		13	SFT	Software lock (control terminal)	Software lock	
		14	AT	analog input voltage/current select	Analog external input	
		15	RS	Reset inverter	Reset inverter	
		16	PID	PID selection (valid/invalid)	PID function	
		17	PID_C	PID integrating reset		
		18	UP	Remote control UP function	Reomte control UP/DOWN function	
		19	DOWN	Remote control DOWN function		
		20	UDCLR	Remote control data clear		

• Default setting of intelligent input terminals is as follows:



Example) FWD command on DI1 terminal, Setting D12~D15 to Multi-speed CF1~CF4 :

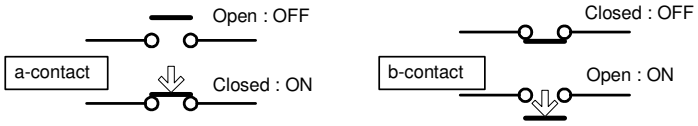


Input terminal a/b (NO/NC) selection (C09~C16)

• It is possible to set a contact input or b contact input to ntelligent input terminals 1-8 and FW terminals individually.

Code	Function name	Data	Description	Initial data
C09~C16	In_TM o/c1 ~ In_TM o/c8 Intelligent input DI1~DI8 a/b(NO/NC) selection	0	NO : a contact (Normally Open)	[C09] In_TM o/c 1 NO 0
		1	NC : b contact (Normally Closed)	

- a contact : "ON" with Close, "OFF" with Open,
- b contact : "ON" with Open, "OFF" with Close
- RS terminal can set only a contact.



Operation run (FWD/REV)

• Set 0(FWD), 1(REV) to intelligent input terminal D10~D18(function code: C01~C08).

Forward : FWD - CM1 terminal, Reverse : REV - CM1 terminal

• When using the FW terminal, it is possible to change the contact from NO to NCby settin a or b (respectively) in C09~C16.

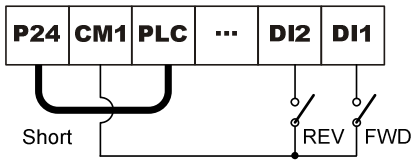
• When forward command and reverse command entered simultaneously, operation command becomes stop command .

• In case of a-contact setting, RUN key(FWD/REV) is ON(1=HIGH) and STOP key is OFF(0=LOW)

Data	Function name	Output status	Description
0	FWD Forward run/stop	OFF	Inverter: Stop mode, Motor: Stop
		ON	Inverter: Forward operation, Motor: Forward opeation
1	REV Reverse run/stop	OFF	Inverter: Stop mode, Motor: Stop
		ON	Inverter: Reverse operation, Motor: Reverse operation

Example) A Setting method for operation command from control terminal

- A02=1(TM), C01=0(FWD), C02=1(REV)
- In case of sink type by using an internal power source (DC24V) of a inverter



⚠ Danger

• If RUN command is previously inputted to an inverter, It is dangerous becasuse a motor start runing as soon as turning it on.
Please check whether run command is inputted or not.

• If FWD/REV command is b contact previously, It is dangerous becasuse a motor start runing as soon as turning it on.
Please be careful in case of selecting b contact.

Multi-speed operation function(CF1~CF4)

• Please set Intelligent input terminals 2(CF1), 3(CF2), 4(CF3), 5(CF4) to D10~D18 (Function code C01~C08).

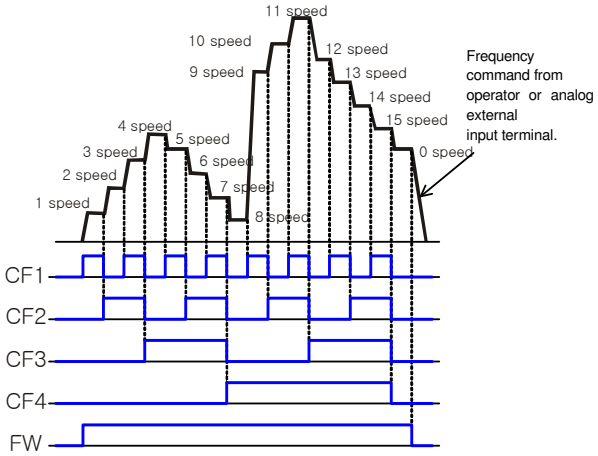
• Multi-speed operation can be selected by binary operation(max. 16 speeds) with 4 terminals or by bit operation (max. 8 speeds) with 7 terminals. It is possible to set multi-speed 0 to 15 by selecting 02 to 05 (CF1 to CF4) on the intelligent input terminals.

• Set frequency setting for speed 1 to 15 with A12-A26.

• Set 0 speed with F001 when frequency command is operator.

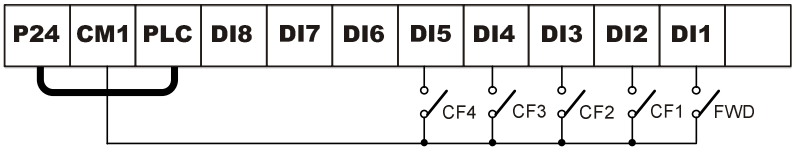
Or when frequency command is control terminal (Terminal), set with O, OI, O2 terminal.

Multi-speed	CF4	CF3	CF2	CF1
0 speed	OFF	OFF	OFF	OFF
1 speed	OFF	OFF	OFF	ON
2 speed	OFF	OFF	ON	OFF
3 speed	OFF	OFF	ON	ON
4 speed	OFF	ON	OFF	OFF
5 speed	OFF	ON	OFF	ON
6 speed	OFF	ON	ON	OFF
7 speed	OFF	ON	ON	ON
8 speed	ON	OFF	OFF	OFF
9 speed	ON	OFF	OFF	ON
10 speed	ON	OFF	ON	OFF
11 speed	ON	OFF	ON	ON
12 speed	ON	ON	OFF	OFF
13 speed	ON	ON	OFF	ON
14 speed	ON	ON	ON	OFF
15 speed	ON	ON	ON	ON



Example) The settig method for Multi-speed operation from control terminals

- A02=1(TM), C01=0(FWD), C02=2(CF1), C03=3(CF2), C04=4(CF3), C05=5(CF4)
- Sink type with internal power source of inverter



Jogging operation (JOG)

• Set one of intelligent input terminals D10~D18(C01~C08) to 06(JG)

• This function can be used to rotate the motor in small steps to allow fine-tuning.

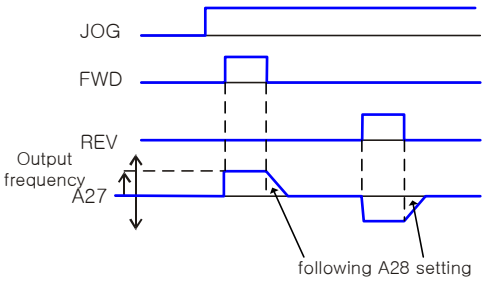
Data	Function name	Output status	Description
0	JOG Jogging operation	OFF	No jogging operation
		ON	Start jogging operation at jogging frequency (A27)

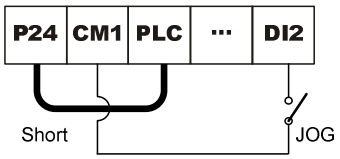
Note) When jogging frequency is set to starting frequency (B10) or 0Hz, the inverter does not operate jogging.

Please make a sure if a motor stoped for certain operation.

(1) Jogging frequency

The jogging operation does not use acceleration, therefore it would be advisable to set the jogging frequency to limit the starting current to a minimum or tripping may occur. Adjust A27 to the jogging frequency required.



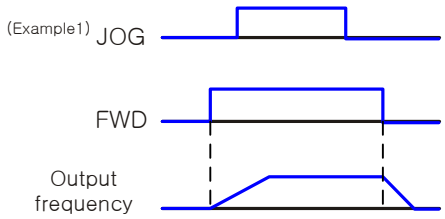


(2) Jogging operation selection

Function code	Function name	Setting range	Description
A27	Jog_F Set Jogging frequency selection	0.00~10.00	Unit : Hz
A28	Jog_Stop Jogging stop selection	0	FRE : Free-run on jogging stop
		1	DEC : Decelerating stop on jogging stop
		2	DCB : Direct braking on jogging stop

(Note1) When using the jogging function, turn FW terminal or RV terminal ON after the JG terminal is turned ON. (It is the same when the operation command point is from the operator.)

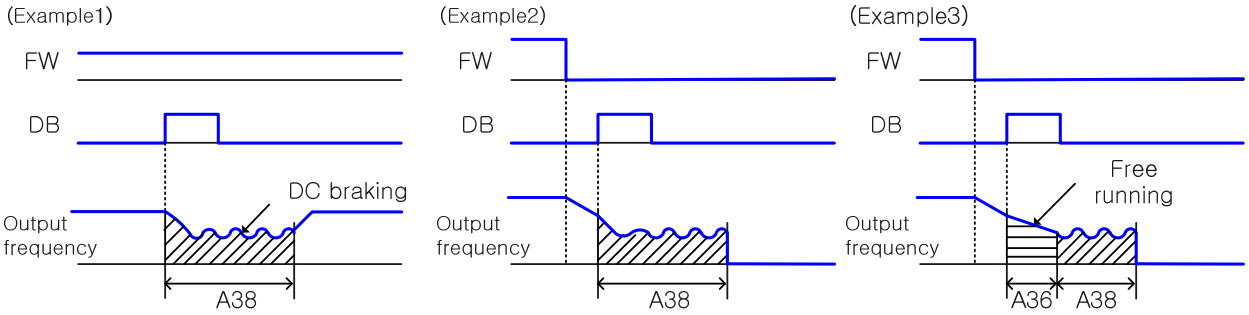
When setting of A28 is 00,01 or 02 and FWD signal is turned ON beforehand, the inverter doesn't operate jogging.



(Note2) In the case that the setting of A28 is 02, data setting of DB is necessary.

Outside DC braking (DB)

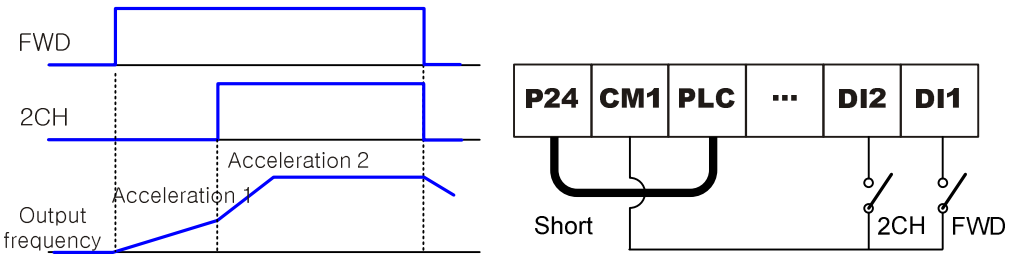
- Set 07(DB) to an intelligent input terminal.
- DC braking is then switched by ON/OFF of DB terminal irrespective of DC braking selection A051.
- Set strength of DC braking power with A37.
- Please set DC braking time A36 or DC braking time by DB terminal paying attention to the heat of the motor.
- Please set each setting in accordance with the system, after level action or edge action are selected with A36.



Two-stage Acceleration and Deceleration Function (2CH)

- By setting this function, it is possible to change the rate of acceleration and deceleration.
- While [2CH]-[CM1] is on, it is possible to operate with two-stage acceleration and deceleration time. When the terminal is open, it will be back to 1st acceleration and deceleration time.
- It is valid when two-stage acceleration and deceleration selection (A57) is 0. It is changed by A59 and A60 when A57 (2nd stage adjustable selection) is 1.

Example) In case 2CH is 8 in input terminal D12(C02)

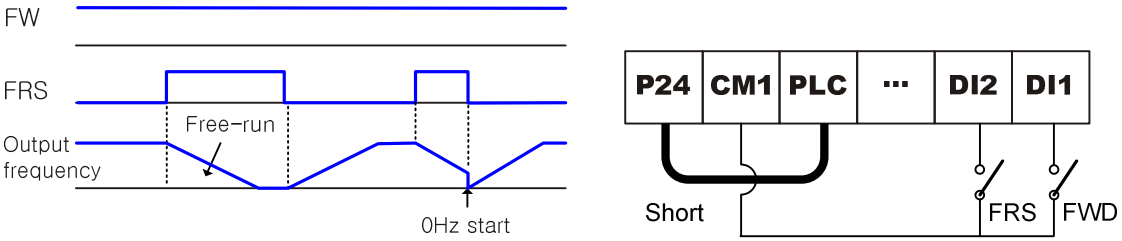


- Refer to page 4-34 for details.

Free-run stop (FRS)

- Assign 9 (FRS) to an intelligent input terminal(C01~C08).
- This free-run stop function will operate when the FRS terminal is ON.
- On restart it is possible to select 0Hz start or matching frequency start as output methods with the free-run stop selection b15.

Example) In case assign FRS(9) to D12(C02) terminal

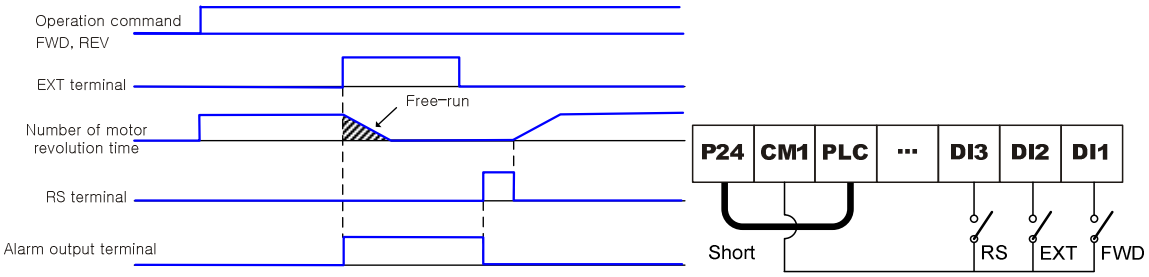


- Refer to page 4-41 for details

External trip (EXT)

- This function can be used to force the Inverter into a trip situation which is Switched by an external input, i.e. PLC or relay contact.
- Assign 10(EXT) to an intelligent input terminal.
- When the EXT terminal is switched ON, the inverter trips on an **EXT.ER** and the outputis switched OFF.
- The trip will not be canceled when the terminal is turned OFF. To cancel the trip, the reset signal must be applied or the Inverter switched OFF and ON again at the supply.

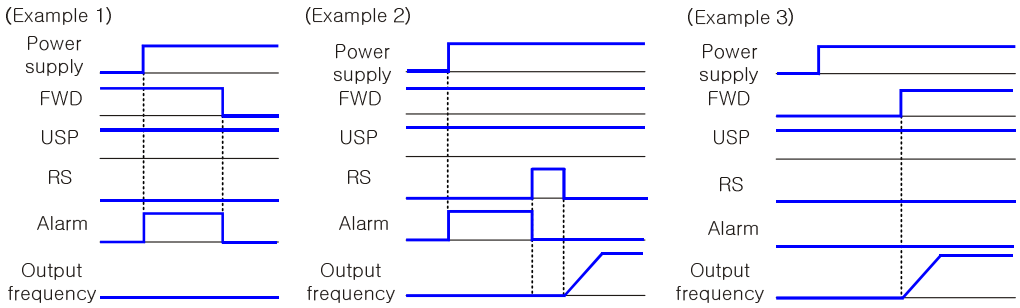
Example) In case assign [EXT] to a terminal(DI2)



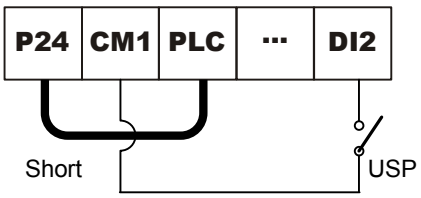
Unattended start protection (USP)

- Assign 11(USP) to an intelligent input terminal.
- The USP function is designed as a fail safe to prevent accidental starting of the Inverter if the RUN signal is ON when the power is restored to the Inverter.
- When this function worked, **USP.ER** is displayed. Either resetting the Inverter or turning the RUN signal OFF can clear the trip
  - This function is able to disarm when the operation command is turned off. (Example 1)
  - If the trip is cancelled while the RUN signal is still ON then the inverter will restart automatically. So please be careful. (Example 2)
  - When the operation command is turned on after the power supply input, the inverter drives normal. (Example 3)

•Unattended start protection is shown as follows



Example) In case Assign 13[USP] to an input terminal (DI2)



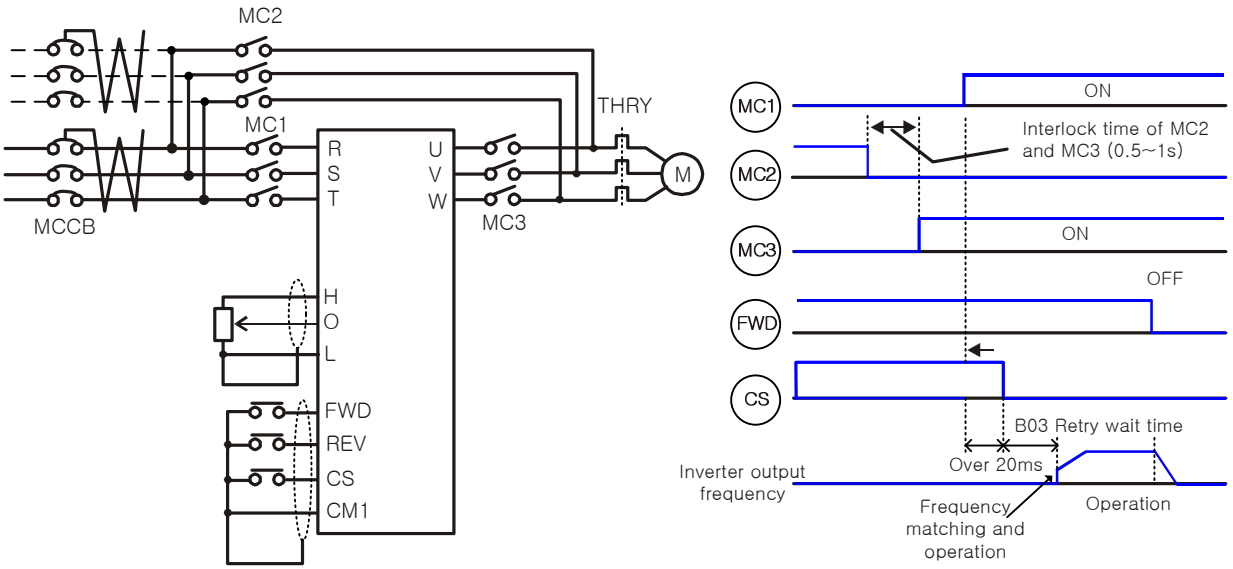
Note)

- Although the trip is cancelled while the RUN signal is still ON then the inverter will restart automatically. So please be careful. (Example 2)
- Although the trip is cancelled by ON/OFF function of terminal [RS] after Under-voltage error, USP function still works.
- If the RUN signal is ON immediately after the power is restored to the Inverter, USP error is displayed. So please turn on the RUN signal after 3 seconds from turning it on.

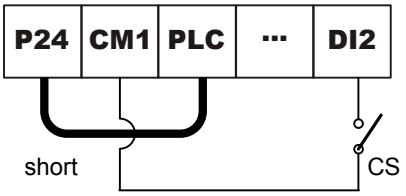
Commercial power source switching (CS)

- This function is used for systems with an excessive amount of starting torque requirements. The motor would be started direct-on-line and then when the motor had started the inverter would take over. This function is comonly used to reduce the costing of the inverter. Assign 12(CS) to an intelligent input terminal.
- Using the example below. When the motor has been started direct-on-line, Mc2 is switched OFF and Mc3 is switched on. With the Forward command to the inverter already on the CS terminal is switched on and Mc1 is closed. The Inverter will then read the motor RPM and when the CS terminal is switched OFF the retry wait time (b03) is started.
- When the MCCB trips on ground fault, the commercial circuit will not operate. When a backup is required, take the supply from the commercial circuit MCCB.
- For FWD, REV, CS, use control relays. The sequence above is reference to the circuit and timing diagram below.
- If an over-current trip occurs when frequency matching, extend the retry wait time (b03).

< Connection figure example and timing on commercial power source switching>



Example) Assigning 12[CS] to an intelligent input terminal [DI2].



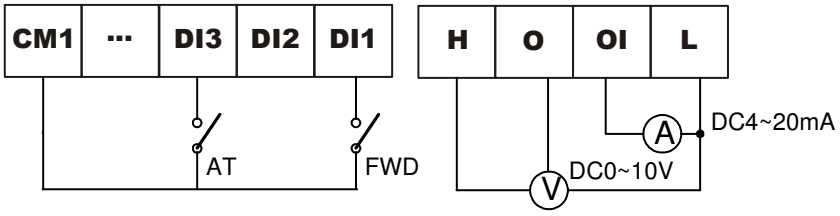
External analog input [AT]

- AT terminal ON: OI-L (4~20mA) valid
  AT terminal OFF: O-L (0~5VDC, 0~10VDC) valid
- When [AT] isn't assigned, the frequency set up becomes the value which current input and voltage input were added to.
  Please assign 16(AT) to intelligent input terminal certainly when selecting one of current input and voltage input.

Example) A05 (External frequency input selection), AT (Analog input voltage/current selection), Frequency setting

case arrording to external voltage/current input

A05	AT	Frequency command
0	OFF ON	O-L input OI-L input
1	OFF ON	OI-L input O-L input



Reset (RS)

- This function resets the inverter when a protective trip has occurred.
- The method of reset is to either push the STOP/RESET key on the digital operator or to switch the RS terminal ON.
- To reset the inverter with the control terminal, assign 15 (RS) to an intelligent input terminal.

UP/DOWN Function

- This function is valid only when the frequency command selection A01 is set to 3(UDT).
- It is possible for the Inverter to retain the frequency setting value from the UP/DWN terminals.
- Assign 18(UP) and 19(DOWN) to two of the intelligent inputs DI1-DI8.

- Acceleration time operates according to F02, F03 when UP/DOWN terminal is ON.

- It is also possible to clear the memory and return to the original set frequency. Assign 20(UDCLR) to an intelligent input terminal and switch it on to clear the memory.
- It is possible for the Inverter to retain the frequency setting value from the UP/DWN terminals. Parameter C57 switches the memory On or OFF.
- The Inverter output freqeuency can be changed when UP/DOWN signal keeps over 50 msec.

Data	Function name	Output status	Description
18	UP Remote control UP function	OFF	Motor output is normal
		ON	Accelerate motor from the current frequency (Output frequency UP)
19	DOWN	OFF	Motor output is normal

	Remote control DOWN function	ON	Decelerate motor from the current frequency (Output frequency DOWN)
20	UDCLR Remote cotrol Data remove	OFF	UP/DOWN status of the memory is normal.
		ON	remove UP/DOWN stauts

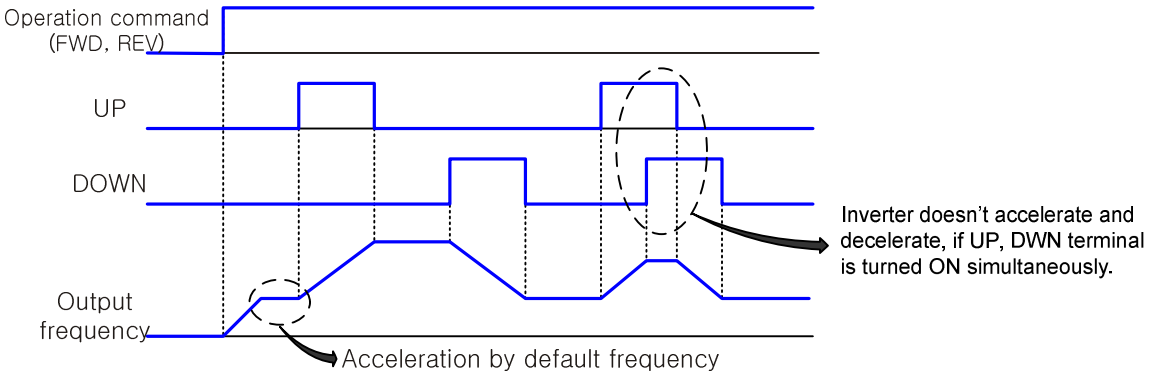
Example) C06=18(UP), C07=19(DOWN), C08=20(UDCLR)

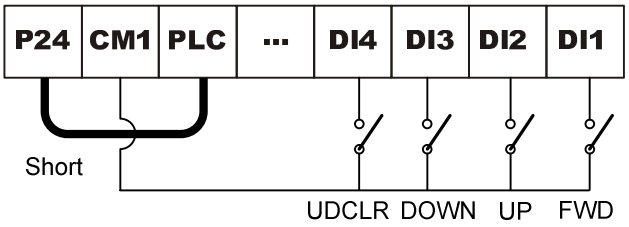
- Acceleration: [UP] ON: Output frequency -> UP

  [UP] OFF: Output frequency -> Keep

- Deceleration : [UP] ON: Output frequency -> Down

  [UP] OFF: Output frequency -> Keep





Intelligent output terminal function [C17]~[C24]

Intelligent output terminal selection (C17~C24)

- Any of the following functions can be assigned to the intelligent output terminals (DO1 - DO5) or the alarm relay (D07-D08).
- Intelligent output terminal is fixed as the READY signal and can not be changed at discretion.
- All three output relays can be selected to be either NO or NC (a or b).

Code	Function name	Data	Description		Reference item	Initial data sign
C17~C24	Out_TM1~Out_TM8 Intelligent output terminal DO1~DO8	0	RUN	Signal during run	Signal during run	[C17] Out_TM1 RUN 0 [C18] Out_TM2 FA2 2 [C19] Out_TM3 OL 3 [C20] Out_TM4 IPS 8 [C21] Out_TM5 THM 10 [C22] Out_TM6 READY 14 [C23] Out_TM7 FA1 1 [C24] Out_TM8 ALM 5
		1	FA1	Constant speed arrival signal	Frequency arrival signal	
		2	FA2	Over setting frequency		
		3	OL	Overload advance notice signal	Overload limit	
		4	OD	output deviation for PID control	PID function	
		5	ALM	Alarm signal	Protection function	
		6	FA3	Arrival signal for only setting frequency	Frequency arrival signal	
		7	IPS	Instantaneous stop signal	Instantaneous stop/under-voltage	
		8	THM	Thermal caution	Electric thermal function	
		9	READY	-	-	

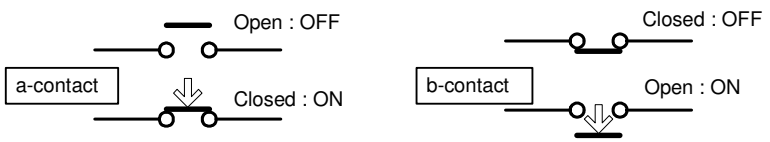
Output terminal a/b (NO/NC) selection (C25~C32)

- This sets the intelligent output terminal DO1-DO5 and alarm relay (D06-D07) output terminal contact condition to either NO or NC, (a or b). Each output is changeable individually.

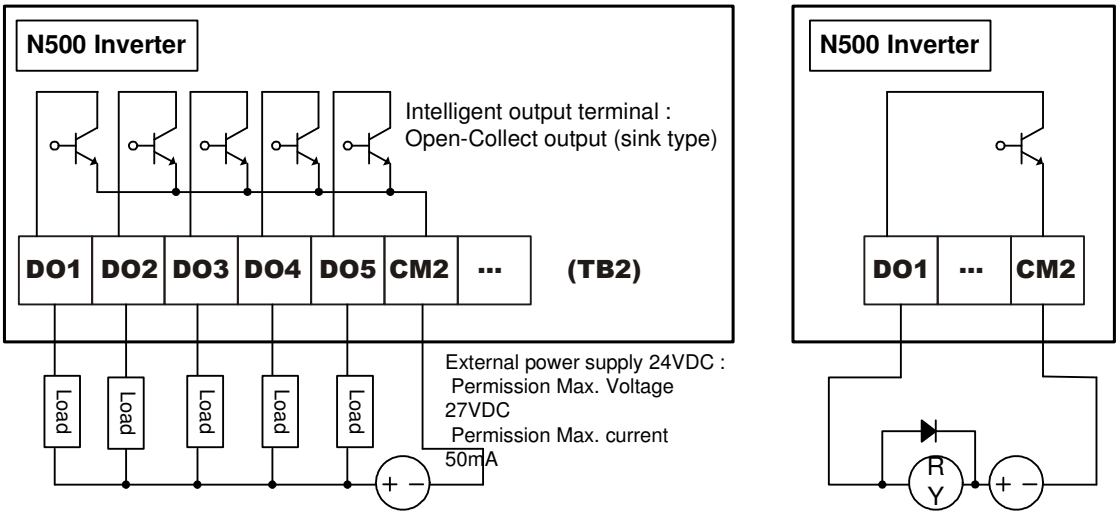
  Both intelligent output terminals DO1-DO5 are Open-Collector outputs and D07-D08 are relay outputs.

Code	Function name	Data	Description	Initial data sign
C25~C32	O_TM o/c1 ~ O_TM o/c8 Output terminal DO1~DO8 a/b selection	0	NO : a contact (Normally Open)	[C25] O_TM o/c1 NO 0
		1	NC : b contact (Normally Closed)	

- a contact: Close with {ON}, open with {OFF}
- b contact: Open with {ON}, close with {OFF}.
- RS terminal: Only a contact



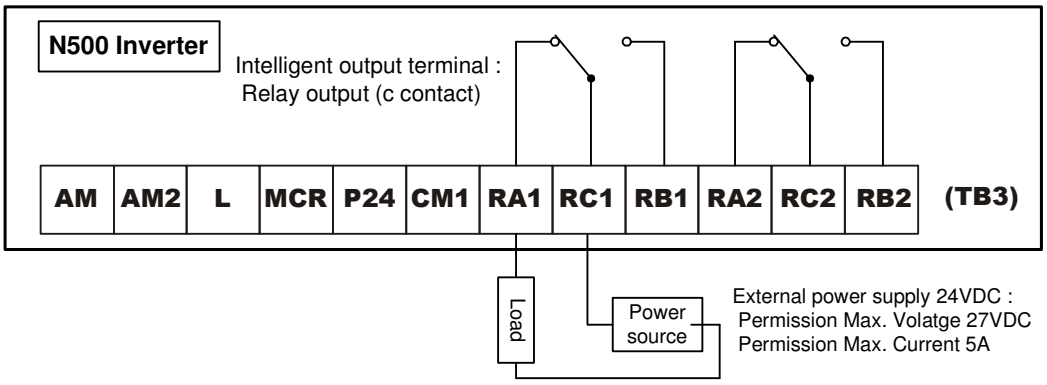
• Specification of the intelligent output terminals D01~D05: (Open-Collector Type)



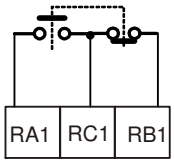
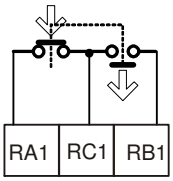
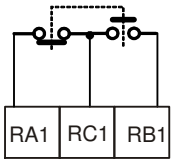
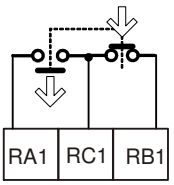
Note) Use Inverter output terminals to operate samall relays when it needs over 50mA.

Use the diode between Relay coils and the Electronic relay instead of the Mechanical relay to reduce spike voltage.

• Specification of the intelligent output terminals DO7 - DO8 (c contact)

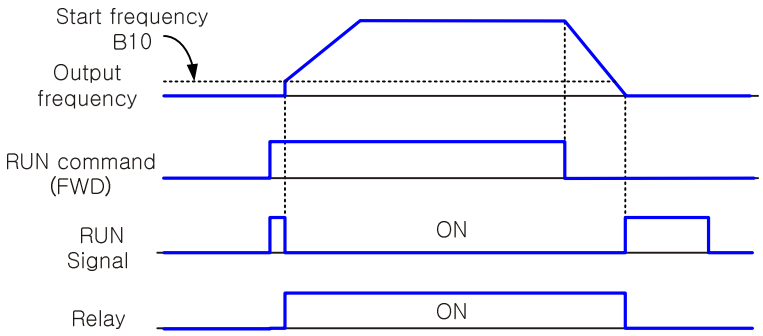


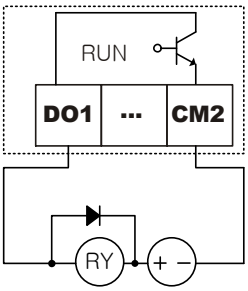
Example of alarm use)

N.O Contact (C31=0, C31=0 : Default)					N.C Contact (C31=1, C32=1 : Changed)				
 On normal or Power off		 Alarm occur			 On normal		 Alarm occur or Power OFF		
Contact	Power source	Operation status	RA1-RC1	RB1-RC1	Conatct	Power source	Operation status	RA1-RC1	RA1-RC1
a-contact (N.O.)	ON	normal	Open	Closed	b-contact (N.C.)	ON	normal	Closed	Open
	ON	Trip	Closed	Open		ON	Trip	Open	Closed
	OFF	-	Open	Closed		OFF	-	Open	Closed

Signal during run (RUN)

- This function is to provide an output signal when the Inverter is in a running condition.
- Assign 0 (RUN: signal during run) to an intelligent output terminal DO1~DO8.
- The signal is still outputted when the dc braking operates.
- Operation is as follows.





Data	Function name	Output status	Description
0	RUN Signal during run	OFF	(STOP Mode)
		ON	(RUN Mode)

Frequency arrival signal 1~3 (FA1/FA2/FA3)

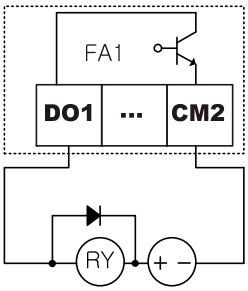
- When the output frequency arrives at the set frequency, an arrival signal is outputted.
- Assign 01(FA1:constant speed arrival signal), 02(FA2:over setting frequency), 06(FA3: only setting frequency) to an intelligent output terminal DO1~DO8.

Data	Function name	Output status	Description
1	FA1 Frequency arrival signal 1	OFF	When the output frequency do not arrive at F01 frequency.
		ON	When the output frequency arrive at F01 frequency.
2	FA2 Frequency arrival signal 2	OFF	When the output frequency is decelerated or less than frequency arrival settin for deceleration (C53)
		ON	When the output frequency is accelerated or over frequency arrival setting for acceleration (C52)
6	FA3 Frequency arrival signal 3	OFF	When the output frequency is accelerated, reachs frequency arrival setting for acceleration (C52) or do not reach frequency arrival setting for deceleration (C53) during the deceleration
		ON	When the output frequency is accelerated, reachs frequency arrival setting for acceleration (C52) or reachs frequency arrival setting for deceleration (C53)

- Acceleration/Deceleration arrival frequency setting is as follows.

Code	Function name	Setting range	Description	Initial data
C52	Acceleration arrival frequency F_Arv Acc	0.00~400.0	Setting the arrival signal on acceleration.	[C52] F_Arv Acc 000.00Hz
C53	Deceleration arriva F_Arv Dec	0.00~400.0	Setting the arrival signal on deceleration	[C53] F_Arv Dec 000.00Hz

(1) Output on constant speed arrival (01:FA1)

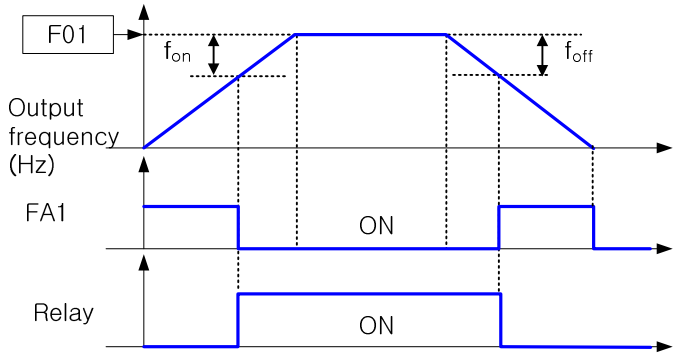


• When the inverter arrives at the set frequency with frequency setting (F01) or multi-speed (A12-A26), the output relay is switched.

• Hysteresis frequency arrival signal is the following.

When ON : ON with (setting frequency -1% of maximum frequency)(Hz)

When OFF: OFF with (setting frequency - 2% of maximum frequency)(Hz)



Setting frequency Fon : 1% of Max. Frequency
Foff : 2% of Max. Frequency

(Example)
max. frequency f max=120(Hz)
setting frequency f set=60(Hz)
f_{on}=120 x 0.01=1.2(Hz)
f_{off}=120 x 0.02=2.4(Hz)
On acceleration: ON with 60 - 1.2=58.8(Hz)
On deceleration: OFF with 60 - 2.4=57.6(Hz)

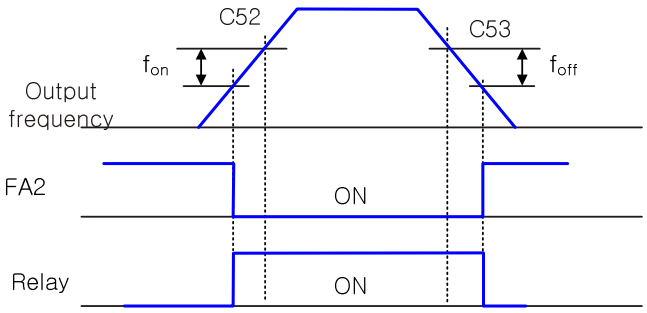
(2) Output over setting frequency (2 : FA2)

• When the output is over the arrival frequency set in [C52, C53 (FA2)] on adjustable speed time, the output relay is switched.

• Hysteresis frequency arrival signal is the following.

When ON : ON with (setting frequency - 1% of maximum frequency)(Hz)

When OFF: OFF with (setting frequency - 2% of maximum frequency)(Hz)



Setting frequency Fon : 1% of Max. Frequency
Foff : 2% of Max. Frequency

(3) Output setting frequency (06:FA3)

• The signal is switched only when the output frequency matches the arrival frequency set in [C52, C53(FA3)] on adjustable speed time.

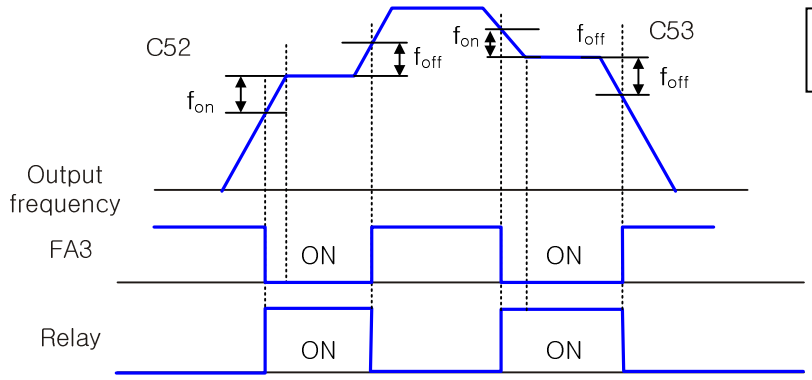
• In case of setting frequency arrival signal 3 (FA3)

When ON on acceleration : ON with (setting frequency - 1% of maximum frequency)(Hz)

When OFF on deceleration : OFF with (setting frequency + 2% of maximum frequency)(Hz)

When ON on deceleration: ON with (setting frequency + 1% of maximum frequency)(Hz)

When OFF on deceleration: OFF with (setting frequency - 2% of maximum frequency)(Hz)



Setting frequency Fon : 1% of Max. Frequency
Foff : 2% of Max. Frequency

Overload advance notice (OL)

- When the inverter reaches the overload restriction level, the Inverter will reduce the output frequency automatically to restrict the overload.This function prevents an over-current trip by inertia during acceleration or radical changes in load at constant speed.
- If the overload restriction constant is set too short, in spite of accelerating, an over-voltage trip is caused with regenerative enegy from the motor on automatic deceleration by this function.
- When the load is high, it is possible to adjust the load again by outputting an overload advance notice.

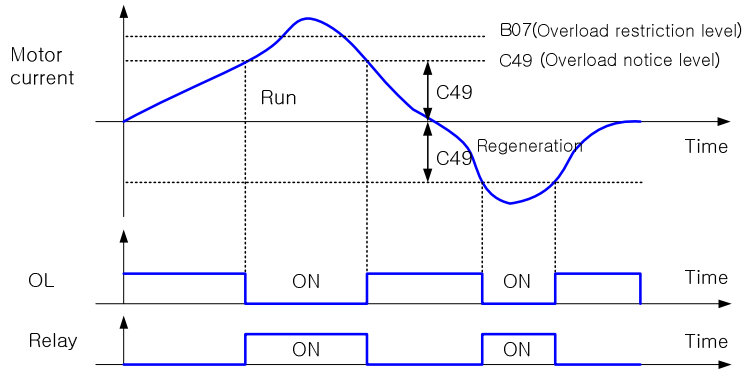
It is used to prevent damage to the machine from too much load, i.e. baggage on a conveyor, the Inverter overload protection will operate.

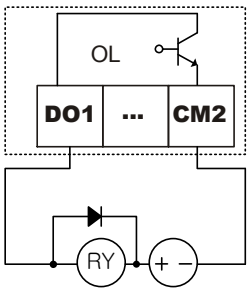
- Assign 03(OL) to an intelligent output terminal DO1 - DO8.

Data	Function name	Output status	Description
3	OL Overload advance notice	OFF	When output current is lower than overload advance notice level (C49).
		ON	When output current is higher than overload advance notice level (C49)

- Please set the output current in case of overload in overload advance notice level (C49)

Code	Function name	Setting range	Description	Initial data
C49	OL PreSet Overload advance notice level	5.0~200.0	Unit : % As load reaches overload advance notice level, OL signal is output.	[C49] OL PreSet 0100.0%





The Maximum PID Deviation Signal (OD)

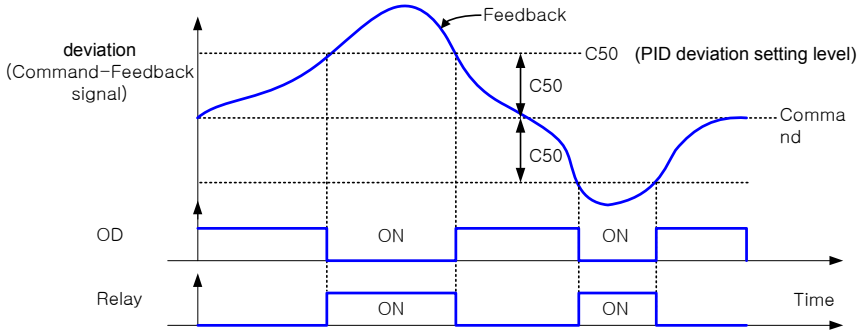
- It is possible to establish the maximum deviation level C50 on PID control. When the PID deviation amount(ε) reaches the set level C50, it is possible to set an intelligent output.
- C50 can be set from 0 to 100% and corresponds with the command; from 0 to maximum.

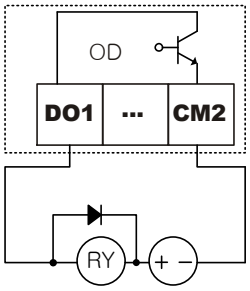
Code	Function name	Data	Description	Initial data
C50	PID PreSet PID deviation level setting	0.0~100.0	Unit : % Setting deviation range between the feedback and command signal	[C50] PID PreSet 0000.0%

- Please set 4 (OD) to intelligent output terminal DO1~DO8(C17~C24)

Data	Function name	Output status	Description
4	OD Overload advance signal	OFF	PID Deviation < Deviation level
		ON	PID Deviation > Deviation level

- Set output current level in overload advance notice level (C49).





Instantaneous power failure / under-voltage (IPS)

- You can select whether the inverter trips or retries (restart) when an instantaneous power failure/under-voltage occurs.
- Alarm outputs while control power of inverter remains.
  Alarm output at an instantaneous power failure and under-voltage during standstill.
- It is possible to use an output by assigning the signal (IPS: 7) to an intelligent output terminal D01-D08(C17-C24).

Thermal warning (THM)

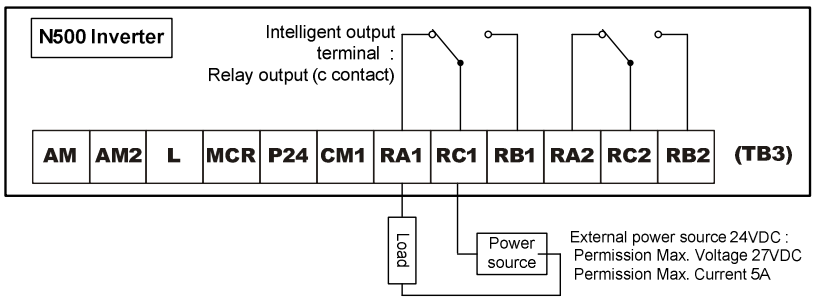
- A warning signal is outputted before overheat protection by the electronic thermal protection occurs.
  Warning level is set with C51.
- Assign 8(THM) to an intelligent output terminal (Do1-DO8).

Data	Function name	Output status	Description	
10	THM Thermal warning signal	OFF	Electronic thermal level < Setting level	
		ON	Electronic thermal level > Setting level	
Code	Function name	Setting range	Description	Initial data
C51	E_Thm Warn Thermal warning level	0.0~100.0	Unit : %	[C51] E_Thm Warn 0080.0%

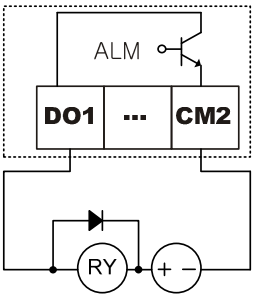
Alarm signal (ALM)

- This is the function that inverter outputs trip factor as signal.
- When the alarm occurs, alarm signal output is outputted in intelligent output terminal.
- Alarm signal AL is outputted with open-collect signal or alarm relay contact signal in terminals (DO1~DO5).

Data	Function name	Output status	Description
5	ALM Alarm signal	OFF	When Alarm signal do not occur after removing the previous alarm signal.
		ON	When Alarm signal occurs not after removing the previous alarm signal.



<Relay output RC1-RA1-RB1, RC2-RA2-RB2>



<Open collect output>

- When alarm output terminal is selected to b-contact (N.C.), there is delay time until the terminal contact is ON for turning on the inverter. So consider about 2 seconds after turn it on.
  (When turning ON/OFF with b-contact, Chattering occurs. Please set external inter-lock circuit in case of ERROR by this action.)
- Please be careful because the open-collector output is different from the relay output.

FM terminals [C33]~[C43]

Digital output signal (FM) Selection (C33)

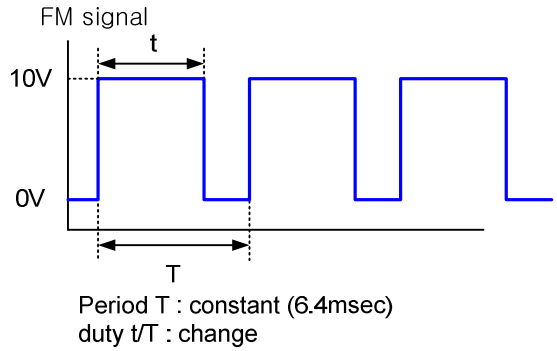
- The FM control terminal can monitor the output frequency and output current.
- FM terminal is a PWM (Pulse Width Modulation) output.

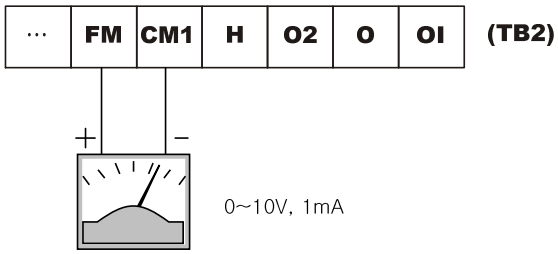
Code	Function name	Data	Description	Initial data
C33	FM_sig Sel Digital output signal (FM) selection	0	OutF : Output frequency	[C33] FM_sig Sel OutF 0
		1	OutC : Output current	
		2	OutV : Output voltage	
		3	OutT : Output torque (Note)	
		4	Out F_Dig : Digital output frequency	
		5	InPwr : Input power	

(Note) Display substitutes only at the time of the sensorless vector control and vector control.

(1) PWM signal: 0, 1, 2, 3, 5

- PWM (Pulse-Width Modulation) is used to operate a commander (Moving-coil type). PWM signal is expressed as the analog average value by a commander (Moving-coil type)



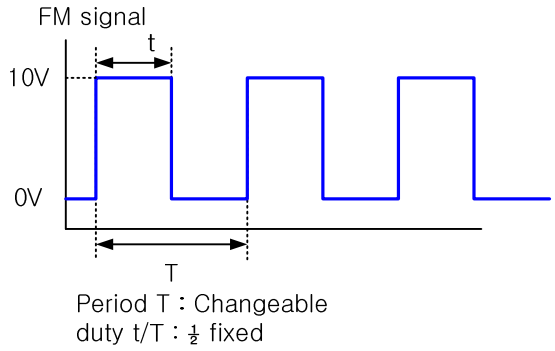


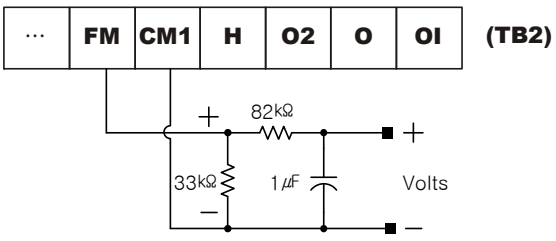
(Note) Standard analog signal is outputted through AM and AM2 terminals.

Please use the circuit like this figure (1) to get the analog output signal by using PWM signal of FM terminal.

(2) FM Signal: 4

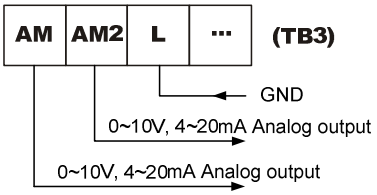
- FM signal is able to change FM frequency according to the inverter output frequency.





Analog output signal (AM/AM2) Selection (C34~C35)

- AM terminal and the AM2 terminals can monitor the output frequency or the output current.
- The AM terminal has an analog output of 0-10V.
- The AM2 terminal has an analog output of 4-20mA.



Code	Function name	Setting range	Description	Initial data
C34	AM_sig Sel Analog output signal (AM) selection	0	OutF : Output frequency	[C34] AM_sig Sel OutF 0
		1	OutC : Output frequency	
		2	OutV : Output current	
		3	OutT : Output torque	
		4	InPwr : Input power	
C35	AM2_sig Sel Analog output signal(AM2) selection	0	OutF : Output frequency	[C35] AM2_sig Sel OutF 0
		1	OutC : Output current	
		2	OutV : Output voltage	
		3	OutT : Output torque	
		4	InPwr : Input power	

- This function is used to calibrate a meter connected to the AM and AMI terminals.

Code	Function name	Setting range	Description	Initial data
C36	AMV_Gain Analog meter 1 voltage gain adjustment	0~10.00	Setting voltage gain of AM terminal	[C36] AMV_Gain 001.00
C37	AMV_Offset Analog meter 1 voltage offset adjustment	0~2000	Setting voltage offset of AM terminal	[C37] AMV_Offset 01000
C38	AMI_Gain Analog meter 1 current gain adjustment	0~10.00	Setting current gain of AM terminal	[C38] AMI_Gain 000.00
C39	AMI_Offset Analog meter 1 current offset adjustment	0~2000	Setting current offset of AM terminal	[C39] AMI_Offset 01000
C40	AM2V_Gain Analog meter 2 voltage gain adjustment	0~10.00	Setting voltage gain of AM2 terminal	[C40] AM2V_Gain 000.00
C41	AM2V_Offset Analog meter 2 voltage offset adjustment	0~2000	Setting voltage offset of AM2 terminal	[C41] AM2V_Offset 01000
C42	AM2I_Gain Analog meter 2 current gain adjustment	0~10.00	Setting current gain of AM2 terminal	[C42] AM2I_Gain 001.00
C43	AM2I_Offset Analog meter 2 current offset adjustment	0~2000	Setting current offset of AM2 terminal	[C43] AM2I_Offset 01000

UP/DOWN memory slection [C57]

- This memorizes the frequency command adjusted with UP/DOWN after power is turned off
- The Data of C57 is 0 : This will not memorize the frequency command adjusted with UP/DWN.

When power is turned ON again, the set value is returned to the value before it was adjusted with UP/DOWN.

• The Data of C57 is 1 : This memorizes the frequency command adjusted with UP/DWN.

When power is turned ON again, the set value is kept the value after it was adjusted with UP/DOWN.

2.4.6 H-Group (Function about Motor constant)

Motor parameter setting function [H03]~[H09]

Motor constant selection

- Motor constant used in sensorless vector control and vector control with sensor can be selected from the following the three.
  (1) Hyundai general purpose motor constant
  (2) Motor constant measured in offline autotuning
  (3) Optional setting motor constant
- When using several motors, add capacity of all motors and select smiliar data for motor capacity.
- In case of automatic torque boost, there may be reduced torque characteristic and motor-hunting because this setting is not always correct.

Code	Function name	Setting range	Description	Initial data
H03	Motor rated current M_RateCurr	0~99999	Unit : A	[H03] M_RateCurr 00656A
H04	Motor poled selection M_Pole	0~5	0 2 poles 1 4 poles 2 6 poles 3 8 poles 4 10 poles 5 12 poles	[H04] M_Pole 4 Pol 1
H05	Motor constant Rs M_Cnst Rr	0.001~6.5535	Unit : ohm Resistance according to the side of a stator.	[H05] M_Cnst Rs 0.0183Ohm
H06	Motor constant Rr M_Cnst Rr	0.001~6.5535	Unit : ohm Resistance according to the side of a rotator.	[H06] M_Cnst Rr 0.0105Ohm
H07	Motor constant Ls M_Cnst Ls	0.01~65.535	Unit : mH Setting magnetic inductance of a stator.	[H07] M_Cnst Ls 027.45mH
H08	Motor constant Lr M_Cnst Lr	0.01~65.535	Unit : mH Setting magnetic inductance of a rotator.	[H08] M_Cnst Lr 027.31mH
H09	Motor constant Lm M_Cnst Lm	0.01~65.535	Unit : mH Setting mutual inductance of a motor.	[H09] M_Cnst Lm 026.93mH

2.5 Communication function

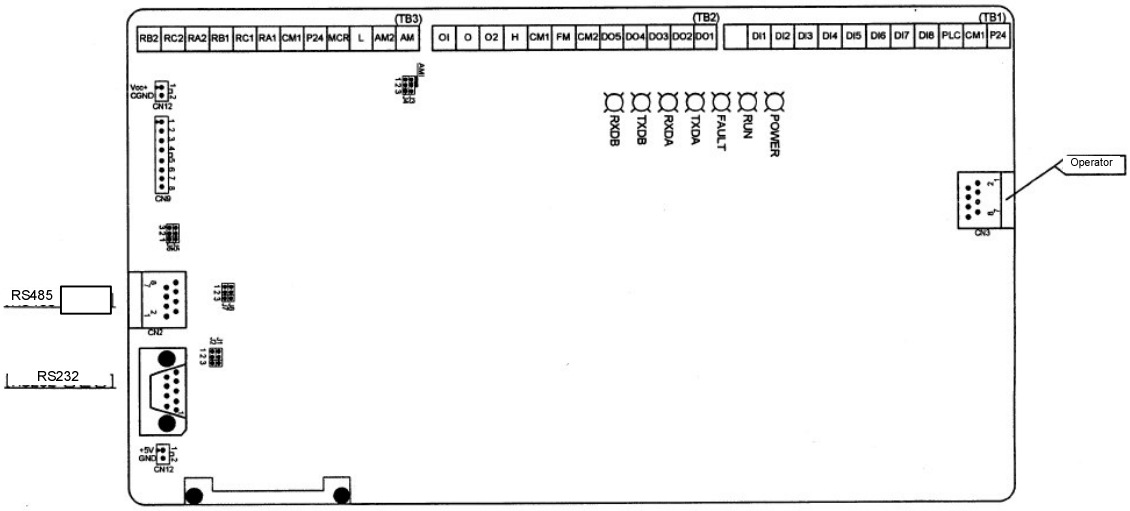
Serial communication is possible from the Inverter to any external equipment using GIMN(General Inverter-Management Net) protocol.

(1) Communication specification

Item	Specification
Synchronizing methods	(Asynchronous)
Communication methods	Half duplex communication methods
Communication interface	RS485
Connect form	1:N (N = Maximum 32)
Transmission speed	2400bps, 38400bps

(2) Communication appearance

- RS485 port : Connect to reomte operator through CN2 connector of the main control board.
- RS232 port : Connect to HMI(human-machine interface) through CN1 connector of the main control board.
- Terminal resistance valid/invalid : Insert a jumper pin between 1(JP1) and 2(JP2).

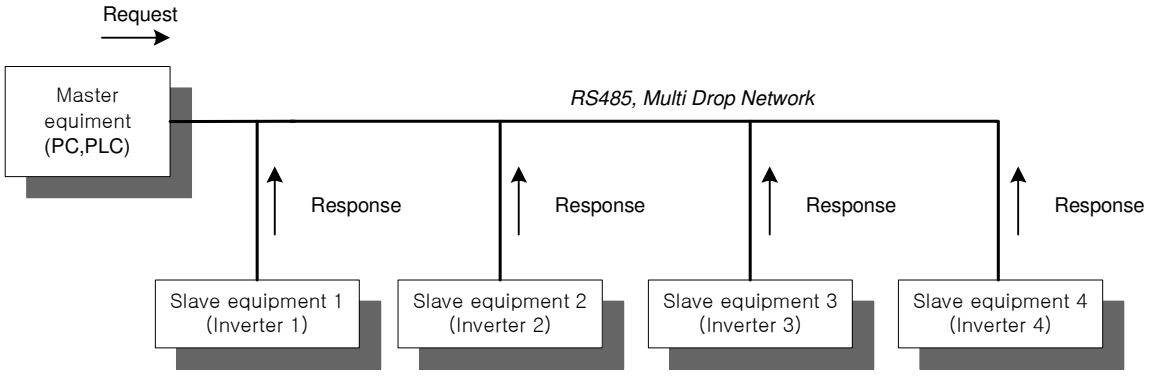


2.5.1 GIMN(General Inverter-Management Net) Protocol

GIMN Protocol

General Inverter-GIMN protcol uses the asynchronous communication (Serial port) and makes it possible to communicate among Inverters effciently.

GIMN protocol connection is as follows. GIMN protocol uses Master/Slave methods. Communication network is controlled by the master equipment, and it is operadted by the method that the slave equipement reply from the transmission request of master equipment.



<GIMN connection and Master/Slave diagram>

All slave equipments have orginal own addresses except master equipments and use address 1~32 (address 0 is for broadcast). Each communication frame has an address field (data size: 1 byte). Master equipment sends the transmission frame (request) by filling addresses of slave equiments with it, and all slave equipments is looking for the address field of this frame. When slave equipments recognized that it is same as its own address, these slave equipments start sending response frame, then the address field of the response frame is filled with its own address.

Framing & Error Control

GIMN protocal constitutes communication frames for the efficient communication among several machines (inverters) by using the 7th-bit-collect encoding method. The process constituting communication frames is explained as follows.

• UDU (User Data Unit)

User data unit means a data unit which has the real transmission data and is a data unit which is send to the Inverter user layer (application layer). The frame format of a user data unit is follows as:

1 Byte	1 Byte	N Bytes
Address	OP. Code	Data

<UDU (User Data Unit) Format>

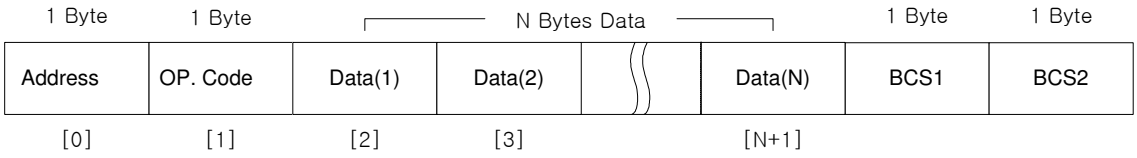
(1) Address : Slave station address(0, 1~32)

(2) OP. Code : Operation code, the type of User data unit (0x40~0x5f)

(3) Data : Actual transmission data

• BCS (Binary Check Sum) Calculation and Addition

BCS is the method to check communication frame errors and is compoed of 2 bytes (BCS1, BCS2). It calculates BCS from UDU (User Data Unit) and then BCS is added behind UDU.



<UDU format added BCS>

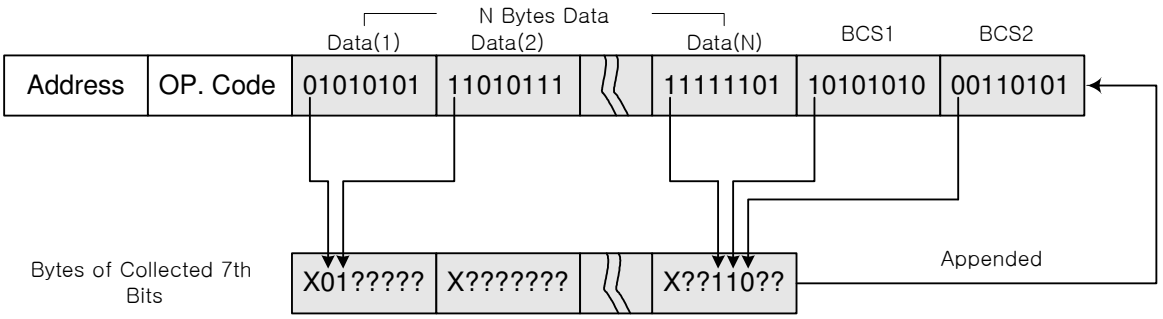
The calculation of BCS is as follows and is disregarded remaing part except subordinate position (1 byte).

(1) BCS1 = [0] + [2] + [4] ..... + [A](A <= N + 1)

(2) BCS2 = [1] + [3] + [5] ..... + [B](B <= N + 1)

• Data & BCS field의 encoding (7th-bit-collect encoding)

The reason of 7th-bit-collect encoding is to define the orginal control byte (Frame start & delimiter) and control data and byte pattern of BCS not to make this control byte repeat during the operation. 7th-bit-collect encoding method is as follows.



<7th-bit-collect encoding>

7th-bit-collect encoding method

(1) It makes new bytes by collecting MSB (7th bit) of All bytes in data and BCS field like this figure, then these bits are arranged from next MSB bit of new bytes.

(2) It is added next BCS field of new bytes.

(3) It all set MSB (7th bit) of Data, BCS, new bytes to 1. So this value becomes over 0x80 and this field is called EDB (Encoded Data & BCS).

• Transmission frame

After BCS and 7th-bit-collect encoding process about UDU, the last transmission frame format is as follows.

1 Byte	1 Byte	1 Byte	N + 2 + X Bytes	1 Byte
STX(0x72)	Address	OP. Code	EDB(Encoded Data & BCS)	ETX(0x73)

<Transmission frame format>

After BCS and encoding 7th-bit-collect process about UDU, the frame start/end delimiter (STX/ETX) is added in the front and the rear frame. So the field value becomes below 0x80.

2.5.2 Remote control of N500 Inverter by using GIMN Protocol

Configuration

• Hardware setting

N500 Inverter supports RS484 communication network using the Half duplex (RS485 signal, 2 lines) method. CN2 (RJ45) connector on the main control board is RS485 port for the remote communication. Number 1 (-) and 2 (+) of this connector are communication lines for RS485 communication, and these are connected to the communication network.

R15 which is the terminal resistance for RS485 communication network is opened and closed by RS485 communication regulation. Please insert the Jumper pin on terminal 1 (JP1) and 2 (JP2) for the remote control.

• Operator setting

Inverter station address tergeted is set by the setting code C55. The station address targeted is set as number 1~32. The maximum station address becomes the total number of inverters which are connected to network. And the station address should be set differently from other inverters in network.

When the station address is 0, the remote control function is going to stop and Inverter operation is goint to become possible through only the operator. When the station address is over 0, the remote control function is going to be active and the operation and auto-tuning through an operator become invalid. Setting about the asynchronous communication method is changed through C56~ C57.

Basic control command Format

Control command format for Inverter control is UDU (User Data Unit) like being explained in the GIMN protocol instruction. UDU format is as follows.

1 Byte	1 Byte	N Bytes
Address	OP. Code	Data

<Inverter control command format>

Address: Inverter station address, OP.Code: Operation code, a type of control commands

Operation command (Address: 0, OP. Code: 0x41)

It is used to transmit operation command. This command uses broadcast address and is simultaneously transmitted to inverters connected to network. Contents of the data field are as following table and there is no inverter response to this command.

• Request (Control device --> Inverter)

Order	Contents							
	7 Bit	6 Bit	5 Bit	4 Bit	3 Bit	2 Bit	1 Bit	0 Bit
Inverter 1(Station Address 1) Control command								
0	Reset						Reverse	Forward
1	Output frequency command (Actual value X 100)							
2								
Inverter 2(Station Address 2) Control command								
3	Reset						Reverse	Forward
4	Output frequency command (Actual value X 100)							
5								
//								
//								
Inverter X(Station Address X) Control command								
(X-1)*3+0	Reset						Reverse	Forward
(X-1)*3+1	Output frequency command (Actual value X 100)							
(X-1)*3+2								

Note1) Each bit command is active high signal.

Note2) Output frequency is composed of 2 bytes and bign-endian type (MSB is the first byte). The actual request command X 100 is transmitted. (Example: 6734 = 67.34Hz)

This command has operation commands about all inverters connected to network and maximum value of X in this table is 32 by the RS485 standard. Namely the frame size of this command is decided by the number of inverters connected to network.

(1) Reset : It is a command to reset this error when an Inverter trip occurs.

(2) Reverse : Reverse command

(3) Forward : Forward command

Request command for operation status (Address: Station number of inverter, OP. Code: 0x42)

It is used to receive the information about inverter operation status. Data field contents are as following table and there is no data field of the request frame.

• Request(Control device --> Inverter)

Data field is not in this table

Order	Contents							
	7 Bit	6 Bit	5 Bit	4 Bit	3 Bit	2 Bit	1 Bit	0 Bit
0	Output frequency (Actual value X 100)							
1								
2	Output current (Actual value X 10)							
3								
4	Output voltage (Actual value X 10)							
5								
6	DC Link voltage (Actual value X 10)							
7								
8	The revolution of Motor (Actual value X 10)							
9								
10	Spare 1							
11								
12	Spare 2							
13								
14	Input Terminal status							
	In_TM8	In_TM7	In_TM6	In_TM5	In_TM4	In_TM3	In_TM2	In_TM1
15	Output Terminal status							
			Out_TM6	Out_TM5	Out_TM4	Out_TM3	Out_TM2	Out_TM1
16	Inverter trip information 1							
17	Inverter trip information 2							
18	Inverter trip information 3							
19	Inverter trip information 4							

• Response (Inverter --> Control device)

Note 3) Each bit and the analog data information are applied to note1, note2 standard of the operation command table

Request command for parameter values (Address: Station number of inverter, OP. Code: 0x43)

It is used to receive parameter (F, A, B, C, H-Group) values set currently. Contents of the data field are as following table.

• Request (Control device --> Inverter)

Order	Contents							
	7 Bit	6 Bit	5 Bit	4 Bit	3 Bit	2 Bit	1 Bit	0 Bit
0	Parameter Index							

(1) Parameter index : It means the orginal parameter number

Please refer to the function code table for the index value about each parameter.

• Response (Inverter --> Control device)

Order	Contents							
	7 Bit	6 Bit	5 Bit	4 Bit	3 Bit	2 Bit	1 Bit	0 Bit
0	Parameter Index							
1	Parameter maximum value							
2								
3	Parameter maximum value							
4								
5	Parameter vlaue							
6								
7	Parameter decimal point location							
8	Parameter characteristic							

(1) Parameter maximum/minimum value : Changeable range of Parameter value

(2) Parameter decimal point location : In case parameter value is 12345 and the decimal point location is 3, the actual parameter value is 12345X10e-3.

Parameter value setting (Address: Station number of inverter, OP. Code: 0x44)

It is used to set the nwe operation parameter values (F, A, B, C, H-Group). Contents of the data field are as follows.

Order	Contents							
	7 Bit	6 Bit	5 Bit	4 Bit	3 Bit	2 Bit	1 Bit	0 Bit
0	Parameter Index							
1	Parameter value							
2								

• Request (Control device --> Inverter)

• Response (Inverter --> Control device)

Order	Contents							
	7 Bit	6 Bit	5 Bit	4 Bit	3 Bit	2 Bit	1 Bit	0 Bit
0	Parameter Index							

Request command for the number of trip event time (Address: Station number of inverter, OP. Code: 0x45)

It is used to receive the number of trips event time. Contents of the data field are as follows, there is no data field of request frame in this table.

• Request (Control device --> Inverter) : No Data field

• Response (Inverter --> Control device)

Order	Contents							
	7 Bit	6 Bit	5 Bit	4 Bit	3 Bit	2 Bit	1 Bit	0 Bit
0	Trip envent time							

Request Command for Trip Event Data (Address: Station number of inverter, OP. Code: 0x46)

It is used to receive contents of the trips event data. Data field is as follows.

• Request (Control device --> Inverter)

Order	Contents							
	7 Bit	6 Bit	5 Bit	4 Bit	3 Bit	2 Bit	1 Bit	0 Bit
0	Trip event Data Index							

(1) Trip event data index : Orginal number to assign the specific event data

In case the trip event time is 6, trip event data index is 0~5 (6-1).

• Response(Inverter --> Control device)

Order	Contents							
	7 Bit	6 Bit	5 Bit	4 Bit	3 Bit	2 Bit	1 Bit	0 Bit
0	Trip event Data Index							
1	Trip code							
2	Trip event time(year)							
3	Trip event time(month)							
4	Trip event time(day)							
5	Trip event time(hour)							
6	Trip event time(minute)							
7	Trip event time(second)							
8	Output frequency in case of trip (Actual value X 100)							
9								
10	Output current in case of trip (Actual value X 10)							
11								
12	DC Link voltage in case of trip (Actual value X 10)							
13								
14	Accumulated time on RUN in case of trip (hour)							
15								
16	Accumulated time on RUN in case of trip (minute)							
17								
18	Power-On time in case of trip (hour)							
19								
20	Power-On time in case of trip (minute)							
21								

Note 4) The information about each bit and analog data is applied to note1), note2) standard.

(1) Trip code : Please refer to the trip code table for trip code contents.

(2) Trip occurrence time : Time which trip occured and BCD (Binary Coded Decimal) fromat

(Example: 0x38 = 38).