SANTERNO
CARRARO GROUP

INDUSTRIAL AUTOMATION

USER MANUAL

Manuale d'uso
Manuel d'emploi
Bedienungsanleitung
Manual de uso
Manual do usuário
Руководство по эксплуатации

VARIABLE FREQUENCY DRIVE

SINUS VEGA

Basic User Manual-Manuale d'uso Basic

EN

1 Preface

Thank you for using SINUS VEGA series inverter made by SANTERNO

SINUS VEGA series satisfies high performance requirements by using a unique control method to achieve high torque, high accuracy and wide speed-adjusting range. Its anti-tripping function and capabilities of adapting severe power network, temperature, humidity, and dusty environment exceeds those of similar products made by other companies, which improves the products reliability noticeably.

SINUS VEGAconsiders customers' needs and combines general purpose function and industrial-oriented function. It features PI control, simple PLC, flexible I/O terminals and pulse frequency setting. You can select whether to save the parameters upon power off or stop, main and auxiliary frequency setting, etc. It is an integral, cost-effective and highly reliable solution for manufacture in the related fields.

SINUS VEGA series can satisfy the customers' requirements on low noise and EMI by using optimized PWM technology and EMC design.

This manual provides information on installation, wiring, parameters setting, trouble-shooting, and routine maintenance. In order to ensure the correct installation and operation of the inverter, please read this manual carefully before using and keep it in a safe place.

2 Inspection

Don’t install or use any inverter that is damaged or have fault parts otherwise may cause injury.

Check the following items when unpacking the inverter.

1. Ensure there is operation manual and warranty cards in the packing box.

2. Inspect the entire exterior of inverter to ensure there are no scratches or other damaged caused by transportation.

3. Check the nameplate and ensure it is what you ordered.

4. Ensure the optional parts are what you need if you have ordered any optional parts.

Please contact the local agent if there is any damage in the inverter or the optional parts.

3 Specifications and Optional Parts

3. 1 Specifications

Table2-1 SINUS VEGA Specifications

Item		Description
Input	Rated voltage；Frequency	SINUS VEGA 4T：380V～440V；50Hz/60Hz SINUS VEGA 2S：200V～240V；50Hz/60Hz
	Permissible fluctuation range	Voltage contant fluctuate ≤±10%, Transient fluctuate: -15%～+10%, out of balance voltage rate: ≤3％, frequency fluctuation:≤5％
Output	Rated voltage	SINUS VEGA 4T：0～380V/440V SINUS VEGA 2S：0～200V/240V
	Rated power	SINUS VEGA 4T：0.75～2.2KW SINUS VEGA 2S：0.40～2.2KW
	Frequency	0Hz～650Hz
Control functions	Modulation mode	Flux vector PWM modulation
	Speed range	1：100
	Starting torque	180% rated torque at 0.5Hz
	Accuracy of speed at steady state	≤±0.5％ rated synchronous speed
	Torque boost	Auto torque boost，Manual torque boost
	Acc/Dec curve	Linear
	Jog	Jog frequency, Acc/Dec time, Jog interval are adjustable
	Multi-speed operation	15 sections of frequency. Able to achieve through the built-in PLC or terminals.
	Closed-loop control	Analog closed-loop
	Auto voltage regulation	Constant output voltage even if electric network voltage fluctuates
	Auto current limiting	Operating current is limited automatically to avoid frequent tripping of the inverter
	Auto carrier-wave regulation	Adjust the carrier frequency automatically according to the load characteristics；
Special functio	Internal counter	Counting the external pulse signal through X terminals

Item		Description
n	Methods of inputting commands	keypad panel, terminals and serial port
	Methods of setting up frequency	Digital setting, AIand communication
	Auxiliary frequency	Flexible auxiliary frequency selectable
	Analog output terminals	0/4～20mA and 0/2～10V(selectable)
Protection function		Phase loss failure, Over/Under current, Over/Under voltage protection, Overheat and overload protection
Environment	Operating environment	In-door， not subject to direct sunlight, no dust, corrosive, flammable gas, oil mist, steam, water, or salt, etc
	Altitude	Less than 1000m, derating is required more than 1000m
	Ambient temperature	-10℃～＋40℃， derating is required from 40～50℃； Increase every 1 above 40℃, derating 2%, highest temperature allowed: 50℃
	Humidity	Less than 95% RH， no condensing
	Vibration	Less than5.9m/s^2（0.6g）
	Storage temperature	-40℃～＋70℃
Enclosure	Protection level	IP20
	Cooling	Fan cooling, natural cooling
Mounting mode		Mounted in a cabinet

3. 2 Products Series Introduction

3.2.1 SINUS VEGA Models

SINUS VEGA 2S/4T

Applicable motor power with power supply：

SINUS VEGA 2S：0～200V/240V

SINUS VEGA 4T：0～380V/440V

Table2-2 Inverter series

Model	Rated capacity（KVA）	Rated output current（A）	Applicable motor power（KW）
SINUS VEGA 0001 2S	1.0	2.5	0.4
SINUS VEGA 0002 2S	1.5	4.0	0.75
SINUS VEGA 0003 2S	3.0	7.5	1.5
SINUS VEGA 0004 2S	4.0	10.0	2.2
SINUS VEGA 0002 4T	1.5	2.3	0.75
SINUS VEGA 0003 4T	3.0	3.7	1.5
SINUS VEGA 0004 4T	4.0	5.0	2.2

3.2.2 Ordering information of SINUS VEGA series

Please refer to Figure2-1a and Figure 2-1b。

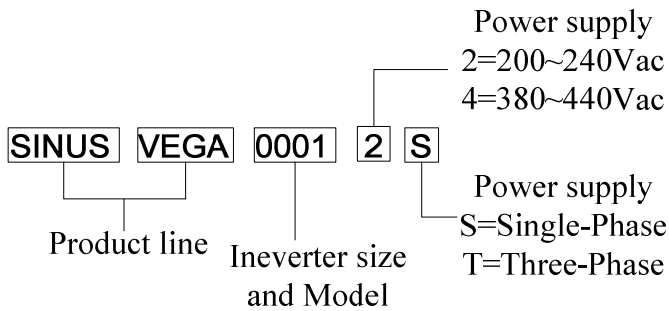


Table2-1a Explanations of inverter models

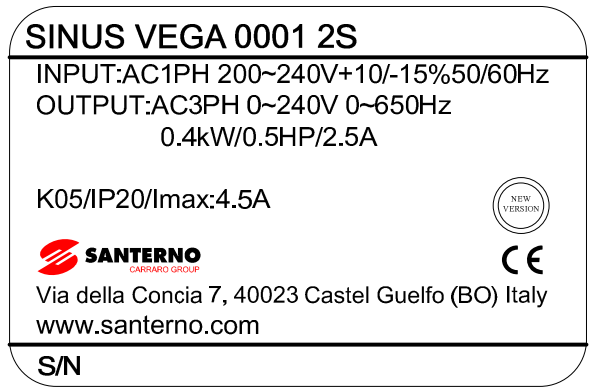


Table2-1b SINUS VEGA series nameplate

3.2.3 Demision

Please refer to Figure 2-2

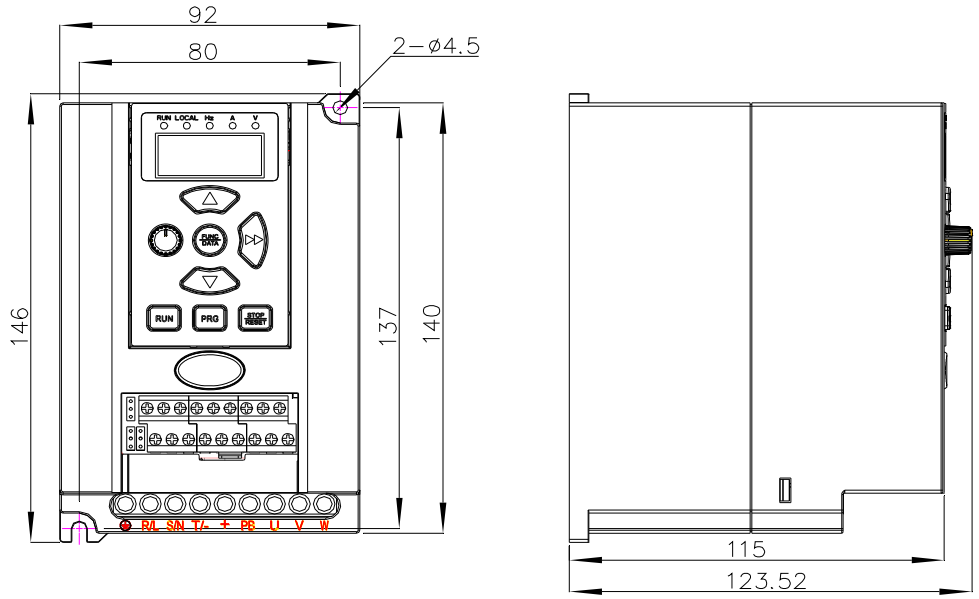


Figure2-2 SINUS VEGA series inverter size

Note: Net weight, 1.04KG

Gross weight (include user manual after package), 1.22KG

3.2.4 LED Keypad Display Unit Size

Through it, operation and configuration of the inverter can be done. Please refer to its size and configuration in Figure 2-3.

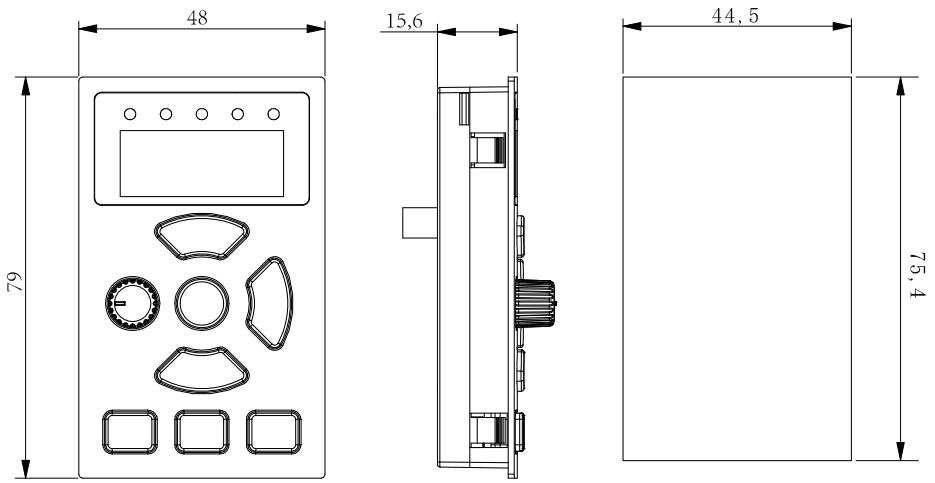


Figure2-3 Keypad display unit

Gross weight (with package and manual) 1.22Kg

Size	Model No.	L(mm)	W(mm)	H(mm)	Weight(Kg)
K05	SINUS VEGA 0001 2S	146	92	123.52	1.22
K05	SINUS VEGA 0002 2S				
K05	SINUS VEGA 0003 2S				
K05	SINUS VEGA 0004 2S				
K05	SINUS VEGA 0002 4T				
K05	SINUS VEGA 0003 4T				
K05	SINUS VEGA 0004 4T				

3.2.5 Optional Parts

Table 2-3: recommended braking resistor

Model	Suggested value of resistance	Suggested power
SINUS VEGA 0002 4T	250-350Ω	100W
SINUS VEGA 0003 4T	200-300Ω	200W
SINUS VEGA 0004 4T	100-250Ω	250W

SINUS VEGA series inverter (3phase product) is equipped with braking unit. If there is a need for energy-consuming braking, please select a braking resistor in Table2-3.

The above Table 2-3 is a guide reference only, users can choose different braking resistance and power according to each application.However, please be remembered that the braking resistance shouldn't be less than the above recommended value, but the power is allowed to be exceed than the recommend numbers.Users need to select the right braking resistors according to each application case,there are quite a few aspects which will determine your choice of the resistors, such as the power of the motor, system inertia,deceleration time, the energy of the load etc.The greater the system inertia is, the shorter the required deceleration time is required,then the braking frequency will be increased, which means you need to choose a bigger power braking resistor with a lower braking resistance.

Note: the 220V single phase inverter has no brake unit buit in.

4 Installation and Wiring

4. 1 Installation

1. Mount the inverter vertically indoors, with good ventilative conditions.

2.Ambient temperature should be within the range of-10℃～40℃. If the temperature is higher than 40 ℃, the inverter should be derated and forced heat dissipation is required.

3. Humidity should be lower than 90%， non-condensing;

4. Mount in the location free of direct sunlight, dust, metal powder, corrosive gas or combustible gas；

5.Mount in the location where vibration is less than5.9m/s^2（0.6g）；

6. Dust-free, floating fiber and metal particles；

7. Install flat solid, no vibration；

8. Away from electromagnetic interference source.

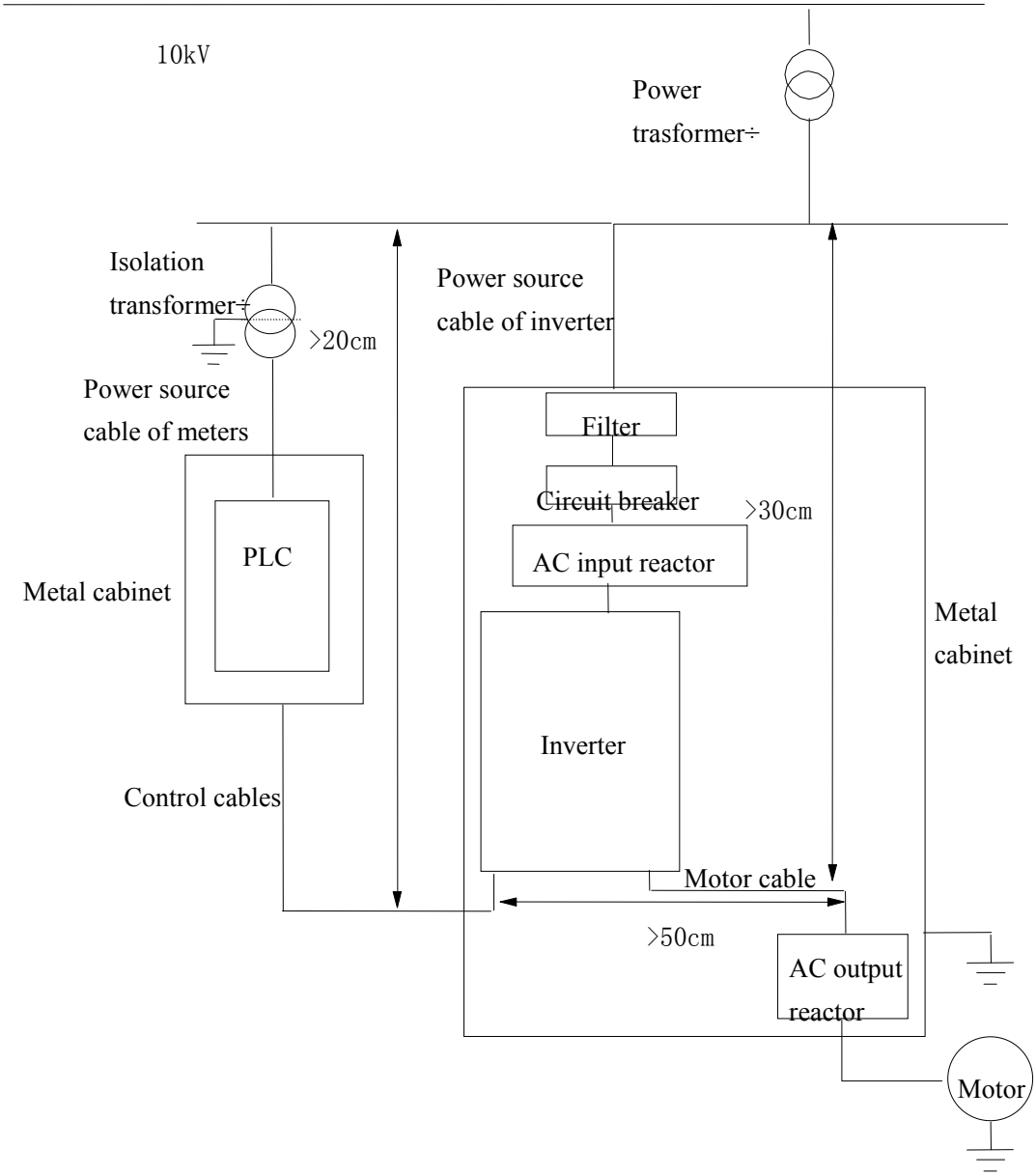


Figure 4-1 Installation of the inverter

4. 2 Wiring

4.2.1 Overview

You should finish the power circuit and control circuit wiring。

The figure below is the systematic wiring of the inverter

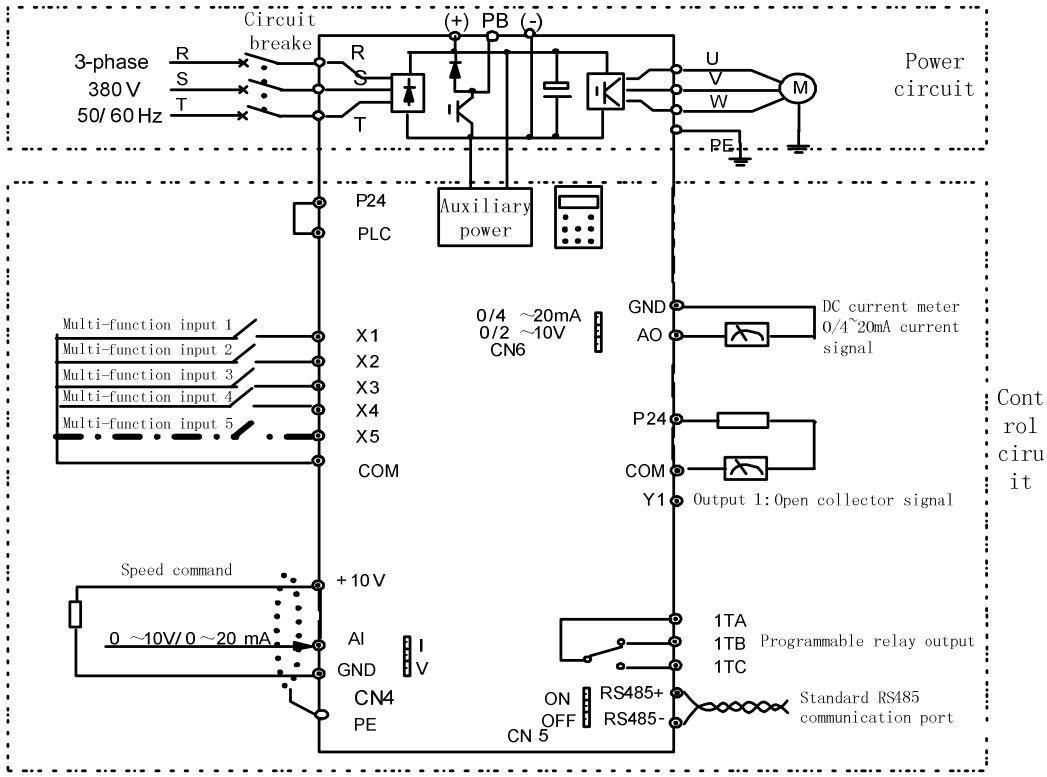


Figure 4-2Systematic Wiring Diagram

Table 4-1 Recommended MCCB Capacity and Copper Cable Section Area

Model	MCCB Circuit breaker (A)	Power circuit (mm²)				Control cable (mm²)
		Input cable	Braking line	Output cable	Earth cable	
SINUS VEGA 0001 2S	16	1.5	1.0	1.0	2.5	1.0
SINUS VEGA 0002 2S	20	2.5	1.0	1.0	2.5	1.0
SINUS VEGA 0003 2S	32	4.0	1.5	2.5	4.0	1.0
SINUS VEGA 0004 2S	50	6.0	1.5	2.5	6.0	1.0
SINUS VEGA 0002 4T	10	1.0	1.0	1.0	2.5	1.0
SINUS VEGA 0003 4T	16	1.5	1.0	1.5	2.5	1.0
SINUS VEGA 0004 4T	16	1.5	1.5	1.5	2.5	1.0

4.2.2 Power Terminals

1． Definitions of power terminals

⏚	R/L	S/N	T/-	+	PB	U	V	W

Table 4-2Definitions of power terminals

Terminal name	Description
R、S、T /L、N	3-phase AC input / 1-phase AC input
(+)、PB	External braking resistor
(+)、(-)	DC positive, negative bus input
U、V、W	3-phase AC outputs
⏚	Protective earth

4.2.3 Control Circuit Wiring

Control Terminals and Jumpers

The terminal row and jumpers on control panel is CN4, CN5, CN6

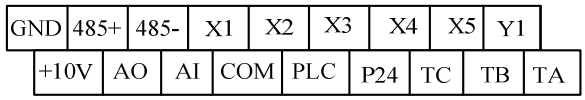
Control terminals functions are listed in Table 3-4，Jumper's functions in 3-5. Be sure to set the jumper and wire the terminals properly. It is recommended to use cable of section area bigger than 1mm^2.

Table 4-3 Function of control terminals

Mark	Function	
CN8- CN10	Analog I/O, digital I/O, relay outputs	
Mark	**Function&Setting**	**Default**
CN4	CCI current/voltage input selection I：0～20mA current signal V：0～10V voltage signal	0～+10V
CN5	485 terminal resistor selection： ON: 120Ω terminal resistor OFF: No terminal resistor.	No terminal resistor
CN6	AO current/voltage input selection 0/4~20mA: AO current signal 0/2~10V: AO voltage signal	0～+10V

Terminal strip layout

The layout is shown below：



TA-TB：Normally closed；TA-TC：Normally open

Table 4-5 Terminal function table

Category	Terminals	Name	Function	Specification
Communication	485＋	RS485communication port	RS485＋(differential signal)	Standard RS-485 communication port, Please use twisted-pair cable or shielded cable
	485-		RS485-(differential signal)	
Analog input	AI	Analog input	Accepting analog voltage/current input.CN4 can select voltage or current input mode，Voltage input mode is the default（Reference ground：GND）	Input voltage range:0~10V (input resistance:100kΩ) Input current range:0~20mA (input resistance:500Ω) resolution:1/2000
Analog output	AO	Analog output	Be able to output analog voltage/current, Jumper CN6 can select voltage or current input mode. Voltage input mode is the default mode. Refer to F6.04 for details (reference ground: GND)	Output current range: 0/4~20mA Output voltage range: 0/2~10V

Category	Terminals	Name	Function	Specification
Digital input	X1～X5	Multi-functional digital inputs 1～5	Can be defined as multi-functional digital inputs, see Section 7.6 Reference ground: COM	Optical-isolator 2-way input input resistance: 2kΩ maximum input frequency: 200Hz Input voltage range: 9~30V
	PLC	Common terminal	Common terminal for multi-functional inputs	
	P24	+24V supply	Providing +24V power supply	Output：+24V,set point accuracy：±10% Max output current：200mA
	COM	+24V common terminal	Isolated internally with GND	Isolated internally with GND
Digital input	Y1	Open collector output 1	Programmable terminals, defined as multi-function digital outputs, see Section 7.7.	Optical-isolator output: 24VDC/50mA
Power supply	+10V	＋10V power supply	Provide +10V power supply	Output: +10V, Setpoint accuracy: ±10% Max. output current: 100mA
	GND	GND of ＋10V power supply	reference ground of analog signal and 10V power supply	Isolated internally with COM
Others	TA/TB/TC	Relay output	TA, TB and TC can be defined as multi-functional digital output signals. please refer to Section 7.7	TA-TB：normally closed; TA-TC：normally open Contact capacity：250Vac/2A（COSφ=1），250Vac/1A（COSφ=0.4），30 Vdc /1A

The PLC terminal can sink or source current. Wire connections X1~X5is flexible and the typical wiring is shown below：

① Connection method 1 (Dry contact)

It is default to use the inverter's internal power source 24V, i.e. PLC connected with P24.

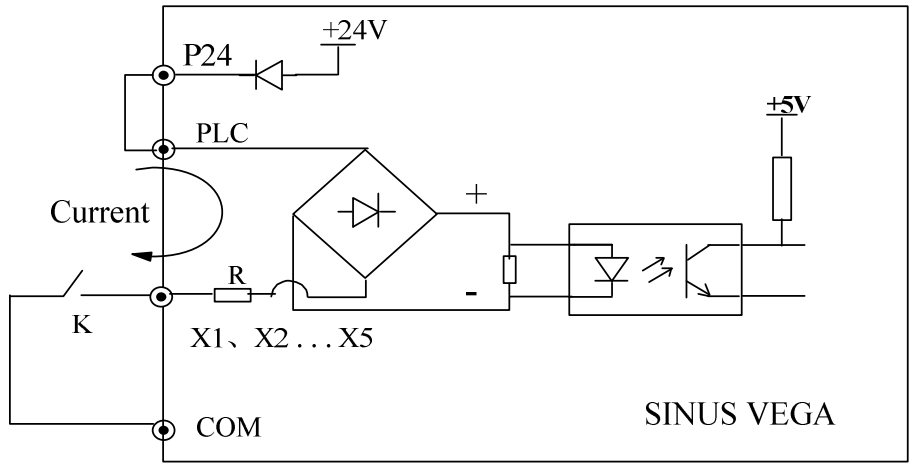
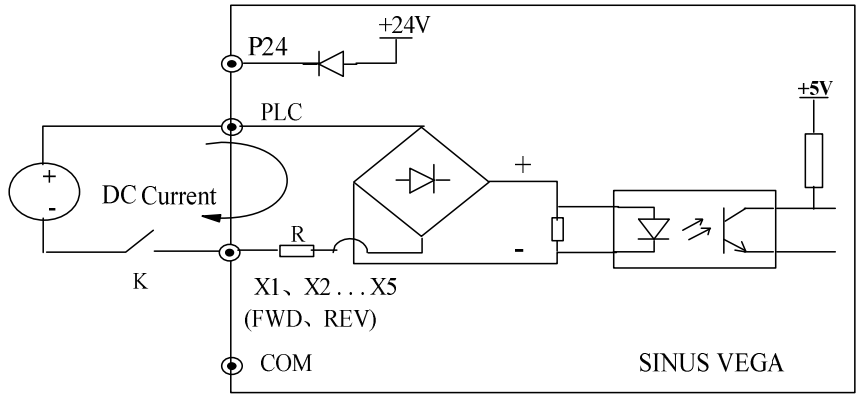


Figure 4-3 External power supply wiring diagram

If you want to use external power supply, make sure to remove the wire between PLC and P24.



② Connection Method 2 (PNP&NPN)

Inverter's internal +24V power supply is used and the external controller uses NPN transistors type, as shown below.

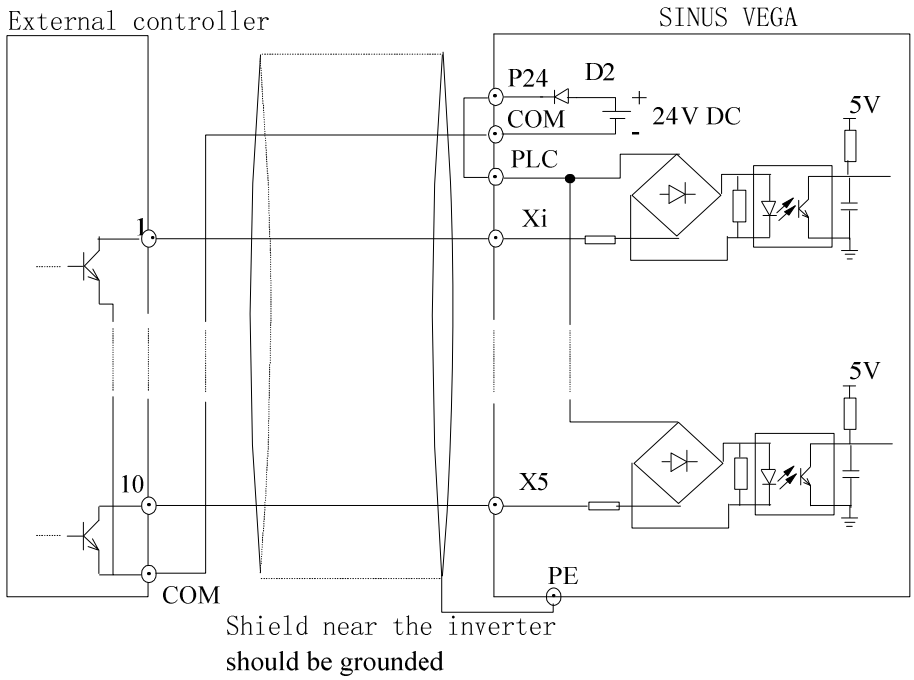


Figure 4-4 Internal +24V wiring diagram (drain)

Inverter's internal +24V power supply is used and the external controller uses PNP transistors type.（Remove the wire between PLC and P24）.

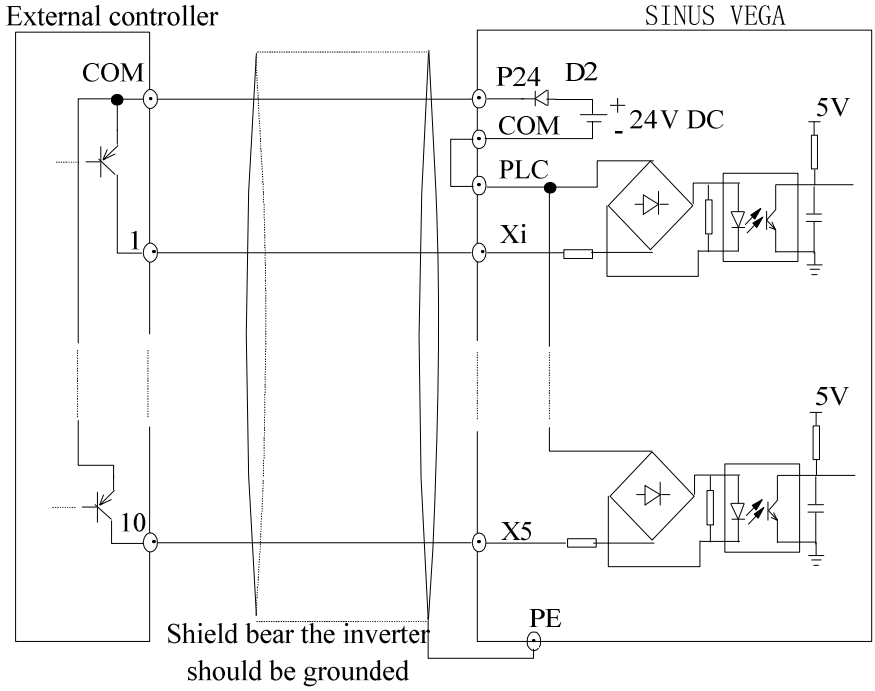


Figure 4-5 Internal +24V wiring diagram (Source)

When using External power supply and the external controller uses NPN
Don’t remember to disconnect PLC and P24

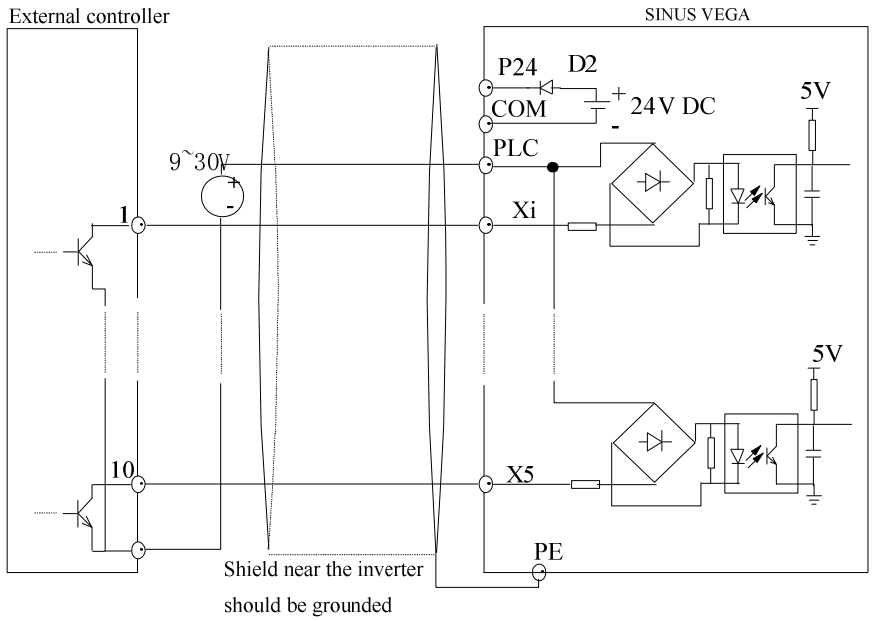


Figure 4-6 External power supply wiring (Drain)

When using External power supply and the external controller uses PNP
Don’t remember to disconnect PLC and P24

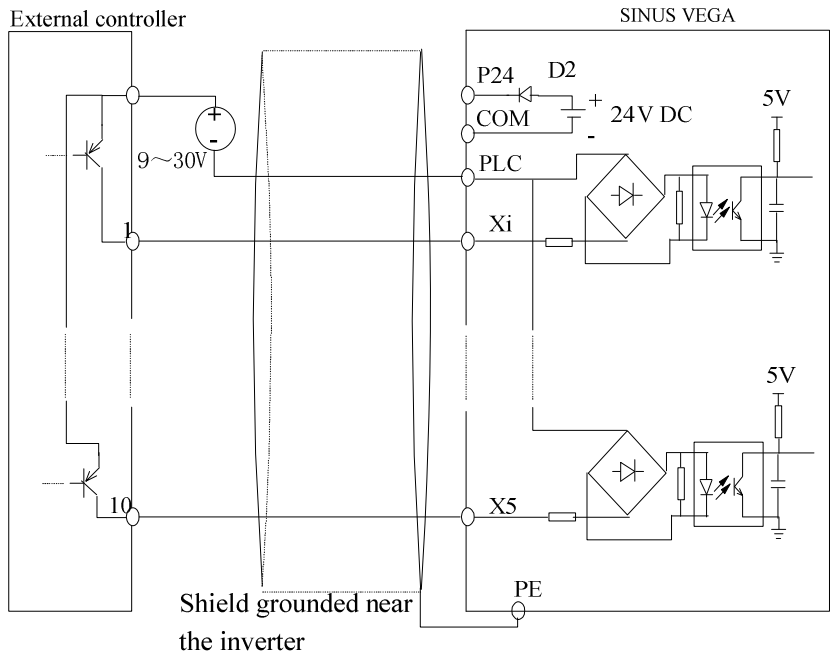


Figure 4-7 External power supply wiring (Source)

5）Multi-function Output Terminal Wiring

1、Terminal Y1 can use the internal 24V power supply, see the figure below：

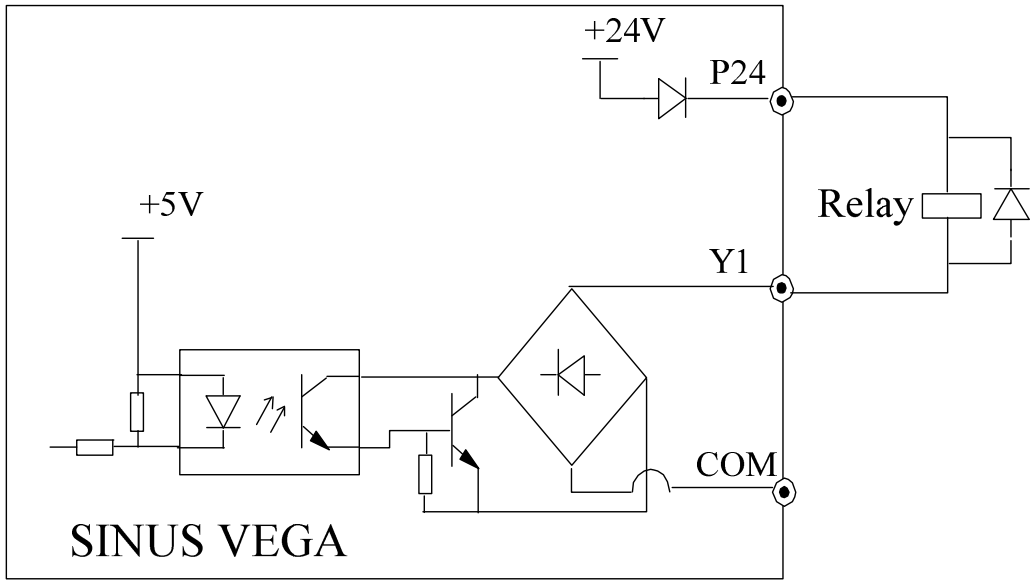


Figure 4-8 Multi-function output terminal wiring1

2、Terminal Y1 can also use external power (9~30V) supply：

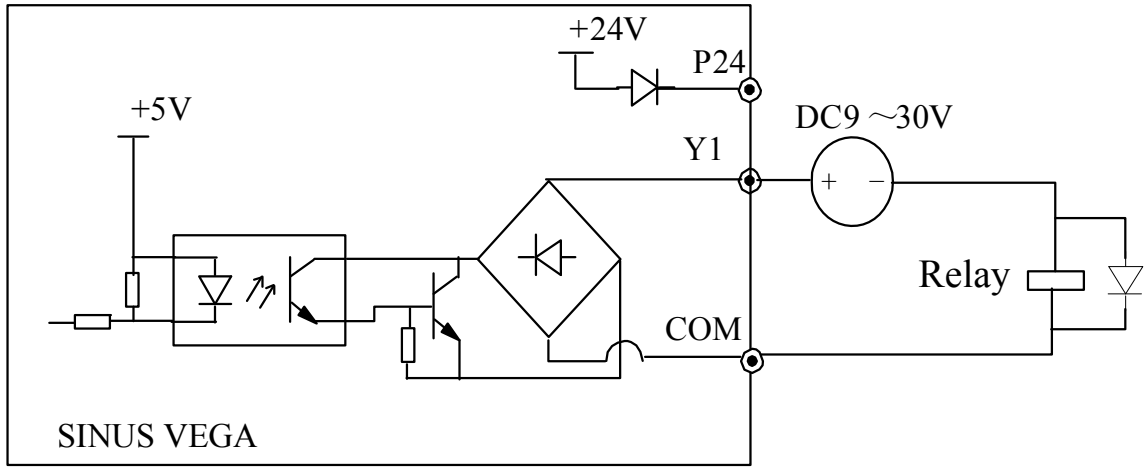


Figure 4-9 Multi-function output terminal wiring2

Note：

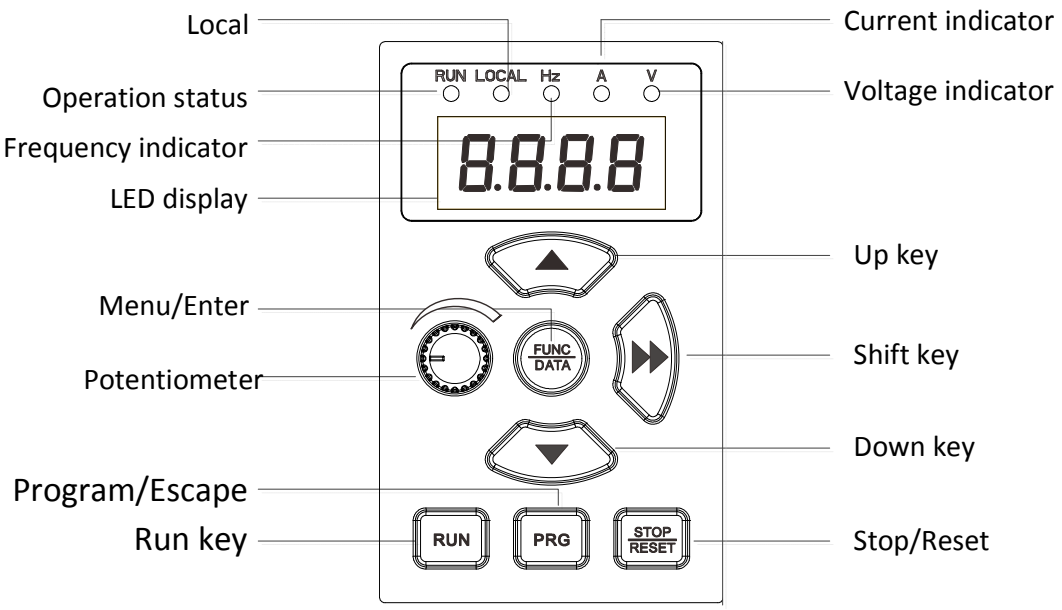
Don’t short terminals P24 and COM, otherwise the control board may be damaged。

5 Operation Procedures

5. 1 Operation Guide

5.1.1 LED Keypad

LED keypad display unit is to receive command and display parameters.



Keypad diagram

5.1.2 Keypad Function Explanation

Keys on the LED keypad display unit refer to the function of each key in Table 6-1.

Table 6-1 Key's function

Key	Name	Function
PRG	Program/Esc key	To shift between program state and Esc state
FUNC/DATA	Function/Data key	To shift between function code menus, confirm modification
▲	Increase key	To increase data or function code number

Key	Name	Function
▼	Decrease key	To decrease data or function code number
▶▶	Shift key	To scroll over the displayed parameters, such as voltage、frequency. To select the digit to be modified
RUN	Run key	In the keypad operating mode, press the key to start running
/	Stop/Reset key	In keypad mode, stop the inverter or reset in case of alarm or fault; Terminal control mode: reset in case of alarm or fault
STOP/RESET	Potentiometer	Set frequency

5.1.3 Indicator Description

Functions of the indicators on the keypad：

Indicator	Meaning	Color	Mark
Status indicator	ON: the inverter is running OFF: the inverter is no output	Green	RUN
Frequency indicator	ON: current LED display is frequency	Green	Hz
Current indicator	ON: current LED display is current	Green	A
Voltage indicator	ON: current LED display is voltage	Green	V
Control mode indicator	ON， keypad control mode； OFF: terminal control mode； Flicker: communication control mode	Green	LOCAL
Potentiometer	Set frequency by the potentiometer	Green	None

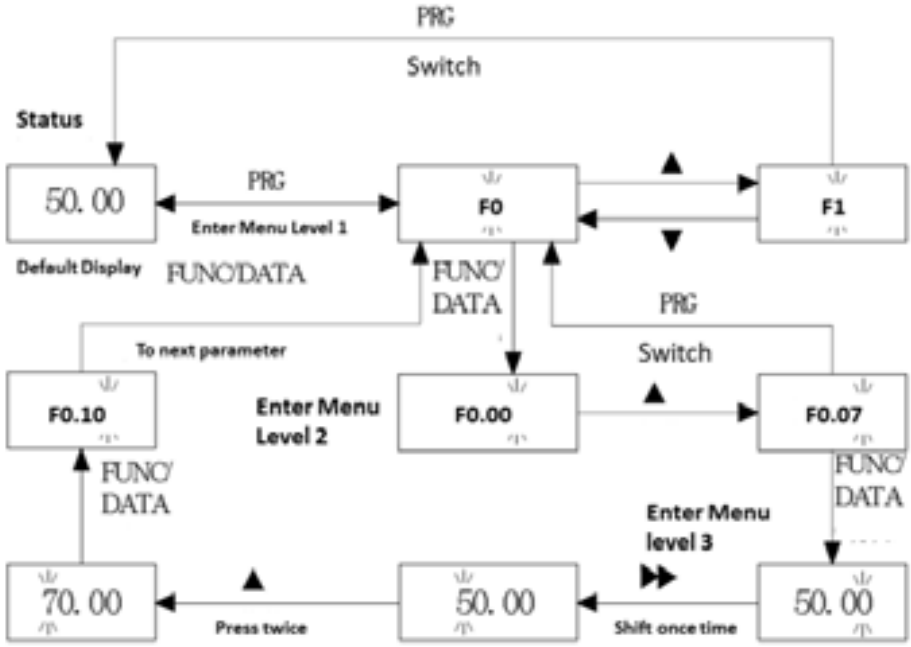
Implication of the combination of indicators：

Indicator combination	Meaning
Hz、A	Set speed（r/min）
Hz、V	Set percentage（%）

5.1.4 Parameter Setting Method

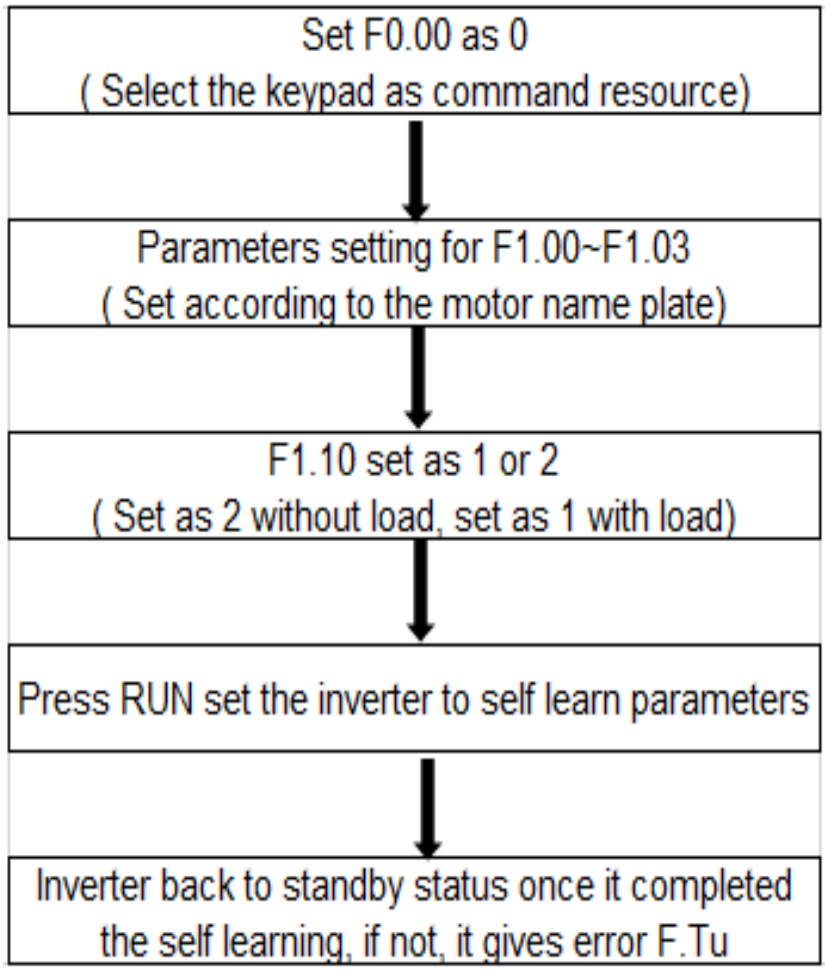
The series inverter has 3 menu structures; function group is listed in menu level 1, parameter in menu level 2, and settings of parameters in menu level 3.

The setting of parameter is presented in decimal (DEC) and hexadecimal (HEX) format. If it is set in hexadecimal format, each digit of the setting is independent to one another.



5.1.5 Motor parameters self learning

In order to achieve a good dynamic and static control performance, inverter needs to complete the motor parameters self learning, see the following proedures:



5.1.6 Password setting

When you need to set the password for the inverter, set FF.00 as a non-zero value, exit the editing status, leave the inverter for five mins without any operation and the password you just set becomes effective. Press the PRG button to enter the function codes setting, it displays 0.0.0.0, it requires the password now to enter next. If you want to cancel the password, just set FF.00 as 0.

6 Parameters

Note：

The contents in the“【】”are factory default.

6. 1 Basic Parameters（F0）

F0.00 Command channel	Range：0～2 【0】

SINUS VEGA has 3 kinds of command channels:

0：LED keypad display unit，use RUN and STOP key on the keypad to control the inverter.

1：Terminal control: Input operating commands via terminals. Use terminals FWD, REV, to start and stop the inverter

2：Serial communication port control.

F0.01 Reserved	Reserved
F0.02 Frequency source setting	Range：0～6 【0】

0：Digital setting 1,set by ▲or▼key.

Initial frequency is the value of F0.04 and it can be adjusted via ▲ and ▼keys on the keypad.

1：Digital setting 2 set by terminal UP/DN.

Initial frequency is the value of F0.02 and it can be adjusted via terminal UP/DN.

2：Digital setting 3, set through serial communication port

Initial frequency is the value of F0.04 and it can be adjusted via serial communication port.

3：Reserved

4：The reference frequency is set by AI input (0～10V/0～20mA), the frequency calculation curve is given in F5.14~F5.17

5：Reserved

6：Keypad Potentiometer Setting

F0.03 Auxiliaryreference frequency	Range：00～13 【0】

Method	Name	Description
0	Invalid	Auxiliary freq.=0
1	Adjust by ▲ and ▼	Default is F0.05
2	Adjust by UP/DN	
3	Set by serial port	
4	Reserved	Depending on actual input.
5	AI	
6	Reserved	
7	Reserved	
8	-AI	
9	Reserved	
10	Reserved	
11	AI-5V	
12	Reserved	
13	Potentiometer	

F0.04 Keypad digital setting	Range：Lower limit of freq.～Upper limit of freq.【50.00Hz】

When the frequency source setting method is defined as keypad digital setting(F0.02=0、1、2), F0.04 is the initial value of frequency.

F0.05 Digital auxiliary frequency	Range：0.00～650.00Hz【0.00Hz】

F0.05：The initial value of digital auxiliary frequency.

It is valid only when F0.03=1～3 and it is the initial value of auxiliary frequency in these three mode

F0.06 Base frequency	Range：0.00～650.00Hz【50.00Hz】
F0.07 Upper limit of freq.	Range：Upper limit～Max output freq. 【50.00Hz】
F0.08 Lower limit of freq	Range：0～Upper limit of freq.【0.00Hz】
F0.09 Max output frequency	Range：Max{50.00, F0.12 upper limit of frequency}～650.00H【50.00Hz】
F0.10 Max output voltage	Range：1～480V 【Inverter's rated】

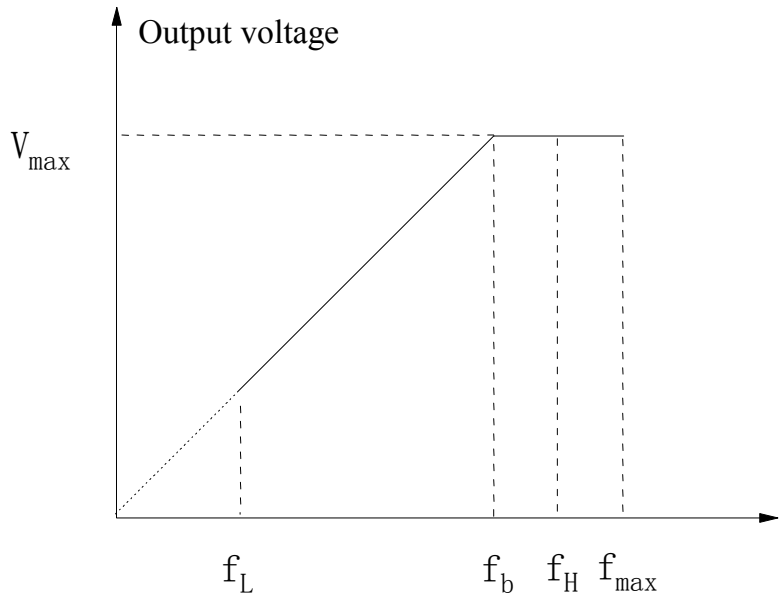


Figure 6-6 Characteristic parameters definition

The max frequency refers to the allowed max output frequency of the inverter. Refer to the f_{max} in Figure 6-6;

Base frequency normally corresponds with the rated frequency of the motor. It is the Min frequency when the inverter outputs the highest voltage, as shown in Figure 6-6 as f_b

Max output voltage is the inverter's output voltage when the inverter outputs base frequency, as shown in Figure 6-6 as V_{max}. This

corresponds to the rated voltage of the inverter

The f_H and f_L are defined by F0.07 and F0.08 as upper limit and lower limit of frequency respectively.

F0.11 Running direction	Range：0、1 【0】

The function is used to select motor direction of rotation when running in keypad control mode.

0：Forward

1：Reverse

In two wire terminal control mode, you can switch motor direction of rotation by change this parameter value.

F0.12 Acc time 1	Range：0.1～3600s（min） 【6.0s】
F0.13 Dec time 1	Range：0.1～3600s（min） 【6.0s】

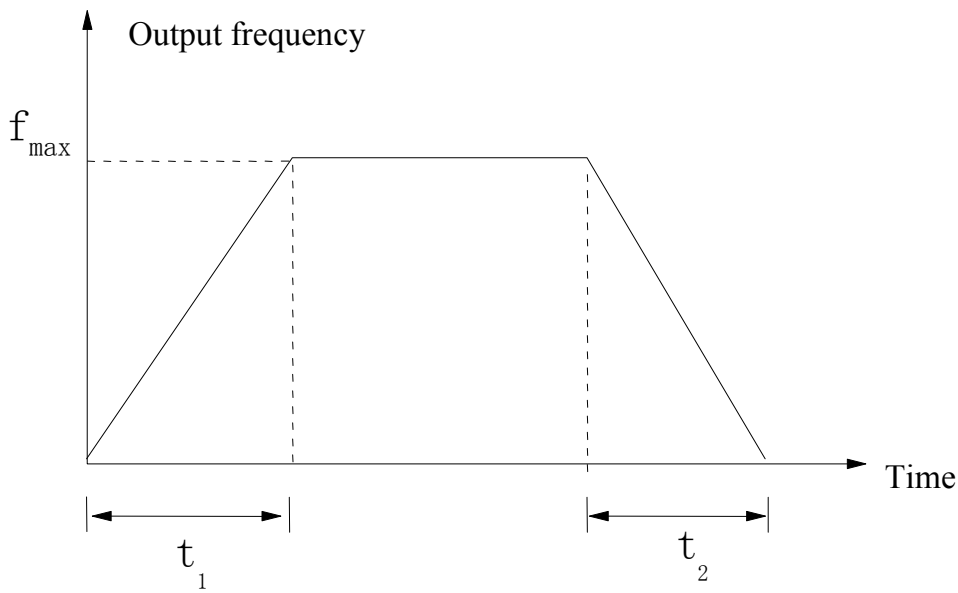


Figure 6-7 Acc/Dec time definition

Acc time is the time taken for the motor to accelerate from 0 Hz to the maximum frequency (as set in F0.09), see t_1 in Figure 6-7. Dec time is the time taken for the motor to decelerate from maximum frequency

(F0.09) to 0 Hz, see t_2 in Figure 6-7.

F0.14 Reserved	Reserved

6.2 Motor Parameter（F1）

F1.00 Reserved	Reserved
F1.01 Motor's poles	Range：2～14【4】
F1.02 Rated power	Range：0.4～1000kW【depending on model】
F1.03 Rated current	Range：0.1～999.9A【depending on model】

F1.01~F1.03 is to set motor's parameters. Be sure to input the values according to motor's nameplate.

F1.04 Current without load	Range：0.1～6553A【depending on model】
F1.05 Stator resistance	Range：0.0～50.00%【depending on model】
F1.06 Leakage inductance	Range：0.0～50.00%【depending on model】
F1.07 Rotor resistance	Range：0.0～50.00%【depending on model】
F1.08 Mutual inductance	Range：0.0～2000.0%【depending on model】

After the success of the motor parameter self learning, P1.04 ~ P1.08 parameters will be automatically updated.

After change P1.02 motor rated power, P1.04 ~ P1.08 parameter value will be back to the factory.

F1.09 Rated slip frequency	Range：0.00～20.00Hz【0Hz】

The motor rated speed can be obtained by the motor nameplate.

F1.10 Auto tuning	Range：0～2【0】

0: Auto-tuning is disabled

1: Stationary auto-tuning (Start auto-tuning to a standstill motor

Before starting auto-tuning, values on the motor's nameplate must be input correctly (F1.01~F1.03). When starting auto-tuning to a standstill motor, the stator's resistance, rotor's resistance and the leakage inductance will be measured and the measured values will be written into F1.05, F1.06 and F1.07 automatically.

2：Rotating auto-tuning

When starting a rotating auto-tuning, at first, the motor is in standstill status, and the stator's resistance , rotor's resistance and the leakage inductance will be measured, and then the motor begins to rotate, mutual inductance, parameters will be measured and written into F1.05, F1.06, F1.07, F1.08 and F1.04 automatically.

After auto-tuning, F1.10 will be set to 0 automatically.

Auto-tuning procedures:

1）Set the "F0.06 basic operating frequency" and "F0.07 Max output voltage" correctly according to the motor's feature;

2）Set the F1.01, F1.02 and F1.03 correctly;

3）If F1.10 is set to 2, Acc time (F0.12) and Dec time (F0.13) should be set correctly and remove the load from the motor and check the safety;

4）Set F1.10 to 1 or 2, press FUNC/DATA, and then press RUN to start auto-tuning;

5）When the operating LED turns off, that means the auto-tuning is over.

Note：

1. When setting F1.10 to 2, you may increase Acc/Dec time if over-current or over-voltage fault occurs in the auto-tuning process;

2. When setting F1.10 to 2, the motor's load must be removed before starting rotating auto-tuning;

3. The motor must be in standstill status before starting the auto-tuning, otherwise the auto-tuning cannot be executed normally;

4. If it is inconvenient to start auto-tuning (e.g. the motor cannot break away from the load), or you don't require much on motor's control performance, you can use stationary auto-tuning or even disable the

function. You may input the values on the motor's nameplate correctly (F1.01~F1.03);

5. If the auto-tuning function is unavailable and there is motor's parameters on the nameplate, you should input the values correctly (F1.01~F1.03), and then input the calculated values (F1.04~F1.08). Please set the parameters correctly;

6. If auto-tuning is not successful, the inverter alarms and displays fault F.tU.

6. 3 Start/Brake Parameter（F2）

F2.00 Reserved	Reserved
F2.01 Start frequency	Range：0.20～60.00Hz【0.50Hz】
F2.02 Start frequency hold time	Range：0.0～10.0s【0.0s】

Start frequency refers the frequency at which the inverter starts, as shown in Figure 6-9 as f_S. Start frequency hold time refers the time within which the inverter runs at start frequency during start up, as shown in Figure 6-9 t_1.

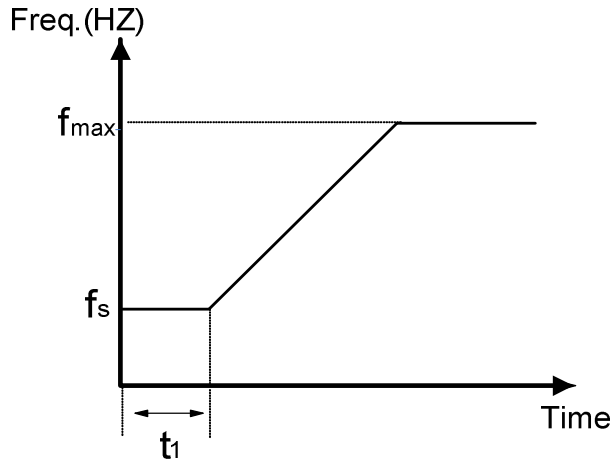


Figure 6-9 Relation of Start Freq. and Start Time

Note：

The start frequency is not limited by lower limit of the frequency.

F2.03~F2.07 Reserved	Reserved
F2.08 Stop mode	Range：0、1、2【0】

0：Decelerate to stop

When the inverter receives Stop command, it will reduce output frequency to zero and stop within preset deceleration time.

1：Coast to stop

When the inverter receives Stop command, it will stop outputting frequency and stop gradually relying on load inertia.

2：Deceleration + DC braking

When the inverter receives Stop command, it will reduce output frequency within preset Dec time. When it arrives at the frequency threshold of DC braking, the DC braking begins. Please refer to F2.09~F2.12.

F2.09 Frequency threshold of DC braking	Range：0.00～60.00Hz【1.00Hz】
F2.10 DC brake delay time	Range：0.00～10.00s【0.00s】
F2.11 DC brake current at stop	0.0~150.0％【120.0％】
F2.12 DC brake time at stop	0.1～60.0s【0.5s】

DC brake starting frequency: in stop process, when the frequency is reached, began to DC brake.

DC brake delay time: before the start of the DC brake, inverter blockade pulse, after the delay time, began to dc brake, used to prevent current overshoot of high-power motor brake starting time.

DC braking current: DC braking current relative to the percentage of the frequency converter rated current.

F2.13 Dynamic braking	Range：0，1【0】

0：Disabled

1：Enabled

Note：

For the occasion of big moment of inertia and a quick stop demand, this feature can be 1, and connect the matching braking resistor, achieve rapid downtime.

F2.14 Reserved	Reserved

6.4 Flux vector control parameters（F3）

F3.00 Reserved	Reserved
F3.01 V/F freq. F3	Range：F3.03～F0.06【0.00Hz】
F3.02 V/F voltage V3	Range：F3.04～100.0%【0.0%】
F3.03 V/F freq. F2	Range：F3.05～F3.01【0.00Hz】
F3.04 V/F voltageV2	Range：F3.06～F3.02【0.0%】
F3.05 V/F freq. F1	Range：0～F3.03【0.00Hz】
F3.06 V/F voltageV1	Range：0～F3.04【0.0%】

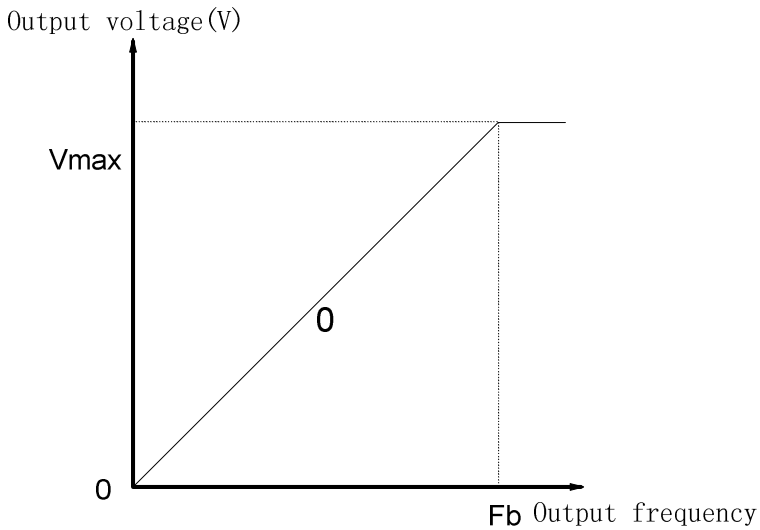
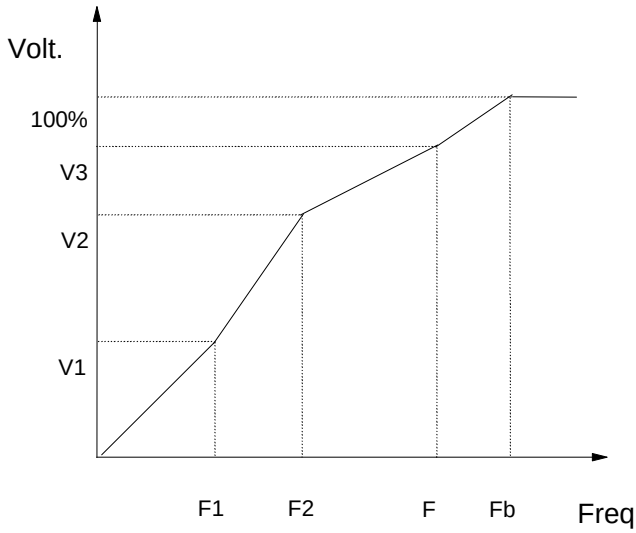


Figure 6-10 V/F curve

You can define a curve by F3.01~F3.06, i.e. a polygonal line defined by

3 points V1, V2, V3 is Relative to the percentage of the maximum output voltage

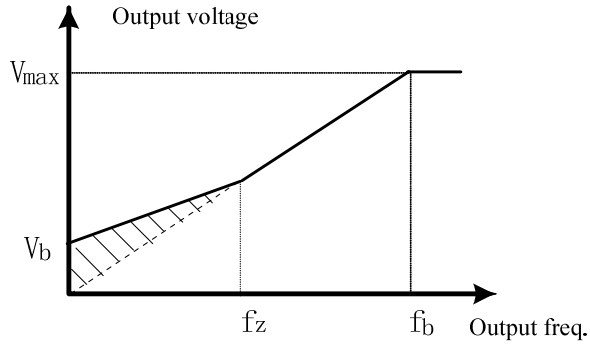


V1~V3: segment 1-3,voltage percentage
F1~F3: frequency segment 1-3
Fb: base frequency F0.06

Figure 6-15 User Defined V/F curve

When VFD worked in low frequency, setting torque boost value reasonablely to counteractthe output voltage reduction,in order to achieve sufficient output torque.

F3.07 Torque boost	Range：0～30.0%【2.0%】
F3.08 Manual torque boost cutoff point	Range：0～50%【10.0%】



Vb:manual torque boost Vmax：Max output volt.
Fz:cut-off freq.for torque boost fb：Basic output freq

Figure 6-16 Torque boost (shadow area: boost value)

F3.07 Torque boost：

0：AutoTorque boost；

Non-0：Mannual Torque boost

F3.08：Manual torque boost cut-off point

Cut-off frequency of relative frequency F0.06 percentage

F3.09~F3.10 Reserved	Reserved
F3.11 Compensation time	Range：0.1～25.0s【0.1s】

Compensation time constant：

To compensate filtering constant of frequency, more less this value more faster the refreshing is.

F3.12 AVR function	Range：0、1、2【0】

0：Disabled

1：Always enabled

2：Disabled during decelerating

AVR: auto voltage adjustment. This function can keep constant output voltage when the input voltage deviates from rated value. Therefore, the function should be enabled all the time especially when the input voltage is higher than the rated value.

If AVR is disabled during deceleration, the Dec time is shorter but the current is higher, otherwise, the motor decelerates smoothly with lower current, but the Dec time is longer.

F3.13 Reserved	Reserved
F3.14 Motor stabilization factor	Range：0～255【Depending on model】

F3.14 is used to suppress the oscillation caused by the inverter and the motor. If the inverter's output current changes constantly at fixed load, the oscillation can be reduced by adjusting F3.14.

6.5 Current vector control parameter（F4）

F4.00~F4.10	Reserved	Reserved

6.6 Multi-function terminal（F5）

F5.00	Function of multi-function terminal X1	Range：0～43【1】
F5.01	Function of multi-function terminal X2	Range：0～43【2】
F5.02	Function of multi-function terminal X3	Range：0～43【0】
F5.03	Function of multi-function terminal X4	Range：0～43【0】
F5.04	Function of multi-function terminal X5	Range：0～45【0】
F5.05~F5.07	Reserved	Reserved

The multi-function terminals can realize various functions. You may assign functions to them by setting parameters F5.00~F5.04. Please refer to Table 6-3. Take X1~X3 for example in the following description.

Setting	Functions	Setting	Functions
0	No function	1	Foreward run
2	Reverse run	3	MS frequency 1
4	MS frequency 2	5	MS frequency 3
6	External fault normally-open input	7	External fault normally-closed input
8	Reset signal	9	Forward jog
10	Reverse jog	11	Coast-to-stop input
12	Frequency increase(UP)	13	Frequency decrease(DN)

Setting	Functions	Setting	Functions
14	PLC operation pause	15	Acc/Dec prohibit
16	3-wire operation control	17	External interrupt signal normally-open input
18	External interrupt signal normally-close input	19	DC injection braking command
20	Disable close-loop	21	Disable PLC
22	Frequency setting method 1	23	Frequency setting method 2
24	Frequency setting method 3	25	Reserved
26	MS frequency 4	27	Terminal control mode is forcibly enabled
28	Control mode 1	29	Control mode 2
30	Reserved	31	Reserved
32	Reserved	35	External stop command
36	Reserved	37	Inverter operation prohibiting
38	Reserved	40	Clear auxiliary reference frequency
41	Reset PLC stop status	42	Clear counter’s record
43	Signal of triggering counter	44	Reserved
45	Reserved		

The functions are explained as follows:

1: Foreward

2: Reverse

3~5: MS terminals（26 is MS frequency 4）

If any three of F5.03~F5.05 are set at 3~5 or 26 respectively, Up to 16 segments of speed can be defined through the combination of the ON and OFF state of the 4 terminals.

6~7: External fault signal (normally-open/close input)

If the setting is 6~7, fault signal of external equipment can be input via the terminal, which is convenient for the inverter to monitor the fault of external equipment. Once the inverter receives the fault signal, it will display "F.ED". The fault signal has two input modes, i.e. normally-open and normally-close.

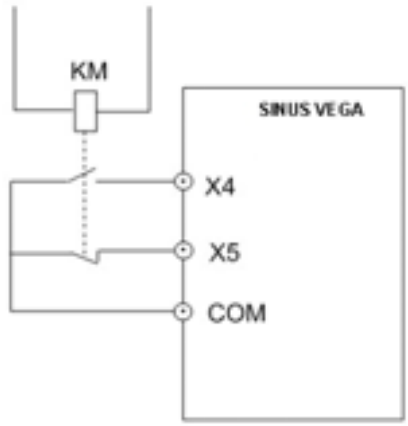


Figure 6-20 Normally-open/close input

In Figure 6-20, X4 is normally open input and X5 normally close input.

KM is external fault relay.

8: Reset

If any of F5.00~F5.04 is set at 8, the inverter can be reset via the terminal when the inverter has a fault. The function of this terminal is the same with the RESET key on the keypad.

9~10: External jog command (JOGF/JOGR)

If any of F5.00~F5.04 is set at 9~10, the terminal can enable the jog operation. JOGF is terminal for forward jog operation command and

JOGR is terminal for reverse jog operation command. Jog frequency, jog interval and jog Acc/Dec time are defined in F9.05~F9.08.

11: Coast to stop

This function is the same with F2.08, however, it is realized by terminal and convenient for remote control.

12~13: Frequency increase (UP) /decrease (DN)

If the setting is 12~13, the terminal can be used to increase or decrease frequency instead of ▲and ▼keys on the panel for remote control. This terminal is valid when F0.00=1 or F0.03=2.

14: Pause command for simple PLC:

If the setting is 14, the terminal is used to pause the PLC operation and the inverter operates at zero frequency when the terminal is enabled, but the running time is not counted. If the terminal is disabled, the inverter will start at start frequency and continue the PLC operation. Refer to FD.00~FD.08 for the use of this terminal.

15: Acc/Dec prohibit

The motor is immune to any external command except Stop command and maintain the present speed.

Note:

This function is disabled during normal decelerating to stop.

16: 3-wire operation control

Refer to F5.08.

17~18: External interrupt signal normally-open input

When the inverter receives an interrupt signal during running, it will stop outputs and run at zero frequency. Once the signal removed, the inverter will resume previous running at start frequency.

As Figure 6-20 shows, there are X4, normally open contacts and X5, normally closed contact.

Note:

Different from function 6~7, the external interrupt signal will not cause alarm, and the inverter will resume previous running once the signal removed.

19: DC Braking (DB)

If the setting is 19, the terminal can be used to perform DC injection braking to the motor that is running for emergency stop and accurate location. Initial braking frequency, braking delay time and braking current are defined by F2.09~F2.11. Braking time is decided by the bigger value between F2.12 and the period that the terminal is effective.

20: Disable close-loop

If the setting is 20, the terminal can be used to realize the flexible switching between close-loop operation and low level operating mode.

When the inverter is switched to low level operating mode, its start/stop, operating direction, ACC/Dec time are shifted to the corresponding operating modes accordingly.

21: Disable PLC

If the setting is 21, the terminal is used to realize the flexible switching between PLC operation and low level operating mode.

When the inverter is switched to low level operating mode, its start/stop, operating direction, ACC/Dec time are shifted to the corresponding operating modes accordingly.

22~24: Reference frequency setting method

Through the combination of the ON/OFF state of X1, X2 and X3, you can select different frequency setting method, which will come into effect regardless of F0.02.

Table 6-5 Frequency Setting Mode Selection

X3	X2	X1	Mode
OFF	OFF	OFF	None
OFF	OFF	ON	Digital setting 1
OFF	ON	OFF	Digital setting 2
OFF	ON	ON	Digital setting 3
ON	OFF.	OFF	VCI analog setting
ON	OFF	ON	CCI analog setting
ON	ON	OFF	Reserved
ON	ON	ON	LED keypad

25：Reserved

26：MS terminals

27：Terminal control mode is enabled

When this terminal function is enabled, the operating command is input through this terminal forcibly. The inverter will be controlled in the previous mode if FWD/REV terminal function is disabled.

28～29：Control mode selection X1~X2

Table 6-6 Control Mode Selection

X2	X1	Control mode
OFF	OFF	None
OFF	ON	LED keypad
ON	OFF	Terminal
ON	ON	Serial port

The selection of control mode is realized by the combination of ON/OFF state of any two of X1~X5. In the above table, you should set F5.00=28, F5.01=29.

30~34: Reserved

35: External Stop command

This Stop command is valid to all control modes. When this function is enabled, the inverter will stop as specified F2.08.

36：Reserved

37: Prohibit inverter from operating

If this function is enabled, the inverter that is operating will coast to stop and the inverter ready to run will be prohibited to start. This function is mainly used as safety protection.

38：Reserved

39：Reserved

40: Clear the setting of auxiliary reference frequency

This function is valid for auxiliary reference frequency (F0.03=1, 2 and 3) to clear it to zero, so that the reference frequency is determined solely by main reference.

41: Reset PLC state

When the inverter stops in PLC mode, the memorized PLC operating information (operating stage, operating time, operating frequency, etc.) will be cleared.

42: Clear the counter to zero

This function is to clear the counter to zero and is used in conjunction with function 43.

43: Input signal to trigger the counter

When the setting is 43, this terminal is used to input counting pulse signal to the internal counter of the inverter. The max.pulse frequency is 200Hz. The present counting value can be saved at power off. See F6.11 and F6.12 for details.

44：Reserved

45：Reserved

F5.08 Terminal control mode	Range：0～3【0】

This parameter defines four operating modes controlled by external terminals.

0：2-wire operating mode 1

K2	K1	Command
0	0	Stop
0	1	FWD
1	0	REV
1	1	Stop

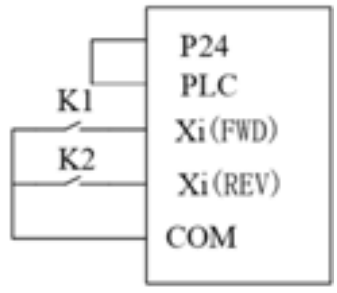


Figure 6-21 2-Wire Operation Mode 1

1：2-wire operating mode 2

K2	K1	Command
0	0	Stop
1	0	Stop
0	1	FWD
1	1	REV

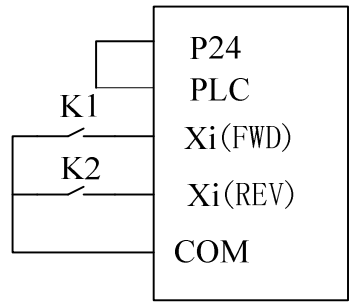


Figure 6-22 2-Wire Operation Mode 2

2：3-wire operating mode 1

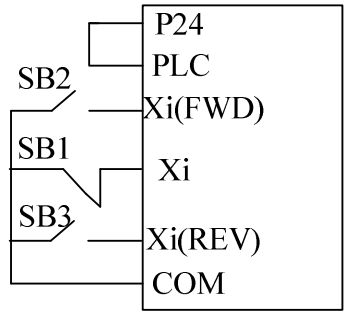


Figure 6-23 3-Wire Operation Mode 1

SB1：Stop button；SB2：Run forward button；SB3：Run reverse button

Terminal Xi is the multi-function input terminal of X1~X5. For this case, the corresponding parameter should be set at 16 (3-wire operation).

3：3-wire operating mode 2

K	Running direction
0	FWD
1	REV

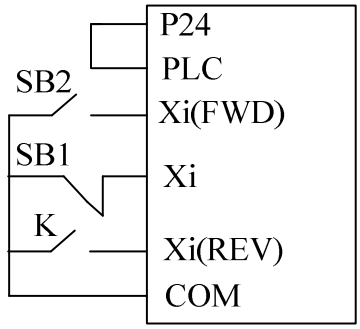


Figure 6-24 3-Wire Operation Mode 2

SB1：Stop button；SB2：Run button

Terminal Xi is the multi-function input terminal of X1~X5. For this case, the corresponding parameter should be set at 16 (3-wire operation).

F5.09~F5.11Reserved	Reserved
F5.12 Filter constant	Range：0.01～50.00s【0.50s】
F5.13 Reserved	Reserved
F5.14 Ratio of Min. input of curve 1	Range：0.0%～F5.16【2.0%】
F5.15 Frequency corresponds to min. input of curve 1	Range：0.0～F0.09【0.00Hz】
F5.16 Ratio of Max. input of curve1	Range：F5.14～100.0%【100.0%】
F5.17 Frequency corresponds to max. input of curve 1	Range：0.0～F0.09【50.00Hz】
F5.18~F5.21Reserved	Reserved

6.7 Output terminal control parameters（F6）

F6.00 Open collector output terminal Y1	Range：0～19【0】
F6.01 Reserved	Reserved
F6.02 Relay 1 output function	Range：0～19【16】
F6.03 Reserved	Reserved

Refer to section 3.3.2 for the output characteristics of Y1 and the relay's output terminal. Table 6-8 shows the functions of the above 3 terminals. Note that one function can be selected repeatedly.

Table 6-8 Parameter Setting and Function of Output Terminals

Setting	Function	Setting	Function
0	Inverter running signal（RUN）	1	Frequency arrival signal（FAR）
2	Frequency detection threshold（FDT1）	3	Reserved
4	Reserved	5	Low voltage lock-up signal（LU）

Setting	Function	Setting	Function
6	External stop command（EXT）	7	Higher limit of frequency（FHL）
8	Lower limit of frequency（FLL）	9	Zero-speed running
10	Completion of simple PLC operation	11	PLC cycle completion indication
12	Preset counting value arrival	13	Specified counting value arrival
14	Inverter running state	15	Inverter is ready（RDY）
16	Inverter fails	17	Extended function 1 of host
18	Reserved	19	Preset operation time out

The explanation of output signal is shown in Table 6-8.

0: Inverter running signal (RUN)

This signal will be given if the inverter is running.

1: Frequency arrival signal (FAR)

See F6.13.

2: Frequency detection threshold (FDT1)

See F6.14~F6.15.

3: Reserved

4: Reserved

5: Low voltage lock-up signal (LU)

The signal will be given when the DC bus voltage is lower than the low voltage limit, and the LED displays “-LU-”.

6: External stopping command (EXT)

The terminal outputs the indicating signal if the inverter outputs tripping signal caused by external fault (F.Ed).

7: Higher limit of frequency (FHL)

The signal is given if the preset frequency is higher than upper limit of frequency and the operating frequency reaches the upper limit of frequency.

8: Lower limit of frequency (FLL)

The signal is given if the preset frequency is higher than lower limit of frequency and the operating frequency reaches the lower limit of frequency.

9: Zero-speed running

The signal is given if the inverter's output frequency is 0 and the inverter is in operating status.

10: Completion of simple PLC operation stages

The signal is given (pulse, 500ms) if the present stage of PLC operation is finished.

11: PLC cycle completion indication

The signal (pulse, 500ms width) is given if one cycle of PLC operation is finished.

12: preset counting value arrival

13: reference length arrival

Refer to F6.11~F6.12.

14: Inverter running state

When inverter is in a state of reverse, output is actived

15: Inverter is ready (RDY)

The RDY signal is output when the inverter has no fault, its DC bus voltage is normal; the Start Prohibit function is disabled. It is ready to start.

16: Inverter fails

The signal is given if the inverter has faults.

17: Extended function 1 of host

The output signal of terminal Y1 or TC is directly controlled by a serial port. Refer to the communication protocol of SINUS VEGA.

19: preset operating time out

The signal is given if the inverter's total operating time (FN.01) reaches preset operating time (FN.00).

F6.04 AO output function	Range：0～12【0】
F6.05~F6.06 Reserved	Reserved

Setting	Function	Range
0	Output freq. before compensation	0～Max. output freq.
1	Output freq. after compensation	0～Max. output freq.
2	Preset freq.	0～Max. output freq.
3	Output current	0～2 times of inverter's rated current
4	Output current	0～2 times of motor's rated current
5	Output torque	0～2 times of motor's torque
6	Output voltage	0～1.2 times of inverter's rated voltage
7	Bus voltage	0～800V
8	Reserved	Reserved
9	AI	0～10V/0～20mA
10	Output power	0～2 times of rated power
11	Extended function 2 of host	0～65535
12	Setting of potentiometer	0～10V

F6.07 Analog output range	Range：00～01【00】

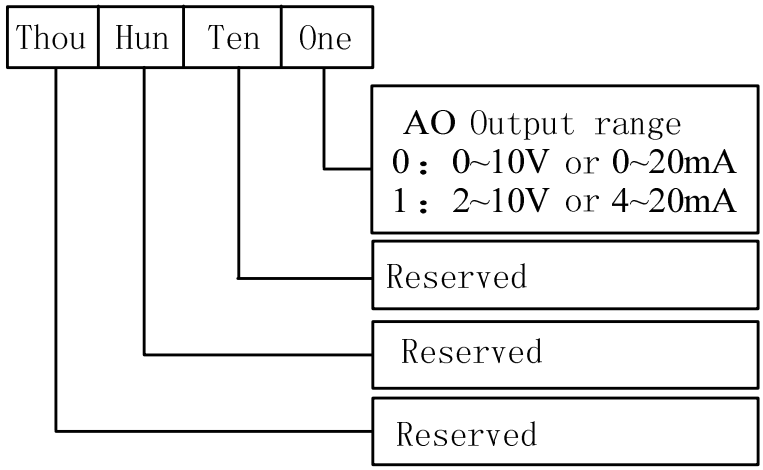


Figure 6-30 Analog Output Type Selection

The parameter is to select the output type, i.e. voltage or current, CN6 jumper is for AO, “I” represents current, “V” represents voltage.

F6.08 AO output gain	Range：0.0～200.0%【100.0%】
F6.09~F6.10 Reserved	Reserved
F6.11 Preset counting value	Range：F6.12～65535【0】
F6.12 Specified counting value	Range：0～F6.11【0】

Frequency inverter through the number 43 function “counter trigger signal input (X terminal) ” to count.

Set count value: when the count value reach to set value, Y terminals output a indicator, counter stop counting;

Specified count value: when the count value reaches the specified count value, Y terminal output indicator, until set count reached;Among them, the current count value F9.35 can be modified.

F6.13 Freq. arrival detection range (FAR)	Range：0.00～650.00Hz【2.50Hz】

Set this function is used to test the current output frequency and frequency deviation, the output terminal function set to 1 (the signal frequency reaches FAR), when the output frequency of frequency

converter and the difference between the set frequency in P6.13 (frequency) to check out the width range, the terminal output frequency to signal (FAR)

F6.14 FDT1 level	Range：0.00～650.00Hz【50.00Hz】
F6.15 FDT1 lag	Range：0.00～650.00Hz【1.00Hz】
F6.16~F6.17 Reserved	Reserved

F6.14~F6.15 is a complement to the No.2 function in Table6-8.

For example: when the inverter's output frequency reaches FDT1level, it outputs an indicating signal until its output frequencydrops below FDT1 level (FDT1 level-FDT1 lag) .As shown inFigure 6-33.

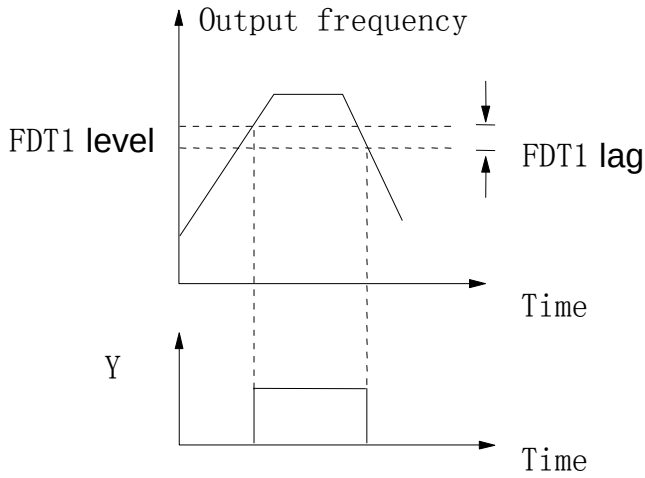


Figure 6-33 Frequency Detection

6.8 Close-loop PID control（F7）

F7.00 Close-loop PID control	Range：0、1【0】

0：Non Closeloop PID control

1：Closeloop PID control

F7.01 Reference input method	Range：0～4【0】

0：Digital setting

Take the value of F7.05

1：Reserved

2：Reserved

3：LED keypad potentiometer given

4：Reserved

F7.02 Reserved	Reserved
F7.03 Input filter	Range：0.01～50.00s【0.50s】
F7.04 Feedback filter	Range：0.01～50.00s【0.50s】
F7.05 Digital reference input	Range：0.00～10.00V【0.00】
F7.06~F7.07 Reserved	Reserved
F7.08 Min. input	Range：0.0%～F7.10【0.0%】
F7.09 Feedback of min. input	Range：0.0～100.0%【0.0%】
F7.10 Max. input	Range：F7.08～100.0%【100.0%】
F7.11 Feedback of max. input	Range：0.0～100.0%【100.0%】

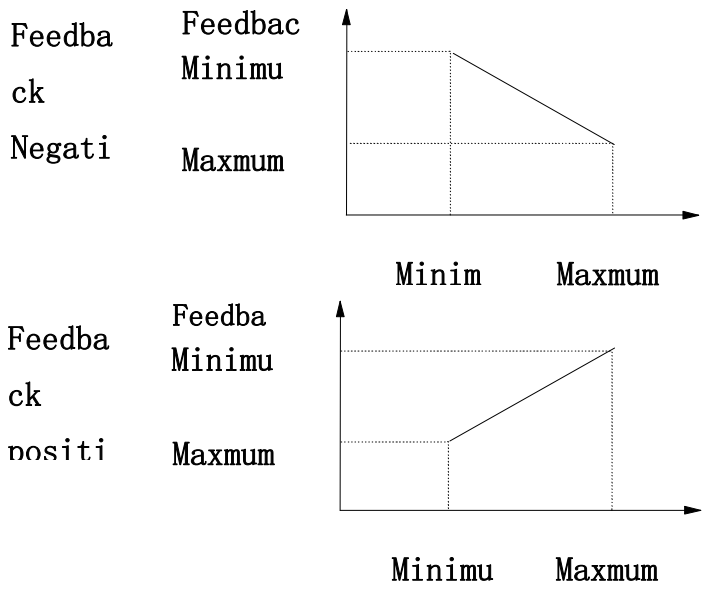


Figure 6-39 Relation of Input and Feedback

F7.12 Proportional gain Kp	Range：0.000～9.999【0.050】
F7.13 Integral gain Ki	Range：0.000～9.999【0.050】
F7.14 Sampling cycle Ts	Range：0.01～50.00s【0.50s】

The bigger the proportional gain, the faster the response, but oscillation may occur easily if proportional gain is too big.

If only proportional gain is used in regulation, the error cannot be eliminated completely. Therefore, it is preferred to use the integral gain to form a PI control system. The bigger the integral gain, the faster the response, but oscillation may occur if integral gain is too big.

F7.14 refers to the sampling cycle of feedback value. The PI regulator calculates once in each sampling cycle. The bigger the sampling cycle the slower the response will.

F7.15 Error limit	Range：0.0～20%【2.0%】

F7.15 is the max. error between system output and the close-loop reference, as shown in Figure 6-40. PI regulator stops operation when the feedback error is within this range. Setting this parameter correctly is helpful to improve the system output accuracy and stability.

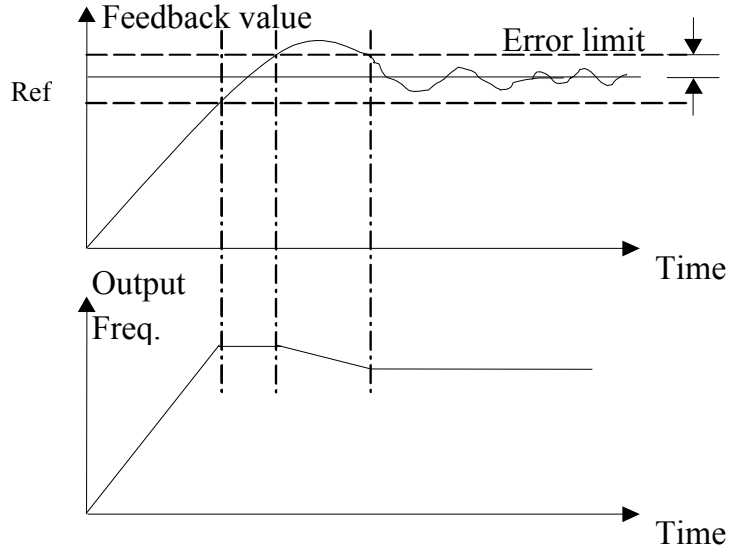


Figure 6-40 Error Limit Schematic Diagram

F7.16 Close-loop regulation characteristics	Range：0、1【0】

0：Positive logic

Set F7.16 to 0 if the motor speed is required to increase with the reference.

1：Negative logic

Set F7.16 to 1 if the motor speed is required to decrease with the increase of the reference.

F7.17~F7.28 Reserved	Reserved
F7.29 PID feedback break line detection	Range：0.0～80.0%【0.00%】
F7.30 PID feedback break line detection time	Range：0.0～999.9s 【0.00s】

If set F7.29 to 0.0%, no feedback break line detection

Feedback break line detection threshold is a percentage of the full feedback.

If PID feedback signal is less than F7.29 and last more than setting time of F7.30, feedback break line alarm will appears.

Note:

Please set F7.29 reasonabely, if not, will cause unnecessary downtime.

F7.31~F7.33 Reserved	Reserved

6. 9 MS parameters（F8）

F8.00 MS freq. 1	Range: lower limit～upper limit【 5.00Hz】
F8.01 MS freq. 2	Range: lower limit～upper limit【10.00Hz】
F8.02 MS freq. 3	Range: lower limit～upper limit【20.00Hz】
F8.03 MS freq. 4	Range: lower limit～upper limit【30.00Hz】
F8.04 MS freq. 5	Range: lower limit～upper limit【40.00Hz】
F8.05 MS freq. 6	Range: lower limit～upper limit【45.00Hz】
F8.06 MS freq. 7	Range: lower limit～upper limit【50.00Hz】
F8.07~F8.14 MS freq. 8~ 15	Range: lower limit～upper limit【50.00Hz】

F8.15~F8.20 Reserved	Reserved

6. 10 Enhanced function（F9）

F9.00~F9.01 Reserved	Reserved
F9.02 Carrier wave frequency	Range：0.7～15.0kHz【6.0kHz】

Table 6-11 Carrier Freq. and Performance

Carrier wave Freq.	Decreasing	Increaseing
Motor noise	↑	↓
Motor temperature rise	↑	↓
Inverter temperature rise	↓	↑
Leakage current	↓	↑
Interference to external	↓	↑
Output current wave	Worse	Better

F9.03 CWF auto adjustment	Range：0、1【0】

0：Disabled

1：Enabled

When CWF auto adjustment is enabled, the inverter can adjust CWF automatically according to the temperature inside the inverter.

F9.04 Reserved	Reserved
F9.05 Jog frequency	Range：0.10～F0.07Hz【5.00Hz】
F9.06 Reserved	Reserved
F9.07 Jog Acc time	Range：0.1～60.0s【6.0s】
F9.08 Jog Dec time	Range：0.1～60.0s【6.0s】

JogFrequency: frequency in Jog mode

Jog acceleration/deceleration time: Acc/Dec time in Jog mode

F9.09~ F9.14 Reserved	Reserved
F9.15 Positive or negative logic of terminal	Range：000～FFFH【000H】

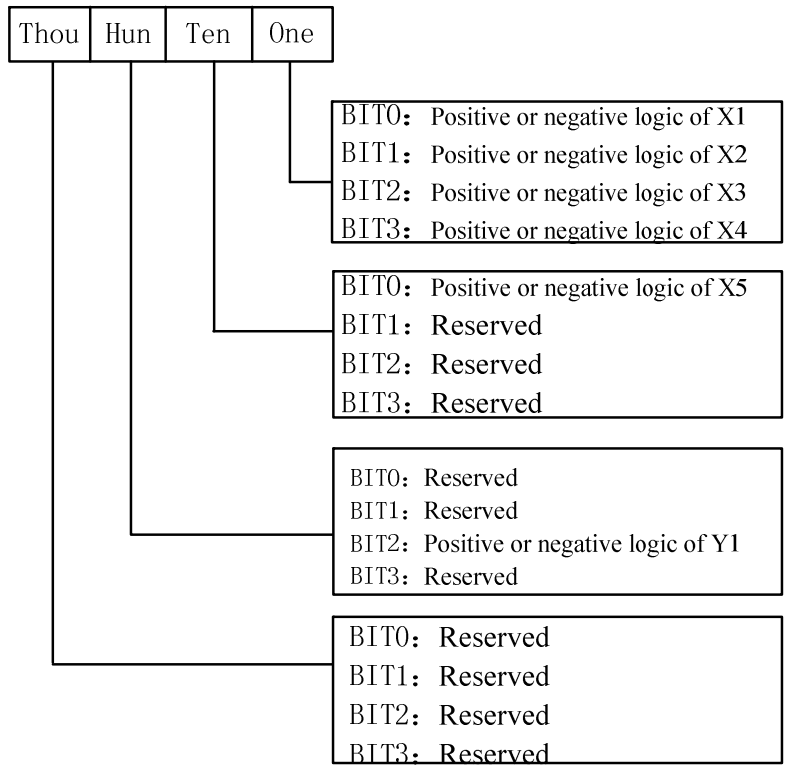


Figure 6-46 Positive or Negative logic of Terminals

BIT Settings:

0: Valid when X and common connected, disconnect is invalid;

1: Invalid when X and common connected, disconnect is valid;

F9.16~F9.17 Reserved	Reserved
F9.18 Digital auxiliary reference control	Range：000～111【000】

F9.18 is only valid when F0.01=1~3

1: Storage control

0: Storage auxiliary frequency when power supply drop off

The auxiliary frequency will be stored in F0.05, auxiliary frequency will superposition polarity stored in F9.18 polarity.

1: don't store auxiliary frequency when power supply drop

Ten: stop frequency processing

0: keep the auxiliary frequency after downtime

1: setting frequency reset after downtime

Hundred: auxiliary frequency superposition of polarity

0: Positive polarity

Sum of main frequency and of auxiliary frequency is defined as set frequency

1: Negative polarity

D-value of main frequency and of auxiliary frequency is defined as set frequency

F9.19~F9.21 Reserved	Reserved
F9.22 Cooling fan	Range：0、1【0】

0：Auto-stop mode

The cooling fan keeps running during operation. After the inverter stops for 3minutes, the cooling fan will continue to run or stop according to the module temperature.

1：Cooling fan keeps running upon power on.

F9.23~F9.29 Reserved	Reserved
F9.30 Conditions of restart after power failure	Range：0、1 【0】

F9.30=0, not auto restart.

In fact, whether to auto restart depends on F9.30, inverter's state at power failure and control mode. Refer to Table 6-14.

Table 6-14 Conditions of Restart after Power-on

F9.30	State before power off	Control mode at power-on				
		Keypad	Serial port	3-wire terminal 1、2	2-wire terminal 1、2	
		None	None	None	None	Yes
0	Stop	0	0	0	0	0
	Run	0	0	0	0	0
1	Stop	0	0	0	0	1
	Run	1	1	1	0	1

Note：

1. Table 6-14 shows the inverter's action under different conditions. "0" means the inverter is ready to start, and "1" means auto start.
2. When the control mode is keypad or serial port or 3-wire terminal 1 and 2, there is no RUN command at power on.
3. If there is a Stop command, the inverter will not start.

F9.31~F9.33 Reserved	Reserved
F9.34 Terminal filter time	Range：0.5~100.0ms 【7.5ms】
F9.35 Current count value	Range：0~65535【0】

Terminal filter time: can increase P9.34 properly, improve the anti-interference ability of the X input terminals.Terminal filter, the longer terminal action delay time is longer.

The current count value: built-in counter for input pulse count, the value can be modified on-line, this value can be saved when power off.

F9.36 Under-voltage point set	Range：75.0%～135.0% 【90%】
F9.37~F9.42 Reserved	Reserved
F9.43 PWM Model optimization	Range： 0000～0211H 【0011】

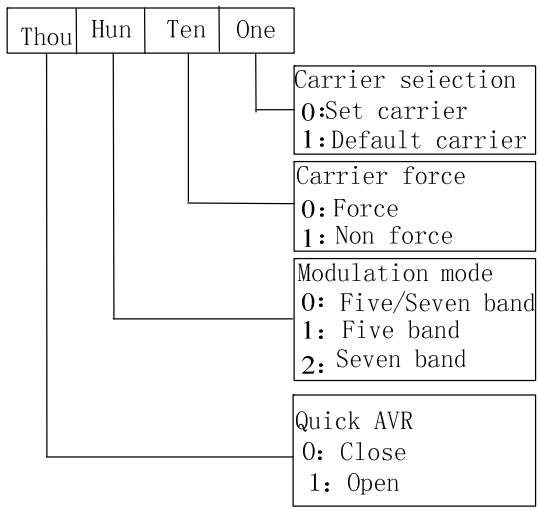


Figure 6-47 PWM model optimization mode selection

F9.44~F9.50 Reserved	Reserved

6. 11 **Display Control Parameters（FA）**

FA.00 LED displayed parameter selection 1	Range：000～3FFH【00DH】

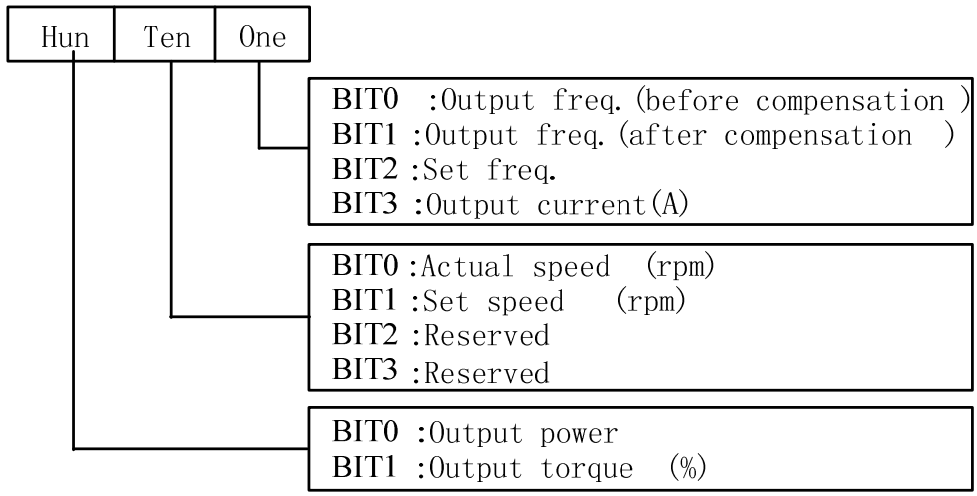


Figure 6-59 LED Displayed Parameter 1 Setting

FA.00 and FA.01 define the parameters that can bedisplayed by LED when the inverter is operating.

If Bit is set at0, the parameter will not be displayed;

If Bit is set at 1, the parameter will be displayed.

As to the conversion of binary format to Hex format, please refer to Table 6-12. You may press key to scroll through the parameters.

FA.01 LED displayed parameter selection 2	Range：000～3FFH【000H】

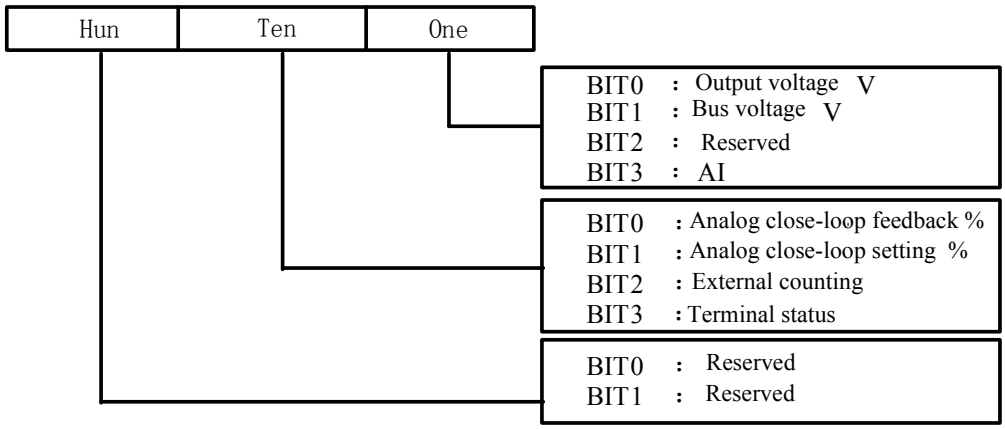


Figure 6-60 LED Displayed Parameter 2 Setting

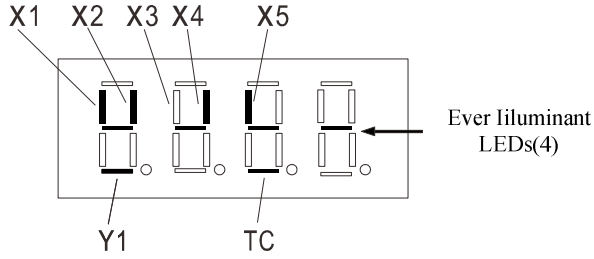


Figure 6-61 Terminal Status Indication

FA.02 Displayed parameter at stop state parameters	Range：0000～3FFFH【2001H】

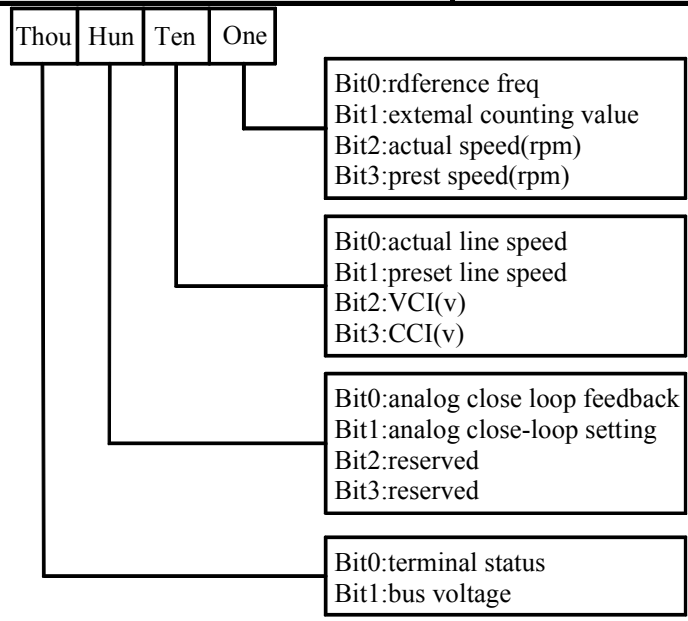


Figure 6-62 Parameter Displayed at Stop State

FA.03~FA.06 Reserved	Reserved

6. 12 Communication（FB）

FB.00 Communication configuration	Range：000～125H【004】

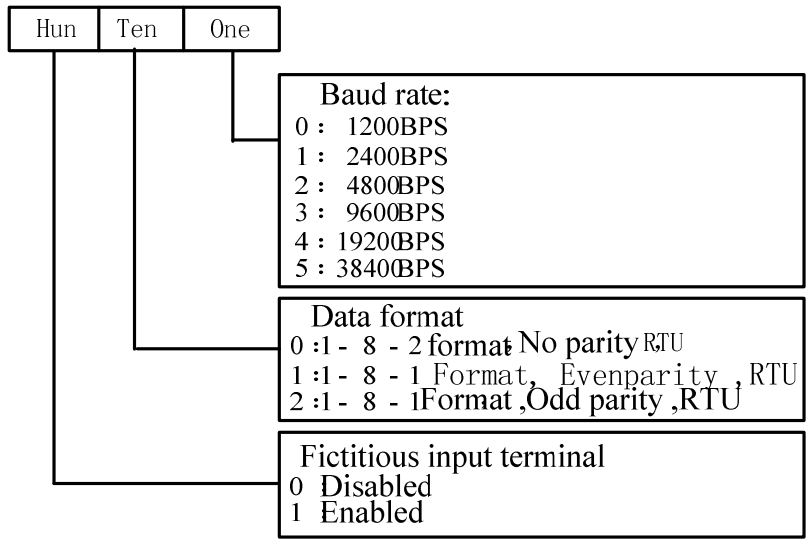


Figure 6-63 Communication Configuration

This function code according to LED mode, used for serial communication preferences. Note: Controller with frequency conversion to set the baud rate and data format must agree, otherwise, the communication can't be.

Virtual terminal is refers to the controller sends commands are adopted to simulate the actual terminal, with each representing a data terminal, each value represents the corresponding terminal state: bit0 ~ bit12: virtual terminal X1 and X5, NC, NC, NC, NC, Y1, NC, TC, NC.PC virtual terminal is valid, the actual terminal function is invalid, virtual terminal equivalent terminal application.

FB.01 Local address	Range：0～247【1】

In serial communication, FB.01 is unique, used to identify the inverter's address.

Note: "0" is the broadcast address. When the address is set to broadcast address, the inverter can receive and execute the command sent by control FC, but will not answer it.

FB.02 Communicate timeout detect	Range：0～1000.0s【0.0s】

When the communication signal is lost for a period longer than the setting of this parameter, the inverter deems that communication fault occurs.

When it is set at 0, the inverter will not detect the signals at the serial port, i.e., this function is invalid.

FB.03 Response delay	Range：0～1000ms【5ms】

Response delay refers to the time from the inverter receiving and executing the command of the host to returning reply frame to the host. For RTU mode, the actual response delay should be no less than 3.5 bytes' transmitting time.

FB.04 Master-slave selection	Range：0～1【0】

0：Slave

1：Master

Note: If master, usually used in multi-inverter interaction applications.

FB.05 Ratio of slave inverter setting frequency	Range：0～10.00【1.00】

This parameter applies only to the slave, used for setting from the receiving master given correction coefficient.

Slave given= FB.05 *(Master given)

6. 13 Professional parameters（FC）

FC.00~ FC.14 Reserved	Reserved

6. 14 PLC parameters（FD）

Simple PLC is a multi-speed generator, through which, the inverter can change frequency and direction according to the running time. This function is realized through PLC (programmable logic controller) before, now the inverter can do it by itself. See Figure 6-67.

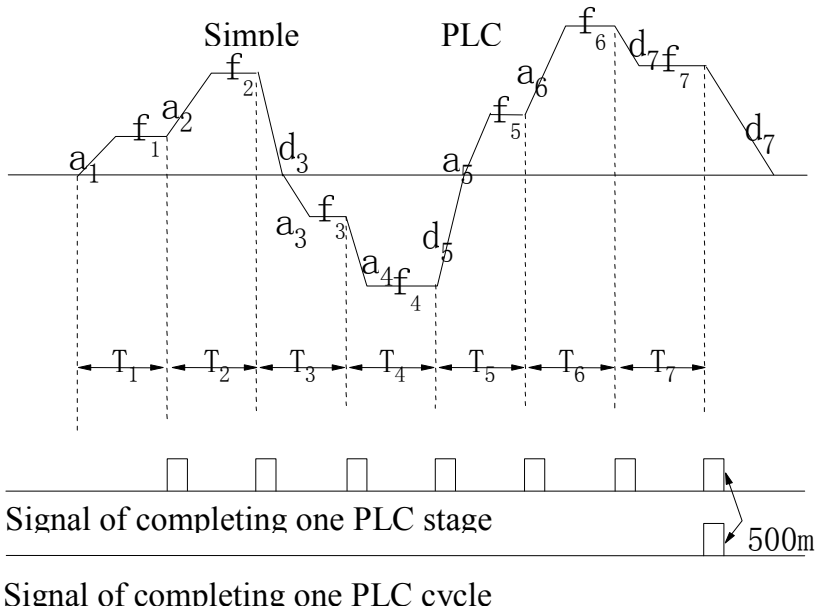


Figure 6-67 Simple PLC Operation

In Figure 6-67, a1~a7, d1~d7 are the Acc and Dec time of the respective stage; f1~f7 and T1~T7 will be defined in later parameters.

The PLC stage and PLC cycle are indicated by the 500mS signals from output terminals Y1 and Y2 of open collector output or relay output. See F6.00~F6.02.

FD.00 Simple PLC mode	Range：0000～1123【0000】

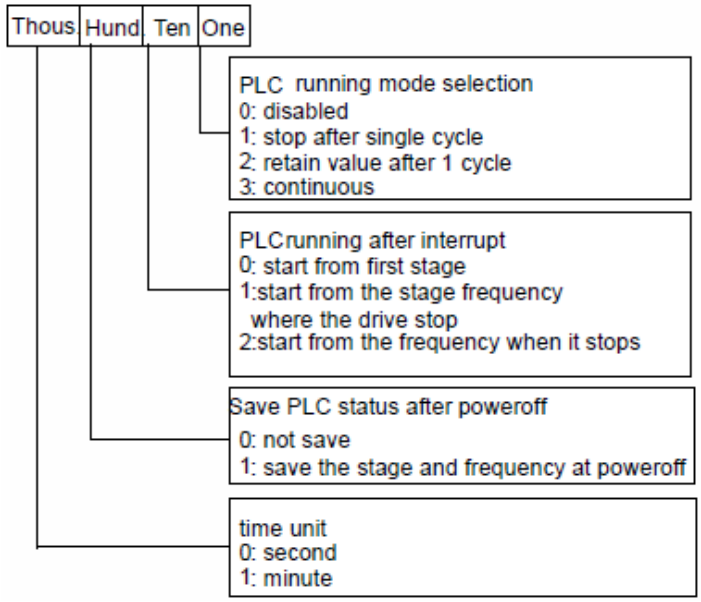


Figure 6-68 Stop after a Single PLC Cycle

One’s place of FD.00, PLC running mode selection

0: Disabled

The PLC function is disabled.

1: stop after a single cycle

As Figure6-69 shows, the inverter stops after a single cycle automatically. It will start given another Run command.

2： Maintain value of the last stage after 1 cycle

As Figure 6-70 shows, the inverter holds the frequency and direction of the last stage after single cycle.

3：（Continuous cycle）：The inverter continues running cycle after cycle until Stop command is received.

Ten’s place of FD.00: Restart mode after PLC interruption:

0: start from the first stage

The inverter restarts from the first stage of PLC after interrupts, such as Stop command, fault or poweroff.

1: continue from the stage frequency where the inverter stops. When the inverter stops caused by Stop command or fault, it can record the time that it has undergone in the current stage. After receiving Run command, it will run at the preset frequency of the stage for the remaining time of the stage

2： Start from the frequency where it stops:

When the inverter stops caused by Stop command or fault, it can record both the time it has undergone in the current stage and the very frequency when the inverter stops. It will pick up the recorded frequency and run for the remaining time of the stage.

Hundred’s place of FD.00: Save PLC state after poweroff:

0: not save

The PLC state will not be saved when poweroff, and the inverter will start from the first stage after powerup.

1: save

The PLC state, including the stage, frequency, run time will be saved when poweroff and the inverter will start according to the setting of ten's place of FD.00 after powerup.

Thousand's place: Selection of time unit:

0: Second

1: Minute

This unit is only valid for defining the PLC operating time. The unit of Acc/Dec time in PLC operation is determined by F9.23.

FD.01 Stage 1 setting	Range：000～323【000】
FD.02 Stage 1 run time	Range：0～6500s（min）【20.0s】
FD.03 Stage 2 setting	Range：000～323【000】
FD.04 Stage 2 run time	Range：0～6500s（min）【20.0s】
FD.05 Stage 3 setting	Range：000～323【000】
FD.06 Stage 3 run time	Range：0～6500s（min）【20.0s】
FD.07 Stage 4 setting	Range：000～323【000】
FD.08 Stage 4 run time	Range：0～6500s（min）【20.0s】
FD.09~FD.30 Reserved	Reserved

FD.01、FD.03、FD.05、FD.07 are to set frequency, direction, Acc/Dec time of PLC stages. See Figure 6-74:

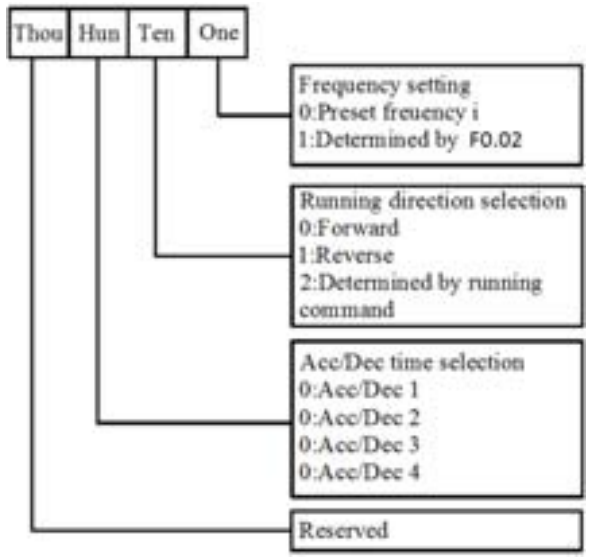


Figure 6-74 PLC Stage i setting（i=1～7）

One's place:

0: select MS frequency i, e.g. i=3, means the frequency forstage 3 is MS frequency 3, see F8.00~F8.06.

1: the frequency is determined by F0.02

6. 15 Constant-pressure water supply (FE)

FE.00~ FE.20 Reserved	Reserved

6. 16 Protection（FL）

FL.00 Motor overload protection	Range：0、1、2【1】

0：Disabled

The overload protection is disabled. Be careful to use this function because the inverter will not protect the motor in case of overload;

1：Common motor (with low speed compensation)

Since cooling conditions of common motor deteriorates at low speed, the motor's thermal protection threshold should also be adjusted. The "Low Speed" here refers to the operating frequency lower than 30Hz.

2：Variable frequency motor (without low speed compensation)

The cooling effect of variable frequency motor is not affected by the motor's speed, so low speed compensation is not necessary.

FL.01 Motor overload protection factor	Range：20.0～110.0%【100.0%】

In order to apply effective overload protection to different kinds of motors, the Max output current of the inverter should be adjusted as shown in Figure 6-75.

The efficient is calculated by the formula below:

$$\text{Motor overload protection coefficient} = \frac{\text{motor rated current}}{\text{inverter's rated output current}} \times 100\%$$

Generally, the Max load current is the motor's rated current.

FL.02 Stall overvoltage	Range：0、1【1】
FL.03 Stall overvoltage point	Range：Depending on model

0：Disabled

1：Enabled

The setting of FL.03 is given in the table below:

Model	Range	Default
380V	120.0%～150.0%	140.0%
220V	110.0%～130.0%	120.0%

When the inverter is decelerating, the motor's decreasing rate may be lower than that of the inverter's output frequency due to the inertia of load. At this time, the motor will feed the energy back to the inverter, resulting in voltage rise on the inverter's DC bus, which will cause overvoltage trip.

Function of FL.03: during the deceleration, the inverter detects the bus voltage and compares it with the stall over voltage point defined by FL.03. If the bus voltage exceeds FL.03, the inverter will stop reducing its output frequency. When the detected bus voltage is lower than the point, the deceleration will continue. Please refer to in Figure 6-76.

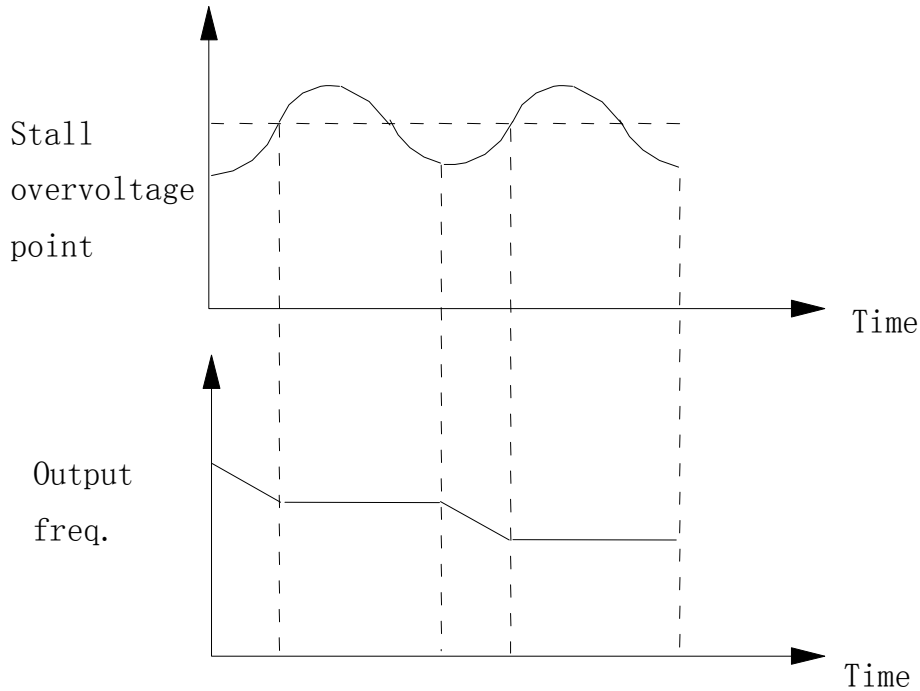


Figure 6-76 Stall Overvoltage

FL.04~ FL.06 Reserved	Reserved
FL.07 Auto current limiting threshold	Range：20~200% 【160%】
FL.08 Reserved	Reserved
FL.09 Action mode of auto current limiting	Range：0～5【5】

Auto current limiting function is used to limit the load current under the preset current in real time to avoid trip due to over-current. This function is especially useful for the applications of larger load inertia or sharp change of load.

FL.07 defines the threshold for current limiting. Its setting is a percentage of inverter's rated current.

The action mode of auto current limiting function is decided by FL.09.

FL.09＝0: When running in constant speed, auto current limit is invalid

FL.09＝1: When running in constant speed, auto current limit is valid

FL.09＝2: Auto current limit is valid all the time (mode 1)

FL.09＝3: Reserved

FL.09＝4: Reserved

FL.09＝5: Auto current limit is valid all the time (mode 2)

Because the output frequency might change during current limiting, the function should be used for applications that require constant speed and stable frequency output.

FL.10~ FL.13 Reserved	Reserved
FL.14 Fault type of the first two times	Range：0～29【0】
FL.15 Fault type of the previous time	Range：0～29【0】
FL.16 Fault type of the last time	Range：0～29【0】
FL.17 Bus voltage at the last fault	Range：0～999V【0V】
FL.18 Output current at the last fault	Range：0～6553A【0.0A】
FL.19 Freq. at the last fault	Range：0.00～650.00Hz【0.00Hz】
FL.20 Heatsink 1 temperature at the last fault	Range：0.0～120.0℃【0℃】
FL.21Reserved	Reserved

SINUS VEGA has 29 kinds of alarms. It can memorize the types of 3 latest faults (FL.14~FL.16) , and the voltage, current and frequency (FL.17~FL.19) of the most recent fault.

See chapter 7 for the detailed introductions to the alarm.

6. 17 Operation Time and Temperature of Cooling Fan（FN）

If the accumulated operating time has amount to FN.00, the inverter will give out an indicating signal. Please refer to F6.00～F6.02.

FN.00	Preset operation time	Range：0～65.535kh【0】
FN.01	Total operation time	Range：0～65.535kh【0】
FN.02	Temperature of heatsink 1	Range：0～120℃【0】
FN.03	Reversed	Reversed

FN.01 is the total accumulated operating time from delivery till now.

FN.02 refers to the temperature of inverter module.

Display range：0～120℃；Accuracy：5％

6. 18 Protection of Parameters（FP）

FP.00 User password	Range：0000～9999【0000】

User’s password can prevent unauthorized persons from checking and modifying the parameters.

Set FP.00 to 0000 if the user’s password is not necessary.

If you want to set the user’s password, input a 4-digit number, press FUNC/DATA to confirm. If not pressing any key within 5 minutes, the password will become effective.

Changing the password:

Press PRG, input the old password, and then select FP.00 (at this time FP.00＝0000) , input new password and press FUNC/DATA to confirm. The password will become effective if not pressing any key within 5 minutes.

Note：

Please learn the password by heart.

FP.01 Write-in protection	Range：0～2【0】

FP.01 is to set the mode of write-in protection of parameters.

0: All parameters are allowed to be changed;;

1: No parameters can be changed except the F0.04 and FP.01;

2: No parameters can be changed except FP.01.

FP.02 Parameter initialization	Range：0～2【0】

0: disabled

1: clear fault record

Clear the contents of FL.14~FL.19.

2: restore to factory defaults

If FP.02 is set at 2, the parameters listed before FL.14 except F1.00 and F1.09will be restored to factory defaults.。

After the initialization, the parameter will change to 0 automatically.

FP.03~FP.06 Reserved	Reserved

6. 19 Factory Default（FU）

FU.00 User password	****

7 Troubleshooting

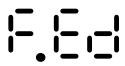
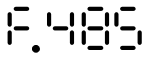
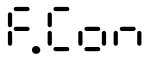
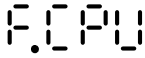
All the possible faults of SINUS VEGA have been given in Table 7-1. Fault code range is F.oC1～F.tU. You can user can check thefaults according to the following table and record detailed fault phenomena before seeking service. Please contact the salesdistributor when you need technical supports.

Table 7-1 Fault Information and Diagnosis

Fault code	Display code	Fault description	Possible reasons	Actions
F.oC1	F.oC 1	Over-current in Acc process	Too short Acc time	Prolong the Acc time
			V/F curve is not suitable	Check and adjust V/F curve, adjust torque boost or set the motor parameters correctly to ensure the normal auto torque boost works well.
			Low AC supply voltage	Check the inverter's input AC supply
			Moment of inertia of the load is too large, heavy impact load	Reduce the load of mutations,prolong the Acc time
			The rotating motor re-starts after the inverter stops instantly	Start when the motor absolutely stops
			Motor parameter setting is not normal	Properly set motor parameters
			Inverter power is too small	Select a higher power inverter
F.oC2	F.oC 2	Over-current in Dec process	Too short Dec time	Prolong the Dec time
			Load inertia is too high	Connect suitable braking device
			Too low inverter's power	Select the inverter with larger capacity
F.oC3	F.oC 3	Over-current in constant speed operation	Sudden change of load	Reduce the change of the load
			Too short Acc/Dec time	Prolong Acc/Dec time
			Abnormal load	Check the load

Fault code	Display code	Fault description	Possible reasons	Actions
			Low AC supply voltage	Check the AC supply voltage
			Too low inverter's power	Select the inverter with larger capacity
F.oU1	F.oU1	Over voltage in Acc process	Abnormal AC supply voltage	Check the AC supply voltage
			Too short Acc time	Prolong the Acc time
			The inverter is re-started with a rotating motor	Start when the motor stops
F.oU2	F.oU2	Over voltage in Dec process	Too short Dec time (with reference to generated energy)	Prolong the Dec time
			The load inertia is too high	Use suitable dynamic braking device
F.oU 3	F.oU3	Over voltage inconstant-speed operating process	Abnormal AC supply voltage	Check the AC supply voltage
			Too short Acc/Dec time	Prolong the Acc/Dec time
			Abnormal change of input voltage	Install input reactor
			Too high load inertia	Use suitable dynamic braking device
F.PoU	F.PoU	Reserved	Reserved	Reserved
F.IPL	F.IPL	Reserved	Reserved	Reserved
F.oPL	F.oPL	Output phase loss	Output phase failure among Phase U, V and W	Check the inverter's output wiring Check the cable and the motor
F.FAL	F.FAL	Inverter moduleprotection	Instant overcurrent	See User's manual
			Interphase shorted or groundshorted	Re-wiring
			Fan duct blockage or damage	Clear the fan duct or replace the fan
			Ambient temperature is too high	Lower the ambient temperature
			Panel wiring or plug-ins losse	Check and re-wiring

Fault code	Display code	Fault description	Possible reasons	Actions
			Output phase loss or some other reasons result in current waveform abnormalities	Check the wiring
			Charge voltage damaged, inverter voltage undervoltage	Seek service
			Straight bridge arm	Seek service
			Panel abnormal	Seek service
F.oH1	F.oH1	Inverter module heatsink overheat	Ambient over-temperature	Lower the ambient temperature
			Obstruction of ventilation channel	Clear the ventilation channel
			Fan does not work	Replace the fan
			Inverter fault	Seek service
F.oH2	F.oH2	Reserved	Reserved	Reserved
F.oL1	F.oL1	Inverter overload	Too short Acc time	Prolong Acc time
			Too large DC braking energy	Reduce DC braking current, prolong braking time
			Improper V/F curveV/F	Adjust V/F curve or torque boost value
			The inverter is re-started with a rotating motor	Start when the motor stops
			Low AC supply voltage	Check the AC supply voltage
			Too heavy load	Select the inverter with larger power
F.oL2	F.oL2	Motor Overload	Improper V/F curveV/F	Set V/F curve and torque boost value correctly
			Low AC supply voltage	Check the AC supply voltage
			Common moter operating at low speed, large load for long time	Select special motor for such operating condition
			Incorrect setting of motor overload protection factor	Correct the setting
			Motor blocked or load sudden change	Check the load

Fault code	Display code	Fault description	Possible reasons	Actions
F.Ed		Emergency stop or external equipment fails	Press STOP key when operating at non-keypad mode	Check the present operating mode
			Press STOP when the inverter is in stall status	Set the operating parameters correctly
			The inverter will report F.Ed fault if it is in stall status for 1 minute	Set the operating parameters correctly
			Terminal used for stopping the inverter in an emergency is closed	Disconnect the terminal if the external fault is cleared
F.EEP		EEPROM R/W fault	R/W fault of control parameters	Press STOP/RESET to reset
F.485		RS485 communication failure	Wrong baud rate setting	Set the baud rate correctly
			Serial port communication error	Press STOP/RESET to reset， Seek service
			Improper setting of alarm conditions	Modify FP.02、FP.03 and FFL.12
			Host FC does not work	Check whether the host FC is working or not; Check the wiring
F.Con		Reserved	Reserved	Reserved
F.Ct		Current detection circuit is faulty	Wires or connectors of control board are loose	Check and re-wire
			Auxiliary power supply is damaged	Seek service
			Current detection circuit fault	Seek service
F.CPU		System disturbance	Severe disturbance from outside	Press STOP/RESET to reset or install power filter at the input side of the inverter.
			DSP control board read and write error	Press STOP/RESET to reset Seek service

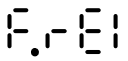
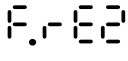
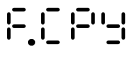
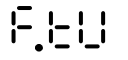
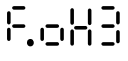
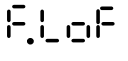
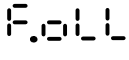
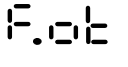
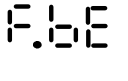
Fault code	Display code	Fault description	Possible reasons	Actions
F.rE 1		Reserved	Reserved	Reserved
F.rE 2		Reserved	Reserved	Reserved
F.CP y		Reserved	Reserved	Reserved
F.tU		Self-Tuning fault	Input motor parameters wrong	Re-input motor parameter according to the nameplate
			Tuning overtime	Check motor cables and limit it within 100m.
F.oH 3		Reserved	Reserved	Reserved
F.Lo F		PID feedback break line	Abnormal PID feedback siganal	Modify F7.29
			Alarm parameters setting inproperly	Check if PID wiring and feedback signal is normal
F.oL L		Reserved	Reserved	Reserved
F. ot		Reserved	Reserved	Reserved
F.bE		Reserved	Reserved	Reserved

Table 7-2 Operation Related Faults and Solutions

Phenomena	Conditions	Possible reasons of fault	Actions
No response of keys	Part of the keys or all the keys are disabled	Keypad locked	In stop or operating state, keep pressing FUNC/DATA key, when pressing ▼ key three times.
			Power off the inverter and then power on again
		Panel's cables are not well connected	Check the wiring
		Panel's keys are damaged	Replay operation panel or seek service
LED no display	No LED segmentilluminates	Not power on.	Power on
		Keypad cable reverse connected	Immediately remove the keypad and connect it again correctly. If the problem persists, please connect our technical support person.
Parameter setting cannot be changed	Cannot be changed during operating	Parameter modification property is ×"	Settings of parameters can be changed in stop status
	Settings of part of parameters cannot be changed.	Set FP.01 to 1 or 2	Set FP.01 to 0
		Parameter's modification property is *	The parameters cannot be changed by user
	No parameter but"0.0.0.0." is displayed when pressingPRG	User's password is required	Input correct user's password
			Seek service
Unexpected stops during running	The inverter stops automatically without STOP command. The RUN indicator goes out.	Alarm occurs	Find out the reason and reset.
		Single cycle of PLC finishes	Check PLC configuration
		Interruption of the communication between the inverter and host or flush mount faceplate	Check communication cables and FB.02, FB.03 settings
		Power failure	Check the power supply
		Command input method changed	Check the command input method and corresponding parameter
		Positive/negative logic of control terminal changed	Check F9.15.

Phenomena	Conditions	Possible reasons of fault	Actions
	The inverter stops automatically without STOP command. The RUN indicator is still on, zero-frequency running	Auto reset of fault	Check reason of fault and the auto reset function
		Simple PLC pause	Check PLC pause function (terminal)
		Interrupt signal feedback from external devices	Check the configuration of external interrupt and faulty external devices
		Reference frequency is 0	Check the reference frequency
		Skip frequency	Check skip frequency
		Positive logic, close loop feedback>reference frequency, Negative logic, close loop feedback<reference frequency	Check the close loop setting and feedback
		Frequency adjustment is set at 0	Check F9.05
		Restart low voltage compensation function enabled, and low supply voltage	Check the configuration of restart and the input voltage
Inverter does not work	The inverter does not work after pressing "RUN" key, and the operating indicator is distinguished.	Terminal of coast to stop is valid	Check the terminal of coast to stop
		Terminal of prohibit running is valid	Check this terminal
		Terminal of external stop is valid	Check this terminal
		Fixed length stop	Check the setting of fixed length or clear the actual length
		The operation control terminal is not closed under 3-wire control mode	Reset and close this terminal
		Faulty alarm	Clear the fault
		Host virtual terminal set incorrectly	Cancel this function or reset F9.15
		FWD/REV logic of input terminal is incorrectly	Check the set of F9.15

Phenomena	Conditions	Possible reasons of fault	Actions
Dispay LU upon power on	Thyristor or contactor is disconnected and the inverter's load is too large	As the thyristor orcontactor is closed, the bus voltage will reduce when the inverter's load is large, so that "LU" is displayed instead of "F.Con"	Operate the inverter after the thyristor or contactor are completely closed

8 Maintenance

Many factors such as ambient temperature, humidity, dust, vibration, internal component aging, and wear and tear will give rise to the occurrence of potential faults. Therefore, it is necessary to conduct routine maintenance to the inverters.

Note:

As safety precautions, before carrying out check and maintenance of the inverter, please ensure that:

The inverter has been switched off;

The charging LED lamp in the inverter is off, which can be seen after removing the cover.

8. 1 Routine Maintenance

The inverter must be operated in the environment specified in the Section 2.1. Besides, some unexpected accidents may occur during operation. The user should perform the routine maintenance to ensure a good operation environment according to the table below. A good way to prolong the lifetime of the inverter is to record the routine operation data, find out and clear faults in the early stage.

Table 8-1 Daily Checking Items

Object	Check		Criterion
	Items	Methods	
Environment	Temperature 、 humidity	Thermometer, hygrometer	-10°C ~+40°C. Derate if at 40°C ~50°C
	Dust, water and leakage	Observe	No sign of leakage
	Vibration	Vibration meter	Less than 5.9m/s2 (0.6g)
	Gas	Smell	No strange smell
Inverter	Heat	Touch the casing	Normal air flow
	Sound	Listen	No strange sound
	Output current	Clamp meter	Within rated range
	Output voltage	Voltage meter	Within rated range
Motor	Heat	Touch	No overheat
	Sound	Listen	No strange sound

8. 2 Periodic Maintenance

You should check the inverter every 3 months or 6 months according to the actual environment.

Note：

1. Only trained personnel can dismantle the inverters for repairing or device replacement;

2. Don't leave metal parts like screws or pads in the inverter, otherwise the equipment may be damaged.

8. 3 General Inspection:

1． Whether screws of control terminals are loose. If so, tighten them with a screwinverterr;

2． Whether the main circuit terminals are properly connected; whether the mains cables are over heated;；

3． Whether the power cables and control cables are damaged, check especially for any wear on the cable insulation;

4． Whether the insulating tapes around the cable lugs are stripped;

5． Clean the dust on FCBs and air ducts with a vacuum cleaner;

6． For inverters that have been stored for a long time, it must be powered on every 2 years. When supplying AC power to the inverter, use a voltage regulator to raise the input voltage to rated input voltage gradually. The inverter should be poweredfor 5 hours without driving a motor load.

7． Before performing insulation tests, all main circuit input/output terminals should be short-circuited with conductors. Then precede insulation test to the ground. Insulation test of single main circuit terminal to ground is prohibited; the inverter can be damaged by such a test. Please use a 500V Mega-Ohm-Meter.

8． If performing insulation test to the motor, be sure to disconnect the cables between the inverter and it. Otherwise, the inverter might be damaged.

Note:

Dielectric test of the inverter has already been done in the factory. It is not necessary for the user to do dielectric test again in order to avoid potential damage of its internal components.

8.4 Replacing Easily-worn Parts

The easily-worn parts of the inverter are cooling fan and electrolytic capacitor, whose life has close relation with the environment and maintenance. Refer to the table below.

Part	Life
Fan	30~40 thousand hours
Electrolytic capacitor	40~50 thousand hours
Relay TA/TB/TC	About 100,000 times

You can decide the time when the components should be replaced according to their service time.

1. Cooling fan

Possible cause of damages: wear of the bearing, aging of the fan vanes.

Criteria: After the inverter is switched off, check if an abnormal condition such as crack exists on fan vanes and other parts. When the inverter is switched on, check if inverter running is normal, and check if there is any abnormal vibration.

2. Electrolytic capacitors

Possible cause of damages: high ambient temperature, aging of electrolyte and large pulse current induced by rapid changing loads.

Criteria: Check if frequent over-current or over-voltage failures occur during inverter start-up with load. Check if there is any leakage of liquids (electrolytes) . Check if the safety valve protrudes. Measure static capacitance and insulation resistance.

3. Relay TA/TB/TC

Possible cause of damages: erosion, frequent operation.。

Criteria: ON/OFF malfunction.

8.5 Storing Inverters

The following points must be followed for the temporary and long-term storage of inverter:

1. Store in locations free of high temperature, humidity, dust, metal powder, and with good ventilation.

2. Long-term storage will cause the deterioration of electrolytic capacitors. Therefore, the inverter must be switched on for a test within 2 years, for at least 5 hours. The input 2 voltage must be applied gradually with a voltage regulator to the rated value.

8.6 Warranty

SANTERNOwill offer warranty service in the case of the following situations:

1. The warranty clause is confined only to the inverter;

2. SANTERNO will take the responsibility of 36 months defects liability period for any faults or damages under the normal operation conditions as of manufacture date. After 36 months, maintenance will be charged;

3． Even within 36 months, maintenance would be charged under the following conditions:

①.Damages incurred to the inverter due to mis-operations which are not in compliance with "User Manual";

②.Damages incurred to the inverter due to fire, flood, and abnormal voltage and so on;

③.Damages incurred to the inverter due to the improper use of inverter functions;

④.Service fee will be charged according to the actual costs. If there are any maintenance contracts, the contract prevails.

9 Parameter profiles

"○": Indicate the set value of the parameter can be changed when the inverter is in stop status or running status.

"×": Indicate the set value of the parameter cannot be changed when the inverter is in running status.

"*": It represents the value of this parameter is the actually measured value and cannot be changed.

"-": It indicates that the parameter is "Factory default parameter" set only by the manufacturer and forbidden for users to change.

"Address" is the address of MODBUS protocol register

F0 Group: Basic Function Parameters (total 15 items)						
Code	Name	Setting Scope	Min Unit	Defaulted Value	Address	Change
F0.00	Command channel	0:Keypad command channel 1:Termminal control 2:Serial communication port control	1	0	000H	○
F0.01	Reserved	-	-	-	001H	*
F0.02	Frequency source setting	0: Digital setting 1 (Up/Down key) 1: Digital setting 2 (Terminal UP/DN) 2: Digital setting3 Serial communication port 3: Reserved 4: AI setting 5: Reserved 6: Keypad potentionmeter setting	1	0	002H	○

F0 Group：Basic Function Parameters（ total 15 items）						
Code	Name	Setting Scope	Min Unit	Defaulted Value	Address	Change
F0.03	Auxiliaryreference frequency	0：Invalid 1： Digital setting,up/down key（Initial value F0.05） 2：Digital setting，terminal UP/DN （ Initial value F0.05） 3：Serial port setting（Initial value F0.05） 4：Reserved 5：AI 6：Reserved 7：Reserved 8：-AI 9：Reserved 10：Reserved 11：AI-5v 12：Reserved 13：Panel potentionmeter setting	1	0	003H	○
F0.04	Keypad digital setting	Low limit frequency ～ upper limit frequency	0.01Hz	50.00Hz	004H	○
F0.05	Digital auxiliary frequency	0.0～650.00Hz	0.01Hz	0.00Hz	005H	○
F0.06	Base frequency	0.0～650.00Hz	0.01Hz	50.00Hz	006H	×
F0.07	Upper limit of freq.	Low limit freqenc～Max output frequency	0.01Hz	50.00Hz	007H	×
F0.08	Lowerlimit of freq.	0.00Hz~upper limit frequency	0.01Hz	0.00Hz	008H	×

F0 Group：Basic Function Parameters（ total 15 items）						
Code	Name	Setting Scope	Min Unit	Defaulted Value	Address	Change
F0.09	Max output frequency	upper limit frequency ~ 650.00Hz	0.01Hz	50.00Hz	009H	×
F0.10	Max output voltage	1～480V	1V	Rated	00AH	×
F0.11	Running direction	0：Forward 1：Revserse	1	0	00BH	○
F0.12	Acc time 1	0.1～3600s	0.1s	6s	00CH	○
F0.13	Dec time 1	0.1～3600s	0.1s	6s	00DH	○
F0.14	Reserved	-	-	-	00EH	*

F1 GROUP：Motor Parameter（total 11 items）						
Code	Name	Setting Scope	Min Unit	Defaulted Value	Address	Change
F1.00	Reserved	-	-	-	100H	*
F1.01	Motor poles	2～14	2	4	101H	×
F1.02	Rated power	0.4～1000kW	0.1KW	Power determination	102H	×
F1.03	Rated current	0.1～6553A	0.1A	Power determination	103H	×
F1.04	Current without load	0.1～6553A	0.1A	Power determination	104H	×
F1.05	Stator resistance	0.0～50.00%	0.01%	Power determination	105H	○
F1.06	Leakage inductance	0.0～50.00%	0.01%	Power determination	106H	○
F1.07	Rotor resistance	0.0～50.00%	0.01%	Power determination	107H	○
F1.08	Mutual inductance	0.0～2000.00%	0.1%	Power determination	108H	○

F1 GROUP：Motor Parameter（total 11 items）						
Code	Name	Setting Scope	Min Unit	Defaulted Value	Address	Change
F1.09	Rated slip frequency	0.00～20.00Hz	0.01Hz	0Hz	109H	○
F1.10	Auto tuning	0: Auto tuning disable 1: Stationary auto tuning 2: Rotating auto tuning	1	0	10AH	×

F2 Group：Start/Stop Parameter（Total 15 items）						
Code	Name	Setting Scope	Min Unit	Defaulted Value	Address	Change
F2.00	Reserved	-	-	-	200H	*
F2.01	Start frequency	0.20～60.00Hz	0.01Hz	0.5Hz	201H	○
F2.02	Start frequency hold time	0.0～10.0s	0.1s	0.0s	202H	○
F2.03 ~ F2.07	Reserved	-	-	-	203H~ 207H	*
F2.08	Stop modes	0：Decelerate to stop 1：Coast to stop 2：Deceleration + DC braking	1	0	208H	×
F2.09	Frequency threshold of DC braking	0.00～60.00Hz	0.01Hz	1.00Hz	209H	○
F2.10	DC brake delay time	0.00～10.00s	0.01s	0.00s	20AH	○
F2.11	DC Brake current	0.0 ～ 150.0% Inverter rated current	0.1%	120.0%	20BH	○

F2 Group：Start/Stop Parameter（Total 15 items）						
Code	Name	Setting Scope	Min Unit	Defaulted Value	Address	Change
F2.12	DC Brake time at stop	0.0s No action； 0.1～60.0s Action	0.1s	0.5s	20CH	○
F2.13	Dynamic braking	0：Disabled 1：Enable	1	0	20DH	×
F2.14	Reserved	-	-	-	20EH	*

F3 GROUP：Magnetic Flux Vector Control Parameters（toal 15 items）						
Code	Name	Setting Scope	Min Unit	Defaulted Value	Address	Change
F3.00	Reserved	-	-	-	300H	*
F3.01	V/F freq F3	F3.03～F0.06	0.01Hz	0.00Hz	301H	×
F3.02	V/F voltage V3	F3.04～100%	0.1%	0.0%	302H	×
F3.03	V/F freq F2	F3.05～F3.01	0.01Hz	0.00Hz	303H	×
F3.04	V/F voltage V2	F3.06～F3.02	0.1%	0.0%	304H	×
F3.05	V/F freq F1	0.00～F3.03	0.01Hz	0.00Hz	305H	×
F3.06	V/F voltage V1	0～F3.04	0.1%	0.0%	306H	×
F3.07	Torque boost	0.0%～30.0%	0.1%	2.0%	307H	○
F3.08	Manual torque boost cutoff point	0.0%～50.0%	0.1%	10%	308H	○
F3.09 ～ F3.10	Reserved	-	-	-	309H ～ 30AH	*
F3.11	Compensation time	0.1～25.0s	0.1s	0.1s	30BH	×

F3 GROUP：Magnetic Flux Vector Control Parameters（toal 15 items）						
Code	Name	Setting Scope	Min Unit	Defaulted Value	Address	Change
F3.12	AVR function	0：null 1：Effect all long 2：Null only deceleration	1	0	30DH	×
F3.13	Reserved	-	-	-	30EH	*
F3.14	Motor stabilization factor	0～255	1	Power determination	30FH	○

F4 GROUP：Reserved Parameter（toal 1）						
Code	Name	Setting Scope	Min Unit	Defaulted Value	Address	Change
F4.00~ F4.10	Reserved	-	-	-	400H~ 40AH	*

F5 GROUP：Multi-function terminal（Total 22）						
Code	Name	Setting Scope	Min Unit	Defaulted Value	Address	Change
F5.00	Function of multi-function terminal X1	0：non-function 1：Forward run 2：Reverse run 3：MS frequency1 4：MS frequency2 5：MS frequency3 6：External fault normally open input 7：External fault normally closed input	1	1	500H	×
F5.01	Function of multi-function terminal X2		1	2	501H	×

F5 GROUP：Multi-function terminal（Total 22）						
Code	Name	Setting Scope	Min Unit	Defaulted Value	Address	Change
F5.02	Function of multi-function terminal X3	8：Failure reset input 9：Forwardjog 10：Reversejog 11：Coast to stop input 12：Frequency increasing input 13：Frequency decreasing input 14：PLC operation pause 15：Acc/Dec prohibit 16：3-wire operation control	1	0	502H	×
F5.03	Function of multi-function terminal X4		1	0	503H	×
F5.04	Function of multi-function terminal X5	17：External interrupt normally open input 18：External interruption normally closed input 19：DC injection braking input 20：Closeloop fairlure input 21：PLC failure input 22：Frequencysetting method 1 23：Frequencysetting method 2 24：Frequencysetting method3 25：Reserved 26：MS frequency 4 27：Terminal control mode is forciblyenabled 28：Control mode 1 29：Control mode 2 30-34：Reserved 35：External stop command 36：Reserved 37：Inverter operation prohibition 38-39：Reserved 40：Clear auxiliary reference frequency	1	0	504H	×

F5 GROUP：Multi-function terminal（Total 22）						
Code	Name	Setting Scope	Min Unit	Defaulted Value	Address	Change
F5.04	Function of multi-function terminal X5	41：Reset PLC Stop status 42：Clear counter's record 43：Signal of triggering counter 44-45：Reserved	1	0	504H	×
F5.05~ F5.07	Reserved	-	-	-	505H~ 507H	*
F5.08	Terminal control mode	0：Two lines 1 1：Two lines 2 2: Three lines 1 3：Three lines 2	1	0	508H	×
F5.09~ F5.11	Reserved	-	-	-	509H~ 50BH	*
F5.12	Filter constant	0.01～50.00	0.01 s	0.50s	50CH	○
F5.13	Reserved	-	-	-	50DH	○
F5.14	Ratio of Min. input of curve1	0.0%～F5.16（Min given value 1/benchmark value 10V/20mA/F5.13）	0.1 %	2.0%	50EH	○
F5.15	Frequency corresponds to min. input of curve1	0.00～F0.09	1	0.00Hz	50FH	○
F5.16	Ratio of Max. input of curve 1	F5.14 ～ 100.0%（Max given 1/benchmark value 10V/20mA/F5.13）	0.1 %	100.0 %	510H	○
F5.17	Frequency corresponds to max. input of curve1	0.00～F0.09	1	50.00 Hz	511H	○
F5.18~ F5.21	Reserved	-	-	-	512H~ 515H	*

F6 Group：Output Terminal Control Parameter（total 18）						
Code	Name	Setting Scope	Min Unit	Defaulted Value	Address	Change
F6.00	Open collector output terminal Y1	0：Inverter Run Signal（RUN） 1：Frequency arrive signal（FAR） 2：Frequency detection threshold（FDT1） 3-4：Reserved 5：Undervoltage lock-up signal（LU） 6：External stop command（EXT） 7：Higher limit of frequency（FHL） 8：Lower limit of frequency（FLL） 9：Zero speed running 10：Completion of simple PLC operation 11：PLC cycle completion indication 12：Preset couting value arrival 13：Specified counting value arrival 14：Inverter run status 15：Inverteris ready(RDY) 16：Inverterfails 17：Extended function1 of host 18：Reserved 19：Preset operation time out 20：Reserved	1	0	600H	×
F6.01	Reserved		-	-	601H	*
F6.02	Relay 1 output function		1	16	602H	×
F6.03	Reserved		-	-	603H	*

F6 Group：Output Terminal Control Parameter（total 18）						
Code	Name	Setting Scope	Min Unit	Defaulted Value	Address	Change
F6.04	AO output function	0：Output frequency before slip compensation（0～Max Output frequency） 1：Output frequency after slip compensation（0～Max Output frequency） 2：Set frequency（0～Max Output frequency） 3：Output current（0～2 times of rated current of Inverter） 4：Output current（0～2 times of rated current of motor） 5：Output torque（0～2 times of rated torque of motor） 6：Output voltage（0～1.2times of rated voltage of Inverter） 7：Bus votlage（0～800V） 8：Reserved 9：AI（0～10V/0～20mA） 10：Output power（0～2 times of rated power） 11：Extended function2 of host（0～65535） 12：Setting of potentionmeter（0~10V）	1	0	604H	○
F6.05~F6.06	Reserved	-	-	-	605H~606H	*

F6 Group：Output Terminal Control Parameter（total 18）						
Code	Name	Setting Scope	Min Unit	Defaulted Value	Address	Change
F6.07	Analog output range	LED Units：AO offset choice 0：0～10V or 0～20mA 1：2～10V or 4～20mA	1	00	607H	○
F6.08	AO output gain	0.0～200.0%	0.1%	100.0%	608H	○
F6.09~F6.10	Reserved	-	-	-	609H~60AH	*
F6.11	Preset counting value	F6.12～65535	1	0	60BH	○
F6.12	Specified counting value	0-F6.11	1	0	60CH	*
F6.13	Freq arrival detection range(FAR)	0.00～650.0Hz	0.01Hz	2.50Hz	60DH	○
F6.14	FDT1 level	0.00～650.0Hz	0.01Hz	50.00Hz	60EH	○
F6.15	FDT1 lag	0.00～650.0Hz	0.01Hz	1.00Hz	60FH	○
F6.16~F6.17	Reserved	-	-	-	610~611H	*

F7 Group：Process Closloop PID Parameters（Toal 34）						
Code	Name	Setting Scope	Min Unit	Defaulted Value	Address	Change
F7.00	Close-loop PID control	0：Non Closeloop PID control run 1：Closeloop PID control run	1	0	700H	×
F7.01	Reference input method	0:Digital setting(F7.05 value) 1：Reserved 2：Reserved 3: LED keypad potentiometer given 4：Reserved	1	0	701H	○
F7.02	Reserved	-	-	-	702H	*
F7.03	Input filter	0.01～50.00s	0.01s	0.5s	703H	○
F7.04	Feedback filter	0.01～50.00s	0.01s	0.5s	704H	○
F7.05	Digital referenceinput	0.00～10.00V	0.01	0.00	705H	○
F7.06	Reserved	-	-	-	706H	*
F7.07	Reserved	-	-	-	707H	*
F7.08	Min input	0.0%～F7.10	0.1%	0.0	708H	○
F7.09	Feedback of Min input	0.0～100.0%	0.1%	0.0%	709H	○
F7.10	Max input	F7.08～100.0%	0.1%	100.0%	70AH	○
F7.11	Feedback of Max input	0.0～100.0%	0.1%	100.0%	70BH	○
F7.12	Proportional gain Kp	0.000～9.999	0.001	0.050	70CH	○
F7.13	Integral gain Ki	0.000～9.999	0.001	0.050	70DH	○
F7.14	Sampling cycle Ts	0.01～50.00s	0.01s	0.50s	70EH	○
F7.15	Error limit	0.0～20.0%	0.1%	2.0%	70FH	○
F7.16	Closed-loop regulation characteristics	0：Positive logic 1：Negative logic	1	0	710H	×

F7 Group：Process Closloop PID Parameters（Toal 34）						
Code	Name	Setting Scope	Min Unit	Defaulted Value	Address	Change
F7.17~ F7.28	Reserved	-	-	-	711H~ 71CH	*
F7.29	PID Feedback break line detection	0.0～80.0%	0.1%	0.0%	71DH	×
F7.30	PID Feedback break line detection time	0～999.9s	1s	0.0s	71EH	×
F7.31~ F7.33	Reserved	-	-	-	71FH ~721H	*

F8 GROUP：Multi Parameters（ total 21）						
Code	Name	Setting Scope	Min Unit	Defaulted Value	Address	Change
F8.00	MS freq 1	Low limit frequency ～ Upper limit ferquency	0.01Hz	5.00Hz	800H	○
F8.01	MS freq 2			10.00Hz	801H	
F8.02	MS freq 3			20.00Hz	802H	
F8.03	MS freq 4			30.00Hz	803H	
F8.04	MS freq 5			40.00Hz	804H	
F8.05	MS freq 6			45.00Hz	805H	
F8.06	MS freq 7			50.00Hz	806H	
F8.07	MS freq 8	Low limit frequency ～ Upper limit ferquency	0.01Hz	50.00Hz	807H	○
F8.08	MS freq 9				808H	
F8.09	MS freq 10				809H	
F8.10	MS freq 11				80AH	
F8.11	MS freq 12				80BH	
F8.12	MS freq 13				80CH	
F8.13	MS freq 14				80DH	

F8 GROUP：Multi Parameters（ total 21）						
Code	Name	Setting Scope	Min Unit	Defaulted Value	Address	Change
F8.14	MS freq 15				80EH	
F8.15~ F8.20	Reserved	-	-	-	80FH~ 814H	*

F9 GROUP：Enhanced Funtion Parameters（total 51）						
Code	Name	Setting Scope	Min Unit	Defaulted Value	Address	Change
F9.00~ F9.01	Reserved	-	-	-	900H~ 901H	*
F9.02	Carrier wave frequency	0.7 kHz～15.0kHz	0.1kHz	6.0kHz	902H	×
F9.03	CWF auto adjustment	0：no action 1：action	0	0	903H	×
F9.04	Reserved	-	-	-	~ 904H	*
F9.05	Jog frequency	0.10 Hz～F0.07	0.01Hz	5.00Hz	905H	○
F9.06	Reserved	-	-	-	906H	*
F9.07	Jog Acc time	0.1～60.0s	0.1	6s	907H	○
F9.08	Jog Dec time	0.1～60.0s	0.1	6s	908H	○
F9.09~ F9.14	Reserved	-	-	-	909H~ 90EH	*
F9.15	Positvie or negative logic of terminal	LED Units： Bit0～Bit3: X1～X4 LED Tens： Bit0：X5 Bit1～Bit3: Reserved LED Hundreds： Bit0 ～ Bit3: Reserved, Reserved,Y1, Reserved LED Thousands： Reserved BIT Settings: 0: Valid when X and common connected, disconnect is invalid; 1: Invalid when X and common connected, disconnect is valid;	1	000	90FH	○
F9.16~ F9.17	Reserved	-	-	-	910H~ 911H	*

F9 GROUP：Enhanced Funtion Parameters（total 51）						
Code	Name	Setting Scope	Min Unit	Defaulted Value	Address	Change
F9.18	Digital auxiliary reference control	LED Units：Storage control 0：power failure storage auxiliary frequency 1：power failure no storage auxiliary frequency LED Tens：Halt frequency control 0：Maintain auxiliary frequency after halt 1：Reset frequency after halt LED Hundreds：Auxiliary given superposition polarity	1	000	912H	○
F9.18	Digital auxiliary reference control	0：Positive polarity 1：Negative polarity	1	000	912H	○
F9.19~F9.21	Reserved	-	-	-	913H~915H	*
F9.22	Cooling fan	0：automatic run 1：run when power on	1	0	916H	×
F9.23~F9.29	Reserved	-	-	-	917H~91DH	*
F9.30	Conditions of restart after power failure	0：invalid 1：valid	1	0	91EH	×
F9.31~F9.33	Reserved	-	-	-	91FH~921H	*
F9.34	Terminal filter time	0.5~100.0ms	0.1 ms	7.5 ms	922H	×

F9 GROUP：Enhanced Funtion Parameters（total 51）						
Code	Name	Setting Scope	Min Unit	Defaulted Value	Address	Change
F9.35	Current count value	0～65535	1	0	923H	○
F9.36	Under-voltage setting	75.0%～135.0%	0.1%	90.0%	924H	×
F9.37~ F9.42	Reserved	-	-	-	925H~ 92AH	*
F9.43	PWM model optimization	**LED Units：** Carrier selection 0：Set the carrier 1：Default carrier **LED Tens：** Carrier force 0：No force 1：Force **LED Hundreds：** Modulation mode 0 ： Fiveections/seven sectionsutomatic swich 1：Five sections 2：seven sections **LED Thousands：** Quick AVR 0：Close 1、Open Note: 0：No display 1：Display	1	0011	92BH	×
F9.44~ F9.50	Reserved	-	-	-	92CH~ 932H	*

FA display Parameters（total 7）						
Code	Name	Setting Scope	Min Unit	Defaulted Value	Address	Change
FA.00	LED displayed parameter selection 1	Binary set： 0：No displaying 1：Displaying LED Units： Bit0：Output frequency(before compensation,Hz) Bit1：Output frequency (after compensation,Hz) Bit2：Setting frequency(Hz blink) Bit3：Output current(A) LED Tens： Bit0：Run speed(RPM) Bit1：Setting speed(RPM) Bit2：Reserved Bit3：Reserved LED Hundreds： Bit0：Output power Bit1：Output torque（%）	1	00D	A00H	○
FA01	LED displayed parameter selection 2	Binary set： 0：No Display 1：Display LED Units： Bit0：Output voltage(V) Bit1：Barbus voltage Bit2：Reserved Bit3：AI(V) LED Tens： Bit0：Analog closeloop feedback (%) Bit1：Analog closeloop setting(%) Bit2：External count Bit3：Terminal state LED Hundreds： Bit0：Reserved Bit1：Setting pressure	1	000	A01H	○

FA display Parameters（total 7）						
Code	Name	Setting Scope	Min Unit	Defaulted Value	Address	Change
FA.02	Displayed parameter at stop state	Binary set： 0：No display 1：Display LED Units： Bit0：Set frequency (Hz) Bit1：External count Bit2：RUN SPEED (RPM) Bit3：Set speed (RPM) LED Tens： Bit0：Reserved Bit1：Reserved Bit2：Reserved Bit3：AI(V) LED Hundreds： Bit0：Analog closeloop feedback (%) Bit1：Analog closeloop setting (%) Bit2：Reserved Bit3：Reserved LED Thousands： Bit0：Terminal status Bit1：Barbus voltage	1	2001	A02H	○
FA.03~FA.06	Reserved	-	-	-	A03H~A06H	*

FB：Communication Parameters（total 6）						
Code	Name	Setting Scope	Min Unit	Defaulted Value	Address	Change
FB.00	Communication configuration	LED Units：Baud rate selection 0：1200bps 1：2400bps 2：4800bps 3：9600bps 4：19200bps 5：38400bps	1	4	B00H	×

FB：Communication Parameters（total 6）						
Code	Name	Setting Scope	Min Unit	Defaulted Value	Address	Change
FB.00	Communication configuration	LED Tens：Data format 0：1-8-2-N format，RTU 1：1-8-1-E format，RTU 2：1-8-1-O format，RTU LED Hundreds：Virtual input terminals 0：Invalid 1：Valid	1	4	B00H	×
FB.01	Local address	0～247，0 is broadcast address	1	1	B01H	×
FB.02	Communication timeout detect	0.0～1000s Don't inspect is beyond time at 0	0.1	0.0s	B02H	×
FB.03	Response delay	0～1000ms	1	5ms	B03H	×
FB.04	Master-slave selection	0：Slave machine 1：Master machine	1	0	B04H	×
FB.05	Ratio of slave inverter setting frequency	0.0~10.00	0.01	1.00	B05H	×

FC：Professional function parameters 1（total 15）						
Code	Name	Setting Scope	Min Unit	Defaulted Value	Address	Change
FC.00~FC.14	Reserved	-	-	0	C00H~C0EH	*

FD Group：Professional function parameters 2（total 31）						
Code	Name	Setting Scope	Min Unit	Defaulted Value	Address	Change
FD.00	Simple PLC mode	LED Units：PLC run mode 0：no-action 1：Stop after ending single running 2：keep the final value when single running ends 3：Continuous circulation LED Tens：Start mode 0：Run from the first stage 1：Continue to run from stage frequency of the break time 2：Continue to run from run frequency of the break time LED Hundreds：Power failure storage 0：No memery 1：Memery LED Thousands：Select the unit of stage time 0：Second 1：Minute	1	0000	D00H	×
FD.01	Stage 1 setting	LEDUnits： 0：Select mulit frequency 1 (F8.00) 1：Frequnecy depends on thefunction code of F0.02 LED Tens： 0：Forward 1：Reverse 2：Subject to run command	1	00	D01H	○
FD.02	Stage 1 run time	0.0~6500 s(min)	0.1	20.0s	D02H	○

FD Group：Professional function parameters 2（total 31）						
Code	Name	Setting Scope	Min Unit	Defaulted Value	Address	Change
FD.03	Stage 2 setting	LED Units： 0：Select mulit frequency 2(F8.01) 1：Frequnecy depends on thefunction code of F0.02 LEDTens： 0：Forward 1：Reverse 2：Subject to run command	1	00	D03H	○
FD.04	Stage 2 run time	0.0~6500 s(min)	0.1	20.0s	D04H	○
FD.05	Stage 3 setting	LEDUnits： 0：Select mulit frequency 3(F8.02) 1：Frequnecy depends on thefunction code of F0.02 LEDTens： 0：Forward 1：Reverse 2：Subject to run command	1	00	D05H	○
FD.06	Stage 3 run time	0.0~6500 s(min)	0.1	20.0s	D06H	○
FD.07	Stage 4 setting	LEDUnits： 0：Select mulit frequency 4(F8.03) 1：Frequnecy depends on thefunction code of F0.02 LEDTens： 0：Forward 1：Reverse 2：Subject to run command	1	00	D07H	○

FD Group：Professional function parameters 2（total 31）						
Code	Name	Setting Scope	Min Unit	Defaulted Value	Address	Change
FD.08	Stage 4 run time	0.0~6500 s(min)	0.1	20.0s	D08H	○
FD.09~ FD.30	Reserved	-	-	-	D09H~ D1EH	*

FE GROUP Reserves 21 parameters

FL Group：Fault Protection Parameters（ total 22）						
Code	Name	Setting Scope	Min Unit	Defaulted Value	Address	Change
FL.00	Motor overload protection	0：Disable 1：Common motor（low speed compensation） 2：Varible frequency motor（No low speed compensation）	1	1	1100H	×
FL.01	Motor overload protection factor	20.0～110%	0.1%	100.0%	1101H	×
FL.02	Stall overvolage	0：Disable 1：Enable	1	1	1102H	×
FL.03	Stall overvoltage point	110.0～150.0%	0.1%	140.0%	1103H	×
FL.04~ FL.06	Reserved	-	-	-	1104H ~ 1106H	*
FL.07	Automatic current limit threshold	20.0～200.0%	0.1%	160.0%	1107H	×
FL.08	Reserved	-	-	-	1108H	*

FL Group：Fault Protection Parameters（ total 22）						
Code	Name	Setting Scope	Min Unit	Defaulted Value	Address	Change
FL.09	Action mode of autocurrent limit	0：Constant speed invalid 1：Constant speed effective 2：Automatic current limit valid in run state 1 3：Reserved 4：Reserved 5: Automatic current limit valid in run state 2	1	5	1109H	×
FL.10~ FL.13	Reserved	-	-	-	110AH ~110DH	*
FL.14	Fault type of the first two time	0：No abnormal records 1：Overcurrent run at acceleration (F.oC1) 2：Overcurrent run at deceleration (F.oC2) 3：Overcurrent run at constant speed(F.oC3) 4：Overvoltage run at acceleration (F.oU1) 5：Overvoltage run at deceleration (F.oU2) 6：Overvoltage run at constant speed (F.oU3) 7：Overvoltage at control voltage (F.PoU) 8：Reserved 9：Phaseloss at outpput (F.oPL)	1	0	110EH	*
FL.15	Fault type of the previoustime		1	0	110EH	*

FL Group：Fault Protection Parameters（ total 22）						
Code	Name	Setting Scope	Min Unit	Defaulted Value	Address	Change
FL.16	Fault type of the lasttime	10：Power module protection (F.FAL) 11：Overheat on heatsink 1 (F.oH1) 12：Reserved 13：Overload on Inverter (F.oL1) 14：Overload on motors (F.oL2) 15：External fault(F.Ed) 16：EEPROM read-write error (F.EEP) 17：Serialport communication abnormal (F.485) 18：Reserve 19：Abnormal circuit/ currentin spection (F.Ct) Hall or amplifying circuit 20：System interference（F.CPU） 21：Reserve 22：Reserve 23：Reserve 24：Abnormal auto tuning（F.tU） 25: Reserve 26：feedback off line（F.LoF） 27：Reserve 28：Reserve 29：Reserve	1	0	110FH	*

FL Group：Fault Protection Parameters（ total 22）						
Code	Name	Setting Scope	Min Unit	Defaulted Value	Address	Change
FL.17	Bus volage at the last fault	0～6553V	1V	0V	1111H	*
FL.18	Output current at the last fault	0.0～6553A	0.1A	0.0A	1112H	*
FL.19	Freq at the last fault	0.00Hz~650.0Hz	0.01Hz	0.00Hz	1113H	*
FL.20	Heatsink 1 temperature at the last fault	0.0～120.0℃	0.1	0℃	1114H	*
FL.21	Reserved	-	-	-	1115H	*

FN Group： Parameter Protection（total 4）						
Code	Name	Setting Scope	Min Unit	Defaulted Value	Address	Change
FN.00	Preset operation time	0～65.535 kHour	0.001kHour	0	1200H	○
FN.01	Total operation time	0～65.535 kHourh	0.001kHour	0	1201H	*
FN.02	Temperature of heatsink 1	0.0～120.0℃	0.1	0℃	1202H	*
FN.03	Reserved	-	-	-	1203H	*

FP Group：Parameter Protection（Total 7）						
Code	Name	Setting Scope	Min Unit	Defaulted Value	Address	Change
FP.00	User password	0000～9999	0	0000	1300H	○
FP.01	Write-in protection	0：All parameters allow to revise 1：Only frequency and the function code can be revised. 2：Only the function code can be revised.	1	0	1301H	○
FP.02	Parameter initialization	0：No action 1：Eliminate malfunction records（FL.14～FL.19） 2：Restore factory parameters	1	0	1302H	×
FP.03～FP.06	Reserved	-	-	-	1303H～1306H	*

FU Group： Factory Function Parameter						
Code	Name	Setting Scope	Min Unit	Defaulted Value	Address	Change
FU.00	Password	****	1	Factory setting	1400H	-

10 Communication Protocal

10.1 Communication Mode

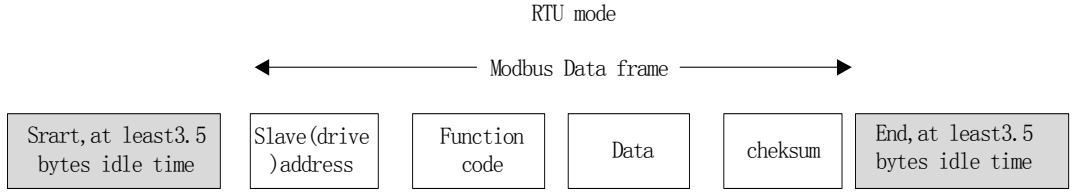
1. Inverter communication protocol is Modbus protocol, and supports the common register read and write。

2. Drive as a slave, master-slave point to point communication. A Master drive uses broadcast address to send a command, the slave does not answer.

3. In the case of long distance or multi-machine communication, we recommend to connect the the master station signal GND with the drive signal "GND", in order to improve the communication of immunity

10.2 Protocol Format

Modbus protocol supports RTU mode, the corresponding frame format is as follows,



Modbus adopts "Big Endian" encoding,firstly transmitting high byte, then low byte。

RTU Mode：In RTU mode, idle time between frames will take the higher one among Modbus internal conventional values and function code setting values. The conventional Min idle frames inside Modbus is as follows: The idle time passed the bus by the header and trailer is not less than 3.5 byte time.

Data verification uses CRC-16. The entire information participates in

verification, High&low bytes of checksum can be sent after exchanging. Specific CRC verification can refer to the example associated with the protocol. It is worth noting, the idle among frames should keep at least 3.5 bytes at the bus. The start and end idle among frames at the bus need not to be accumulated

Through the function codes Drives can set different response delay to suit the specific application needs of various master stations.In RTU mode, the actual response delay is not less than 3.5 bytes intervals.

10. 3 Protocol Function

Modbus main function is to read and write parameters. Different function codes apply to different operation request. Inverter Modbus protocol supports the following function codes：

Function Codes	Description
0x03	Read inverter function code parameter and operating condition parameters
0x06	Modify single inverter function codes or control parameters , not saved after power failure
0x10	Rewrite multiple function codes or control parameters , not saved after power failure
0x41	Rewrite single drive or control parameters ,saved after power failure

Parameters of the inverter (Function code, control parameters and status parameters) are mapped to Modbus read & write register. Read & write nature and scope of function code parameters comply with specificatoins in the user manual. Group numbers of functions codes are mapped to the high byte of register address.The group index is mapped to the low byte of register address. Control parameters and status parameters of the inverter are virtualized as inverter function code groups. Correspondence relation between the register address high byte and function codes group number is as follows

F0 Group：0x00；F1 Group：0x01；F2 Group：0x02；F3 Group：0x03；F4 Group：0x04；F5 Group：0x05；F6 Group：0x06；F7 Group：0x07；F8 Group：0x08；F9 Group：0x09；FA Group：0x0A；FB Group：0x0B；FC Group：0x0C；FD Group：0x0D；FE Group：0x0E；FL Group：0x11；FN Group：0x12；FP Group：0x13；FU Group：0x14；Inverter control parameters Group：0x32；Inverter state parameter Group：0x33。

E.g. the inverter function code parameter F3.02 maps to register address 0x302. The function code parameter FB.01 maps to the register address 0xB01.

As already described the formatting of an entire data frame, the following will focus on the Modbus protocol function codes and the format and meaning of the data. It refers to the content of "function code" and "Data" section in the data frame format. The two parts compose a Modbus application layer protocol data unit. The application-layer protocol data unit mentioned below refers to these two parts.

The application layer protocol data unit for reading inverter parameters is as follows:

Application layer protocol Data Unit	Data length（number of bytes）	Values or range
Function code	1	0x03
Initial register address	2	0x0000~0xFFFF
Register number	2	0x0001~0x0004

Response format as below：

Application layer protocol Data Unit	Data length（number of bytes）	Values or range
Function code	1	0x03
Read number of bytes	1	2* Register number
Read content	2* Register number	

If the operation fails, error code and exception code will be responded.

The error code is “function code + 0x80”, exception code denotes the cause of the error. Exception code listed below:

exception code	Description
0x1	Illegal function code
0x2	Illegal register address.
0x3	Data error, i.e., data more than upper limit or lower limit。
0x4	Operation failure of slave drive (including error caused by invalid data in the range of upper limit and lower limit)
0x5	Command is valid and in process, mainly used for storing data to the nonvolatile storage.
0x6	Slave drives are busy, please try again later, mainly used for storing data into the non-volatile storage
0x18	Information frame error: including information length error and calibration error
0x20	Parameters cannot be modified
0x22	Parameters are protected by password.

Single drive parameter rewrite application layer protocol data unit as follows:：

Request format：

Application layer protocol Data Unit	Data length（number of bytes）	Values or range
Function code	1	0x06
Register address	2	0x0000~0xFFFF
Register contents	2	0x0000~0xFFFF

Response format is as follows：

Application layer protocol Data Unit	Data length（number of bytes）	Values or range
Function code	1	0x06
Register address	2	0x0000~0xFFFF
Register contents	2	0x0000~0xFFFF

If the operation fails, error code and exception code will be responded. The error code is “function code + 0x80”, exception code refers to the previous description.

Inverter control parameters can accomplish functions such as start, stop, operation frequency, etc. By retrieving the inverter state parameter, users can obtain operation parameters such as frequency, output current and output torque. Specific frequency converter control parameters and status parameters enumerated below：

Inverter control parameter index

Register address	Name of parameter	Power-down save?
0x3200	Control command word	No
0x3201	Main setting	Yes
0x3202	Operation frequency setting	Yes
0x3203	Digital closed-loop given	Yes
0x3204	Reserved	No
0x3205	Analog output AO setting	No
0x3206	Reserved	No
0x3207	Digital output Y1 setting	No
0x3208	Set the frequency ratio	No
0x3209	Virtual terminal control seting	No
0x320A	Set acceleration time 1	Yes
0x320B	Set deceleration time 1	Yes

SINUS VEGA inverter state parameter index

Register address	Parameter name
0x3300	Running status word 1
0x3301	The practical operation value of the current main setting
0x3302	Slave drive model
0x3303	Inverter type
0x3304	Software version
0x3305	Present running frequency
0x3306	Output current
0x3307	Output Voltage

Register address	Parameter name
0x3308	Output Power
0x3309	Running RPM
0x330A	Reserved
0x330B	Analog closed-loop feedback
0x330C	Busbar voltage
0x330D	External counter
0x330E	Output torque
0x330F	Switch input and output terminals status：BIT0~15=X1~X5, NC,NC,NC,Y1, NC, TC,NC, FAN, BRAKE, NC, NC
0x3310	Preserve
0x3311	Operation frequency after compensation
0x3312	The first run failure
0x3313	The second run failure
0x3314	The third(last time) run failure
0x3315	Operation frequency setting
0x3316	Running speed setting
0x3317	Analog closed-loop given
0x3318	Reserved
0x3319	Reserved
0x331A	AI
0x331B	Reserved
0x331C	Set acceleration time 1
0x331D	Set deceleration time 1
0x331E	Command given channel： 0：Panel control 1：Terminal control 2：Serial port control
0x331F	Inverter status word 2
0x3320	Frequency given channel： 0：Digit given 1，Keypad ∧∨ adjustment 1：Digit given 2：Terminal UP/DN adjustment 2：Digit given 3：Serial port 3：Reserved 4：AI Analog given 5：Reserved

Inverter control word bits are defined as follows：

Control word（bit）	Value	Function	Description
Bit2、1、0	111B	Run Command	Start the inverter
	110B	Mode 0 stop	Stop according to setting deceleration time
	101B	Mode 1 stop	Free stop
	011B	Mode 2 stop	Reserved
	100B	External fault stop	Freestop,Inverter display external fault
	Rest	No command	
Bit3	1	Reverse	Run setup effective operation direction (Inching mode is invalid)
	0	Forward	
Bit4	1	Inching to run froward	
	0	Inching to stop the forward run	
Bit5	1	Inching to reverse	
	0	Inching to stop reverse	
Bit6	1	Allow acceleration/ deceleration	Reserved
	0	Forbidden for acceleration/ deceleration	
Bit7	1	Host computer control valid	The control word sent by the current FC is effective
	0	Host computer control invalid	The control word sent by the current FC is invalid
Bit8	1	The main set effective	Enable the main setting
	0	The main set is invalid	Ban the main setting

Control word（bit）	Value	Function	Description
Bit9	1	Failure reset effective	
	0	Failure reset is invalid	
Bit15~Bit10	000000B	Reserved	

Note： Inching to run given (Bit4, Bit5) shall not be effective simultaneously with the control word Bit0 ~ Bit2 !

The inverter status word 1 bits are defined as follows：

Status word（bit）	Value	Function	Remark
Bit0	1	Inverter operation	
	0	Inverter stop	
Bit1	1	Inverter reverse	
	0	Inverter forward	
Bit2	1	Reach main setting	
	0	Not reach main setting	
Bit3	1	Allow commmunciation control	
	0	Ban commmunciation control	
Bit7~4	0000B	Reserved	
Bit15~8	00~0xFF	Faule code	0：Normal ； None 0：Fault，Specific fault codes details refer to the inverter user manual E.g. ,motor overload F.oL2 will be the fault code of 0x0E，undervoltage will be 0x1F。

10. 4 Instruction

1、Inverters cannot communicate during the restoring default parameters and parameter identification phase, after that communication back to be normal.

2、Inverter internal parameters F1.10, FP.03 cannot be modified through communication setting.

3、 Writing FP. 00 can verify the user password. after the success of the authentication of password, the host FC gets permission of accessing the inverter parameters. After finishing the accessing, writing an invalid password to FP. 00 can shut down the access permissions.

4、The same function setting for Multiple multi-function input terminals function will cause dysfunction, which situation should be avoided when users modify multi-function terminal function through the MODBUS protocol.

Application Examples:

Rewrite the 1 # Inverter operation frequency to be 35.00 HZ (internally denote to be 3500), command as follows：

	address	Function Code	Register address	Register content	Checksum
Request	0x01	0x06	0x3202	0x0DAC	0x225F
Response	0x01	0x06	0x3202	0x0DAC	0x225F

Start the 1 # Inverter to run forward, set the speed as 50.00 HZ (internally denote to be 5000), command as follows：

	address	Function Code	Register address	Register number	Register content bytes	Register content	Checksum
Request	0x01	0x10	0x3200	0x0002	0x04	0x01C7, 0x1388	0x0399
Response	0x01	0x10	0x3200	0x0002	none	none	0x4F70

Read 1 # Inverter output current, the Inverter responds output current of 30.0 A (internally donote to be 300)：

	address	Function Code	Register address	Register number or read number of bytes	Register content	Checksum
Request	0x01	0x03	0x3306	0x0001	none	0x6B4F
Response	0x01	0x03	none	0x02	0x012C	0xB809

10.5 The scaling rule of Inverter

A）The calibration of frequency is 1:100

To make inverter running at 50 hz, the main setting should be 0 x1388（5000）.

B）The calibration of time is 1:10

To make the acceleration time to be 30s, the function code setting should be 0x012c（300）.

C）The calibration of current is1:10

If the feedback current of inverter is 0x012c，the current of the inverter is 30A.

D）Output power is its absolute value.

E）Other issues(such as input and output terminals, etc.), please refer to the user manual.

11 Warranty Agreement

1. The warranty period of the product is 18 months (refer to the barcode on the equipment). During the warranty period, if the product fails or is damaged under the condition of normal use by following the instructions, Santerno will be responsible for free maintenance.
2. Within the warranty period, maintenance will be charged for the damages caused by the following reasons:
a. Improper use or repair/modification without prior permission
b. Fire, flood, abnormal voltage, other disasters and secondary disaster
c. Hardware damage caused by dropping or transportation after procurement
d. Improper operation
e. Trouble out of the equipment (for example, external device)
3. If there is any failure or damage to the product, please correctly fill out the Product Warranty Card in detail.
4. The maintenance fee is charged according to the latest Maintenance Price List of Santerno.
5. The Product Warranty Card is not re-issued. Please keep the card and present it to the maintenance personnel when asking for maintenance.
6. If there is any problem during the service, contact Santerno's agent or Santerno directly.
7. This agreement shall be interpreted by Santerno Limited.

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