CONTENTS

I. Product

Power range:0.4～400KW; 3 kinds of structure mode; ISO9001 certified.

Proper grounding with grounding resistance not exceeding 4Ω; ensure good ventilation; separate wiring between control loop and power loop; shielded wire is used as signal wire.

This manual offers a brief introduction of the installation connection, parameters setting and operations, and should therefore be properly kept. Please contact manufacturer or dealer in case of any malfunction during application.

1.1 Nameplate

Taking for instance the ELM1000-G series 15KW inverter with three-phase input, its nameplate is illustrated as Fig 1-1.

3Ph: three-phase input; 380V, 50/60Hz: input voltage range and rated frequency.

3Ph: 3-phase output; 32A, 15KW: rated output current and power; 0.50～400.0Hz: output frequency range.

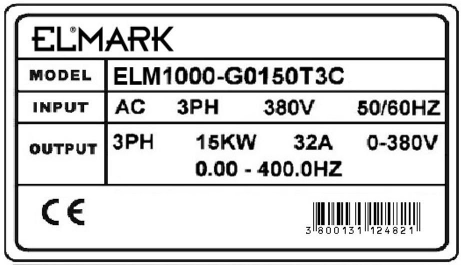


Fig 1-1 Nameplate Illustration

1.2 Model Illustration

Taking the same instance of 15KW inverter with three-phase, its model illustration is shown as Fig 1-2.

ELM1000–G 0150 T3 C

- C: Structure mode code (C: metal hanging; B: plastic housing; D: metal cabinet)
- T3: Power input (T3: 3-phase 380VAC input ; S2: single-phase 220VAC input)
- 0150: Applicable motor power (15KW)
- G: Series code
- ELM1000: Manufacturer's name and upgrade code

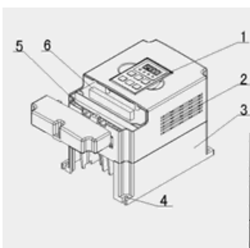
Fig 1-2 Product Model Illustration

1.3 Appearance

The external structure of ELM1000-G series inverter is classified into plastic and metal housings. Only wall hanging type is available for plastic housing while wall hanging type and cabinet type for metal housing.

Good poly-carbon materials are adopted through die-stamping for plastic housing with nice form, good strength and toughness.

Taking ELM1000-G0015XS2B for instance, the external appearance and structure are

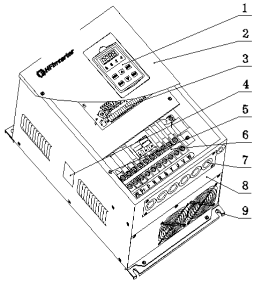


1—Keypad Controller
2—Vent Hole
3—Heatsink
4—Mounting Hole
5—Power Terminal
6—Control Terminal

Fig 1-3 Appearance of Plastic Housing

shown as in Fig 1-3. Process of low sheen and silk screen printing are adopted on the housing surface with soft and pleasant gloss.

Meanwhile, metal housing uses advanced exterior plastic- spraying and powder-spraying process on the surface with elegant color. Taking ELM1000-G0220T3C for instance, its appearance and structure are shown as in Fig 1-4, with detachable one-side door hinge structure adopted for front cover, convenient for wiring and maintenance.



1-Keypad Control Unit
2-Front Panel
3-Control Termianl
4-Nameplate
5-Mounting Screw
6-Power terminal
7-Outlet Hole
8-Body
9-Mouting Holes

1.4 Technical Specifications

Table1-1 **Technical Specifications for ELM1000–G Series Inverters**

	Items	Contents
Input	Rated Voltage Range	3-phase 380V±15%; single-phase 220V±15%
	Rated Frequency	50/60Hz
Output	Rated Voltage Range	3-phase 0～380V;3-phase 0～220V
	Frequency Range	0.50～400.0Hz
V/FContrtol	Control Mode	Linear V/F control; space voltage vector+random PWM
	Frequency Resolution	Max 0.01Hz, adjustment allowed
	Torque Promotion	Torque Promotion curve (V/F) can be set within 1～16;
	Stall Prevention	Current output is restricted, and threshold current can be adjusted.
	Overload Capacity	150% rated current,1minute
Operation Function	Frequency Setting	Potentiometer or external analog signal (0～5V, 0～10V, 0～20mA); keypad (terminal)▲ / ▼ keys, external control logic and PLC setting.
	Start/Stop Control	Passive contact switch control or keypad control
	Frequency Change Rate	0.1～3000S (time required for certain frequency change)
Protection Function	Input out-phase, input under-voltage, DC over-voltage, over-current, over-load, current stall, over-heat, external disturbance	

Display	LED nixie tube showing present output frequency, present rotate-speed (rpm), present output current, present output voltage, present linear-velocity, types of faults, and parameters for the system and operation; LED indicators showing the current working status of inverter.	
Environment Conditions	Equipment Location	Free of tangy caustic gases or dust
	Environment Temperature	-10□～+50□
	Environment Humidity	Below 90% (no water-bead coagulation)
	Vibration Strength	Below 0.5g (acceleration)
	Height above sea level	1000m or below
Applicable Motor	0.4～400KW	

1.5 Designed Standards for Implementation

*GB/T 12668.2 2002 Stipulation of rated value of AC low voltage electric drive system;

*GB 12668.3 2003 Standard for EMC and the specific experimental methods

*GB 12668.5 Drives electric system of speed control Part 5-1: security requirements relating to electric, heat and energy.

1.6 Precautions

1.6.1 Notice for Application

- Installation and application environment should be free of rain, drips, steam, dust and oily dirt; without corrosive or flammable gases or liquids, metal particles or metal powder.
- Environment temperature within the scope of -10□～+50□.
- Inverter is installed in a control cabinet, and smooth ventilation should be ensured.
- Do not drop anything into the inverter.
- Never touch the internal elements within 15 minutes after power off. Wait till it is completely discharged.
- Input terminals R, S and T are connected to power supply of 380V and single-phase input terminals R,T are connected to 220V while output terminals U, V and W are connected to motor.
- Proper grounding should be ensured with grounding resistance not exceeding 4Ω; separate grounding is required for motor and inverter. No grounding with series connection is allowed.
- No load switch is allowed at output while inverter is in operation.
- AC reactor or/and DC reactor is recommended when your inverter is above 37KW.

- There should be separate wiring between control loop and power loop to avoid any possible interference.
- Signal line should not be too long to avoid any increase with common mode interference.
- It shall comply with the requirements for surrounding environment as stipulated in Table 1-1 **“Technical Specifications for ELM1000–G Series Inverter”**.

1.6.2 Maintenance

- Cooling fan should be cleaned regularly to check whether it is normal; remove the dust accumulated in the inverter on a regular basis.
- Check inverter’s input and output wiring regularly.
- Replace inverter’s cooling fan, starting contactor (relay) regularly.
- Check if all terminal wiring screws are fastened and if wirings are aging.

1.6.3 Special Warning!!

- Never touch high-voltage terminals inside the inverter to avoid any electric shock.
- All safety covers should be well fixed before inverter is power connected, to avoid any electric shock.
- Only professional personnel are allowed for any maintenance, checking or replacement of parts.
- No live-line job is allowed.

II. Operation Panel

Two forms and specifications of keypad controllers are available, with “six keys” or “six-key + potentiometer”.

Besides the function of “stop” and fault “reset”, “stop/reset” key can also be used to switch over of function code in a code group or between two code groups when setting parameters.

Operation panel and monitor screen are both fixed on keypad controller. Two kinds of controllers (with and without potentiometer) are available for ELM1000-G series inverters, and each keypad controller has two kinds of size. Refer to note for Fig2-1.

2.1 Panel Illustration

The panel covers three sections: data display section, status indicating section and keypad operating section, as shown in Fig. 2-1.

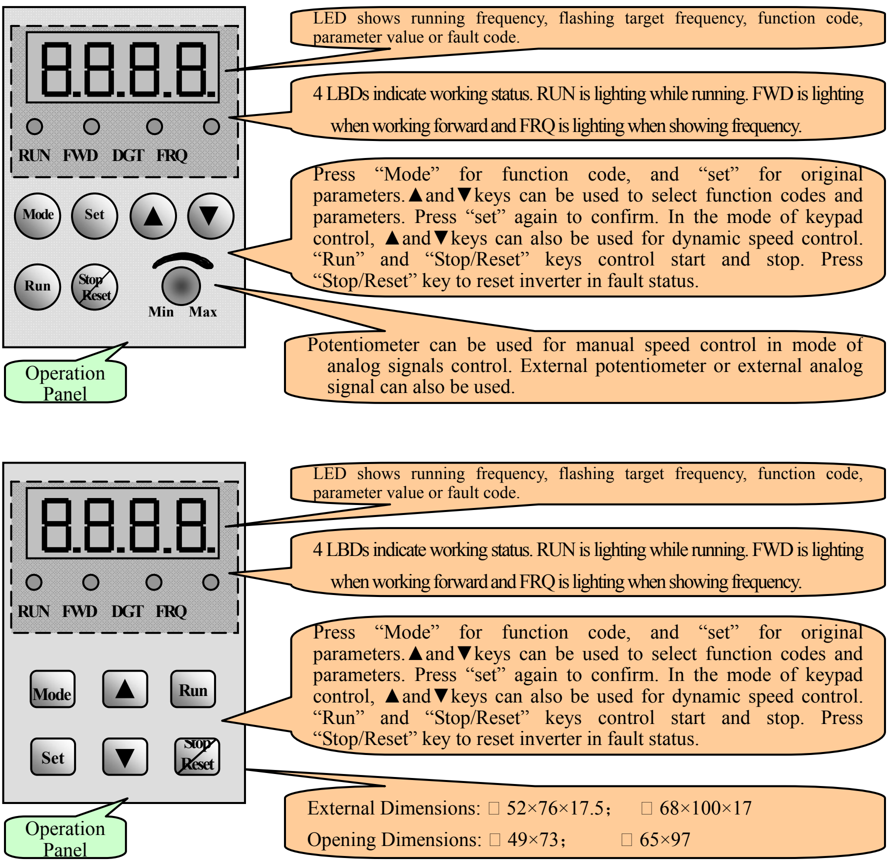


Fig.2-1 Operation Panels in Two Kinds

2.2 Panel Operating

All keys on the panel are available for user. Refer to Table 2-1 for their functions.

Table 2-1 **Uses of Keys**

Keys	Names	Remarks
Mode	Mode	To call function code and switch over display mode.
Set	Set	To call and save data.
▲	Up	To increase data (speed control or setting parameters)
▼	Down	To decrease data (speed control or setting parameters)
Run	Run	To start inverter; to call keypad operation; to call auto circulating operation; to switch over display mode.
Stop/reset	Stop or reset	To stop inverter; to reset in fault status; to change function codes in a code group or between two code groups.

2.3 Parameters Setting

This inverter has numerous function parameters, which the user can modify to effect different modes of operation control. If user wants to set parameters after power off or error protection, user's password must be entered firstly, i.e., to call F100 as per the mode in Table 2-2 and enter the correct code. Default value of user's password is 8.

Table 2-2 Steps for Parameters Setting

Steps	Keys	Operation	Display
1	Mode	Press "Mode" key to display function code	F100
2	▲ or ▼	Press "Up" or "Down" to select required function code	F112
3	Set	To read data set in the function code	5.0
4	▲ or ▼	To modify data	9.0
5	Set	To show corresponding target frequency by flashing after saving the set data	10.00
	Mode	To display the current function code	F112

The above-mentioned step should be operated when inverter is in stop status.

2.4 Function Codes Switchover in/between Code-Groups

This inverter has more than 140 parameters (function codes), which are divided into 9 sections as indicated in Table 2-3.

Table 2-3 **Function Code Partition**

Group Name	Function Code Range	Group No.	Group Name	Function Code Range	Group No.
Basic Parameters	F100～F160	1	Reserved	F600～F660	6
Run Control Mode	F200～F260	2	Timing control and protection function	F700～F760	7
Multi-Speed Parameters	F300～F360	3			
Terminal Function Definition	F400～F460	4	Analog signals of input/ourput	F800～F860	8
V/F Control	F500～F560	5	Communication	F900～F960	9

As parameters setting costs time due to numerous function codes, such function is specically designed as "Function Code Switchover in a Code Group or between Two Code-Groups" so that parameters setting become convenient and simple.

Press "Mode" key so that the keypad controller will display function code. If press "▲" or "▼" key then, function code will circularly keep increasing or decreasing by degrees within the group; if press again the "stop/reset" key, function code will change circularly between two code groups when operating the "▲" or "▼" key.

e.g. when function code shows F111, DGT indicator will be on. Press "▲"/ "▼" key, function code will keep increasing or decreasing by degrees within F100～F160; press "stop/reset" key again, DGT indicator will be off. When pressing "▲"/ "▼" key, function codes will change circularly among the 9 code-groups, like F211, F311…F911, F111…, Refer to Fig 2-2 (The sparkling "10.00" is indicated the corresponding target frequency values).

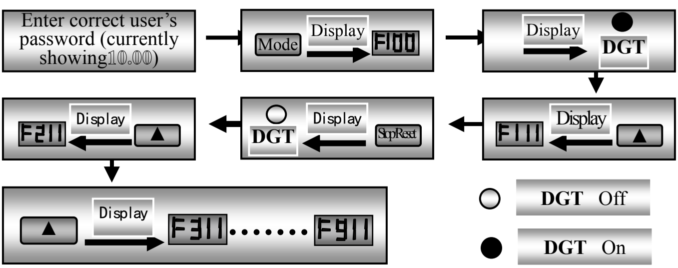


Fig 2-2 Swtich over in a Code Group or between Different Code-Groups

2.5 Panel Display

Table 2-4 Items and Remarks Displayed on the Panel

Items	Remarks
HF-0	This Item will be displayed when you press “Mode” in stopping status, which indicates jogging operation is valid.
HF-1,HF-2, HF-3,HF-4	This Item will be displayed when you press “Mode” in running status. And press “Set’ to display relevant contents. HF-1, HF-2, HF-3 and HF-4 correspond to “output current” , “output voltage”, “rotate speed” and “linear velocity” respectively.
-HF-	It stands for resetting process and will display “0” after reset.
O.C.,O.E.,O.L.,O.H.,P.O.,P.F., ERR	Fault code, indicating “over-current”, “over-voltage”, “over-load”, “over-heat”, “under-voltage for input”, “out-phase for input” and “external interference”respectively. It shows “0” after reset.
H.H.	Interruption code, indicating “external intrruption” signal input and showing “0” after reset.
F152	Function code (parameter code).
10.00	Indicating inverter’s current running frequency (or rotate speed) and parameter setting values, etc.
10.00	Sparkling in stopping status to display target frequency (except for analog signals speed control).
0.	holding time when changing the rotating direction. When “Stop” or “Free Stop” command is ecxcuted, the holding time can be canceled
A100、U100	Output current (100A) and output voltage (100V). Keep one digit of decimal when current is below 100A.
Err1	Indicating error. It shows when parameters are modified; wrong password or no password is entered.

III. Installation & Connection

Ensuring ventilation and cooling; separate grounding with inverter and motor; enough carrying capacity with wiring.

Separate wiring with power loop and control loop. Shielded wires required for control wiring; AC or/and DC reactor is needed in case of large fluctuation with power network or load

3.1 Installation

Inverter should be installed vertically, as shown in Fig 3-1. Sufficient ventilation space should be ensured in its surrounding. Clearance dimensions (recommended) are available from Table 3-1 for installing the inverter.

Table 3-1 Clearance Dimensions

Inverter Model	Clearance Dimensions	
Hanging（<22KW	A≥150mm	B≥50mm
Hanging（≥22KW	A≥200mm	B≥75mm
Cabinet (110～400KW)	C≥200mm	D≥75mm

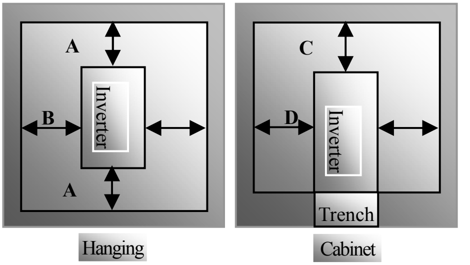
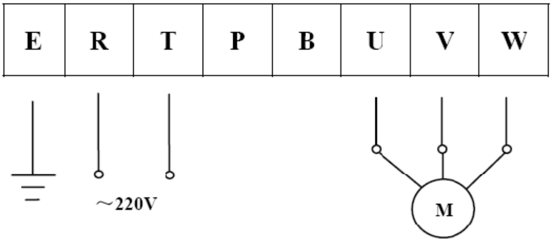
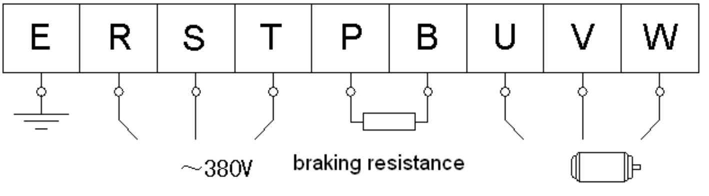


Fig 3-1 Installation Sketch

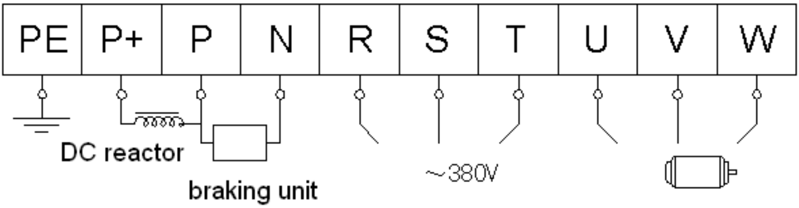
3.2 Connection

- In case of 3-phase input, connect R, S and T terminals (R and T terminals for single-phase) with power source from network and PE(E) to earthing, U, V and W terminals to motor.
- Motor shall have to be ground connected.
- For inverter with 3-phase input and power lower than 15kw, braking cell is also built-in. If the load inertia is moderate, it is Ok to only connect braking resistance with built-in braking cell.





(The figure is only sketch, terminals order of practical products may be different from the above-mentioned figure. Please pay attention when connecting wires)



Introduction of terminals of power loop

Terminals	Terminal Marking	**Terminal Function Description**
Power Input Terminal	R, S, T	Input terminals of three-phase 380V AC voltage (R and T terminals for single-phase)
Output Terminal	U, V, W	Inverter power output terminals, connected to motor.
Grounding Terminal	PE(E)	Inverter grounding terminal or connected to ground.
Braking Terminal	P, B	External braking resistor (Note: no Terminals P or B for inverter without built-in braking unit).
	P, N	DC bus-line output, externally connected to braking resistor P connected to input terminal "P" of braking unit or terminal "+", N connected to input terminal of braking unit "N" or terminal "－".
	P, P+	Externally connected to DC reactor

Wiring for control loop as follows:

A) The following sketch is control terminals for single-phase 0.4KW, 0.75KW, 1.5KW and built-in braking cell inveters.

A+	B-	OUT	12V	CM	OP1	OP2	OP3	OP4	OP5	OP6	OP7	OP8	V1	V2	V3	I2	FM	IM	TA	TB	TC

B) The following sketch is control terminals for single-phase 2.2KW inveters.

B−	OUT	OP6	OP7	OP8	V1	V2	V3	I2	FM	IM
A+	12V	OP1	OP2	OP3	OP4	OP5	CM	TA	TB	TC

C) The following sketch is control terminals for three-phase 0.75~400KW inverters.

A+	B-	OUT1	OUT2	+12V	CM	OP1	OP2	OP3	OP4	OP5	OP6	OP7	OP8	V1	V2	V3	I2	FM	IM	TA	TB	TC

Terminals A^{+} and B^{-} are only valid when MODBUS communication is required by customers.

3.3 Wiring Recommended

Table 3-2 **Wiring for Power Loop**

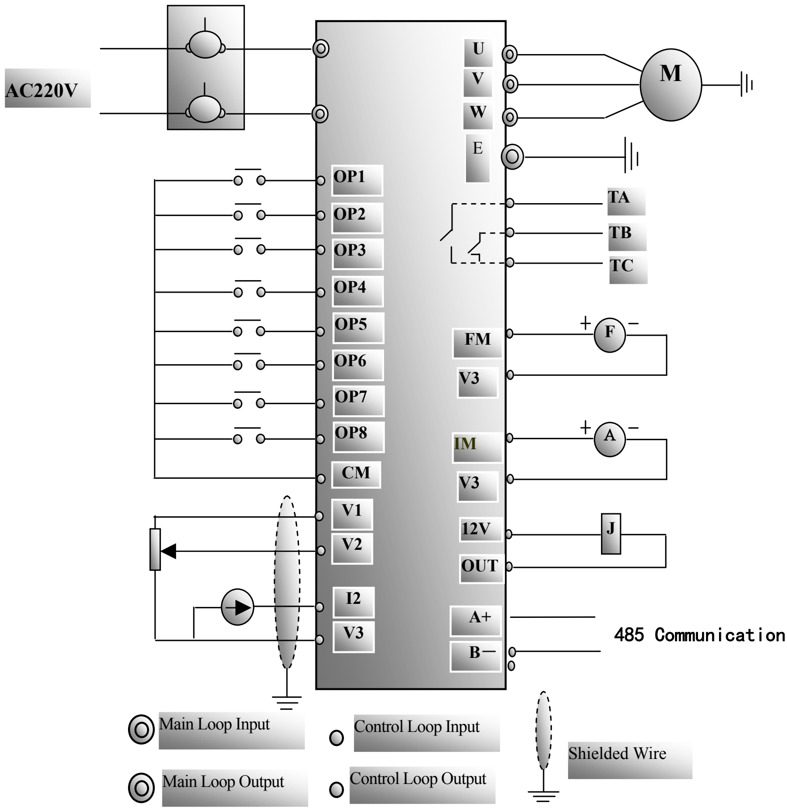
Inverter Model	Lead Section Area(mm^2)	Inverter Model	Lead Section Area(mm^2)	Inverter Model	Lead Section Area(mm^2)
ELM1000-	1.5	ELM1000-	4	ELM1000-	70
ELM1000-	1.5	ELM1000-	4	ELM1000-	95
ELM1000-	2.5	ELM1000-	6.0	ELM1000-	120
ELM1000-	2.5	ELM1000-	10	ELM1000-	150
ELM1000-	2.5	ELM1000-	16	ELM1000-	150
ELM1000-	2.5	ELM1000-	16	ELM1000-	185
ELM1000-	4.0	ELM1000-	25	ELM1000-	240
ELM1000-	1.5	ELM1000-	25	ELM1000-	240
ELM1000-	2.5	ELM1000-	35	ELM1000-	300
ELM1000-	2.5	ELM1000-	35	ELM1000-	300
ELM1000-	2.5	ELM1000-	50	ELM1000-	400
ELM1000-	2.5	ELM1000-	70		

3.4 Lead section area of protect conductor (grounding wire)

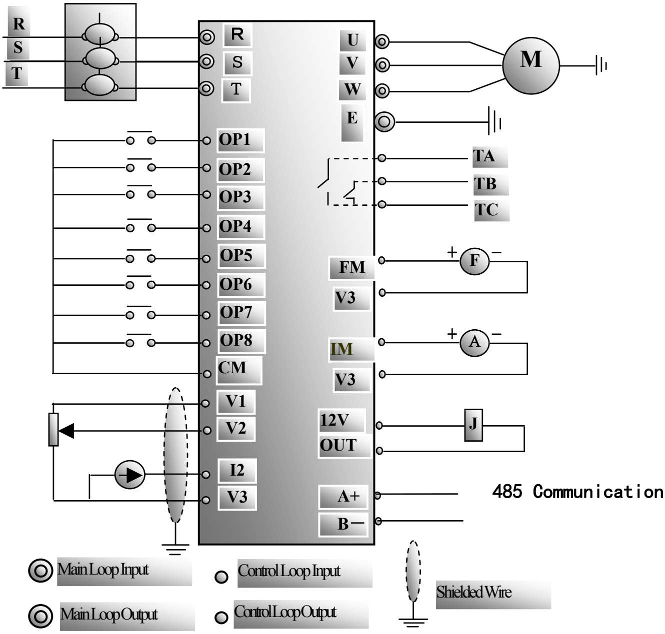
Lead section area S of U,V,W (mm^2)	Min lead section area S of E (mm^2)
$S \leq 16$	S
$16 < S \leq 36$	16
$35 < S$	S/2

3.5 Overall Connection and "Three- Line" Connection

* Refer to next figure for overall connection sketch for ELM1000-G series inverters. Wiring mode is available for various terminals whereas not every terminal needs connection when applied.

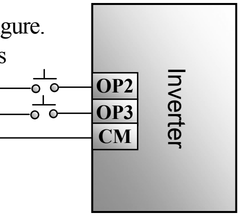


Standard Wiring Diagram for Single-Phase Inverter



Standard Wiring Diagram for Three-Phase Inverter

"Three-Line" Connection can fulfill start/stop control by using parameter setting and terminal definition, as indicated in the right Figure. If F200=1, F202=1, start/stop command will be excuted by terminals respectively; F409=6, OP2 is defined as running terminal; F410=7, OP3 is defined as stop terminal. When OP2 or OP3 are connected with CM terminal, it will control inverter's start and stop respectively. Take care that these two terminals cannot be connected to CM at the same time.



Three-Line Connection

IV. Operation

Voltage or current analog signals input; multiple control terminals; coding switch selecting analog singals input range.

Start/stop control terminals, direction terminal, analog signals input/output terminals, function switchover terminal, state-indicating terminal and multiple speed control terminals.

It is essential to correctly and flexibly use control terminals for operation of inverter. Of course, control terminals are not used separately, but together with corresponding parameter setting. User can make a flexible use of basic functions of control terminals, with reference to relevant descriptions in the rest of this manual.

4.1 Function of Control Terminal

Table 4-1 Function of Control Terminal

Terminal	Class	Name	Function	
OUT	Output Signal	Running Signal	The value between this terminal and CM during running is 0V, and 12V when it stops. It is used in single-phase inverter.	For function of these output terminals, please refer to mfr's value; it can be changed by modifying the parameter.
OUT1		Running Signal	The value between this terminal and CM during running is 0V, and 12V when it stops. It is used in three-phase inverter.	
OUT2		Running Signal	The value between this terminal and CM during running is 0V, and 12V when it stops. It is used in three-phase inverter.	
TA TB TC		Relay Contact	TC: common point; TB-TC: normally closed contact; TA-TC: normally open contact; contact current not exceeding 2A (Voltage not exceeding 250VAC).	
FM		Running Frequency	When connected to cymometer or tachometer, its cathode connected to V3. Refer to F420~F427	
IM		Current Display	When connected to ammeter, its cathode connected to V3. Refer to F420~F427. (1-phase inverter has no this function)	
V1	Voltage Control	Self-Contained Power Source	5V self-contained power source available inside inverter for its own use; it can only be used for external use as powersource for voltage control signal with current limit below 20mA.	
V2		Voltage Analog Signals Input Port	In case of analog signals speed control, voltage signal is input from this terminal. Voltage input range: 0～5V or 0～10V, grounding: V3. When potentiometer is used for speed control, this terminal is connected to iput signals, and grounding to V3. **Cautious: V2 and keypad potentiometer cannot be used at the same time.**	
V3		Self-contained Power Source Ground	Grounding end of external control signal (voltage control signal or current source control signal), also 5V power source ground of this inverter.	
I2	Current Control	Input Port for Current Analog Signals	In case of analog signals speed control, current signal is input from this terminal. Current input range: 0～20mA, grounding: V3. if 4～20mA is input, lower limit of analog signals input can be adjusted through parameter setting.	
12V	Power Source	Control Power Source	Power: 12±1.5V, grounding :CM; current for external use: below 100mA.	
OP1	Function Operation	Jogging Terminal	This terminal is connected to CM, inverter will run by jogging. Jogging function of the terminal works both in "Stop" and "Run" states.	The function of these Input terminals is defined as per mfr's value; and may also be defined for other functions by modifying parameters.
OP2 OP3 OP4	Speed Setting	Multi-Speed Control Terminal	Normally these three terminals are defined to be "three-stage speed" or "seven-stage speed" transfer terminals; and may also use them for other functions control.	
OP5	Function Operation	Free Stop	This terminal is connected to CM during running, inverter will realize free stop	

		Forward Command	When this terminal is connected to CM, inverter will run forward	
OP7		Reverse Command	When this terminal is connected to CM, inverter will reverse.	
OP8		Fault Resetting	Make this terminal connected to CM in fault state to reset inverter	
CM	Common Port	Control Power Source Ground	Ground for 12V power source and other control signal.	

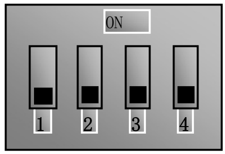
4.2 Coding Switch

4.2.1 A red four-digit coding switch SW1 is available around three-phase inverter’s control terminal block, as shown in Fig 4-1.

The function of coding switch is to select the input range (0～5V/0～10V) of input Terminal V2 for voltage-type analog signals, and must be used together with Function Code F204/F209. F209 is used to select the input channal of analog signals, to be interpreted as:

F204=3, select analog signals speed control

F209 {
0, select V2 Channel
1, Reserved
2, Select I2 Channel



SW1

Fig 4-1 Coding Switch

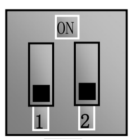
Table 4-2 In case of analog signals speed control, coding switch and parameters setting

If F204 is 3 and F209 is 0, V2 channel is selected.			If F204 is 3 and F209 is 2, I2 channel is selected.		
Code switch 1	Code switch 3	Modes of speed control	Code switch 2	Code switch 4	Modes of speed control
OFF	OFF	5V voltage	OFF	OFF	5V voltage
OFF	ON	10V voltage	OFF	ON	10V voltage
ON	OFF	0~20mA current	ON	OFF	0~20mA current
ON code switch is on the top					
OFF code switch is in the bottom					

4.2.2 A red four-digit coding switch SW1 is available around single-phase inverter’s control terminal block, as shown in Fig 4-2.

The function of coding switch is to select input range (0～5V/0～10V) of input Terminal V2 for voltage-type analog signals, and must be used together with Function Code F209. F209 is used to select input channel of analog signals, to be interpreted as:

F209 {
0, select V2 Channel
1, Reserved · 1
2, Select I2 Channel



SW1

Fig 4-2 Coding Switch

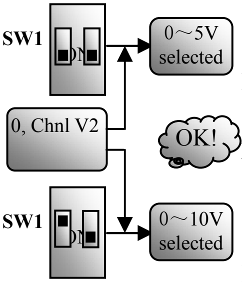


Fig 4-2
Application of Coding Switch

Fig 4-2 shows how coding switch of inverter selects the range of analog signals. The black blocks in the diagram indicate the position of SW1.

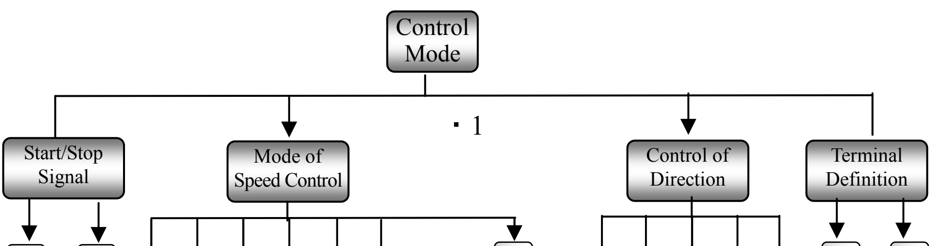
Select Channel V2 in the mode of analog signals speed control, 0~5V or 0~10V can be chosen by different positions of coding switch.

Please note that coding switch can only be used in mode of analog signals speed control and signal of speed control is input from external terminals. When potentiometer of keypad is selected for the input voltage analog speed control, coding switch must select 0～5V. Keypad voltage analog signals and terminal voltage analog signals can not be entered at the same time.

4.3 Main Functions

There are total 14 kinds of speed control running modes with ELM1000-G series inverters covering *jogging, keypad, terminal, "three-stage speed", "seven-stage speed", "auto circulating", analog signal, combination of keypad and terminals, combination of "three-stage and seven-stage speeds" with terminal, combination of "three-stage and seven-stage" with keypad, combination of analog signals and "three-stage speed", combination of analog signals and "seven-stage speed", coding speed control and communication speed control.* All these must work with corresponding parameters setting, as shown in Fig 4-3.

ELM1000-G series inverters also have other efficient control functions, such as switchover of acceleration/deceleration time, acceleration/deceleration forbidden, state token output, interruption control, switchover of display contents, etc. Refer to "Terminal Function Definition"and "Operation Panel".



V. Basic Parameters

Running characteristics are set forth by compensation curve, acceleration/deceleration time, jogging parameters and other system parameters.

Running at parameters set by manufacturer is free running, which adopts keypad control mode, but does not contain many special functions.

F100 User's Password	Setting Range:0～9999	Mfr's Value:8

·Correct user's password must be entered when power is supplied again or parameter modification is intended after fault resetting. Otherwise, parameter setting would not be possible with indicating "Err1".

·User may modify "User's Password", in the same way as modifying other parameters.

F103 Inverter's Power (kw)	Setting Range: 0.40～400.0	Mfr's Value: this inverter's power value

·This inverter is marked with power, for recording product information.

F106 Inverter's Input Voltage Type	Setting Range: 0: single phase, 1:three-phase	Mfr's Value: Debugging Value
F107 Output Voltage Proportion	Setting Range: 1～100%	Mfr's Value: 100%
F109 Min Frequency displayed by current	Setting Range: 5.00~50.00	Mfr's Value: 15.00
F111 Max Frequency limit (Hz)	Setting Range:F113～400.0	Mfr's Value:50.00Hz

·Indicating inverter's max running frequency (this inveter's max designed frequency: 400.0Hz).

·F109=15 means when frequency is below 15HZ, current displays 0.

F112 Min Frequency Limit(Hz)	Setting Range:0.50～F113	Mfr's Value:0.50Hz

·Indicating inverter's min running frequency. The value of min frequency limit must be set below F113.

F113 Target Frequency (Hz)	Setting Range:F112～F111	Mfr's Value:10.00Hz

·Indicating the preset frequency. Inverter will run automatically to this frequency after startup in keypad or terminal control mode.

F114/F116 1st and 2nd Acceleration Time(S) F115/F117 1st and 2nd Deceleration Time (S)	Setting Range: 0.1～3000	Mfr's Value:0.4～3.7KW: 5.0S 5.5～30KW:30.0S 37～400KW:60.0S

·Acceleration/Deceleration Time: The time required for acceleration/deceleration from 0 (50Hz) to 50Hz (0) [Note 1].

F118 Turnover Frequency（Hz）	Setting Range:15.00～400.0	Mfr's Value:50.00Hz

·Constant torque output when running frequency is below this value, and constant power output when exceeding this value. Turnover Frequency normally adopts 50Hz. Avoid setting turnover frequency below 50Hz except for special occasions. Please consider motor nameplate parameters on special occasions.

F119 Latent Frequency（Hz）	Setting Range:F112～F111	Mfr's Value:5.00Hz

·When output frequency exceeds this value, status of the output terminal may be defined as reverse; status of terminal will have its state restored when below this frequency.

·When the definable output terminal is defined as function of “Over Latent Frequency”, this parameter setting is valid.

F120 Dead-Time of Switch Between Corotation and Reverse (S)	Setting Range:0.0～3000	Mfr’s Value:0.0S

• If “Stop” signal is given within the“Dead-Time of Switch between Corotation and Reverse”, this holding(waiting)time can be terminated, and inverter will immediately switch over to and run in another direction. This function is fit for all modes of speed control except auto circulating running.

·This function can alleviate the current impact during direction switch process, with manufacturer’s setting value at 0S.

F121 Stop Mode	Setting Range: 0: Stop at Deceleration Time 1: Free Stop	Mfr’s Value:0

·“Free Stop” means that motor will have free running with an immediate output cutoff and stop by friction upon receiving the “stop” command.

·This function can be used for “stop” operation in mode of keypad control and interrupting direction signal operation in mode of terminal control.

F123 Jogging Function	Setting Range:0:Invalid jogging function 1:Valid jogging function	Mfr’s Value: 1
F124 Jogging Frequency (Hz)	Setting Range: F112～F111	Mfr’s Value: 5.00Hz
F125 Jogging AccelerationTime(S)	Setting Range: 0.1～3000	Mfr’s Value: 0.4～3.7KW:5.0S 5.5～30KW:30.0S 37～400KW:60.0S
F126 Jogging DecelerationTime(S)		

·It includes keypad jogging and terminal jogging. Keypad jogging is only valid in stop state while terminal jogging works both in run and stop states.

·Jogging operation on the keypad (in stop state):

a. Press “Mode” key to display “HF-0”, and press “Set” to confirm showing “0”.

b. Press “Run”, and inverter will run to “Jogging Frequency” (“Keypad Jogging” will be canceled by pressing “Mode” again).

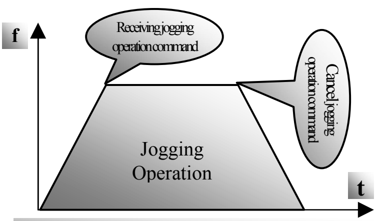


Fig 5-1 Jogging Operation

·In case of terminal jogging, make “Jogging” terminal (like OP1) connected to CM, and inverter will run to the jogging frequency.

Note1.“Stalling Adjusting” and F120 is invalid in mode of jogging operation.

F127/F129 Skip Frequency A, B (Hz)	Setting Range: 0～400.0	Mfr’s Value: 0Hz
F128/F130 Skip Area A, B (Hz)	Setting Range:±2.5	Mfr’s Value: 0.5

·System resonance will occur around a certain frequency point during motor running. This parameter is set specifically to avoid resonance.

·When output frequency reaches the setting value of this parameter, inverter will automatically run by tripping off this "Skip Frequency".

·"Skip Area" refers to the difference value between upper and lower frequencies of the skip frequency, e.g., with skip frequency of 20Hz, and skip area of ±0.5Hz, automatic tripping off will happen when inverter has its output within 19.5～20.5Hz (as F1～F2 in Fig 5-2).

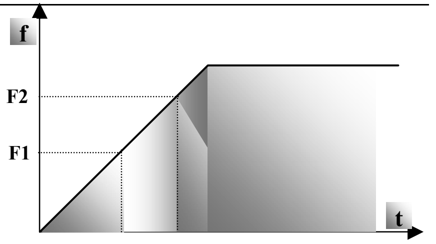


Fig 5-2 Skip Frequency

·This function is invalid during acceleration / deceleration process.

F131 Display Contents	Setting Range: 0: Frequency; 1: Rotate Speed; 2: Linear Velocity; 3: Output Voltage; 4: Output Current	Mfr's Value: 0
F132 Numbers of Motor Poles	Setting Range: 2～100	Mfr's Value: 4
F133 Drive Ratio of Driven System	Setting Range: 0.10～200.0	Mfr's Value: 1.00
F134 Range of Linear Velocity	Setting Range: 1～60000	Mfr's Value: 1800

·F131=0, running frequency, Hz; F131=1, theoretic rotate speed of shaft end of driven system, rpm; F131＝2, theoretic linear velocity of shaft end of driven system; F131=3, output voltage, V; F131＝4, output current, A.

·No matter what values F131 is set, corresponding target frequencies will be sparklingly showed on the panel when inverter stops.

·Calculation on rotate speed and linear velocity

When inverter operates at max frequency limit, the setting value of F134 shall equal to the product of loaded rotate speed of shaft and its perimeter, with unit subjecting to user. E.g., max frequency limit F111＝50.00Hz, numbers of motor poles F132＝4, drive ratio F133＝1.00, radius of drive shaft R＝50mm, then,

Perimeter of drive shaft: 2πr=2×3.14×50=314 (mm)

Rotate speed of drive shaft: 60×running frequency/(numbers of pole pairs×drive ratio）=60×50/（2×1.00）=1500rpm

shaft linear velocity: rotate speed×perimeter=1500×314＝471000 (mm/minute)

If calculation result exceeds the range of F134 (1～60000), unit conversion will be required. Should a precision of 0.1m/min is needed, F134=471 can be set. If a value of 1869 is indicated then, it means that the current linear velocity is 1869 decimeter per minute.

F137 Frequency Memory	Setting Range: 0: Invalid frequency memory 1: Valid frequency memory	Mfr's Value: 0

·"Frequency memory" will only automatically memorize the frequency values that user adjusts, in mode of keypad or terminal speed control.

F138 Auto Start of Analog Signals Speed	Setting Range: 0: Auto start; 1: Press "Run" to start	Mfr's Value: 1

·"Auto start of analog signal speed control" means, in mode of analog signal speed control, inverter will automatically run without the signals of "RUN", once analog signal is input.

F139 Auto Start After Power Resupplied or Reset	Setting Range: 0: Invalid; 1: Valid	Mfr's Value: 0

·"Auto start after power resupplied or reset" means whether there will be auto start after power resupplied or fault reset in the mode of keypad speed control or terminal speed control. If "invalid" is selected, inverter can only operate after "Run" signal is given.

F140 Start by the Terminal Direction Signal	Setting Range: 0, Invalid; 1, Valid	Mfr's Value: 0

·"Start by Terminal Direction Signal" means that a direction signal given externally can be used to start inverter directly without giving a separate "Run" signal in case of keypad speed control, terminal speed control or their combined speed control.

F141 Accelerating by keypad	Setting range: 0：Proportional to Acceleration /Deceleration time; 1：Slow	Mfr's Value: 0

·" Accelerating by keypad" : When inverter runs, changing speed of modifying parameters.

F141=0: speed of modifying parameters is proportional to Acceleration/Deceleration time. The longer setting time for Acceleration /Deceleration time is, the slower speed of modifying parameters is. Conversely, the speed is faster. The setting time for Acceeleration/Deceleration time is the time that inverter is using. When inverter is running by jogging, the setting time for Acceeleration/Deceleration time is the jogging Acceleration/Deceleration time.

F141=1: when inverter is running, the speed of modifying parameters is slower. But the key is pressed longer, the speed of modifying parameters is faster.

F148 Stopping inverter is controlled by ▼ keys ar "DOWN" terminal.	Setting range: 0: Operating ▼ keys and DOWN terminal normally; 1: after reaching mix frequency, stop inverter by ▼ keys and DOWN terminal.	Mfr's Value: 0
F149 code function setting	Setting Range: 0: code must be entered 1: code need not be entered.	Mfr's Value: 0

If inverter stops at frequency below 0.5HZ, set F418 to 1. When F148 is 0, operate normally ▼ keys and DOWN terminal; when F148 is 1, after reaching mix frequency, stop inverter by ▼ keys and DOWN terminal. Start command must be given if you want to run inverter again.

F160 Reverting to Mfr's Value	Setting Range: 0: Not Reverting to Mfr's Value 1: Reverting to Mfr's Value	Mfr's Value: 0

·Set F160 to 1 when there is disorder with inverter's parameters and Mfr's values need to be restored. After "Reverting to Mfr's values" is done, F160 values will be automatically changed to 0.

·"Reverting to Mfr's value"will not work for the function-codes marked "○" in the "Note" column in the Appendix 2 Function-coe Zoom Table. These function codes are properly preset before delivered. Please do not change the parameter of these function codes.

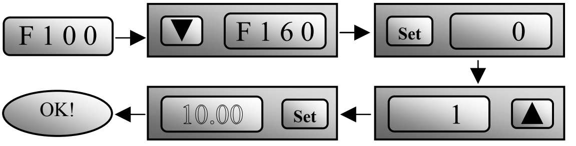


Fig 5-3 Reverting to Mfr's Values

VI. Operation Control	Running mode is fixed by basic (extra) speed control, start/stop (extra) control and direction giving.	Numerous modes of speed control are produced by keypad speed control, terminal speed control, multi-speed control, analog signal speed control and their combinations.

6.1 Parameters Setting

F200 Start Control	Setting Range: 0:Keypad control; 1:Terminal control; 2~4:Reserved	Mfr's Value: 0
F201 Additional Start Control	Setting Range: 0: No additional start function; 1: Keypad control 2: Terminal control 3, 4: Reserved	Mfr's Value:0

·"Keypad Control" means that start command will be given by the "RUN" key on the keypad; "Terminal Control" means that start command will be given by the defined "RUN" terminal. F200 and F201 can be used in combination.

·Inverter will be started by making the defined "start" terminal connected to CM when using "terminal control".

F202 Stop Control	Setting Range: 0: Keypad Control; 1: Terminal Control; 2~4: Reserved	Mfr's Value:0
F203 Additional Stop Control	Setting Range: 0: No Additional stop function; 1: Keypad control; 2: Terminal control; 3, 4:Reserved	Mfr's Value:0

·"Keypad Control" means that stop command will be given by the "Stop" key on the keypad; "Terminal Control" means that stop command will be given by the defined "Stop" terminal. F202 and F203 can be used in combination.

·Inverter will be stopped by making the defined "stop" terminal connected to CM when using "terminal control".

F204 Basic Modes of Speed Control	Setting Range: 0: Keypad Speed Control; 1: Multi-speed Control ; 2: Terminal Speed Control; 3: Analog Signal Speed Control; 4: Coding Speed Control;	Mfr's Value: 0
F205 Additional Mode of Speed Control	Setting Range:0:No Additional Speed Control Mode; 1: Keypad Speed Control 2: Multi-speed Control; 3: Terminal Speed Control	Mfr's Value: 0

·when F204=0,2,3 and PC/PLC control is valid, the function of speed control is joint speed control.

·"Keypad Speed Control" means that running frequency will be adjusted by the "▲"/"▼" keys on the keypad; "Terminal Speed Control" means that running frequency will be adjusted by the defined "UP"/"DOWN" terminals; and "Multi-speed Control" refers to "three-stage Speed Control", "Seven-stage Speed Control" and auto circulation speed control with reference to Parameter F210.

·"Analog Signal Speed Control" refers to the speed control by adopting anaolog signals of "0～5V", "0～10V" or "0～20mA". Refer to F209.

·"Coding Speed Control" refers to the running frequency given to the inverter by combinations of various switch-statuses of Terminals OP1～OP8.

F206 Direction Given	Setting Range: 0: Lock corotation; 1: Lock reverse 2: Given direction of forward and reverse terminals level 3: Given direction of forward and reverse terminal pulse 4: Given direction of direction terminal level 5: Given direction of direction terminal pulse	Mfr's Value: 0

·When F206=0 or 1, running direction is decided internally, not controlled by external signal.

·If a terminal is defined as one to control direction, then its signal form (level or pulse) shall only depend on Function Code F206, without being controlled by F400～F407 (signal type of terminal).

·When F206=2, "forward" and "reverse" are set by the defined "forward terminal" and "reverse terminal", in the mode of "level", i.e., valid when connected to CM and invalid when disconnected, and inverter will stop as well.

·When F206=3, "forward" and "reverse" are given by the defined "forward terminal" and "reverse terminal" respectively in the mode of "pulse", i.e., an instant connection between "forward terminal" and CM give "forward" signal, and another instant connection between "reverse terminal" and CM will give "reverse" signal.

·When F206=4, "forward" and "reverse" are given by the defined "direction terminal" in the mode of "level", i.e., connection between "direction terminal" and CM give "reverse" signal, and "forward" signal is given when disconnected from CM.

·When F206=5, "forward" and "reverse" are given by the defined "direction terminal" in the mode of "pulse", i.e., instant connection between "direction terminal" give "forward" signal, instant connection for one more time give "reverse" signal.

·When delivered by the manufacturer, Terminal OP6 has the signal of forward, and OP7 the signal of reverse.

F209 Selection of Analog Signal Input Channel	Setting Range: 0:V2 Channel 1: Reserved 2: I2 Channel (0～20mA)	Mfr's Value: 0

·Voltage analog signals "0～5V" and "0～10V" are input through V2 channel, "0～5V" or "0～10V" can be chosen by the different positions of coding switch (SW1).

·Current input signal "0～20mA" is input through I2 channel with grounding of V3.

F210 Multi-Speed Types	Setting Range:0:3-stage speed control; 1:7-stage speed control; 2: Auto-circulation speed control	Mfr's Value:0

·In case of multi-speed control (F204=1), choice must be made from “3-stage speed control”, “seven-stage speed control” or “auto-circulation speed control”, of which, “auto-circulation speed control” is further divided into “auto circulation of two-stage speed”, “auto circulation of three-stage speed”, … “auto circulation of seven-stage speed”, subject to F211. Refer to Table 6-1.

Table 6-1 **Selection of Multi-Speed Control Mode**

F204	F210	Operation Mode	Remarks
1	0	3-stage Speed Control	Start/stop is not controlled by “Start” and “Run” signals; priority level is successively 1st-stage, 2nd-stage and 3rd-stage speed. 3-stage speed control can be used with analog signal speed control for combined speed control. “3-stage Speed Control” takes priority of analog signal speed control.
1	1	7-stage Speed Control	Start/stop is not controlled by “Start” and “Run” signals; 7-stage speed control can be used with analog signal speed control for combined speed control. “7-stage Speed Control” takes priority of analog signal speed control.
1	2	Auto-circulation Speed Control	Manual adjustment is not allowed to adjust the running frequency. The running frequency can be set by parameter setting as “2-stage speed auto circulation”, “3-stage speed auto circulation”, “7-stage speed auto circulation”.

F211 Selection of Stage Speed Under Auto-circulation Speed Control	Setting Range: 2～7	Mfr’s Value:7
F212 Selection of Times of Auto-circulation Speed Control	Setting Range:0～9999	Mfr’s Value: 0
F213 Status After Auto-circulation Running Finished.	Setting Range: 0: Stop; 1: Run at the speed of last stage	Mfr’s Value: 0

·That the inverter runs at the preset stage speed one by one under the auto-circulation speed control is called as “one time”.

·If F212＝0, inverter will run at infinite auto circulation, which will be stopped by “stop” signal.

·If F212>0, inverter will run at auto circulation conditionally. When auto circulation of the preset times is finished continuously (set by F212), inverter will finish auto-circulation running conditionally. If F213=0, then inverter will stop after auto circulation is finished. If F213=1, then inverter will run at the speed of the last stage after auto-circulation is finished as follows:

F212
- = 0, inverter will run at infinite auto circulation
- > 0
  - F213=0, inverter will stop after auto circulation is finished.
  - F213=1, run at the speed of the last stage after auto-circulation is finished.

e.g., F211=3, then the inverter will run at auto circulation of 3-stage speed; F212=100, then the inverter will run 100 times of auto circulation; F213=1, the inverter will run at the speed of the last stage after the auto-circulation running is finished.

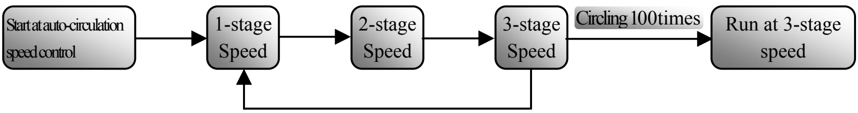


Fig 6-1 Diagram of Auto-circulation running

·The inverter can be stopped by pressing "stop" or sending "stop" signal through terminal during auto-circulation running.

F230 Precision of Frequency Showing (Hz)	Setting Range: 0.01～2.00	Mfr's Value:0.01Hz

·The change gradient of frequency or speed can be changed by adjusting the value of F230. If F230＝0.03 and inverter shows a rotate speed (F131＝1), then the rotate speed will be increased or decreased by one round each time when ▲/▼keys are pressed. The corresponding frequency will then have a change of 0.03Hz each time.

F231 Speed of Frequency Change	Setting Range: 0: Normal; 1: Slow 2: Fast	Mfr's Value: 0

· In case of keypad speed control and terminal speed control, press▲/▼keys or terminals "UP" and "DOWN" (without releasing), to control the change of frequency.

6.2 Basic Modes of Speed Control

With the help of "Basic Speed Control Mode", "Additional Speed Control Mode", "Stop Mode", "Additional Stop Mode", "Start Mode", "Additional Start Mode", "Direction Giving Mode" (F200～F206), numerous various modes of speed control can be produced through free combination, including mutual control by keypad and analog signal (i.e., joint control by keypad and terminal block). User may have more options for speed control through parameter setting based on his own requirements. Hereunder are a few basic operation control modes and operation modes of joint control.

6.2.1 Keypad Speed Control

F204＝0.

Keypad speed control is the most basic mode of speed control. Press “Run” to start, inverter will automatically accelerate to the target frequency. After that, it will stably run. During its stable running, the dynamic speed control can be realized by press “▲”/“▼” keys. Keypad speed control is the manufacturer’s default mode of speed control.

6.2.2 Terminal Speed Control

F204＝2.

Terminal speed control is effected by Terminals “UP” and “DOWN” for dynamic speed control, the rest of which is the same as those of keypad speed control. Terminals “UP” and “DOWN” are defined by F408～F415. Terminal “UP” works like “▲” key on the keypad and Terminal “DOWN” like “▼” key. If F409=11, OP2 is defined as Terminal “UP”. If connected with CM, the frequency will increase. If F410=12, OP3 is defined as Terminal “DOWN”. If connected with CM, the frequency will drop.

6.2.3 Joint Speed Control with Keypad and Terminal

F204＝0, F205=3.

Speed control is made with “▲” / “▼” keys or “UP” / “DOWN” terminals. F409=11, OP2 is defined as “UP” terminal; F410=12, OP3 is defined as “DOWN” terminal.

6.2.4 Analog Signal Speed Control

F204=3.

Inverter’s output frequency is regulated by voltage (or current) analog signal. The voltage analog signal may be given by the potentiometer of the keypad controller or by the external potentiometer, or by the analog signal output from other devices. The current analog signal can be given by the corresponding sensors or the output signal of other control equipment.

Analog signal are input through Terminal “V2”, potentiometer of keypad or Terminal “I2”. The input ports of analog signal are selected by F209, with three kinds of signals for analog input: 0～5V, 0～10V and 0～20mA. Input of 0～5V and 0～10V may also be obtained through external potentiometer, “0～5V” or “0～10V” can be chosen by the different position of coding switch (SW1). e.g.

F204=3, F209=0, voltage analog signal is input from Port V2, and grounding is V3.

F204=3, F209=1, Reserved

F204=3, F209=2, current analog signal (0～20mA) is input from Port I2, and grounding is V3.

6.2.5 Coding Speed Control

F204=4.

Eight-bit binary digits data are indicated by the different combination of switching states of Terminals OP1～OP8, of which, OP8 is the highest bit and OP1 is the lowest bit. It is prescribed that the terminal connected with “CM” gives 1 in binary digit, and “0” in binary digit if disconnected from “CM”.

Eight-bit binary digits input through OP1～OP8 are converted into digits of decimal system through CPU. The value of decimal system is divided by 255, and multiplied inverter's upper limiting frequency. Then we will have the actual output frequency of coding speed control. E.g.:

Upper Limiting Frequency F111＝50Hz, Terminal OP8 and Terminal CM will be connected and the rest of terminals will be disconnected. Enter binary digits 10000000, i.e. digits of decimal system 128. We will therefore have the running frequency of (128／255)×50＝25.10Hz.

6.2.6 Computer or PLC Control

Compute or PLC control is adopted for inverters. Function Code F900, F903 and F904 will be set as the address, parity check and Baud rate of inverter respectively. For the relevant data of computer and PLC, please refer to user's manual and communication protocol.

6.2.7 Multi-Speed Control (see next chapter)

6.2.8 Example of Speed Control Selection

If F200=0, F201=0, F202=0, F203=0, F204=3, F205=0, F206=2, then the operation control mode: analog signals (or potentiometer) will control output frequency, and the "Run" and "Stop/Reset" keys on the keypad will control "Run" and "Stop". The direction will be given by the defined "Forward Terminal' and "Reverse Terminal" by electrical level.

If F413=13, OP6 will be "Forward Terminal"; F414=14, OP7 will be "Reverse Terminal". The inverter will have forward corotation when OP6 is connected with CM, and reverse corotation when OP7 is connected with CM. OP6 and OP7 cannot be connected with CM at the same time.

VII. Multi-Speed Control

"Multi-Speed" parameters include accel./decel. time, running time, running frequency and running direction.

Three terminals; each terminal controls 1-stage speed on the status of "3-stage speed control"; combination of the three terminals' states will be used for "7-stage speed control"

7.1 Parameters Setting

F300,F306,F312,F318,F324,F330,F336 Multi-Speed Running Direction	Setting Range: 0: Forward; 1: Reverse	Mfr's Value:F300＝0; F306＝1 F312＝0; F318＝1;F324＝0; F330＝1; F336＝0

·Direction is given respectively for the 1st-stage speed up to 7th-stage speeds, These parameter s only work in "auto-circulation running".

F301,F307,F313,F319,F325,F331,F337 Multi-Speed Acceleration Time (S)	Setting Range: 0.1～3000	Mfr's Value:0.4～3.7KW: 5.0S 5.5～30KW: 30.0S 37～400KW: 60.0S

·Acceleration time is given respectively for the 1st-stage speed up to 7th-stage speeds.

F302,F308,F314,F320,F326,F332,F338 Multi-Speed Running Frequency (Hz)	Setting Range: F112～F111	Mfr's Value: F302＝5.00 F308＝10.00 F314＝15.00 F320＝20.00 F326＝25.00 F332＝30.00 F338＝35.00

·Running frequency is given respectively for the 1st-stage speed up to 7th-stage speeds.

F303,F309,F315,F321,F327,F333,F339 Multi-Speed Running Time (S)	Setting Range: 0.1～3000	Mfr's Value: 0.4～3.7KW: 5.0S 5.5～30KW: 30.0S 37～400KW: 60.0S

·Running time is given respectively for 1st-stage speed up to 7th-stage speeds, These parameters only work in "auto-circulation running".

F304,F310,F316,F322,F328,F334,F340 Multi-Speed Deceleration Time (S)	Setting Range: 0.1～3000	Mfr's Value: 0.4～3.7KW:5.0S 5.5～30KW: 30.0S 37～400KW: 60.0S

·Deceleration Time is given respectively for the 1st-stage speed up to 7th-stage speeds. These parameters only work in "auto-circulation running".

F305,F311,F317,F323,F329,F335,F341 Multi-Speed Interval (S)	Setting Range: 0.1～3000	Mfr's Value: 0.0

·It is the interval that the speed of one stage is going to convert to the speed of next stage. If it is "0", it indicates an immediate switchover.

7.2 Multi-Speed Control and Joint Speed Control

7.2.1 Three-Stage Speed Control

F204=1, F210=0.

"Three-Stage Speed" are the three speeds properly preset inside the inverter (their frequency value, acceleration/deceleration time can be modified through setting parameters). Make the defined "Three-Stage Speed Terminal 1", "Three-Stage Speed Terminal 2" and "Three-Stage Speed Terminal 3" connected with "CM", then you can get 1st-

stage, 2nd-stage and 3rd-stage speeds.

The priority order for the three speeds goes from "high" to "low": 1st-stage speed, 2nd-stage speed and 3rd-stage speed. The speed with a higher priority level may interrupt the one with a lower priority level, e.g. when running at the 2nd-stage speed, if "three-stage speed Terminal 1" is connected with "CM", inverter may interrupt the 2nd-stage speed and start the 1st-stage speed. Until the call signal for the 1st-stage speed is canceled, it will not return to the 2nd-stage speed.

e.g.

F409=0, Terminal OP2 is defined as "3-Stage Speed Terminal 1" and connected with CM, inverter will start 1st-stage speed;

F410=1, Terminal OP3 is defined as "3-Stage Speed Terminal 2" and connected with CM, inverter will start 2nd-stage speed;

F411=2, Terminal OP4 is defined as "3-Stage Speed Terminal 3" and connected with CM, inverter will start 3rd-stage speed.

7.2.2 7-Stage Speed Control

F204=1, F210=1.

"7-Stage Speeds" are the seven speeds properly preset inside the inverter (their frequency values, acceleration/deceleration time can be modified through parameters) and gotten by the defined "7-stage Speed Terminal 1", "7-stage Speed Terminal 2" and "7-stage Speed Terminal 3". The seven stages speed can be respectively gotten according to the state combination of making these three terminals connect or disconnect with "CM".

F409=0, F410=1, F411=2, Terminals OP2, OP3 and OP4 will be defined as "7-stage Speed Terminal 1", "7-stage Speed Terminal 2" and "7-stage Speed Terminal 3" respectively. Refer to Table 7-1 for their combined transfer signal:

Table 7-1 Calling Modes of Seven-Stage Speeds

7-stage Speed Terminal 3	0	0	0	0	1	1	1	1
7-stage Speed Terminal 2	0	0	1	1	0	0	1	1
7-stage Speed Terminal 1	0	1	0	1	0	1	0	1
Transfer Speed	Stop	1st-stage	2nd-stage	3rd-stage	4th-stage	5th-stage	6th-stage	7th-stage

Note:1 indicates input signal terminal is connected with CM; 0 shows input signal terminal is disconnected from CM.

7.2.3 Coordinate Speed Control with Aanalog signal and 3-stage Speed

F204=3, F205＝2, F210=0.

Analog signal speed control can be operated with the 3-stage Speed control in the meanwhile. Priority level of 3-stage Speed control is higher than analog signal speed control. 3-stage speed control can be implemented first if it has a valid signal of 3-stage speed in the mode of analog signal speed control.

7.2.4 Coordinate Speed Control with Aanalog signal and 3-stage Speed

F204=3, F205＝2, F210=1.

Analog signal speed control can be operated with the 7-stage Speed control in the meanwhile. Priority level of 7-stage Speed control is higher than analog signal speed control. 7-stage speed control can be implemented first if a valid signal of 7-stage speed is input in the mode of analog signal speed control.

7.2.5 Coordinate Speed Control with 3-Stage or 7-Stage Speeds and Keypad or Terminal

F204=1, F205＝1 or 3, F210=0 or 1.

Adjustment will be made to the 3-Stage or 7-Stage Speeds by using the "▲" / "▼" keys on the keypad or "UP" / "DOWN" terminals.

7.2.6 8-Stage Speed Control

F204=3, F205＝2, F210=1, F807＝ the running frequency for 1st-stage speed of the 8-Stage Speed.

"8-Stage Speeds" are realized by coordinate speed control of 7-Stage Speed control and analog signal speed control, through special setting. If the three stage-speed terminals are all disconnected from "CM", the analog signal input is the lower limit value, and "corresponding frequency of lower limit of analog signal" (F807) is set as the required speed value, then additional stage speed can be obtained (normally using it as the 1st-stage speed).

e.g. F807=5Hz; F409=0, OP2 is defined as "7-Stage Speed Terminal 1"; F410=1, OP3 is defined as "7-Stage Speed Terminal 2"; F411=2, OP4 is defined as "7-Stage Speed Terminal 3", then refer to Table 7-2 for selection of "8-Stage Speeds".

Table 7-2 Methods on Effecting Eight-Stage Speed Control

Speed	OP4	OP3	OP2	Acceleration Time	Deceleration Time	Frequency of each stage	Direction Setting
1st stage	0	0	0	F114	F115	F807	F206
2nd stage	0	0	1	F301	F304	F302	
3rd stage	0	1	0	F307	F310	F308	
4th stage	0	1	1	F313	F316	F314	
5th stage	1	0	0	F319	F322	F320	
6th stage	1	0	1	F325	F328	F326	
7th stage	1	1	0	F331	F334	F332	
8th stage	1	1	1	F337	F340	F338	

Note:1 indicates input signal terminal is connected with CM; 0 shows input signal terminal is disconnected from CM.

7.2.7 Auto-Circulation Running

F204=1, F210=2.

"Auto-Circulating Running" means auto circulating running at "multi-stage speed", i.e., inverter will automatically change its stage speed and run at the acceleration / deceleration time, running time, running frequency, running direction of the "speeds" properly preset after giving "Run" command; should "Stop" command fail to be given, inverter will keep running in cycles as per the number of circulating times set by F212.

"Auto-Circulation Running" can be started by the "Run" key or the defined "Run" terminal, and canceled by the "Stop" key on the keypad or the defined "Stop" terminal.

"Auto Circulation Running" may effect automatic circulating running at 2nd-stage～7th-stage speeds (set by F211). Inverter will automatically stop or maintain a steady running at the frequency of the last speed (set by F213) after reaching the number of circulating times.

e.g.

F211＝7, select "7-stage speed" auto circulating running.
F212＝1000, auto circulating running for 1,000 times.
F213＝0, automatically stop after circulating running is completed.
F300～F341, set the corresponding parameters of the 7-stage speeds.

VIII. Terminal Definition

Definable input terminals: OP1～OP8; definable output terminals: OUT, TA, TB, TC.

Each input terminal may have 22 kinds of functions, same function cannot be defined for more than one input terminal. Two output terminals can be defined for same function.

8.1 Definable Input Terminal

F400～F407 Terminal Input Signal	Setting Range 0:Level triggering; 1:Pulse triggering	Mfr's Value: 0

·Define the input signal of Terminals OP1～OP8 respectively. "Electrical level triggering"shall be valid when this terminal is connected with CM to input stable electrical level signal; "pulse triggering" shall be valid when this terminal is instantly connected with CM to input pulse signal.

·On the state of "pulse triggering", when pulse signal is input once, port function is valid; when pulse signal is input again, port function is invalid.

F408～F415 Terminal Function Definition	Setting Range:0～22	Mfr's Value: F408=3; F409=0; F410=1; F411=2; F412=5; F413=13; F414=14; F415=4

·Functions of Terminals OP1~OP8 shall be defined separately. Only one function code is available to define each terminal.

Table 8-1 **Optional Functions of Definable Input Terminal**

F408～F415	Interpretation	F408～F415	Interpretation
0	This terminal is defined as 3-stage/7-stage speed terminal 1	11	This terminal is defined as terminal of "UP" (frequency increase by degrees)
1	This terminal is defined as 3-stage/7-stage speed terminal 2	12	This terminal is defined as terminal of "DOWN" (frequency decrease by degrees)
2	This terminal is defined as 3-stage/7-stage speed terminal 3	13	This terminal is defined as "Forward" terminal
3	This terminal is defined as jogging terminal.	14	This terminal is defined as "Reverse" terminal
4	This terminal is defined as "Reset" terminal.	15	This terminal is defined as "Direction" terminal
5	This terminal is defined as "Free Stop" terminal.	16	This terminal is defined as "Acceleration/ Deceleration Time Switchover" terminal
6	This terminal is defined as "Run" terminal.	17	This terminal is defined as "External Interruption" terminal
7	This terminal is defined as "Stop" terminal.	18	This terminal is defined as "Coding Speed Control" input terminal
8	This terminal is defined as "Acceleration/Deceleration Forbidden" terminal.	9,10,19~22 Function Reserved	

·"Run", "Stop" and "Reset" terminal singals are all pulse signals, and are not restricted by the types of signals (F400～F407).

·If "Acceleration/Deceleration Forbidden" terminal is connected with CM during acceleration/deceleration, inverter will stop acceleration/deceleration and maintain its current running frequency; if this terminal is disconnected from CM, acceleration/deceleration will continue. This function is only limited to keypad speed control, terminal speed control and analog signal speed control.

·Terminal "UP" is equivellent to "▲" key on the keypad and Terminal "DOWN" to "▼" key, applicable for terminal speed control.

·"Forward" terminal, "Reverse" terminal and "Direction" terminal"cannot be defined at the same time.

·If the terminal of "acceleration/deceleration time switchover" is connected with CM during acceleration/deceleration, inverter will start the second acceleration/deceleration time. If this terminal is disconnected from CM, and the first acceleration/deceleration time will be used. This function is only restricted to keypad speed conotrol, terminal speed control and analog signal speed control.

·If receiving interruption signal input by the "external interruption" terminal during operation, inverter will make an immediate stop of output and indicate "H.H." in the meantime. Once the exernal interruption signal is canceled, then inverter will restore its running after "Reset".

e.g. F408＝17, OP1 is set to be "external interuption" terminal. Make an instant connection with CM, inverter will have free stop, and indicate "H.H." at the same time. Interruption will be canceled after "Reset".

·All F408～F415 are set to 18 at time of "Coding Speed Control". As external binary digits input terminals, OP1～OP8 cannot be used for other purpose. Refer to 6.2.5 for "Coding Speed Control".

8.2 Definable Output Terminal

F416 Token Output of Relay	Setting Range: 0～12	Mfr's Value: 0
F417 Token Output of Terminal OUT1		Mfr's Value: 3
F418 Token Output of Terminal OUT2		Mfr's Value: 3

·Output terminals including state terminal OUT and relay output Terminals TA, TB and TC can be defined, with 12 optional functions for each. Normally, TA/TC are normally open while TB/TC are normally close; voltage between OUT and CM is 12V.

·When relay works, TA/TC will close and TB/TC will be disconnected; As OUT state overturns, the voltage with CM becomes 0 from 12V.

·There is no terminals OUT1/OUT2 in single-phase inverter, it only has terminal OUT and define the terminal by setting F417.

·Two definable output terminals allow for functions with the same definition.The functions of the definable output terminal are as follows:

Table 8-2 **Optional Functions of the Definable Output Terminals**

F416,F417,F418	Significance	F416,F417,F418	Significance
0	Fault Protection Token Output	4	DC Braking Token Output
1	Over Latent Frequency Token Output	5	Token Output of Accel/Decel Time Switchover
2	Free Stop Token Output	6	Action when Frequency reaches larger of Target frequency and threshold frequency.
3	Running Token Output	7～12	Function Reserved

·F416/F417=0, as inverter has fault protection (OC, OE, PF, PO, OL and OH, etc), this terminal will work.

·F416/F417=1, as running frequency is above the setting value of F119, this terminal will work. As the running frequency is below the setting value, this terminal restores its state.

·F416/F417=2, this terminal will work when inverter free stops.

·F416/F417=3, this terminal will work when inverter runs; the terminal will restore its state when inverter stops.

·F416/F417=4, this terminal will work when inverter is in the state of DC braking.

·F416/F417=5, this terminal will work when "Acceleration/Deceleration Time Switches" F416/F417=6, this terminal will work when inverter runs to target frequency and running frequency is above the setting value of F428.

8.3 Special Output Terminal

F419 Duty Ratio of Brake Signal	Setting Range: 0～100 (%)	Mfr's Value: 80

·This parameter is used to set the duty ratio of this brake signal.(The single-phase inverters have no the function)

F420 Lowest Frequency at Max FM /IM (Hz)	Setting Range: F112～400.0	Mfr's Value: 50.00Hz
F421 FM Output Range Selection	Setting Range:0 :0～5V; 1: 0～10V	Mfr's Value: 0
F422 FM Output Compensation	Setting Range:0～120%	Mfr's Value: 100

·"0～5V" and "0～10V" are available for frequency meter connected to Terminal FM.

·F420 means the minimum corresponding running frequency within the range (“0～5V” or “0～10V”) at FM’s max output value. When running frequency is greater than or equal to this preset frequency, FM will have its max output; when running frequency is smaller than this preset frequency, FM will have its output voltage proportional to the running frequency. E.g., if F421=0, F420=60Hz, FM will have an output of 5V when running frequency ≥60Hz; if running frequency＝30Hz, then FM＝2.5V.

·F422 is used to compensate for FM’s output error, and compensation value shall be fixed based on the actual measuring.*

F423 FM/IM Output Parameter Selection	Setting Range: 0.0～10.0	Mfr’s Value:2.0
F424 IM Output Compensation	Setting Range: 0～120%	Mfr’s Value: 100
F425 IM Output Range Selection	Setting Range: 0: 0～20mA 1: 4～20mA	Mfr’s Value: 0
F426 FM Function Selection	Setting Range:0:Output Frequency Display 1:Output Current Display	Mfr’s Value: 0
F427 IM Function Selection	Setting Range:0:Output Frequency Display 1:Output Current Display	Mfr’s Value: 1
F428 Threshold frequency	Setting Range: 0.50~400.00	Mfr’s Value: 10

·Terminal IM will output 0～20mA or 4~20mA signals as per the changes of inverter’s output current (between IM and V3).

·F423 is used to rectify the display accuracy of FM/IM’s external ammeters with various measuring ranges. If IM is externally connected to an ammeter with an input of 0～20mA and a measuring range of A, and inverter has “I” for its output rated current, then F423 can be set as (A/I), and ammeter will have a correct indication of inverter’s output current, i.e. the motor current.

Note: Manufacturer can only guarantee the correct output of IM when motor current is less than twice of inverter’s rated current. Single phase inverter has no this function.

·F424 is used to compensate the output error of IM, and compensation value shall be fixed based on the actual measuring.*

·F428 is subsidiary function of F417/F418=6. F428 is the threshold frequency of Frequency Reach. When current frequency exceeds the setting frequency of F428 and reaches target frequency, output terminal is in action.

IX. V/F Control & Protection

V/F compensation and carrier-wave frequency impact torque; timing control brings you more convenience in operation

Overload protection value =overload time ×overload-protection current.. overload protection occurs when accumulated overload value is more than overload protection value

9.1 V/F Control

9.1.1 V/F Compensation and Carrier-Wave Frequency

F500 Compensation of Speed Difference	Setting Range: 0～8	Mfr's Value: 0

·The load is higher, the speed difference is larger. Adjusting the parameter value will make motor's actual rotate-speed close to the rated rotate-speed.

F501 Torque Compensation	Setting Range: 0: Beeline type compensation; 1:Reserved; 2:Reserved	Mfr's Value: 0
F502 Beeline-type Torque Compensation Curve	Setting Range: 1～16	Mfr's Value 0.4～3.7KW: 5; 5.5～30KW: 4; 37～400KW: 3
F503 Reserved		

·There are altogether 16 "beeline torque compensation curves", which are used to increase the output torque at low frequency. Compensation will be increased with bigger values, as indicated in Fig 9-1.

·Over-setting values of torque compensation curve may incur current impact during starting process and may further result in inverter's over-current protection.

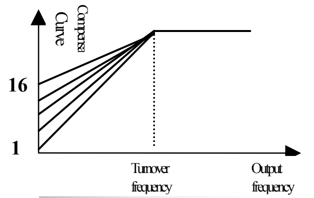


Fig 9-1 Torque Promotion Curve

·A smaller torque compensation curve should be selected when inverter has a bigger power.

·Carrier-Wave Frequency" should also be considered when selecting "Torque Compensation Curve". Normally, compensation curve can be increased to a certain extent with a high carrier-wave frequency.

F512 Setting Carrier-Wave Frequency	Setting Range 0.4～3.7KW: 1000～10000 5.5～30KW: 1000～9000 37～400KW: 1000～6000	Mfr's Value 0.4～3.7KW: 1000 5.5～30KW: 1000 37～400KW: 1000

·Motor will have a lower electromagnetic noise with a higher carrier-wave frequency. But inverter will have its temperature increased and output torque decreaed.

·Normally, there will be significant reduction with motor noise when carrier-wave frequency is higher than 5KHz. "Carrier-wave frequency" can be set as "7000" for low-power (below 7.5KW) inverters where "mute" running is required. It is recommended that carrier-wave frequency should not be set above 6KHz for a high-power inverter.

·Recommended setting range for carrier-wave frequency: 1000～6000.

On Torque Compensation and Carier-Wave Frequency

The output torque and carrier capacity of an inverter are closely related with "Torque Compensation Curve" and carrier-wave frequency. This inverter will automatically start "random carier-wave PWM" control below 3KHz for purpose of reducing the noise at low carrier-wave frequency.

"Torque Compensation Curve" and "Carrier-Wave Frequency" should be well matched in actual application. Torque compensation can be higher comparatively when there is a higher carrier-wave frequency; torque compensation can be lower comparatively when there is a lower carrier-wave frequency. However, higher power inverter is not advisable to adopt a higher carrier-wave frequency or higher torque compensation curve. The following value range is recommended for F502 and F512:

F502: 3～8　F512: 1000～6000

9.1.2 DC Braking

F514 DC Braking Function Selection	Setting Range 0: DC braking function forbidden 1: Braking before starting 2: Braking during stopping 3: Braking before start & during stop	Mfr's Value: 0
F515 Initial Frequency of DC Braking (Hz)	Setting Range: 1.00～5.00	Mfr's Value:1.00Hz
F516 DC Braking Voltage (V)	Setting Range: 0～60	Mfr's Value: 10V
F517 Braking Duration Before Starting (S)	Setting Range: 0.0～10.0	Mfr's Value: 0.5S
F518 Stop-Braking Duration (S)	Setting Range: 0.0～10.0	Mfr's Value: 0.5S

·In case where a blower fan is used, adopting "Braking before Starting" will ensure that the fan stays in a static state before starting.

·Parameters related to "DC Braking": F515, F516, F517 and F518, interpreted as follows:

a. F515: Initial frequency of DC braking. DC braking will start to work as inverter's output frequency is lower than this value.

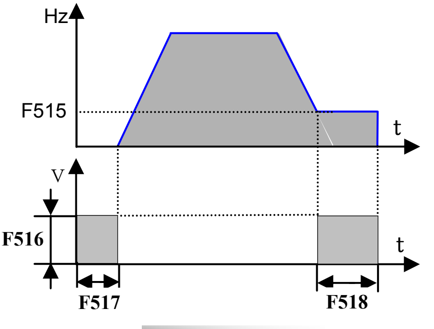


Fig 9-2 DC Braking

b. F516: DC braking voltage. The bigger value will result in a quicker braking. However, motor will overheat with too big value.

c. F517: Braking duration before starting. The time lasted for DC braking before inverter starts.

d. F518: Braking duration when stopping. The time lasted for DC braking while inverter stops.

·Refer to Fig 9-2 for DC braking process.

9.1.3 Stalling Adjusting

F525 Selecting Function of Stalling Adjusting	Setting Range 0:Invalid; 1:Valid	Mfr's Value: 0
F526 Stalling Adjusting Function during Acceleration	Setting Range 0:Invalid; 1:Valid	Mfr's Value: 0
F527 Stalling Adjusting Function during Running	Setting Range 0:Invalid; 1:Valid	Mfr's Value: 0
F528 Stalling Adjusting Function during Deceleration	Setting Range 0:Invalid; 1:Valid	Mfr's Value: 0
F529 Stalling Adjusting Function during Stopping	Setting Range 0:Invalid; 1:Valid	Mfr's Value: 0
F530 Fluctuation Removing Time when Stalling Setting Starts (S)	Setting Range:0.1～50.0	Mfr's Value:1.0
F531 Time for Stalling Adjusting to Start (S)	Setting Range:0.1～150.0	Mfr's Value 0.4～3.7KW:5.0S 5.5～30KW:30.0S 37～400KW:60.0S
F532 Lower Frequency Limit of Stall Setting (Hz)	Setting Range:F112～F111	Mfr's Value:5.00
F533 Fluctuation Removing Time when Stalling Setting Quits (S)	Setting Range: 0.0～50.0	Mfr's Value:1.0
F534 Quiting Time of Stalling Adjusting (S)	Setting Range:0.1～150.0	Mfr's Value 0.4～3.7KW:5.0S 5.5～30KW:30.0S 37～400KW:60.0S
F535 Protection Time of Stalling Adjusting (S)	Setting Range:0.1～100.0	Mfr's Value:4.0

·When "Stalling Adjusting" function is valid, inverter will adjust output frequency automatically, restricting the output current within a certain range. The frequency will therefore fluctuate within a smaller range.

·**Conditions for "Stalling Adjusting":** when output current is higher than "Initial Overload Current","Stalling Adjusting"starts to work. Refer to "Overload Protection" for "Initial Overload Current".

·**"Fluctuation Removing":** the fluctuation of output current for a short time during stalling adjusting is considered "fluctuation" and is ignored, which can increase the stability of output frequency. The effect of "fluctuation removing" is subject to "the time of removing fluctuation". The longer it is, the more stable with output. However, the effect of Stalling Adjusting wil be influenced. "Mfr's Value" is normally adopted.

·**"Time to Remove Fluctuation" when Stalling Adjusting Starts (F530):** "Stalling Adjusting" will not happen immediately when inverter's output current exceeds the "Initial Overload Current", but will wait for a certain period of time (setting value of F530). If output current is higher than "Initial Overload Current" all the time during waiting time, inverter will start "Stalling Adjusting".

·**"Time to Remove Fluctuation" when Stalling Adjusting Quits (F533):** When output current is lower than "Initial Overload Current" during stalling adjusting, "Stalling Adjusting" will not stop immediately but wait for a certain period of time (setting value of F533). If output current is lower than "Initial Overload Current" all the time during waiting time, inverter will quit "Stalling Adjusting" function.

·**Lower Frequency Limit of Stalling Adjusting (F532):** Output Frequency will drop automatically during "Stalling Adjusting" till it reaches the "Lower Frequency Limit of stalling adjusting". Inverter will maintain this frequency should the stalling fail to be eliminated.

·**Protection Time of Stalling Adjusting (F535):** When Output Frequency drops to the "Lower Frequency Limit of Stalling Adjusting" during "Stalling Adjusting", and if stalling still continues after waiting for a certain period of time (setting value of F535), inverter will enter "Overload" (OL) protection state. This period of time shall be the protection time of Stalling Adjusting.

·**Action Time and Quiting Time of Stalling Adjusting (F531, F534):** In case of "stalling", the time of frequency drop will be the acting time of "Stalling Adjusting"; when "stalling" is canceled, the time of frequency raising will be the quiting time of "Stalling Adjusting".

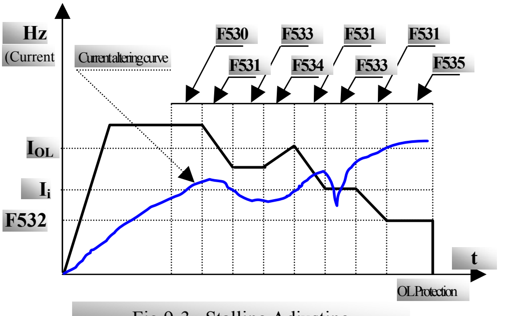


Fig 9-3 Stalling Adjusting

·Fig 9-3 indicates the process of Stalling Adjusting:

a. "I_i" is initial overload current. When output current is higher than this value, the inverter will judge the fluctuation-removing time. If current does not become smaller during the fluctuation-removing time (F530), then the Stalling Adjusting start.

b. After Stalling Adjusting starts to work, decelerate as per the time Stalling Adjusting works (Deceleration Time) (F531); before dropping to the Lower Frequency Limit (F532) of Stalling Adjusting, if current drops below I_i, the inverter will judge the fluctuation-removing time (F533) when Stalling Adjusting quits. If current remains below I_i within this time, then quit Stalling Adjusting.

c. If current rises above I_i before completely quiting Stalling Adjusting, Stalling Adjusting will continue to work. The inverter will judge the protection time (F535) of Stalling Adjusting when current continues to rise and frequency keeps dropping until it reaches the Lower Frequency Limit（F532）of Stalling Adjusting. If the current remains high during this time, overload protection will occur.

9.2 Timing Control

"Timing Control" mainly refers to "Timing of Free Stop" and "Timing Action" of the corresponding output terminal. E.g.

F700 Selection of Free-Stop Mode	Setting Range 0: Immediate free-stop 1: Delayed free-stop	Mfr's Value: 0
F701 Action Delay Time of Free Stop and Output Terminal (S)	Setting Range:0.0～60.0	Mfr's Value: 0

·"Selection of Free Stop Mode" is only used for "Free Stop" mode of terminal control. When selecting "Immediate Free-Stop", delay time (F701) will not work; when delay time is 0 (i.e. F701=0), it works as immediate free stop.

·"Delayed Free-Stop" means that inverter will not stop immediately upon receiving the signal of "Free Stop", but will wait for some time before implementing the command of "Free Stop", delay time is subject to F701.

·When F701>0, delay time is valid, and the corresponding output terminal will carry out its delay action or delay overturn as per this time.

F702	Fan control mode (only valid for the power 18.5-400kw)	0:controlled by termperature 1:controlled by inverter's power	Mfr's Value:1

·F702=0; Fan's run is controlled by the radiator; Fun will be run if inverter's termperature is up to stated temperature;

·F702=1; Fan will run when power is supplied to the inverter..And fan will not stop until pwer off.

9.3 Programmable Protection Function

9.3.1 Under-Voltage Protection and Out-Phase Protection

F708 Function Selection of Under-Voltage	Setting Range: 0:Invalid; 1:Valid	Mfr's Value: Setting Value
F709 Under-Voltage Protected Voltage (V)	Setting Range:200～400	Mfr's Value: Setting Value
F710 Filtering Constant of Under-Voltage	Setting Range:0.0～60.0	Mfr's Value: Setting Value
F711 Function Selection of Out-phase	Setting Range 0:Invalid; 1:Valid	Mfr's Value: Setting Value
F712 Filtering Constant of Out-phase	Setting Range: 0.0～60.0	Mfr's Value: Setting Value

·**"Under-Voltage" means too low voltage at AC input**. "Out-Phase" means lack of phase of the input 3-phase power.

· Filtering constant of "Under-Voltage" / "Out-Phase" signals are used to remove interference to avoid mis-protection. The greater the setting values are, the longer the constants of filtering time, and the better filtering effect

9.3.2 Overload Protection

F715 Overload Duration (S)	Setting Range: 0.0～100.0	Mfr's Value: Setting Value
F716 Overload Coefficient	Setting Range: 0.0～1.8	Mfr's Value: Setting Value
F717 Overload Interruption Time(S)	Setting Range: 0.0～60.0	Mfr's Value: Setting Value
F718 Inverter's Rated Current (A)	Setting Range: 1.0～1000	Mfr's Value: Setting Value
F719 Current Compensation Coefficient	Setting Range: 0.0～2.0	Mfr's Value: Setting Value
F720 Relative Overload Value	Setting Range: 1～4	Mfr's Value: Setting Value

·Inverter will have "overload protection" when output current is accumulated to the set "overload accumulation value".

·**Overload Lasting Time:** The time from the moment when output current is greater than "Initial Overload Current" to the moment when "Overload Protection" occurs.

·**Overload coefficient:** The ratio of the current when overload protection occurs over the rated current. The values to be taken shall be subject to the actual load.

·**Overload Interuption Time:**

a. **"Initial Overload Current"** refers to the current starting to calculate the overload time.

b. **Overload Ampere-Second Value** refers to the product of the current exceeding "Initial Overload Current" values and time. The accumulation (integral) of overload ampere-second value is called **accumulated overload value**. Overload protection value is actually understood as "current×time".

c. If output current remains higher than the value of "Initial Overload Current", then the system will accumulate the overload Ampere-Second Value; if output current suddenly drops below "Initial Overload Current", then **overload Ampere-Second Value** will stop its accumulation. If the current is still lower than "Initial Overload Current" after a certain period of time (setting value of F717), then the accumulated overload value made before will be eliminated. If output current exceeds again "Initial Overload Current" value during this time, then **Overload Ampere-Second Value** will be continuously accumulated on basis of the previous accumulation value.

d. Therefore, the setting time of F717 is called "Overload Interruption Time".

·**Current Compensation Coefficient:**

a. There may be some errors between the current value that inverter has obtained through galvanoscopy and the value actually measured. Compensation can be made by setting F719.

b. 0.1～0.9 are negative compensation. The current display will have a smaller value with a smaller coefficient;

c. 1.1～2.0 are positive compensation. The current will display a bigger value with a bigger coefficient;

d. F719=1.0, no compensation.

·**Relative Overload Value:**

a. This parameter indicates the difference value between overload protection current and “Initial Overload Current”, adopting positive integer. Relative Overload Value=[(overload protection current – initial overload current) /rated current]×10

b. E.g, overload coefficient =1.5, relative overload value =2, rated current＝30A; then the initial overload current value= （1.5-0.2） ×30=1.3×30＝39A. i.e., overload time is calculated from the moment when output current is 39A.

·**Diagram of Overload Protection:**

Refer to Fig 9-4 for overload protection.

a. I_i: initial overload current, I_{OL}: overload protection current; F717 in the frame shows overload interruption time.

b. Sum of shaded area equals to the accumulated overload value; overload protection value=F715×overload protection current.

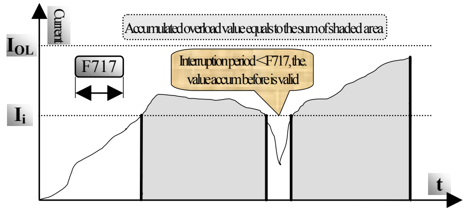


Fig 9-4 Overload Protection

c. When sum of shaded area is more than overload protection value, overload protection occurs.

In analog speed control mode, moderate adjustment is sometimes required for an ideal effect on the lower and upper limits of input analog, the relation between analog changes and output frequency, and the corresponding output frequency as min analog is input.

If **F204＝3**, then select **Analog Speed Control**.

F800 Lower Limit of Analog Input	Setting Range:0～1023	Mfr's Value:20
F801 Upper Limit of Analog Input	Setting Range:0～1023	Mfr's Value:1000
F806 Analog Input Compensation	Setting Range:0～100	Mfr's Value:0
F807 Corresponding Frequency of Lower Limit of Analog Signal (Hz)	Setting Range: 0～F111	Mfr's Value:0
F808 Relation Between Analog Changesand Output Frequency	Setting Range 0:Direct proportion; 1:Inverse proportion	Mfr's Value:0

·**Setting the Lower and Upper Limits of Analog:**

a. If analog reaches the max input but running frequency still fails to reach the upper limiting frequency, then reduce the F801 value gradually until requirement is met.

b. In case of min input with analog while inverter cannot have its output drop to 0Hz, then increase the value of F800 gradually until meeting the requirements.

c. Parameter F806 is used for fine adjustment of inverter's running frequency.

·**Corresponding Frequency to the Lower Limit**: As the value of F807 is higher than Lower Frequency Limit（F112）, inverter will still keep running at a certain frequency even if a min analog value is input.

·**Analog Speed Control:**

a. As F808=0, direct ratio between input analog and output frequency, i.e. 0～5V (or 0～10V or 0～20mA) corresponds to 0～upper limiting frequency.

b. As F808=1, inverse proportion between input analog quantity and output frequency, i.e. 5～0V (or 10～0V or 20～0mA) corresponds to 0～upper limiting frequency.

F810 analog filter constant	Setting range：0～800	Mfr's value：setting value
F811 analog filter width	Setting range：0～20	Mfr's value: setting value

F810, F811 usually are used together to adjust reaction time and precision of analog.

Appendix 1 Trouble Shooting

When malfunction occurs to inverter, don't run by resetting immediately. Check any causes and get it removed if there is any.

Take counter measures by referring to this manual in case of any malfunctions on inverter. Should it still be unsolved, contact the manufacturer. Never attempt any repairing without due authorization.

Table 1-1 **Inverter's Common Cases of Malfunctions**

Fault 显示	Description	Causes	Countermeasures
O.C.	Overcurrent	* too short acceleration time * short circuit at output side * locked rotor with motor	*prolong acceleration time; *whether motor cable is broken; *check if motor overloads; *reduce V/F compensation value
O.L.	Overload	* load too heavy	*reduce load; *check equipment drive ratio; *increase inverter's capacity
O.E.	DC Over-Voltage	*supply voltage too high; *load inertia too big *deceleration time too short; *motor inertia rise again	*check if rated voltage is input; *add braking resistance(optional); *increase deceleration time
P.F.	Out-Phase Protection	*out-phase with input power	*check if power input is normal; *check if parameter setting is correct.
P.O.	Under-Voltage Protection	*input voltage on the low side	*check if supply voltage is normal *check if parameter setting is correct.
O.H.	Radiator Overheat	*environment temperature too high; *radiator too dirty *install place not good for ventilation; *fan damaged	*improve ventilation; *clean air inlet and outlet and radiator; *install as required; *change fan
C.B.	Contactor does not suck	*Too low voltage of power network *AC contactor damaged	*check the voltage *check the AC contactor
Motor not Running		*wrong wiring; *wrong setting; * too heavy load;	*check input, output and control line; *check parameter setting; *increase inverter's output capacity
Power Trips	Line-Current Too Big	*short circuit at input side; *too small capacity with air switch;*motor overload	*check input line; *check air switch capacity; *reduce load

* No P.F. protection for single-phase and three-phase under 3.7KW.
* C.B. protection only for cabinet-type inverters from 110KW to 400KW.

Table 1-2 **Motor Malfunction and Counter Measures**

Malfunction	Items to Be Checked	Counter Measures
Motor not Running	Supply voltage is on or normal? Normal with U,V,W 3-phase output? Locked rotor with motor? Panel with trouble indication?	Get connected with power; Check wiring; Disconnect and Reconnect; Reduce load; Check against Table 1-1
Wrong Direction of Motor Running	U, V, W wiring correct?	To correct wiring
Motor Turning but Speed Change not Possible	Wiring correct for lines with given frequency? Correct setting of running mode? Too big with load?	To correct wiring; To correct setting; Reduce load
Motor Speed Too High or Too Low	Motor's rated value corrrect? Drive ratio correct? Max output frequency value correct? Check if voltage drops between motor terminals too high?	Check motor nameplate data; Check speed change mechanism; Check setting; Check V/F Characteristic value
Motor Running Unstable	Too big load? Too big with load change? Single-phase or 3-phase for power?Out-phase?	Reduce load;reduce load change, increase capacity; Reactor to be added for single -phase power input.

Appendix 2 Zoom Table of Function Code

Function Section	Function Code	Function Definition	Setting Range	Mfr's Value	Change
Basic Parameters	F100	User's Password	0～9999	8	√
	F101, F102	Reserved			
	F103	Inverter's Power	0.40～400.0	This inverter's power value	△
	F104	Reserved			
	F105	Softwae Version No			△
	F106	Inverter's Input Voltage Type	0:Single-phase 1:3-phase		△
	F107	Output Voltage Proportion	1～100%	100	×
	F108	Reserved			
	F109	Min Frequency displayed by current	5.00~50.00	15.00	√
	F110	Reserved			
	F111	Max Frequency Limit	F113～400.0	50.00	×
	F112	Min Frequency Limit	0.50～F113	0.50	×
	F113	Target Frequency	F112～F111	10.00	×

	F114	1st Acceleration Time	0.1～3000	5.0S for 0.4～3.7KW 30.0S for 5.5～30KW 60.0S for 37～400KW	×
	F115	1st Deceleration Time	0.1～3000	5.0S for 0.4～3.7KW 30.0S for 5.5～30KW 60.0S for 37～400KW	×
	F116	2nd Acceleration Time	0.1～3000	5.0S for 0.4～3.7KW 30.0S for 5.5～30KW 60.0S for 37～400KW	×
	F117	2nd Deceleration Time	0.1～3000	5.0S for 0.4～3.7KW 30.0S for 5.5～30KW 60.0S for 37～400KW	×
	F118	Turnover Frequency	15.00～400.0	50.00	×
	F119	Latent Frequency	F112～F111	5.00	√
	F120	Dead-Time of Switch Between Corotation and Reverse	0.0～3000	0.0	√
	F121	Stop Mode Selection	0: Stop by deceleration time 1: Free stop	0	√
	F122	Reserved			
	F123	Jogging Function	0: Invalid jogging function 1: Valid jogging function	1	×
	F124	Jogging Frequency	F112～F111	5.00	√

Basic parameters	F125	Jogging Acceleration Time	0.1～3000	5.0S for 0.4～3.7KW 30.0S for 5.5～30KW 60.0S for 37～400KW	√
	F126	Jogging Deceleration Time	0.1～3000	5.0S for 0.4～3.7KW 30.0S for 5.5～30KW 60.0S for 37～400KW	√
	F127	Skip Frequency A	0.00～400.0	0.00	×
	F128	Skip Area A	±2.5	0.5	×
	F129	Skip Frequency B	0.00～400.0	0.00	×
	F130	Skip Area B	±2.5	0.5	×
	F131	Display Contents	0:Frequency; 1:Rotate speed 2:Linear velocity; 3:Output voltage; 4: Output current	0	√
	F132	Numbers of Motor Poles	2～100	4	√
	F133	Drive Ratio of Driven System	0.10～200.0	1.00	√
	F134	Range of Linear Velocity	1～60000	1800	√
	F135,F136	Reserved			
	F137	Frequency Memory	0:Invalid 1:Valid	0	×
	F138	Auto Start of Analog Signals Speed Control	0:Auto start 1:Press “Run” to start	1	×

	F139	Auto Start After Power Resupplied or Reset	0:Invalid restart 1:Valid restart	0	×
	F140	Start by the Terminal Direction Signal	0:Invalid 1:Valid	0	×
	F141	Accelerating by keypad	Setting range: 0：Proportional to Acceleration /Deceleration time; 1：Slow	0	
	F142~F147	Reserved			
	F148	Stopping inverter is controlled by ▼ keys and “DOWN” terminal.	0: Operating “▼” and “DOWN” normally; 1: after reaching min frequency, stop inverter by “▼”and “DOWN”.	0	×
	F149	code function setting	0: code must be entered 1: code need not be entered.	0	×
	F150～F159	Reserved			
	F160	Restore Mfr’s Value	0:Not reverting to Mfr’s Value 1:Reverting to Mfr’s Value	0	×
	F200	Start Control	0:Keypad command 1:Terminal command 2,3,4:Reserved	0	×

Running Control Mode	F201	Additional Start Control	0:No additional start function 1:Keypad command 2:Terminal command 3,4:Reserved	0	×
	F202	Stop Control	0: Keypad Command 1: Terminal Command 2,3,4: Reserved	0	×
	F203	Additional Stop Control	0: No additional start function 1:Keypad command 2:Terminal command 3,4:Reserved	0	×
	F204	Basic Modes of Speed Control	0: Keypad speed control 1: Multi speed control 2: Terminal speed control 3: Analog speed control 4: Coding speed control	0	×

	F205	Additional Modes of Speed Control	0: No additional start function 1:Keypad speed control 2: Multi speed control 3:Terminal speed control	0	×
	F206	Direction Given	0～5	0	×
	F07/F208	Reserved			
	F209	Selection of Analog Signal Input Channel	0:V2 channel 1:Reserved 2:I2 channel	0	×
	F210	Multi-Speed Types	0: 3-stage speed running 1: 7-stage speed running 2: Auto circulating running	0	×
	F211	Selection of Stage Speed Under Auto-circulation Speed Control	2～7	7	×
	F212	Selection of Times of Auto-irculation Speed Control	0～9999	0	×
	F213	Status After Auto-circulation Running Finished.	0:Stop 1:Run at the speed of last stage	0	×
	F214～F229	Reserved			
	F230	Precision of Frequency Showing	0.01～2.00	0.01	√

	F231	Speed of Frequency Change	0:Normal 1:Slow 2:Fast	0	√
	F232～F260	Reserved			
Multi-Speed Parameters	F300	1st Speed Running Direction	0:Forward; 1:Reverse	0	√
	F301	1st Speed Acceleration Time	0.1～3000	5.0S for 0.4～3.7KW 30.0S for 5.5～30KW 60.0S for 37～400KW	√
	F302	1st Speed Running Frequency	F112～F111	5.00	√
	F303	1st Speed Running Time	0.1～3000	5.0S for 0.4～3.7KW 30.0S for 5.5～30KW 60.0S for 37～400KW	√
	F304	1st Speed Deceleration Time	0.1～3000	5.0S for 0.4～3.7KW 30.0S for 5.5～30KW 60.0S for 37～400KW	√
	F305	1st Speed Interval	0.0～3000	0.0	√
	F306	2nd Speed Running Direction	0:Forward; 1:Reverse	1	√

	F307	2nd Speed Acceleration Time	0.1～3000	5.0S for 0.4～3.7KW 30.0S for 5.5～30KW 60.0S for 37～400KW	√
	F308	2nd Speed Running Frequency	F112～F111	10.00	√
	F309	2nd Speed Running Time	0.1～3000	5.0S for 0.4～3.7KW 30.0S for 5.5～30KW 60.0S for 37～400KW	√
	F310	2nd Speed Deceleration Time	0.1～3000	5.0S for 0.4～3.7KW 30.0S for 5.5～30KW 60.0S for 37～400KW	√
	F311	2nd Speed Interval	0.0～3000	0.0	√
	F312	3rd Speed Running Direction	0:Forward; 1:Reverse	0	√
	F313	3rd Speed Acceleration Time	0.1～3000	5.0S for 0.4～3.7KW 30.0S for 5.5～30KW 60.0S for 37～400KW	√
	F314	3rd Speed Running Frequency	F112～F111	15.00	√

	F315	3rd Speed Running Time	0.1～3000	5.0S for 0.4～3.7KW 30.0S for 5.5～30KW 60.0S for 37～400KW	√
	F316	3rd Speed Deceleration Time	0.1～3000	5.0S for 0.4～3.7KW 30.0S for 5.5～30KW 60.0S for 37～400KW	√
	F317	3rd Speed Interval	0.0～3000	0.0	√
	F318	4th Speed Running Direction	0: Forward; 1: Reverse	1	√
	F319	4th Speed Acceleration Time	0.1～3000	5.0S for 0.4～3.7KW 30.0S for 5.5～30KW 60.0S for 37～400KW	√
	F320	4th Speed Running Frequency	F112～F111	20.00	√
	F321	4th Speed Running Time	0.1～3000	5.0S for 0.4～3.7KW 30.0S for 5.5～30KW 60.0S for 37～400KW	√
Multi-Speed Parameters	F322	4th Speed Deceleration Time	0.1～3000	5.0S for 0.4～3.7KW 30.0S for 5.5～30KW 60.0S for 37～400KW	√
	F323	4th Speed Interval	0.0～3000	0.0	√
	F324	5th Speed Running Direction	0:Forward;1:Reverse	0	√

	F325	5th Speed Acceleration Time	0.1～3000	5.0S for 0.4～3.7KW 30.0S for 5.5～30KW 60.0S for 37～400KW	√
	F326	5th Speed Running Frequency	F112～F111	25.00	√
	F327	5th Speed Running Time	0.1～3000	5.0S for 0.4～3.7KW 30.0S for 5.5～30KW 60.0S for 37～400KW	√
	F328	5th Speed Deceleration Time	0.1～3000	5.0S for 0.4～3.7KW 30.0S for 5.5～30KW 60.0S for 37～400KW	√
	F329	5th Speed Interval	0.0～3000	0.0	√
	F330	6th Speed Running Direction	0:Forward; 1:Reverse	1	√
	F331	6th Speed Acceleration Time	0.1～3000	5.0S for 0.4～3.7KW 30.0S for 5.5～30KW 60.0S for 37～400KW	√
	F332	6th Speed Running Frequency	F112～F111	30.00	√
	F333	6th Speed Running Time	0.1～3000	5.0S for 0.4～3.7KW 30.0S for 5.5～30KW 60.0S for 37～400KW	√
	F334	6th Speed Deceleration Time	0.1～3000	5.0S for 0.4～3.7KW 30.0S for 5.5～30KW 60.0S for 37～400KW	√
	F335	6th Speed Interval	0.0～3000	0.0	√
	F336	7th Speed Running Direction	0:Forward; 1:Reverse	0	√
	F337	7th Speed Acceleration Time	0.1～3000	5.0S for 0.4～3.7KW 30.0S for 5.5～30KW 60.0S for 37～400KW	√

	F338	7^{th} Speed Running Frequency	F112～F111	35.00	√
	F339	7^{th} Speed Running Time	0.1～3000	5.0S for 0.4～3.7KW 30.0S for 5.5～30KW 60.0S for 37～400KW	√
	F340	7^{th} Speed Deceleration Time	0.1～3000	5.0S for 0.4～3.7KW 30.0S for 5.5～30KW 60.0S for 37～400kw	√
	F341	7^{th} Speed Interval	0.0～3000	0.0	√
	F342～F360	Reserved			
Terminal Functions Parameter	F400	OP1 terminal input signal type	0:Level touch off 1:Pulse touch off	0	√
	F401	OP2 terminal input signal type	0:Level touch off 1:Pulse touch off	0	√
	F402	OP3 terminal input signal type	0:Level touch off 1:Pulse touch off	0	√
	F403	OP4 terminal input signal type	0:Level touch off 1:Pulse touch off	0	√
	F404	OP5 terminal input signal type	0:Level touch off 1:Pulse touch off	0	√
	F405	OP6 terminal input signal type	0:Level touch off 1:Pulse touch off	0	√
	F406	OP7 terminal input signal type	0:Level touch off 1:Pulse touch off	0	√

	F407	OP8 terminal input signal type	0:Level touch off 1:Pulse touch off	0	√
	F408	OP1 Function Setting	0:3rd/7th speed terminal1 1:3rd/7th speed terminal2 2:3rd/7th speed terminal3 3:jogging terminal 4:reset terminal 5:free-stop terminal 6:run terminal 7:stop terminal 8:acce/decel forbidden terminal 11:Up frequency increase teminal 12:DOWN frequency decrease teminal 13:corotationterminal 14: reverseterminal 15:direction terminal 16:acce/deceleration time switch terminal 17:external interruption terminal 18:input terminal of codingsped control 9,10,19～22:Reserved	3	√
	F409	OP2 Function Setting		0	√
	F410	OP3 Function Setting		1	√
	F411	OP4 Function Setting		2	√
	F412	OP5 Function Setting		5	√
	F413	OP6 Function Setting		13	√
	F414	OP7 Function Setting		14	√
	F415	OP8 Function Setting		4	√
	F416	Token Output of Relay	0～12（See Table 8-2）	0	×
	F417	Token Output of Terminal OUT1		3	×
	F418	Token Output of Terminal OUT2		3	×
	F419	Duty Ratio of Brake Signal	0～100(%)	80	√
	F420	Lowest Frequency at Max FM/IM	F112～400.0	50.00	√
Terminal Functions Parameter	F421	FM Output Range Selection	0:0～5V; 1:0～10V	0	√
	F422	FM Output Compensation	0～120%	0	√
	F423	FM/IM Output Parameter Selection	0.0～10.0	2.0	√

	F424	IM Output Compensation	0～120%	0	√
	F425	IM Output Range Selection	0: 0～20mA 1: 4～20mA	0	√
	F426	FM Function Selection	0:Output Frequency Display 1:Output Current Display	0	√
	F427	IM Function Selection	0:Output Frequency Display 1:Output Current Display	1	√
	F428	Threshold frequency	5.00~400.00	10.00	×
	F429～F460	Reserved			
V/F Control	F500	Compensation of Speed Difference	0～8	0	√
	F501	Torque Compensation	0:Beeline type compensation 1~2:Reserved	0	×
	F502	Beeline-type Torque Compensation Curve	1～16	0.4～3.7KW:5 5.5～30KW:4 37～400KW:3	×
	F503～F511	Reserved			
	F512	Setting Carrier-Wave Frequency	0.4～3.7KW:1000-10000 5.5～30KW:1000-9000 37～400KW:1000-6000	0.4～3.7KW:1000 5.5～30KW:1000 37～400KW:1000	×
	F513	Reserved			
	F514	DC Braking Function Selection	0: DC braking function forbidding 1: Braking before start 2: Braking during stop 3: Braking both before start &during stop	0	×
	F515	Initial Frequency of DC Braking	1.00～5.00	1.00	√
	F516	DC Braking Voltage	0～60	10	√
	F517	Braking Duration Before Starting	0.0～10.0	0.5	√

	F518	Stop-Braking Duration	0.0～10.0	0.5	√
	F519～F524	Reserved			
	F525	Selection Function of Stalling Adjusting	0:Invalid; 1:Valid	0	√
	F526	Stalling Adjusting Function During Accelerationion	0:Invalid; 1:Valid	0	√
V/F Control	F527	Stalling Adjusting Function During Running	0:Invalid; 1:Valid	0	√
	F528	Stalling Adjusting Function in During Deceleration	0:Invalid; 1:Valid	0	√
	F529	Stalling Adjusting Function during Stopping	0:Invalid; 1:Valid	0	√
	F530	Fluctuation Removing Time When Stalling Setting Starts	0.1～50.0	1.0	√
	F531	Time for Stalling Adjusting to Start	0.1～150.0	5.0S for 0.4～3.7KW 30.0S for 5.5～30KW 60.0S for 37～400KW	√
	F532	Lower Frequency Limit of Stalling Setting	F112～F111	5.00	√
	F533	Fluctuation Removing Time When Stalling	0.0～50.0	1.0	√
	F534	Quiting Time of Stalling Adjusting	0.1～150.0	5.0S for 0.4～3.7KW 30.0S for 5.5～30KW 60.0S for 37～400KW	√
	F535	Protection Time of Stalling Adjusting	0.0～100.0	4.0	√
	F536～F560	Reserved			
	F600～F660	Reserved			
	F700	Selection of Free Stop Mode	0: Immediate free stop 1: Delayed free stop	0	√

Timing Control and Protection Function	F701	Action Delay Time of Free Stop and Output Terminal	0.0～60.0S	0.0	√
	F702	Fan control mode (only valid for the power 90-400kw)	0:controlled by termperature 1:controlled by inverter's power	1	√
	F703～F707	Reserved			
	F708	Function Selection of Under-Voltage	0:Invalid 1:Valid	Setting Value	○
	F709	Under-Voltage Protection Voltage	200～400	Setting Value	○
	F710	Filtering Constant of Under-voltage	0.0～60.0	Setting Value	○
	F711	Function Selection of Out-phase	0:Invalid; 1:Valid	Setting Value	○
	F712	Filtering Constant of Out-phase	0.0～60.0	Setting Value	○
	F713、F714	Reserved			
	F715	Overload Duration	0～100.0S	Setting Value	○
	F716	Overload Coefficient	0.0～1.8	Setting Value	○
	F717	Overload Interruption Time	0～60.0S	Setting Value	○
	F718	Inverter's Rated Current	1.0～1000A	Setting Value	○
	F719	Current Compensation Coefficient	0.0～2.0	Setting Value	○
	F720	Relative Overload Value	1～4	Setting Value	○
	F721～F760	Reserved			
Input Analog Parameters	F800	Lower Limit of Analog Input	0～1023	20	√
	F801	Upper Limit of Analog Input	0～1023	1000	√
	F802～F805	Reserved			
	F806	Analog Input Compensation	0～100	0	√
	F807	Corresponding Frequency of Lower Limit of Analog Signal	0～F111	0	√

	F808	Relation Between Analog Changes and Output Frequency	0: Direct proportion 1: Inverse proportion	0	×
	F809～F860	Reserved			
Communication Function	F900	Inverter's Address	1～247	1	×
	F901	MODBUS mode selection	1: ASCII mode 2: RTU mode	1	×
	F902	Reserved			
	F903	Parity Check Selection	0:No checkout 1:Odd 2:Even	0	√
	F904	Baud Rate Selection	1:2400 2:4800 3:9600	1	√
	F905～F960	Reserved			

Note: × indicating that function code can only be modified in stop state.

√ indicating that function code can be modified both in stop and run state.

△ indicating that function code can only be checked in stop or run state but cannot be modified.

○ indicating that function code cannot be initialized as inverter restores manufacturer's value but can only be modified manually.

Appendix 3 Products & Structures

ELM1000-G series inverter has its power range between 0.4～400KW. Refer to Tables 3-1 and 3-2 for main data. There may be two (or more than two) kinds of structures for certain products. Please make a clear indication when placing your order.

Inverter should operate under the rated output current, with overload permitted for a short time. However, it shall not exceed the allowable values at working time.

Table 3-1 Product Summary of ELM1000-G

Model	Applicable Motor (kw)	Rated Current Output (A)	Structure Code	Cooling Mode	Remarks
ELM1000-G0004S2B	0.4	2.5	B0	Self-cooling	Single-Phase Plastic Hanging
ELM1000-G0004XS2B	0.4	2.5	B0	Self-cooling	
ELM1000-G0007S2B	0.75	4.5	B0	Air Cooling	
ELM1000-G0007XS2B	0.75	4.5	B0	Air Cooling	
ELM1000-G0015S2B	1.5	7	B2	Air Cooling	
ELM1000-G0015XS2B	1.5	7	B2	Air Cooling	
ELM1000-G0022S2B	2.2	10	B3	Air Cooling	
ELM1000-G0007T3B	0.75	2	B2	Air Cooling	

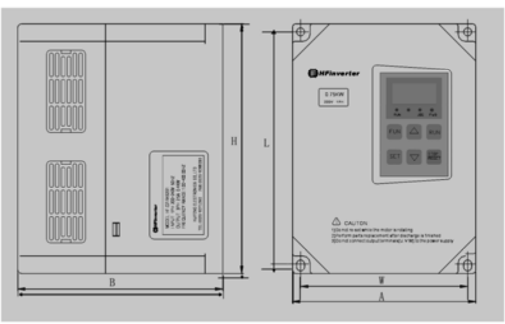
ELM1000-G0015T2B	1.5	4	B2	Air Cooling	Three-Phase Plastic Hanging
ELM1000-G0022T2B	2.2	6.5	B2	Air Cooling	
ELM1000-G0037T2B	3.7	8	B4	Air Cooling	
ELM1000-G0040T2B	4.0	9	B4	Air Cooling	
ELM1000-G0055T2B	5.5	12	B5	Air Cooling	
ELM1000-G0075T2B	7.5	17	B5	Air Cooling	
ELM1000-G0110T3C	11	23	C1	Air Cooling	Three-Phase Metal Hanging
ELM1000-G0150T3C	15	32	C2	Air Cooling	
ELM1000-G0185T3C	18.5	38	C3	Air Cooling	
ELM1000-G0220T3C	22	44	C3	Air Cooling	
ELM1000-G0300T3C	30	60	C4	Air Cooling	
ELM1000-G0370T3C	37	75	C5	Air Cooling	
ELM1000-G0450T3C	45	90	C5	Air Cooling	
ELM1000-G0550T3C	55	110	C6	Air Cooling	
ELM1000-G0750T3C	75	150	C6	Air Cooling	
ELM1000-G0900T3C	90	180	C7	Air Cooling	
ELM1000-G1100T3C	110	220	C7	Air Cooling	
ELM1000-G1320T3C	132	265	C8	Air Cooling	
ELM1000-G1600T3C	160	320	C8	Air Cooling	
ELM1000-G1800T3C	180	360	C9	Air Cooling	
ELM1000-G2000T3C	200	400	CA	Air Cooling	
ELM1000-G2200T3C	220	440	CA	Air Cooling	
ELM1000-G1100T3D	110	220	D0	Air Cooling	Three-Phase Metal Cabinet
ELM1000-G1320T3D	132	265	D1	Air Cooling	
ELM1000-G1600T3D	160	320	D1	Air Cooling	
ELM1000-G2000T3D	200	400	D2	Air Cooling	
ELM1000-G2200T3D	220	440	D2	Air Cooling	
ELM1000-G2500T3D	250	490	D3	Air Cooling	
ELM1000-G2800T3D	280	550	D3	Air Cooling	
ELM1000-G3150T3D	315	620	D3	Air Cooling	
ELM1000-G3550T3D	355	700	D3	Air Cooling	

ELM1000-G4000T3D	400	800	D4	Air Cooling	

Note: The “X” in the ELM1000-G0004XS2B, ELM1000-G0007XS2B and ELM1000-G0015XS2B is built-in braking unit!

Table 3-2 ELM1000-G Types of Product Structure

Structure Code	External Dimension (A×B×H)	Mounting Size(W×L)	Mounting Bolt	Remarks
B0	105×120×150	94×139	M4	Plastic Housing
B2	125×140×170	114×160	M5	
B3	143×148×200	132×187	M5	
B4	162×150×250	145×233	M5	
B5	200×160×300	182×282	M6	
C1	225×220×340	160×322	M6	Metal Hanging
C2	230×225×380	186×362	M6	
C3	265×235×435	235×412	M6	
C4	314×235×480	274×464	M6	
C5	360×265×555	320×530	M8	
C6	411×300×630	370×600	M10	
C7	516×326×760	360×735	M12	
C8	560×326×1000	390×970	M12	
C9	400×385×1300	280×1272	M10	
CA	535×380×1330	470×1300	M10	
D0	580×500×1410	410×300	M16	Metal Cabinet
D1	600×500×1650	400×300	M16	
D2	660×500×1950	450×300	M16	
D3	800×600×2045	520×340	M16	
D4	1000×550×2000	800×350	M16	



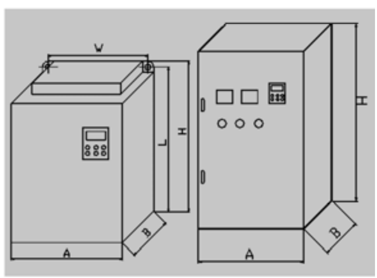


Fig 3-1 Plastic Profile

Fig 3-2 Metal Profile

Inverter Models	Applicable Motor Power（KW）	Applicable Braking Resistance
ELM1000-G00004XS2B	0.4	Al Housing 150W/60Ω
ELM1000-G00007XS2B	0.75	Al Housing 150W/60Ω
ELM1000-G00015XS2B	1.5	Al Housing 150W/60Ω
ELM1000-G0007T3B	0.75	Al Housing 80W/200Ω
ELM1000-G0015T3B	1.5	Al Housing 80W/150Ω
ELM1000-G0022T3B	2.2	Al Housing 150W/150Ω
ELM1000-G0037T3B	3.7	
ELM1000-G0040T3B	4.0	
ELM1000-G0055T3B	5.5	Al Housing 250W/120Ω
ELM1000-G0075T3B	7.5	Al Housing 500W/120Ω
ELM1000-G0110T3C	11	Al Housing 1KW/90Ω
ELM1000-G0150T3C	15	Al Housing 1.5KW/80Ω

Appendix 4 Selection of Braking Resistance

Appendix 5 Communication Manual

(Version 1.6)

I. General

Modbus is a serial and asynchronous communication protocol. Modbus protocol is a general language applied to PLC and other controlling units. This protocol has defined an information structure which can be identified and used by a controlling unit regardless of whatever network they are transmitted.

You can read reference books or ask for the details of MODBUS from manufactures.

Modbus protocol does not require a special interface while a typical physical interface is RS485.

II. Modbus Protocol

1. Overall Description

(1) Transmission mode

1) ASCII Mode

In ASCII mode, one Byte (hexadecimal format) is expressed by two ASCII characters.

For example, 31H (hexadecimal data) includes two ASCII characters’3(33H)’,’1(31H)’.

Common characters, ASCII characters are shown in the following table:

Characters	**‘0’**	**‘1’**	**‘2’**	**‘3’**	**‘4’**	**‘5’**	**‘6’**	**‘7’**
ASCII Code	**30H**	**31H**	**32H**	**33H**	**34H**	**35H**	**36H**	**37H**
Characters	**‘8’**	**‘9’**	**‘A’**	**‘B’**	**‘C’**	**‘D’**	**‘E’**	**‘F’**
ASCII Code	**38H**	**39H**	**41H**	**42H**	**43H**	**44H**	**45H**	**46H**

2) RTU Mode

In RTU mode, one Byte is expressed by hexadecimal format. For example, 31H is delievered to data packet.

(2) Baud rate

Setting range: 1200, 2400, 4800, 9600, 16200

(3) Frame structure:

1) ASCII mode

Byte	Function
1	Start Bit (Low Level)
7	Data Bit
0/1	Parity Check Bit (None for this bit in case of no checking. Otherwise 1 bit)
1/2	Stop Bit (1 bit in case of checking, otherwise 2 bits)

2) RTU mode

Byte	Function
1	Start Bit (Low Level)
8	Data Bit
0/1	Parity Check Bit (None for this bit in case of no checking. Otherwise 1 bit)
1/2	Stop Bit (1 bit in case of checking, otherwise 2 bits)

(4) Error Check

1) ASCII mode

Longitudinal Redundancy Check (LRC): It is performed on the ASCII message field contents excluding the ‘colon’ character that begins the message, and excluding the CRLF pair at the end of the message.

The LRC is calculated by adding together successive 8–bit bytes of the message, discarding any carries, and then two’s complementing the result.

A procedure for generating an LRC is:

1. Add all bytes in the message, excluding the starting ‘colon’ and ending CRLF. Add them into an 8–bit field, so that carries will be discarded.

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

3. Add 1 to produce the twos–complement.

2) RTU Mode

Cyclical Redundancy Check (CRC): The CRC field is two bytes, containing a 16–bit binary value.

The CRC is started by first preloading a 16–bit register to all 1’s. Then a process begins of applying successive 8–bit bytes of the message to the current contents of the register. Only the eight bits of data in each character are used for generating the CRC. Start and stop bits, and the parity bit, do not apply to the CRC.

A procedure for generating a CRC-16 is:

1. Load a 16–bit register with FFFF hex (all 1's). Call this the CRC register.
2. Exclusive OR the first 8–bit byte of the message with the high–order byte of the 16–bit CRC register, putting the result in the CRC register.
3. Shift the CRC register one bit to the right (toward the LSB), zero–filling the MSB. Extract and examine the LSB.
4. (If the LSB was 0): Repeat Step 3 (another shift).

(If the LSB was 1): Exclusive OR the CRC register with the polynomial value A001 hex (1010 0000 0000 0001).

5. Repeat Steps 3 and 4 until 8 shifts have been performed. When this is done, a complete 8–bit byte will have been processed.

When the CRC is appended to the message, the low-order byte is appended first, followed by the high-order byte.

2. Command Type & Format

(1) The listing below shows the function codes.

code	name	description
03	Read Holding Registers	Read the binary contents of holding registers in the slave. (Less than 10 registers once time)
06	Preset Single Register	Preset a value into holding register

(2) Format

1) ASCII mode

Start	Address	Function	Data				LRC check		End	
: (0X3A)	Inverter Address	Function Code	Data Length	Data 1	… …	Data N	High-order byte of LRC	Low-order byte of LRC	Return (0X0D)	Line Feed (0X0A)

2）RTU mode

Start	Address	Function	Data	CRC check		End
T1-T2-T3-T4	Inverter Address	Function Code	N data	Low-order byte of CRC	High-order byte of CRC	T1-T2-T3-T4

3) Protocol Converter

It is easy to turn a RTU command into an ASCII command followed by the lists:

1) Use the LRC replacing the CRC.
2) Transform each byte in RTU command into a corresponding two byte ASCII. For example: transform 0x03 into 0x30, 0x33 (ASCII code for 0 and ASCII code for 3).
3) Add a 'colon' (:) character (ASCII 3A hex) at the beginning of the message.
4) End with a 'carriage return – line feed' (CRLF) pair (ASCII 0D and 0A hex).

So we will introduce RTU Mode in followed part. If you use ASCII mode, you can use the up lists to convert.

(3) Address and meaning

The part introduces inverter running, inverter status and related parameters setting.

Description of rules of function codes parameters address:

1) Use the function code as parameter address

General Series:

High-order byte: 01~0A (hexadecimal)

Low-order byte: 00~50 (max range) (hexadecimal) Function code range of each partition is not the same. The specific range refers to manual.

For example: F114 (display on the board), parameter address is 010E (hexadecimal).

F201 (display on the board), parameter address is 0201 (hexadecimal).

Note: in this situation, it allowes to read six function codes and write only one function code.

Some function codes can only be checked but cannot be modified; some function codes can neither be checked nor be modified; some function codes can not be modified in run state; some function codes can not be modified both in stop and run state.

In case parameters of all function codes are changed, the effective range, unit and related instructions shall refer to user manual of related series of inverters. Otherwise, unexpected results may occur.

2) Use different parameters as parameter address

(The above address and parameters descriptions are in hexadecimal format, for example, the decimal digit 4096 is represented by hexadecimal 1000).

1. Running status parameters

Parameters Address	Parameter Discription（read only）
1000	Output frequency
1001	Output voltage
1002	Output current
1003	Pole numbers/ control mode, high-order byte is pole numbers, low-order byte is control mode.
1004	Bus-line voltage
1005 ----F2000	Drive ratio/inverter status High-order byte is drive ratio, low-order byte is inverter status Inverter status: 00: Standby mode 01: Forward running 02: Reverse running 04: Over-current (OC) 05: DC over-current (OE) 06: Input Out-phase (PF1) 07: Frequency Over-load (OL1) 08: Under-voltage (LU)

	09: Overheat (OH) 0A: Motor overload (OL2) 0B: Interference (ERR) 0C: LL 0D: External Malfunction (ESP) 0E: ERR1 0F: ERR2

2. Control commands

Parameters Address	Parameters Discription（write only）
2000	Command meaning: 0001：Forward running (no parameters） 0002：Reverse running（no parameters） 0003：Deceleration stop 0004：Free stop 0005：Forward jogging start 0006：Forward jogging stop 0007：Reserved 0008：Run（no directions） 0009：Fault reset 000A: Forward jogging stop 000B: Reverse jogging stop
2001	Lock parameters 0001：Relieve system locked (remote control locked） 0002：Lock remote control (any remote control commands are no valid before unlocking）

Command types of F2000 series do not belong to every inverter models.

3. Illegal Response When Reading Parameters

Command Disciption	Function	Data
Slave parameters response	The highest-oder byte changes into 1.	Command meaning: 0001: Illegal function code 0002: Illegal address 0003: Illegal data 0004: Slave fault 0005: Slave busy 0008: Parity check fault

The following is response command when read/write paremeters:

Eg1: In RTU mode, change acc time (F114) to 10.0s in NO.01 inverter.

Query

Address	Function	Register Address Hi	Register Address Lo	Preset Data Hi	Preset Data Lo	CRC Lo	CRC Hi
01	06	01	0E	00	64	E8	1E

Function code F114 Value: 10.0S

Normal Response

Address	Function	Register Address Hi	Register Address Lo	Response Data Hi	Response Data Lo	CRC Lo	CRC Hi
01	06	01	0E	00	64	E8	1E

Function code F114 Normal Response

Abnormal Response

Address	Function	Abnormal code	CRC Lo	CRC Hi
01	86	04	43	A3

The max value of function code is 1. Slave fault

Eg 2： Read output frequency, output voltage, output current and current rotate speed from N0.2 inverter.

Host Query

Address	Function	First Register Address Hi	First Register Address Lo	Register count Hi	Register count L0	CRC Lo	CRC Hi
02	03	10	00	00	04	40	FA

Communication Parameters Address 1000H

Slave Response：

Address	Function	Byte Count	Data Hi	Data Lo	Data Hi	Data Lo	Data Hi	Data Lo	Data Hi	Data Lo	Crc Lo	Crc Hi
02	03	08	13	88	01	7C	00	3C	02	05	82	F6

Output Frequency Output Voltage Output Current Numbers of Pole Pairs Control Mode

NO.2 Inverter's output frequency is 50.00Hz, output voltage is 380V, output current is 6.0A, numbers of pole pairs are 2 and control mode PC/PLC control.

Eg 3： NO.1 Inverter runs forwardly.

Host Query:

Address	Function	Register Hi	Register Lo	Write status Hi	Write status Lo	CRC Lo	CRC Hi
01	06	20	00	00	01	43	CA

Communication parameters address 2000H Forward running

Slave Normal Response:

Address	Function	Register Hi	Register Lo	Write status Hi	Write status Lo	CRC Lo	CRC Hi
01	06	20	00	00	01	43	CA

Normal Response

Slave Abnormal Response:

Address	Function	Abnormal Code	CRC Lo	CRC Hi
01	86	01	83	A0

The max value of function code is 1. Illegal function code (assumption)

Eg4: Read the value of F113, F114 from NO.2 inverter

Host Query:

Address	Function	Register Address Hi	Register Address Lo	Register Count Hi	Register Count L0	CRC Lo	CRC Hi
02	03	01	0D	00	02	54	07

Communication Parameter Address F10DH Numbers of Read Registers

Slave Normal Response:

Address	Function	Byte count	The first parameters status Hi	The first parameters status Lo	The second parameters status Hi	The second parameters status Lo	CRC Lo	CRC Hi
02	03	04	03	E8	00	78	49	61

The actual value is 10.00. **The actual value is 12.00.**

Slave Abnormal Response:

Address	Function Code	Abnormal Code	CRC Lo	CRC Hi
02	83	08	B0	F6

The max value of function code is 1. **Parity check fault**

3. Additional Remarks

Expressions during communication course:

Parameter Values of Frequency＝actual value X 100 (General Series)

Parameter Values of Frequency＝actual value X 10 (Medium Frequency Series)

Parameter Values of Time=actual value X 10

Parameter Values of Current=actual value X 10

Parameter Values of Voltage=actual value X 1

Parameter Values of Power=actual value X 100

Parameter Values of Drive Ratio=actual value X 100

Parameter Values of Version No. =actual value X 100

Instruction: Parameter value is the value sent in the data package. Actual value is the actual value of inverter. After PC/PLC receives the parameter value, it will divide the corresponding coefficient to get the actual value.

NOTE: Take no account of radix point of the data in the data package when PC/PLC transmits command to inverter. The valid value is range from 0 to 65535.

08041517