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

Contents

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, bind frequency setting channel with command channel, zero frequency return difference zero frequency hysteresis, main and auxiliary frequency setting, traverse operation, length control, 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. Safety precautions

3.1 Safety definition

In this manual, the safety precautions are sorted to "Danger" or "Caution"

DANGER

Operations without following instructions can cause personal injury or death.

CAUTION

Operation without following instructions can cause personal injury or damage to product or other equipment.

3.2 Safety items

Before installation:

DANGER

1. Please don't use the inverter of being scathed or loss of parts!
2. Please use the insulating motor upwards B class; otherwise it will result in death or serious injury on account of getting an electric shock!

When installation:

DANGER

Please install the inverter on the fireproofing material (such as metal) to prevent fire!

CAUTION

1. When you need to install two or more inverters in one cabinet, cooling fans should be provided to make sure that the ambient temperature is lower than 45℃. Otherwise it could cause fire or damage to the device.
2. No wires head or screws fall into the inverter!

When wiring:

DANGER

1. Only qualified personnel shall wire the inverter!
2. Inverter and power must be comparted by the breaker; otherwise the fire will be caused!

3. Never wire the inverter unless the input AC is totally disconnected!
4. The ground terminal must be properly earthed to reduce electrical accident!

CAUTION

1. Connect input terminals(R,S,T) and output terminals(U,V,W) correctly. Otherwise it will cause damage the inside part of inverter!
2. Make sure that the wring according with EMC requirements and saf ety standards in the region, the wire diameter used reference the manual suggested; otherwise it will cause an accident!
3. Brake resistor cannot be directly connected between پDC bus+پ and پDC bus-پ terminals, or it may cause a fire!

Before power-on:

DANGER

1. Please confirm whether the power and voltage level is consistent with the rated voltage of the inverter, input and output wiring position is correct or not, and pay attention to check whether there are short-circuit in the external circuit phenomenon, ensure the line is fasten ed. Otherwise the inverter may cause damadge!
2. Install the cover before power-on, in order to reduce the danger of electric shock!

CAUTION

1. Inverters do not need to do pressure test, factory products have made this test, and otherwise it may cause an accident!
2. All the external parts are connected exactly in accordance with this manual, or it may cause an accident!

After power-on:

DANGER

1. Do not open the cover after power-on, otherwise there is a risk of electric shock!
2. Do not wire and operate the inverter with wet hands, otherwise there is a risk of electric shock!

3. Do not touch inverter terminals (inclu ding the control terminals), otherwise there is a risk of electric shock!
4. At the beginning of power-on, the inverter can carry out safety testing for external strong electric cir cuit automatically, at this time, please do no t touch U,V,W terminals or motor terminals, otherwise there is a risk of electric shock!

CAUTION

1. If you need parameter identification, please note that the risk of injuries in motor rotation, otherwise it may cause an accident!
2. Please do not arbitrarily change the parameters of inv erter manufactures; otherwise it may result in equipment damage!

Operating status:

DANGER

1. When the us er selects the function re-starting, please do not stay close to the mechanical equipment, otherwise it may cause personal injury!
2. Do not touch the radiator, otherwise it may cause burn!
3. Only qualified personnel shall detect the signal, otherwise it may cause personal injury or equipment damage!

CAUTION

1. When the inver ter is running, please avoid the sundries fall into th e device, otherwise it would cause equipment damage!
2. Please do not us e the method of contactor on and off to control the inverter start-stop, otherwise it would cause equipment damage!

When maintaining:

DANGER

1. Never service and maintain inverter with electrification, otherwise it may cause injury or electric shock!
2. Ensue the inverter CHARGE light turns of f before the maintenance and repair of the inverter, otherwise the residual charge on the capacitor may cause

personal injury!

3. Only trained personnel shall operate and maintain this equipment, otherwise it will cause personal injury or equipment damage!

3.3 Notice Items

1. Insulation of Motors

   Before using the inverter, the insulation of motors must be checked, especially, if it is used for the first time or if it has been stored for a long time. This is to reduce the risk of the inverter from being damaged by the poor insulation of the motor winding. Please use 500V insulation tester to measure the insulation resistance. It should not be less 5MΩ.

2. Thermal protection of the motor

   If the selection of motor and rated capacity of the inverter does not match, especially when rated power of the inverter is greater than rated power of the motor, be sure to adjust the motor protection-related parameters in the inverter or pre-installed in the motor thermal relay for motor protection.

3. Working above power frequency

   The inverter can provide 0Hz-60Hz output frequency, if the customers need to run at 50Hz or above, please consider the affordability of mechanical devices.

4. The vibration of mechanical devices

   When the output frequency to achieve certain values of the inverter, you may encounter a mechanical resonance point of the load devices. It can be avoided by setting the parameters of the frequency jump in inverter.

5. Regarding motor heat and noise

   Because the output voltage of the inverter is the PWM wave，it contains some harmonics wave, Therefore, there will be some increase in temperature、noise、libration in motor and Work-frequency.

6. Varistors for Surge Protection or Capacity Used to improve the Power Factor

   Don’t connect any varistors or capacitors to the output terminals of the inverter. Because the inverter’s output voltage waveform is pulse wave, otherwise, it may cause tripping or damage to components.

7. If circuit breaker or contactor needs to be connected between the inverter and the motor, be sure to operate these circuit breakers or contactor when the inverter has no output to avoid damaging of the inverter. Otherwise it may cause damage to the inverter module.

8. Using outside rated voltage

The inverter is not suitable to be used out of the specified range of operating voltage. If needed, please use suitable voltage regulation device.

9. Three-phase input change to Two-phase input

Don't permit of changing three-phase inverter as two-phase to be used, or it will result in failure or damage to inverter.

10. Protection against lightning strike

There are transient surge suppressors inside the inverter that protect it against lightning strike.

11. Derating due to Altitude

Derating must be considered when the inverter is installed at high altitude, greater than 1000m. This is because the cooling effect of the inverter is less effective in the thin air. For details, please contact us.

12. Some special usages

If the customers need to use the wiring diagram that the manual did not mention ， such as the common DC bus, please contact us.

13. Disposing Unwanted inverters

1）The capacitors may explode when they are burnt.

2）Poisonous gas may be generated when the plastic parts like front covers are burns.

3）Please dispose the inverter as industrial waste.

14. Adaptive motor

1）Standard adaptive motor for 4 grade Squirrel-cage asynchronous induction motor. If it is not above motor that may select the inverter according to rated current of motor. If you need to inverter permanent magnet synchronous motor, please ask for support.

2）The cooling fan of non-inverter motor and the rotor axis is a coaxial connection,the effect of fan cooling is poor when the speed decreases, therefore, should be retrofitted with exhaust fan or replace for the inverter motor in the motor overheat occasion.

3）The inverter has built-in standard parameters of adaptive motor, according to the actual situation ,Motor parameter identification needs to be done or personality default value in order to be compatible with the actual value,otherwise it will affect the running results and protection performance.

4）If the short-circuit occurred in the cable or the internal motor will cause the inverter alarm, and even deep-fried machine.When the motor and cable just installed, please first conduct insulation short-circuit tests, routine maintenance is also required to conduct this test regularly.

Before using, please read this manual thoroughly to ensure proper usage. Keep this manual at an easily accessible place so that can refer anytime as necessary.

4. Specifications and Optional Parts

4.1 Specifications

Table2-1 SINUS VEGA Specifications

Item		Description
Input	Rated voltage; Frequency	SINUS VEGA 4T：380V～440V；50Hz/60Hz three phase
	Permissible fluctuation range	Continuous fluctuation range≤±10%，Short time fluctuation range≤-15%～+10%； Voltage unbalance range≤3%；Frequency≤5%
Output	Rated voltage	SINUS VEGA 4T：0～380V/440V
	Frequency	0Hz～650Hz
	Over load ability	Heavy Duty：150%rated current for 1 minute，180% rated current for 3s/1s（380V/220V series）,200% rated current for 0.5s； Normal Duty：120% rated current for 1 minute
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、S curve；4 Acc/Dec time； Unit(minute/second)，60hours at most
	Jog	Jog frequency: 0.10-60.00Hz: Acc/Dec time: 0.1-60.0s. Jog interval adjustable
	Multi-speed operation	Seven sections of frequency. Able to achieve through the built-in PLC or terminals.
	Closed-loop control	Analog closed-loop，speed closed-loop control
	Auto energy saving operation	Voltage output is optimized automatically according to the load condition to perform energy-saving operation.
	Auto voltage regulation	Constant output voltage even if electric network voltage fluctuates

Item		
	Auto carrier-wave regulation	Adjust the carrier frequency automatically according to the load characteristics;
Customized and operating functions	Traverse for textile motor	Traverse control, central traverse adjustable
	Set length control	When reaching set length, the inverter will stop
	Constant-pressure water supply	Constant-pressure water supply with PID control
	Tone selection	Set the tone of the motor when it is running
	Immunity to transient power failure	The inverter gives output even if power failure occurs
	Channel binding	Command channel can bind with frequency. Setting channel and switched synchonizingly
	Methods of inputting commands	Via keypad panel、terminals and serial port
	Methods of setting up frequency	Digital setting、VCI、CCI、pulse setting、serial port
	Auxiliary frequency	Flexible auxiliary frequency tuning、frequency synthesis
	Pulse output terminal	0～50kHz pulse signal output . Signals can be reference frequency and output frequency
	Analog output terminals	2 analog outputs of 0/4～20mA and 0～10V(selectable). Be able to output signals like reference frequency and output frequency.
Water Supply Special Functions	Constant-pressure water supply special functions	Smart constant-pressure water supply control system, including sleep, wake-up, pressure feedback off-line detection, multi-pressure setting, etc.
	Work Mode Selection	Multi water supply mode selection
	Closed-loop setting	Setting by digital voltage / analog voltage / analog current / communication
	Multi-pressure setting	Up to 6 steps of pressure commands setting per day
	Sleep/wake-up control	Complete sleep/wake-up of pump automatically

Item		
Control panel	LED keypad	Able to show many parameters, such as: frequency setting, output frequency, output voltage, etc.
	Keypad lock	Total lock or partially lock, in order to avoid misoperation
Protection function		Phase loss failure, Over/Under current, Over/Under voltage protection, Overheat and overload protection
Environment	Operating environment	In-door，
	Altitude	Less 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
Mounting mode		Mounted in a cabinet

4.2 Products Series Introduction

4.2.1 SINUS VEGA Models

SINUS VEGA 4T
Applicable motor power with power supply 380 ÷ 440Vac

Table2-2 Inverter series

Model	Inom	Imax	Applicable motorpower			Applicable motorpower		
			NORMAL DUTY			*HEAVY DUTY*		
			kW	H	A	kW	H	A
SINUS VEGA 0002 4T	2.3	3.5	0.75	1	2.3	0.75	1	2.3
SINUS VEGA 0003 4T	3.7	5.5	1.5	2	3.7	1.5	2	3.7
SINUS VEGA 0004 4T	5	7.5	2.2	3	5	2.2	3	5
SINUS VEGA 0005 4T	9	14	4	5.5	9	4	5.5	9
SINUS VEGA 0007 4T	17	20	7.5	10	17	5.5	7.5	13
SINUS VEGA 0011 4T	25	26	11	15	25	7.5	10	17
SINUS VEGA 0015 4T	32	38	15	20	32	11	15	25
SINUS VEGA 0018 4T	37	48	18.5	25	37	15	20	32
SINUS VEGA 0022 4T	45	56	22	30	45	18.5	25	37
SINUS VEGA 0030 4T	60	68	30	40	60	22	30	45
SINUS VEGA 0037 4T	75	90	37	50	75	30	40	60
SINUS VEGA 0045 4T	90	113	45	60	90	37	50	75
SINUS VEGA 0055 4T	110	135	55	75	110	45	60	90
SINUS VEGA 0075 4T	152	165	75	100	152	55	75	110
SINUS VEGA 0090 4T	176	228	90	125	176	75	100	152
SINUS VEGA 0110 4T	210	264	110	150	210	90	125	176
SINUS VEGA 0132 4T	260	315	132	180	260	110	150	210
SINUS VEGA 0160 4T	305	390	160	220	305	132	180	260

NORMAL DUTY: *Overaload 120% rated current for 1 minute- for applications which use self-ventilated induction motors and require a low overload capability (e.g. fans, pumps)*

HEAVY DUTY: *Overaload 150% rated current for 1 minute- Overload 180% rated current for 3 Sec Overload 200% rated current for 0.5 Sec, for constant torque applications which require a high overload capability (e.g. cranes, hoists)*

4.2.2 Ordering information of SINUS VEGA series

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

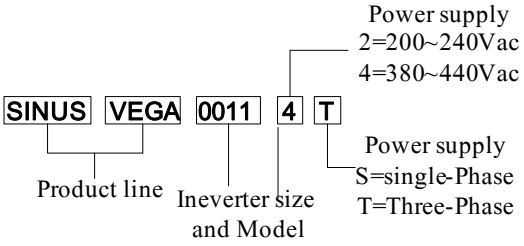
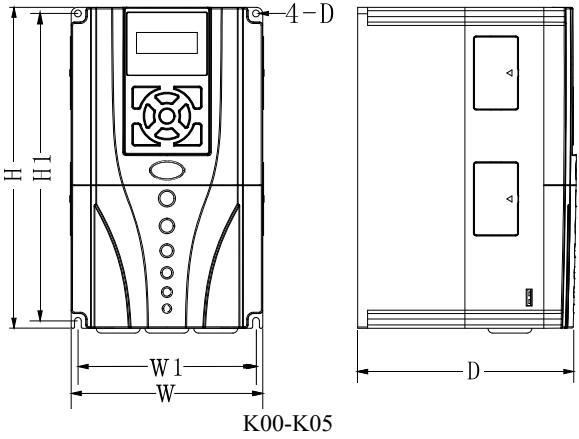


Table2-1a Explanations of inverter models

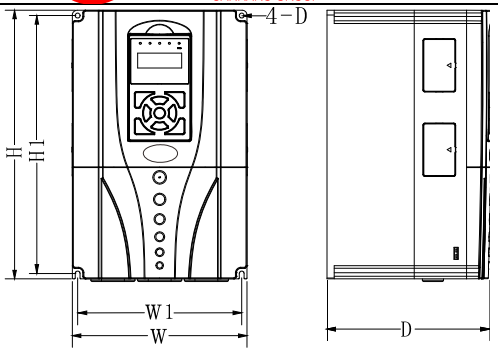
Table2-1b SINUS VEGA series nameplate

4.2.3 Size

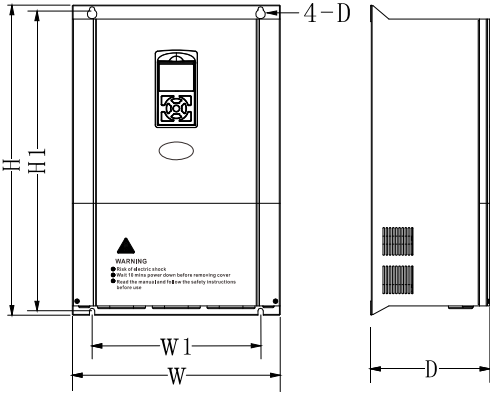
Please refer to Figure 2-2 and Table 2-3.



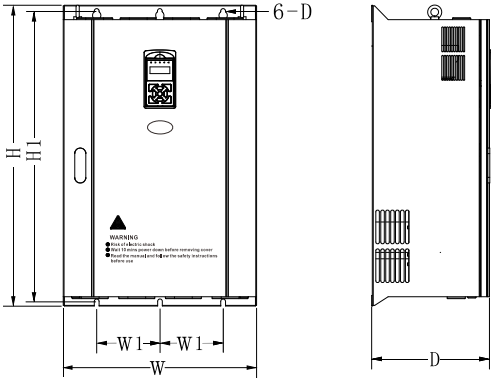
K00-K05



K10-15



K20-25



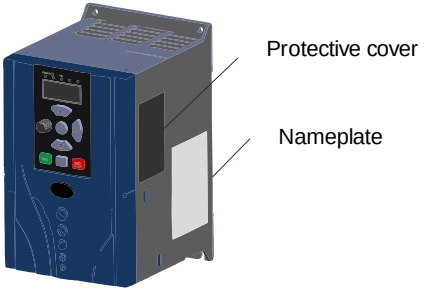
K30-35

Figure2-2 SINUS VEGA series inverter size

Table 2-3 Dimensions of SINUS VEGA series（mm）

Size	W (mm)	H (mm)	Mounting hole	D (mm)	Weight (kg)
K00	105	180	5	135	1.8
K05	140	215	5.5	175	2.5
K10	157	262	5.5	181	5
K15	198	305	5.5	181	8
K20	276	438	7	220	18
K25	395	589	10	231	45
K30	489	759	12	298	75
K35	539	889	12	370	125

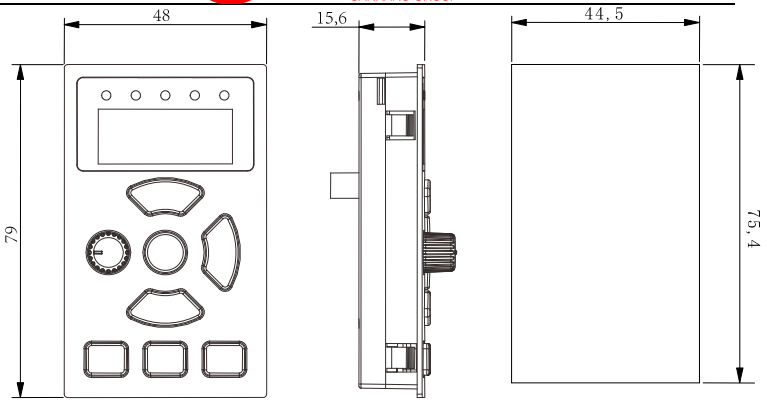
4.2.4 Protective cover



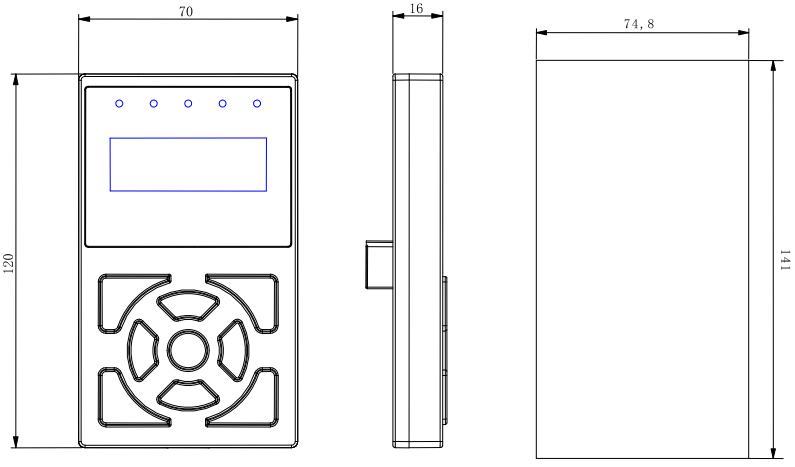
Notice：For ventilation, try not to use protective cover, unless there is a need, so that you can extend the inverter's life.

4.2.5 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.



Keypad dimensions of SINUS VEGA 0002 4T ~ 0004 4T



Keypad dimensions of SINUS VEGA 0005 4T~ 0160 4T

Figure2-3 Keypad display unit

4.2.6 Optional Parts

You may order the optional parts below from our company.

Part name	Applicable range	Specification	Remarks
Braking resistor	Pls refer to tale 2-4	Pls refer to table 2-4	
Keypad connect board	0.4KW~4.0KW optional	-	Ethernet connection will be enabled

Part name	Applicable range	Specification	Remarks
Keypad tray	Above 5.5KW optional	74.7.141	dimension
Keypad extension cable	0.4KW~4.0KW optional	1.5m	Flat cable
	0.4KW～160KW optional	2m、3m	Internet cable ; 0.4KW~4.0KW keypad connection board is required if you want to use internet cable to extend the connection
Basement	132KW~160KW optional	539*370*485	132KW~160KW basement is ap plicable for both cabinit and wall type interers
Direct current reactor	132KW~160KW optional	-	-

4.2.7 Braking Resistor and Recommendation of Braking Unit

SINUS VEGA series inverter is equipped with braking unit. If there is a need for energy-consuming braking, please select a braking resistor in Table2-4; please refer the wiring of braking resistor and the inverter to Figure2-4. The wire specifications are listed in Table2-4.

Table2-4 Braking Resistor and Recommendation of Braking Unit

Model	Suggested value of resistance	Suggested power	Suggested model of braking unit	Remark
SINUS VEGA 0002 4T	250-350Ω	100W	Built-in standard parts	Nospecial instructions
SINUS VEGA 0003 4T	200-300Ω	200W	Built-in standard parts	Match Proper Motor
SINUS VEGA 0004 4T	100-250Ω	250W		
SINUS VEGA 0005 4T	100-150Ω	300W		
SINUS VEGA 0007 4T	80-100Ω	500W		
SINUS VEGA 0011 4T	60-80Ω	700W		
SINUS VEGA 0015 4T	40-50Ω	1KW		
SINUS VEGA 0018 4T	30-40Ω	1.5KW		
SINUS VEGA 0022 4T	25-30Ω	2KW	Built-in optional parts	Add ـB at the end of model
SINUS VEGA 0030 4T	20-25Ω	2.5KW		
SINUS VEGA 0037 4T	15-20Ω	3KW		
SINUS VEGA 0045 4T	15-20Ω	3.5KW	Built-in optional parts	Add ـB at the end of model
SINUS VEGA 0055 4T	10-15Ω	4.5KW		

Model	Suggested value of resistance	Suggested power	Suggested model of braking unit	Remark
SINUS VEGA 0075 4T	10-15Ω	5.5KW		
SINUS VEGA 0090 4T	8～10Ω	7.5 KW	BU4R150	optional parts
SINUS VEGA 0110 4T	8～10Ω	9 .0KW		
SINUS VEGA 0132 4T	6～8Ω	11 .0KW		
SINUS VEGA 0160 4T	6～8Ω	13.5KW	BU4R250	optional parts

P.S: the calculation method of braking resistance:

When braking is enabled, almost all renewable energy have been consumed by the braking resistor, please follow the following formula:

U.U/R=Pb

In this formula: U means the braking voltage of the system(The value of U may differ from each system, I.e, 380Vac system, U is 700V generally.

Pb is the braking power

Power selection for braking resistor

Theoretically, the braking resistor بِ power is the same as the braking power, however by taking the 70% derate into consideration, you can use the following formula to calculate the braking resistor بِ power:

0.7.Pr=Pb.D

Pr--power of the braking resistor

D--braking frequency

Braking frequency values for standard elevator and winder applications:

Applications	Elevator	Winding and unwinding	Centrifuge machine	Occasionally braking load	General applications
Braking frequency(D)	20% ~30%	20 ~30%	50%~60%	5%	10%

The above Table 2-4 is a gu ide reference only, users can choo se different braking resistance and power according to each application.However, please be remembered that the brak ing resistance shouldn بِ be less than the abov e 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 th e 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.

5. Installation and wiring

5.1 Installation

Please mount the inverter vertically indoors, with good ventilative conditions.

When selecting mounting environment, the followings should be taken into account：

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.

Humidity should be lower than 95%， non-condensing;

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

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

If there are any special requirements for installation, please contact us for clarifications。

The requirements on mounting space and clearance are shown in figure 3-1 and 3-2；When two inverters are mounted one on top the other, an air flow diverting plate should be fixed in between as shown in figure 3-3。

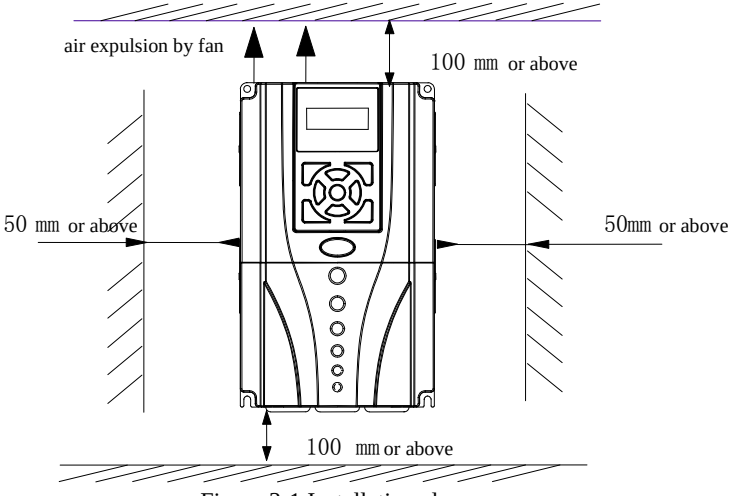


Figure 3-1 Installation clearance

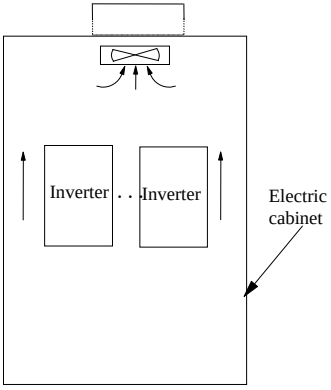


Figure3-2 Installation of several inverters

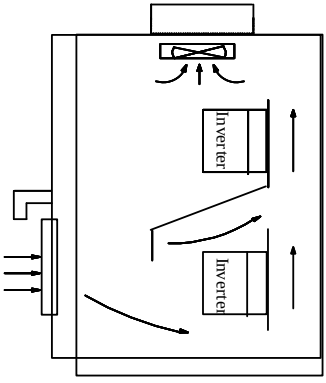


Figure3-3 Installation of one on top theother

5.1.1 EMC Compliance Installation

In a traction system composed of a inverter and a motor， if the inverter, controllers and transduser are installed in one cabinet, the disturbance they generate should be depressed at the connection points, therefore, a noise filter and inrush reactor should be installed in the cabinet, so that EMC requirement is met inside it.

The inverter is usually installed in a metal cabinet, the instruments outside the metal cabinet is shielded and may be disturbed lightly. The cables are the main EMI source, if you connect the cables in according to the manual, the EMI can be suppressed effectively.

In system design phase, to reduce EMI, insulating the noise source and use the noise subber are the best choice, but the choice is considerable. If there are a few sensitive devices on site, just install the power line filter beside them is enough note that the inverter and the contactor are noise source, and the automatic devices encoder and conductor are sensible to them.。

Divide the system into several EMC parts; refer to figure 3-4.

Note：

1．After installing EMI filter and AC reactor, the inverter can satisfy IEC 61800—3 standard.

2．The input/output filter should be installed close to the inverter as possible.

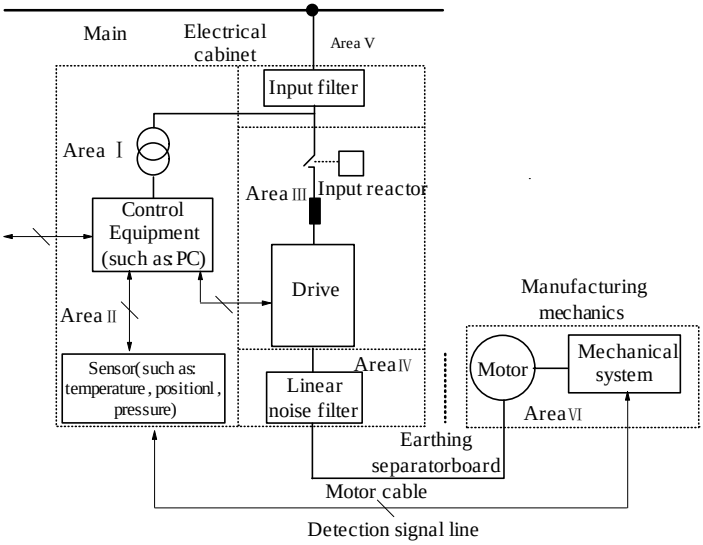


Figure3-4 Recommended System Layout：

Area Ⅰ： Should be used to install transformers for control power supply, control system and sensor.

Area Ⅱ： should be used for interface of signal and control cables with good immunity level。

AreaⅢ： Should be used to install noise generating devices such as input reactor, inverter, brake unit and contactor.

AreaⅣ： should be used to install output noise filter.

Area Ⅴ： should be used to install power source and cables connecting the RFI filter。

AreaⅥ： should be used to install the motor and motor cables。

Areas should be isolated in space, so that electro-magnetic decoupling effect can be achieved. The shortest distance between areas should be 20cm. Earthing bars should be used for decoupling among areas; the cables from different area should be placed in different tubes.

The filter should be installed at the interfaces between different areas if necessary. Bus cable (such as RS485) and signal cable must be shielded.

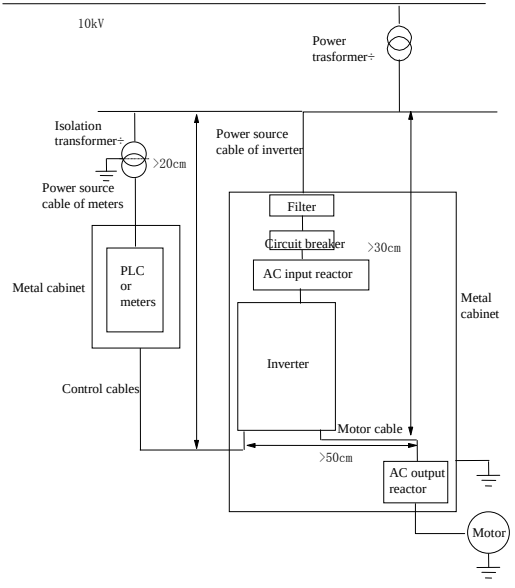


Figure 3-5 Installation of the inverter

5.1.2 Noise Suppression

The noise generated by the inverter may disturb the equipment nearby; the degree of disturbance is depend on the inverter system, immunity of the equipment, wire connections, installation clearance and earthing methods.

Noise emission paths	Actions to reduce the noise
If the external equipment shares the same AC supply with the inverter, the inverter's noise may be transmitted along its input power supply cables, which may cause nuisance tripping to other external equipment.。	Install noise filter at the input side of the inverter, and use an isolation transformer or line filter to prevent the noise from disturbing the external equipment
If the signal cables of measuring meters, radio equipment and sensors are installed in a cabinet together with the inverter, these equipment cables will be easily disturbed.	1) The equipment and the signal cables should be as far away as possible from the inverter. The signal cables should be shielded and the shielding layer should be grounded. The signal cables should be placed inside a metal tube and should be located as far away as possible from the input/output cables of the inverter. If the signal cables must cross over the power cables, they should be placed at right angle to one another. 2) Install radio noise filter and linear noise filter (ferrite common-mode choke) at the input and output sides of the inverter to suppress the emission noise of power lines. 3) Motor cables should be placed in a tube thicker than 2mm or buried in a cement conduit. Power cables should be placed inside a metal tube and be grounded by shielding layer (Motor cable should be a 4-core cable, where one core should be connected to the PE of the inverter and another should be connected to the motor's enclosure)
If the signal cables are routed in parallel with the power cables or bundle these cables together, the induced electro-magnetic noise and induced ESD noise may disturb the signal cables.	Avoid this kind of routing. Other equipment sensible to EMI should also be located as far away as possible from the inverter. The signal cables should be placed inside a metal tube and should be placed as far away as possible from the input/output cables of the inverter. The signal cables and power cables should be shielded cables. EMC interference will be further reduced if they could be placed inside metal tubes. The clearance between the metal tubes should be at least 20cm.

Table3-1 Actions to reduce the noise

5.1.3 Using Surge Suppressor

The device such as relay, contactor and electro-magnetic braking kit, which may generate great noises, should be installed with surge suppressor even if installed outside of the device cabinet.

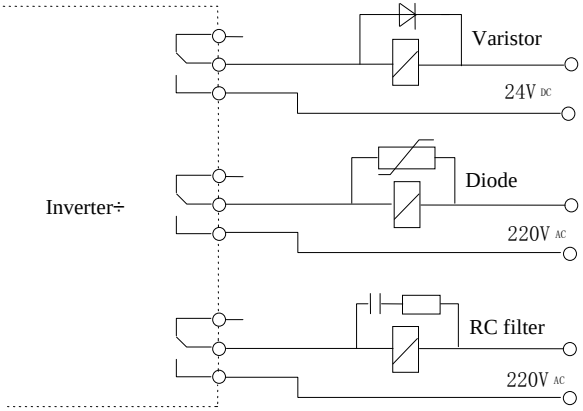


Figure3-6 Installation of Relay, contactor and electro-magnetic braking kit

5.1.4Leakage Current

Leakage current may flow through the inverter's input and output capacitors and the motor's capacitor. The leakage current value is dependent on the distributed capacitance and carrier wave frequency. The leakage current includes ground leakage current and the leakage current between lines 。

Ground leakage current

The ground leakage current not only flows into the inverter's system, but also into other equipment via earthing cables. It may cause leakage current circuit breaker and relays to be falsely activated. The higher the inverter's carrier wave frequency, the higher the leakage current, and also, the longer the motor's cable, the greater is the leakage current.

Suppressing methods：

Reduce the carrier wave frequency, but the motor noise may be higher；

Motor cables should be as short as possible；

The inverter and other equipment should use leakage current circuit breaker designed for protecting the products against high-order harmonic/surge leakage current 。

Leakage current between lines

The line leakage current flowing outside though the distributed capacitor of the inverter may false trigger the thermal relay, especially for the inverter of which power rating is less than 7.5KW. If the cable is longer than 50m, the ratio of leakage current to motor rated current may increase to a level that can cause external thermal relay to trigger unexpectedly.

Suppression methods：

Reduce the carrier wave frequency, but the motor audible noise is higher；

Install reactor at the output side of the inverter.

In order to protect the motor reliably, it is recommended to use a temperature sensor to detect the motor's temperature, and use the inverter's over-load protection device (electronic thermal relay) instead of an external thermal relay.

5.1.5 Applications of Power Filter

Power source filter should be used in the equipment that may generate strong EMI or the equipment that is sensitive to EMI. The power source filter should be a low pass filter through which only 50Hz current can flow and high frequency current is rejected.

The power filter ensures the equipment can satisfy the conducting emission and conducting sensitivity in EMC standard. It can also suppress the radiated emission of the equipment

It can prevent the EMI generated by the equipment from entering power cable, and also prevent the EMI generated by the power cable from entering the equipment.

Common mistakes in using power line filter

Power cable is too long

The filter inside the cabinet should be located near to the input power source. The length of the cables should be as short as possible.

The input and output cables of the AC supply filter are too close

The distance between input and output cables of the filter should be as far apart as possible, otherwise the high frequency noise may be coupled between the cables and bypass the filter. Thus, the filtering effect becomes ineffective.

Bad earthing of filter.

The filter enclose must be must be connected properly to the metal casing of the inverter. In order to be earthed well, a special earthing terminal on the filter's enclosure should be used. If you use one cable to connect the filter to the case, the earthing is useless due to high frequency interference. When the frequency is high, so too is the impedance of cable, hence there is little bypass effect.

The filter should be mounted in the enclosure of equipment. Ensure to clear away the insulation paint between the filter case and the enclosure for good earth contact.

5.1.6 AC Line Reactor Applications

Input AC Line Reactor:

A line reactor should be used if the distortion of power network is severe or the input current harmonic level is high even after a DC reactor has been connected to the inverter. It can also be used to improve the AC input power factor of the inverter.

Output AC Line Reactor:

When the cables from the inverter to motor are longer than 80m, multi-strand cables and an AC line reactor should be used to suppress the high frequency harmonics. Thus, the motor insulation is protected. At the same time, leakage current and unexpected trigger are reduced.

5.2 Wiring

DANGER
·Wiring can only be done after the Variable Speed Inverter's AC power is disconnected; all the LEDs on the operation panel are off and after waiting for at least 10 minutes. Then, you can remove the panel. ·Wiring job can only be done after confirming the Charge indicator inside the inverter has extinguished and the voltage between main circuit power terminals + and - is below DC36V. ·Wire connections can only be done by trained and authorize personnel. ·For the sake of safety, the inverter and motor must be earthedbecause there is leakage current inside the inverter; Check the wiring carefully before connecting emergency stopping or safety circuits。 ·Check the Variable Speed Inverter's voltage level before supplying power to it; otherwise human injuring or equipment damage may happen.

CAUTION
·Check whether the inverter's rated input voltage is in compliant with the AC supply voltage before using. ·Dielectric strength test of the inverter has been done in factory and the user needs not do it again ·Refer to chapter 2 on how to connect braking resistor or braking。 ·It is prohibited to connect the AC supply cables to the inverter's terminals U, V and W. ·Grounding cables should be copper cables with cross-sectional area bigger than 2.5 mm^2, and the grounding resistance should be less than 10Ω. ·For the sake of safety, the inverter and motor must be earthed because there is

⚠CAUTION
• The control circuits of SINUS VEGA are isolated from the power circuits in the inverter by basic insulation (single insulation) only. If the control cables are to connect to external control circuit exposing to human contact, an extra insulating layer, rated for use at the AC supply voltage of the load, must be applied. ·If the control circuits are to connect to other circuits classified as Safety Extra Low Voltage (SELV), e.g. connecting the RS485 port of the inverter to a personal computer through an adapter, an additional isolating barrier must be included in order to maintain the SELV classification.

⚠CAUTION
·The control terminals of the inverter are of ELV (Extra Low Voltage) circuit. Do not touch them once energized； ·If the external device has touchable terminals of SELV (Safety Extra Low Voltage) circuit. Remember to connect isolating protections in between. Otherwise, the SELV circuit will be degraded to ELV circuit;； ·When connecting the inverter with PC, do choose RS485/232adapterswith isolating protections that measure up to safety requirements.。

5.2.1 Overview

You should finish the power circuit and control circuit wiring。

First, open the front door， and then you will see the power terminals and control terminals

For different models of the inverter, the power terminals layout is different, which is described in details as below.

（Jumpers：CN is for inverters 4.0KW and below， SW(or J) is for inverters 5.5kw~160kw）

Beneath the keypad display unit, there are control terminal strip and jumpersCN4(J2 OR SW2)，CN5(J3 OR SW3)，CN7(J1 OR SW1)，CN14(J4 OR SW4)。

Terminal strip is relay output, analog, digital I/O and communication interfaces. CN4(J2 OR SW2)， CN5(J3 OR SW3) and CN7(J1 OR SW1) are jumpers through which the output of voltage or current signal is set， the terminals will be described in details later.

The figure below is the systematic wiring of the inverter

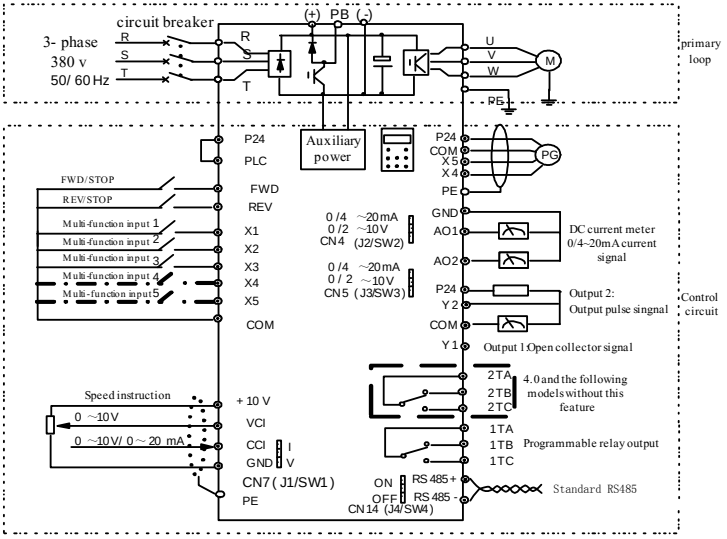


Figure 3-7 Systematic Wiring Diagram

Note：

1．In the above figure, ○ is the terminal in power circuit, and ⊙ is the control terminal；

2．Terminal CCI can input voltage or current signal by switching the jumper CN10 on control board；

3．Built-in braking kit is installed and a braking resistor is required to be connected between P (+) and PB；

4．Refer to section 3.2.3 for the using of control terminals;

5．MCCB must be installed at the input side of each inverter in the cabinet;

6．Refer the cable section area and MCCB capacity to Table 3-2.

Table 3-2 Recommended MCCB Capacity and Copper Cable Section Area

Model	MCCB Circuit breaker（A）	Power circuit（mm^2）				Control cable（mm^2）
		Input cable	Braking line	Output cable	Earth cable	
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
SINUS VEGA 0005 4T	25	2.5	1.5	2.5	2.5	1.0
SINUS VEGA 0007 4T	32	4.0	2.5	4.0	4.0	1.0

Model	MCCB Circuit breaker（A）	Power circuit（mm^2）				Control cable（mm^2）
		Input cable	Braking line	Output cable	Earth cable	
SINUS VEGA 0011 4T	32	4.0	2.5	4.0	4.0	1.0
SINUS VEGA 0015 4T	40	6.0	4.0	6.0	6.0	1.0
SINUS VEGA 0018 4T	63	6.0	4.0	6.0	6.0	1.0
SINUS VEGA 0022 4T	63	10	10	10	10	1.0
SINUS VEGA 0030 4T	80	16	16	16	16	1.0
SINUS VEGA 0037 4T	100	25	25	25	16	1.0
SINUS VEGA 0045 4T	160	25	10	25	16	1.0
SINUS VEGA 0055 4T	200	35	16	35	16	1.0
SINUS VEGA 0075 4T	200	35	25	35	25	1.0
SINUS VEGA 0090 4T	250	70	Pls refer to brake resistor manual	70	35	1.0
SINUS VEGA 0110 4T	310	70		70	35	1.0
SINUS VEGA 0132 4T	400	95		95	50	1.0
SINUS VEGA 0160 4T	400	150		150	75	1.0

Note：

If the control circuit uses multi-strand cable, the single-core cable section area can be $0.5mm^2$.

5.2.2 Power Terminals

1．SINUS VEGA 0002 4T ~ 0005 4T

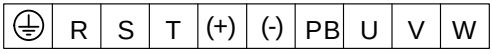
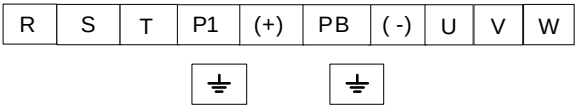


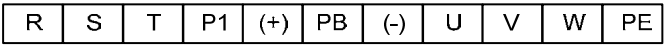
Table 3-4 Definitions of power terminals

Mark	Definition
R、S、T	3-phase AC input
+、PB	External braking resistor
+、-	DC positive, negative bus input
U、V、W	3-phase AC outputs
PE/	Protective earth

2．SINUS VEGA 0007 4T~ 0018 4T



3. SINUS VEGA 0022 4T ~ 0075 4T



4. SINUS VEGA 0090 4T and above：

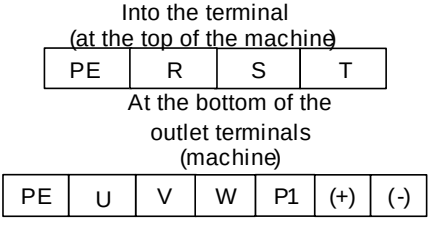


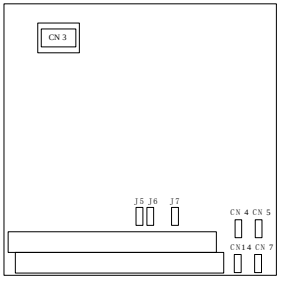
Table 3-5Definitions of power terminals

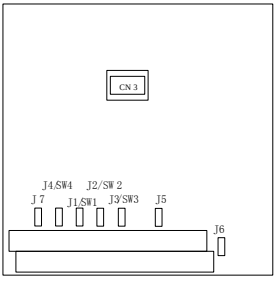
Mark	Definition
R、S、T	3-phase AC input
P1、（+）	External DC reactor reserved terminals (connect with steel before use)
（+）、PB	External braking resistor
(-)	DC negative bus input
U、V、W	3-phase AC outputs
PE	Protective earth

5.2.3 Control Circuit Wiring

Control Terminals and Jumpers

Refer the layout to Figure 3-8. Control terminals functions are listed in Table 3-6，Jumper’s functions in 3-7. Be sure to set the jumper and wire the terminals properly. It is recommended to use cable of section area bigger than $1mm^2$.





Up to SINUS VEGA 0055 4T SINUS VEGA 0075 4T and above

Figure 3-8 Layouts of control terminals and jumpers

Table 3-6 Function of control terminals

Mark	Function
CN6- CN11	Analog I/O, digital I/O, relay outputs

Table 3-7 Jumpers' function

Mark	Function&Setting	Default
CN7 (J1 OR SW1)	CCI current/voltage input selection I：0～20mA current signal V：0～10V voltage signal	0～10V
CN14 (J4 OR SW4)	485 terminal resistor selection：ON: 120Ω terminal resistor，OFF: No terminal resistor.	No resistor
CN4 (J2 OR SW2)	AO1 current/voltage input selection 0/4~20mA: AO1 current signal 0/2~10V: AO1 voltage signal	0～10V
CN5 (J3 OR SW3)	AO2 current/voltage input selection 0/4~20mA: AO2 current signal 0/2~10V: AO2 voltage signal	0～10V
J5	Y2 selection of pull-up resistor PU：With pull-up resistor OC：Without pull-up resistor	No Pull-up resistor

Jumper usage

CN4(J2 OR SW2)、CN7(J1 OR SW1) or CN5(J3 OR SW3) jumper usage：

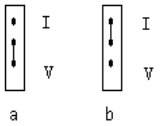


Figure a means that 0~10V analog voltage input is selected； Figure b means that 0/4~20mA analog current input is selected.

CN14(J4 OR SW4) jumper usage：

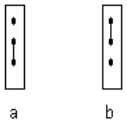


Figure a means that there is a resistor（OFF）； Figure b means that there is no resistor（ON）.

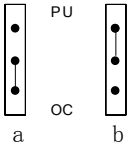


Figure a means that there is no pull-up resistor（OFF）； Figure b means that there is a 10KΩ resistor（ON）

Terminal strip layout

The layout is shown below

SINUS VEGAup to 0005 4T terminal strip layout：

TC	TB	TA	Y1	Y2	FWD	REV	AO1	AO2	VCI	CCI	GND
COM	PLC	P24	X1	X2	X3	X4	X5	+10V	GND	485+	458-

SINUS VEGA 0007 4T (and above) terminal strip layout：

485+	485-	GND	AO1	AO2	X1	X2	X3	X4	X5	COM	1TA	1TB	1TC	
+10V	VCI	CCI	GND	P24	PLC	COM	FWD	REV	Y1	Y2	2TA	2TB	2TC	

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

Contact capacity：250Vac/2A（COSφ=1），250Vac/1A（COSφ=0.4），30Vdc /1A

TA, TB and TC can be defined as multi-functional digital output signals. Please refer to Section 5.7

Relay output TA、TB、TC Wiring：

If there are inductive loads, such as: electro-magnetic relay and contactor, surge snubber circuit, e.g. RC circuit, varistor, fly-wheel diode (pay attention to the polarity when used in a DC circuit), should be installed. Note that the leakage current should be less than the current in the contactor or relay. The components in the snubber circuit should be installed near to the relay or contactor coil.

Note：

The “+RS485-” in the above figure means RS485+ and RS485-.

Table 3-8 Terminal function table

Category	Terminals	Name	Function	Specification
Communication	485＋	RS485communication port	RS485＋	Standard RS-485 communication port, please use twisted-pair cable or shielded cable
	485-		RS485-	
Analog input	VCI	Analog input VCI	Analog voltage input (reference ground: GND)	Input voltage range:0~10V (input resistance:100kΩ) resolution:1/2000
	CCI	Analog input CCI	Accepting analog voltage/current input.CN7(J1 OR SW1) 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	AO1	Analog output 1	Be able to output analog voltage/current, (total 12 kinds of signal). Jumper CN4(J2 OR SW2) can select voltage or current input mode. Voltage input mode is the default mode. Refer to F6.03 for details (reference ground: GND)	Output current range: 0/4~20mA Output voltage range: 0/2~10V

Category	Terminals	Name	Function	Specification
	AO2	Analog output 2	Be able to output analog voltage/current (total 12 kinds of signals). Jumper CN5(J3 OR SW3) can select voltage or current input mode, Voltage input mode is the default mode. Refer to F6.04 for details.(reference ground: GND)	
Digital input	X1～X3	Multi-functional digital inputs 1～3	Can be defined as multi-functional digital inputs, see Section 5.7 Reference ground: COM	Optical-isolator 2-way input input resistance: 2kΩ maximum input frequency: 200Hz Input voltage range: 9~30V
	X4～X5	Multi-functional digital inputs 4～5	Having the same function as X1~X3, besides, it can be defined as high-speed pulse inputs. See Section 5.7. Reference ground: COM	Optical-isolator 2-way input Single way max. input frequency: 100kHz, 2-way max. input frequency: 50kHz Max. reference pulse frequency: 50Hz Input voltage range: 9~30V Input impedance: 2Ω
	FWD	Run forward command	Optical-isolator two-way input programmable terminal, max. input frequency: 200Hz	
	REV	Reverse run command	Optical-isolator two-way input programmable terminal, max. input frequency: 200Hz	
	PLC	Common terminal	Common terminal for multi-functional inputs	

Category	Terminals	Name	Function	Specification
	P24	+24V supply	Providing +24V power supply	Output：+24V,set point accuracy：±10% Max output current：200mA（150mA for 2S0007G and 2S0004G）
	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 5.7.	Optical-isolator output: 24VDC/50mA
Digital output	Y2	Open collector output 2	Programmable terminals, defined as multi-function digital outputs, see Section 5.7.	Optical-isolator output: 24VDC/50mA，Y2 can be used as digital output，Max output frequency :50kHz
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	1TA/1TB/1TC/2TA/2TB/2TC（Only one group relay below SINUS VEGA 0005 4T	Relay output	TA, TB and TC can be defined as multi-functional digital output signals. Please refer to Section 5.87	TA-TB：normally closed；TA-TC：normally open Contact capacity：250Vac/2A（COSφ=1），250Vac/1A（COSφ=0.4），30 Vdc /1A

1）Analog Input Terminal Wiring

①Terminal VCI receives analog voltage input, the wiring is as follows：

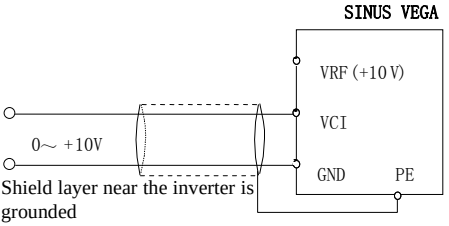


Figure 3-9 VCI Wiring Diagram

②Terminal CCI receives analog signal. Select current or voltage signal by setting jumper. Refer to the figure below：

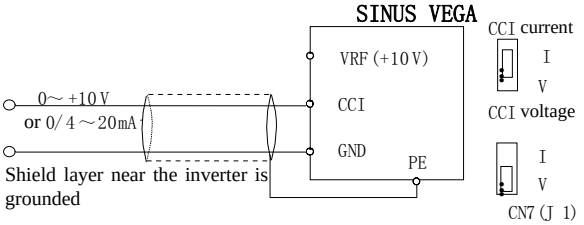


Figure 3-10 CCI Wiring Diagram

2）Analog Output Terminal Wiring

If the analog output terminal AO1 and AO2 are connected with analog meter, it can measure many parameters. The jumpers for AO1 and AO2 are CN4 (J2 OR SW2) and CN5 (J3 OR SW3).

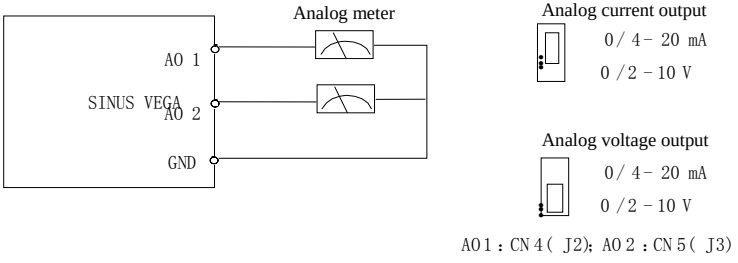


Figure3-11 Analog Output Terminal Wiring

Note：

1．When using analog input, you should install capacitor-filter or common-mode inductor between VCI and GND, or between CCI and GND.

2．Analog I/O signals are sensible to interference, ensure to use shielded cable and ground it properly. The cable length should be as short as possible.

3）Serial Communication Port Connection

The inverter can be connected to the host with RS485 port directly.

Figure 3-12 shows the connection of the inverter with the host with RS232 port.

Using above wiring method, you can built a “single-master single-slave” system or a “single-master multi-salves” system. The inverter in the network can be monitored, can be controlled remotely automatically in real time by using a PC or PLC controller. Thus more complicated operation control can be realized.

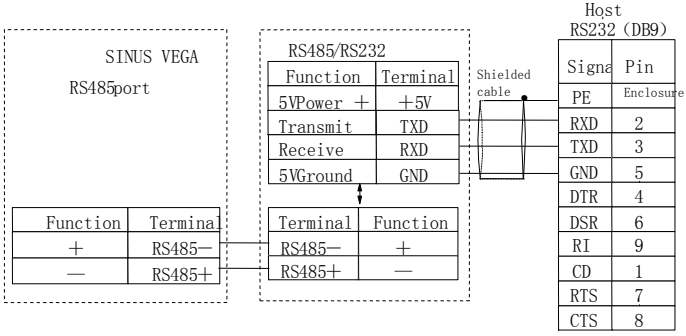


Figure3-12 RS485- (RS485/RS232) -RS232 communication cable

Precautions for communication port connection：

The PE terminal of each inverter should be earthed at a nearby grounding point；

The GND terminal of each inverter should be connected together；

RS485 communication uses shielded cables, which is earthed at one side. The earth wire of the shielded cable is connected to RS485 communication module (PE).

If the above standard wiring methods cannot meet the requirements, you can take the actions below：

Use isolated RS485 communication module；

If the noise is transmitted through the GND line to the inverter or other devices, which results in malfunction of them, you may disconnect the GND lines.

4）Multi-function Input Terminal and FWD, REV Wiring

The multi-function input terminals use full-bridge rectifying circuit, as the below figure shows. PLC is the common terminal for X1~X5, FWD and REV. The PLC terminal can sink or source current. Wire connections X1~X5, FWD and REV is flexible and the typical wiring is shown below：

① Connection method 1

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

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

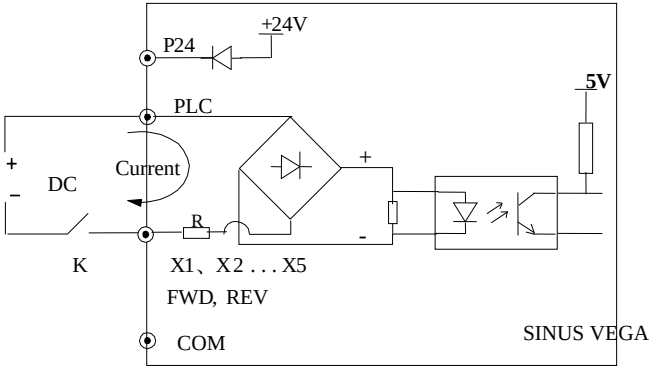


Figure 3-13 External power supply wiring diagram

②Connection Method 2

Inverter's internal +24V power supply is used and the external controller uses PNP transistors whose common emitters are connected, as shown in Figure 3-14.

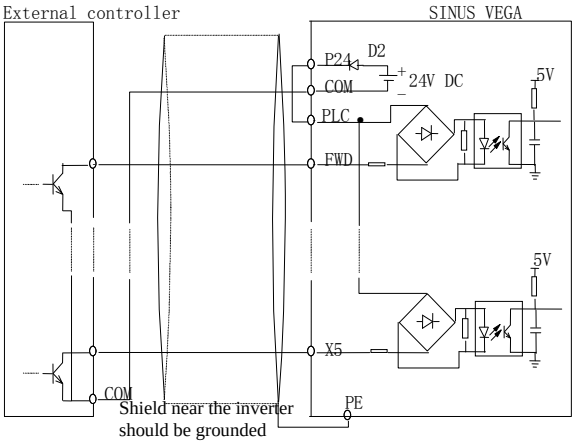


Figure 3-14 Internal +24V wiring diagram (source)

Inverter's internal +24V power supply is used and the external controller uses PNP transistors whose common emitters are connected.（Remote the wire between PLC and P24）.

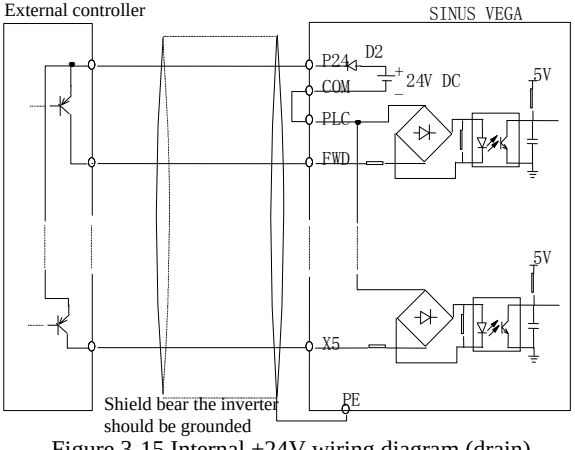


Figure 3-15 Internal +24V wiring diagram (drain)

When using External power supply, remember to disconnectPLC and P24

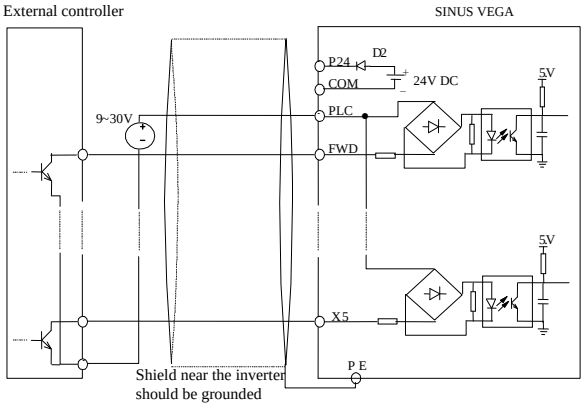


Figure 3-16 External power supply wiring (source)

External power supply wiring (drain)（Remember to disconnect PLC and P24）

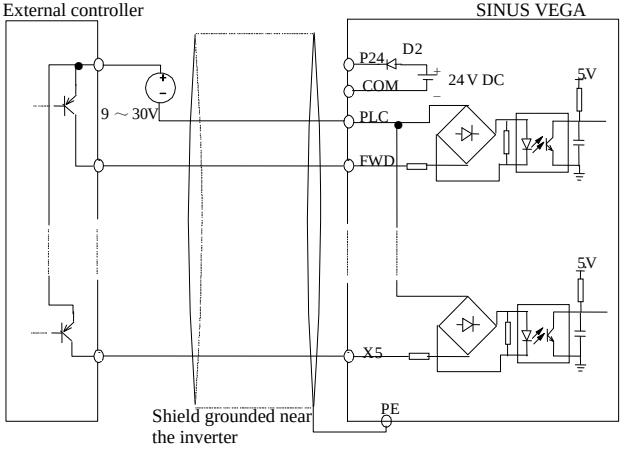


Figure 3-17 External power supply wiring (drain)

5）Multi-function Output Terminal Wiring

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

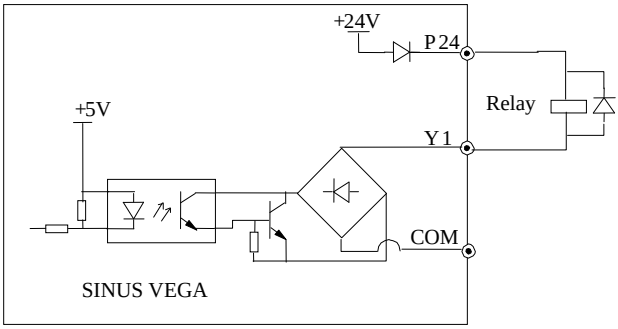


Figure 3-18 Multi-function output terminal wiring1

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

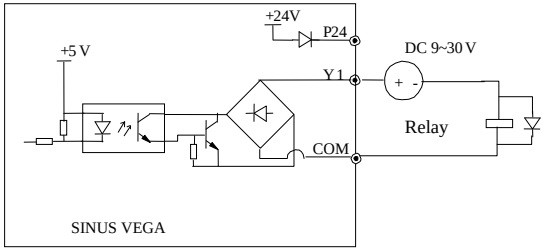


Figure 3-19 Multi-function output terminal wiring2

③When Terminal Y2 is used as digital pulse frequency output, it can also use the internal 24V power supply：

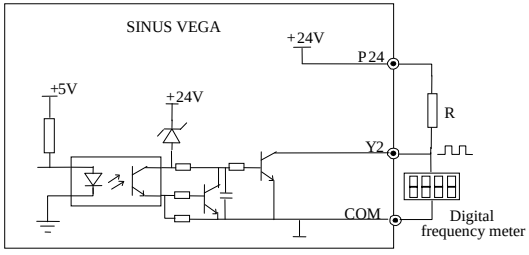


Figure 3-20 Terminal Y2 wiring 1

④When Terminal Y2 is used as digital pulse frequency output, it can also use the external power supply (9~30V)：

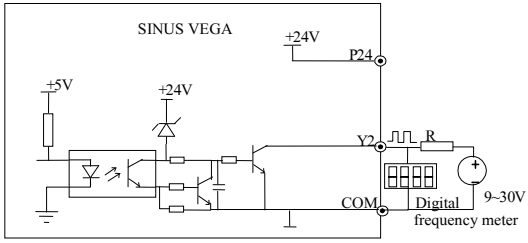


Figure 3-21 Terminal Y2 wiring 2

Note：

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

2．Use multi-core shielded cable or multi-strand cable (above 1mm) to connect the control terminals.

3．When using a shielded cable, the shielded layer's end that is nearer to the inverter should be connected to PE。

4．The control cables should be as far away (at least 20cm) as possible from the main circuits and high voltage cables (including power supply cables, motor cables, relay cables and cables of contactor). The cables should be vertical to each other to reduce the disturbance to minimum.

5.2.4 Onsite Wiring Requirements

To avoid mutual EMI disturbance, the control cables, power cable and motor cable should be installed as apart as possible, especially when they are routed in parallel for rather long distance. If the signal cable must cross the power cable or motor cable, keep them at right angle to each other.

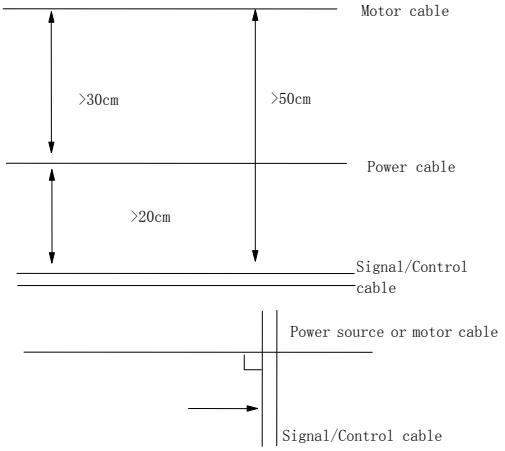


Figure 3-22 Cable routing schematic diagram

If the section area of the motor cable is too big, the motor should derate. Refer the inverter's cable specs in Table 3-2. Since the larger the section area of cables, the greater their capacitance to the ground, therefore, the output current should derate 5% with increasing every category of cable section area

Shielded/armored cable: high-frequency low-impedance shielded cable should be used, such as woven copper mesh, aluminum mesh or metal mesh.

The control cable should be shielded, and the clamps at both ends of the metal mesh should be connected to the earth terminal of the inverter enclosure.

Use conductive plate and dentate pad to clear away the paint between the screws and metal casing, to ensure good conductivity.

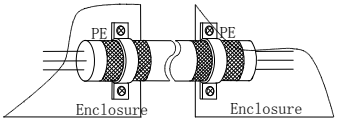
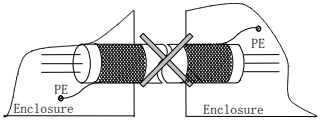


Figure 3-23 Correct shield layer earthing



Fugure3-24 Incorrect shield layer earthing

5.2.5 Earthing

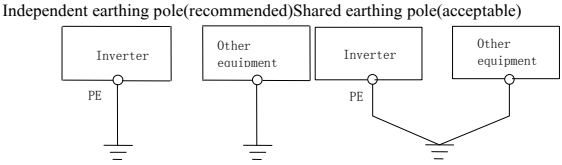


Figure 3-25 Earthing Diagram 1

Figure 3-26 Earthing Diagram 2

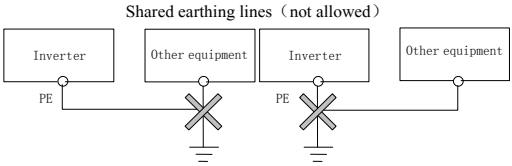


Figure 3-27 Earthing Diagram 3

Besides, pay attention to the following points：

In order to reduce the earthing resistance, flat cable should be used because the high frequency impedance of flat cable is smaller than that of round cable with the same CSA.

For 4-core motor cable, the end of one cable should be connected to the PE of the inverter, and the other end should be connected to the motor's enclosure. If the motor and the inverter each have its own earthing pole, then the earthing effect is better.

If the earthing poles of different equipment in one system are connected together, then the leakage current will be a noise source that may disturb the whole system. Therefore, the inverter's earthing pole should be separated with the earthing pole of other equipment such as audio equipment, sensors and PC, etc.

In order to reduce the high frequency impedance, the bolts used for fixing the equipment can be used as the high frequency terminal. The paints on the bolt should be cleaned。

The earthing cable should be as short as possible, that is, the earthing point should be as close as possible to the inverter.

Earthing cables should be located as far away as possible from the I/O cables of the equipment that is sensitive to noise, and lead should also be as short as possible.

6. Operation Procedures

6.1 Term Definition

6.1.1 Inverter Control modes

There are three control modes：

（1）Keypad control：The inverter is controlled by RUN、STOP key.

（2）Terminal control：The inverter is controlled by FWD、REV and COM (two-wire mode), Xi (3-wire mode).

（3）Communication：The operations such as START and STOP are controlled by RS485.

The control modes can be selected by parameters, switched by multi-function input terminals (function code 27、28、29 of F5.00).

6.1.2 Frequency Setting Method

Methods to set frequency：

（1）▲ and ▼ on the keypad；

（2）Terminal UP/DN；

（3）Serial communication port；

（4）Analog VCI；

（5）Analog CCI；

（6）Terminal (PULSE)；

（7）Potentiometer（for power rate lower than 4.G）

How to set frequency：

Main reference frequency: Set by F0.02, multi-speed (MS) or close loop control.

The main reference frequency is decided by the priority of running mode. The priority level is Jog>close loop>PLC>MS (multi-speed) >common running, e.g. if the inverter is running in MS mode, the primary reference frequency is MS frequency.

Auxiliary reference frequency: set byF0.03、F9.17、F0.05、F9.18.

Preset frequency: the sum of main and auxiliary frequency multiply a factor, which is set in F9.19 and F9.20. Please refer to F9.19, F9.20 and Figure 5-1 in chapter 5.

6.1.3 Inverter Operation Status

（1）Stop: After the inverter is switched on and initialized, if no operating command is received or the stop command is executed, then the inverter enters stop status.

（2）Operating: After receiving run command, the inverter begins to operate.

（3）Motor parameter tuning: If F1.10 is set at 1 or 2, after giving RUN command, the inverter will enter motor parameter tuning status, and then it will stay in stop status.

6.1.4 Operating Mode

There are 5 kinds of operating modes of SINUS VEGA，which can be arranged in the sequence of：Jog>Close loop operation>PLC>MS>Simple operation according to the priority.

（1）Jog：When the inverter is in stop status, it will operate according to Jog frequency after it receives the Jog operation command.（See F9.05～F9.08）

（2）Close-loop operation：If the close-loop operating function is enabled (F7.00=1) , the inverter will select the close-loop operation mode, meaning that it will perform PI regulation according to the reference and feedback values (See explanations of Parameter F7) . Close-loop operating function can be disabled by multi-function terminal (function No. 20) , and the inverter will then select other operating mode of lower priority level.

（3）PLC running：PLC function is enabled if the one's place of FD.00 setting is a non-zero value. The inverter will run according to the preset mode, see FD function group. It can be disabled by multi-function terminal (function No.21) .

（4）MS running：Select multi-frequency 1~7 (F8.00~F8.06) by the combination of multi-function terminal (function No. 1, 2, 3), which is not zero.

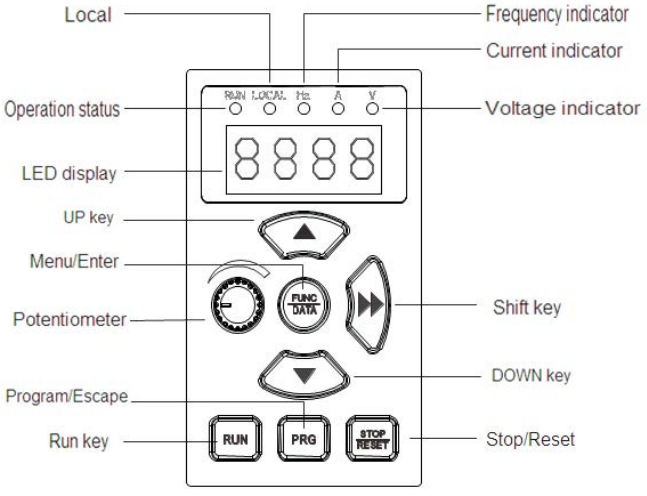
（5）Simple running：Simple open-loop operation.

The above 5 operating modes determine 5 frequency setting sources. Except Jog, the other four frequency settings can be adjusted or combined with auxiliary frequency. The frequency of PLC, MS and simple running can also be adjusted by traverse.

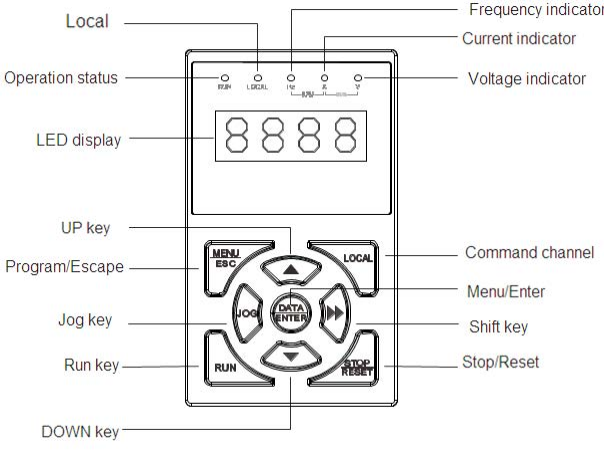
6.2 Operation Guide

6.2.1 LED Keypad

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



Keypad diagram of SINUS VEGA 0002 4T~0004 4T



Keypad diagram of SINUS VEGA 0005 4T and above

Figure 4-1 LED Keypad Display Unit

6.2.2 Keypad Function Explanation

Keys on the LED keypad display unit refer to the function of each key in Table 4-1.

Table 4-1 Key's function of SINUS VEGA 0002 4T~0005 4T

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
▼	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	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
/	Potentiometer	Set frequency

Key's function SINUS VEGA 0007 4T～SINUS VEGA 0160 4T

Key	Name	Function
MENU/ESC	Program/Esc key	To shift between program state and Esc
ENTER/DATA	Function/Data key	To enter sub-menu, confirm modification
▲	Increase key	To increase data or function code number
▼	Decrease key	To decrease data or function code number
▶▶	Shift key	In the edit state, you can select the modified bit of set digit; In other state, to scroll over the displayed parameters.
LOCAL	Control mode	Control mode selection, press ENTER/DATA to confirm
JOG	Jog key	In panel control mode, press Jog to start running
RUN	Run key	In panel control mode, press the key to start running.
STOP/RESET	Stop/Reset key	Reset in case of alarm or fault

6.2.3 Indicator Description

Functions of the indicators on the keypad：

Indicator	Meaning	Color	Mark
Status indicator	ON: the inverter is running	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）
A+V	Set line speed（m/s）
Hz+V	Set percentage（%）

If all the above indicators (A, V, Hz) go out, it means the displayed parameter has no unit.

6.2.4 Parameter Setting Method

Parameter system

The SINUS VEGA series inverter has 19 function groups: F0~F9, FA, FB, FC, FD, FE, FL, FN, FP and FU. Each function group includes manyparameters, which is presented as function group number + parameter number, e.g. F7.08.

Menu structure and parameter

When setting parameter through LED keypad display unit, function group is listed in menu level 1, parameter in menu level 2, and settings of parameters in menu level 3.

Examples of Parameter Setting

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, which can be 0~F. There are at most 4 digits, they are: one’s place, ten’s place, hundred’s place and thousand’s place. You may

select certain digit by pressing ▶▶key, and use ▲and ▼ key to increase or decrease values.

Example 1：To change the frequency from 50Hz to 40Hz（F0.07:50.00 change to40.00）

1．Press PRG key to enter programming state, the LED displays F0.

2．Press FUNC/DATA key, “F0.00” is displayed. Press ▲ key until “F0.07” is displayed.

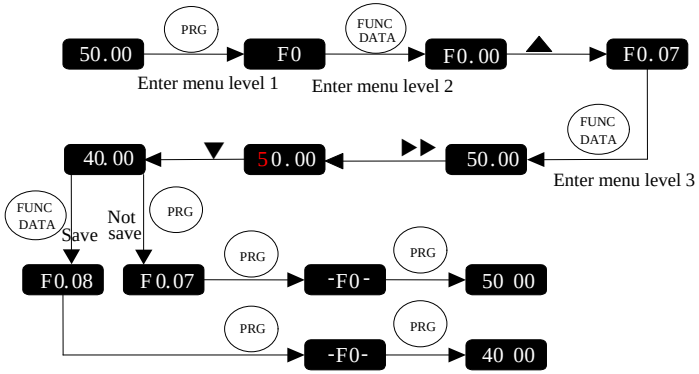
3．Press FUNC/DATA key, you will see 50.00.

4．Press ▶▶key, to move the cursor to the digit “5”.

5．Press ▼ key once, to change the digit to “4”.

6．Press FUNC/DATA key to save the modification and you will see the next parameter F0.08.

7．Press PRG key to exit the programming state.



Example 2：Settings of HEX format：

Take FA.00 (Display parameter during running) for example. Suppose you hope to display: reference setting, actual speed, set speed, actual line speed and set line speed.

Since each digit is mutually independent, you may set them separately. First you should decide the binary value, and then convert it into hex format. The conversion of binary value to HEX value is shown in Table 5-9.

1．Set one’s place.

Refer to the figure below. Reference Frequency is decided by the BIT2 of the one’s place of FA.00. If BIT2=1, it means the parameter will be displayed. For those parameters you don’t want to display, you may set the

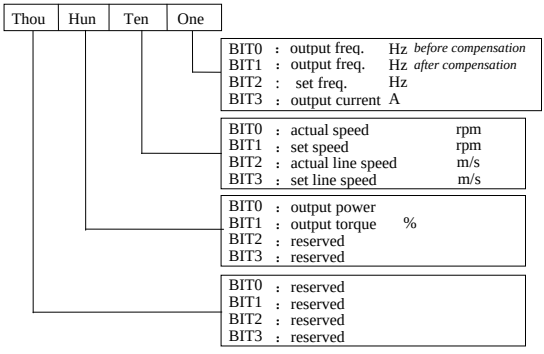
corresponding bit at Zero. Therefore, it turns out to be “0100”, after converting to HEX value, it is 4. So, you should set the one’s place at 4.

2. Set Ten’s place：

Similarly, set the corresponding bit at “1” for those parameters you want to display, you will get “1111”, i.e. “F”.

3. Set Hundred’s and Thousand’s place：

Since no parameters related to hundred’s and thousand’s place are required to display, so they are set at zero, from the above, FA.00 is set at 00F4.



Under menu level 3, if no digit of a parameter is blinking, it means it is unchangeable. The possible reasons are:

The parameter is unchangeable, such as measured parameters, operation log, etc;

The parameter can be changed at stop state only;

The parameter is protected. When FP.01=1 or 2, the parameter is protected. You should set FP.01=0 to allow the modification.

6.2.5 Speed Setting

If the initial state is actual speed, set speed, actual line speed or set line speed, you may press ▲or ▼key to change the set speed and set line speed real-time. If you want to change the reference setting, press ▶▶key to shift the LED display to frequency then change it.

6.2.6 Locking/Unlocking Keypad

Lock Keypad: Set the hundred’s place of F9.21 at non-zero value. Press FUNC/DATA key and PRG key at the same time, thus the keypad is locked.

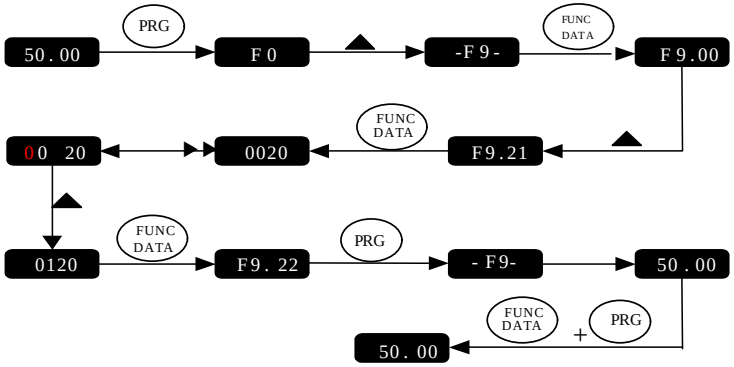


Figure 4-2 Lock LED keypad display unit

Unlock: at stop or operating state, press FUNC/DATA key, and then press ▼ three times. Note that the operation will not change the value of F9.21.

Note:

Even though the hundred's place of F9.21 is not zero (allow to lock the keypad), every time the inverter is powered up, the keypad is not locked.

7. Parameters

Note：

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

7.1 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 Control mode	Range：0～1 【0】

0：V/F control

1：Vector control

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：VCI

The reference frequency is set by voltage input via terminal VCI and the input voltage range is DC 0~10VDC.。

4：CCI

The reference frequency is set by voltage or current input via terminal CCI and the input range is DC 0~10 VDC (if jumper CN7 (J1 OR SW1) is placed at V side) or DC0~20mA (if jumper CN7 (J1 OR SW1) is placed at I side).

5：Terminal Pulse Setting

The reference frequency is set by terminals X4 or X5, see F5.03~F5.04. The input pulse range: 15~30V, 0~50.0 kHz.

6：Keypad Potentiometer Setting （for power rate lower than SINUS VEGA 0005 4T）

The reference frequency is set by potentiometer, the adjusting range is 0～Max (F0.09).

Note：

For method 3, 4 and 5, the frequency calculation curve is given in F5.10~F5.21, please refer to 5.5.

F0.03 Auxiliar y reference frequency	Range：00～13 【0】

The setting frequency of SINUS VEGA is composed of main reference frequency and auxiliary reference frequency. F0.03、F0.05、F9.17、F9.18 are used to define auxiliary reference frequency. Figure 5-1 shows the formation process of setting frequency.

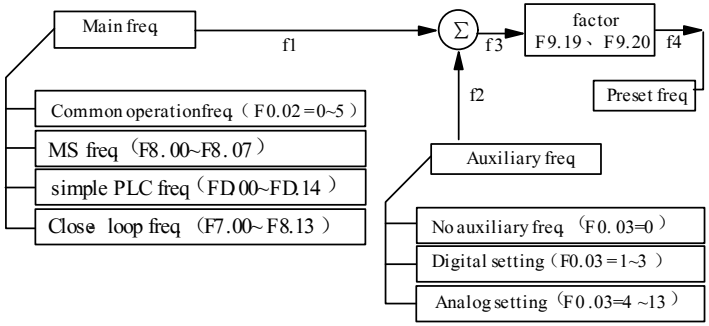


Figure 5-1 Preset Freq. Calculation Method

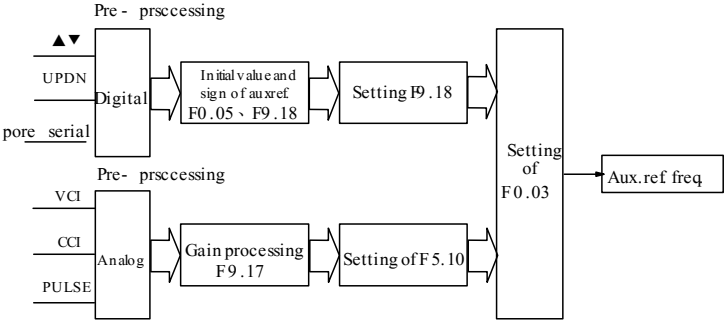


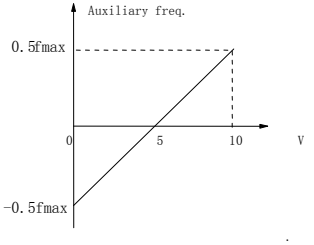
Figure 5-2 Auxiliary Frequency Processing

Table 5-1 Auxiliary reference frequency method selection

Method	Name	Description
0	Invalid	Auxiliary freq.=0
1	Adjust by ▲ and ▼	Set by F0.05
2	Adjust UP/DN	
3	Set by serial port	
4	VCI	Depending on actual input. Refer to F5. 10
5	CCI	
6	PULSE	
7	- VCI	
8	- CCI	
9	- PULSE	
10	VCI-5	
11	CCI-5	
12	PULSE-0.5×Max pulse input freq.	
13	Potentiometer（for power rate lower thanSINUS VEGA 0005 4T）	

Select digital setting 3, you may set F0.03 via serial port to change auxiliary frequency.

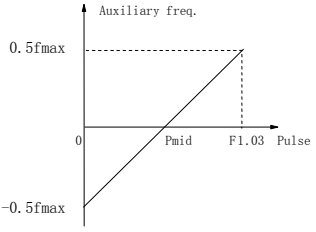
If VCI-5 or CCI-5 is selected, take 5V input as the point corresponding to zero frequency, 0~5V input corresponds to negative output, 5~10V input corresponds to positive output. See Figure5-3.



f_{max}—frequency corresponding to Max analog value(F5.17 or F5.21)

Figure 5-3 Frequency Setting Via VCI-5 or CCI-5

If PULSE-0.5 × F5.13 is taken as auxiliary frequency setting method, one half of F5.13 (max. pulse freq.) as the point corresponding to zero frequency, 0~0.5 times of F1.03 input corresponds to negative output, 0.5~1 times of F5.13 input corresponds to positive output. See Figure5-4.



P_{mid}—1/2*F5.13

f_{max}—frequency corresponding to Max analog value (F5.17 or F5.21)

Figure 5-4 PULSE-0.5 × F5.13 As Freq. input

F9.17: Analog auxiliary reference factor

It is valid when F0.03=4~12. The auxiliary reference undergoes F9.17 gain calculation first, and then output according to F5.10.

F9.18: digital auxiliary reference control

It is valid when F0.03=1~3. See Figure 5-5.

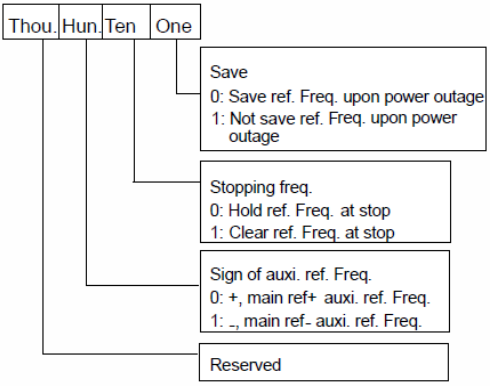


Figure 5-5 Digital Auxiliary Freq. Setting

One's place of F9.18

0: save the auxiliary freq. at power off

The auxiliary frequency will be saved in F9.03, and the sign of the freq. saved in F9.18.

1: not save the auxiliary freq. at power off

Ten's place of F9. 18

0: maintain the auxiliary freq. if the inverter stops

1: preset frequency is cleared if the inverter stops

Hundred's place of F9.18: sign of auxiliary freq.

0: (+) positive sign.

Preset freq. is the sum of main freq. and auxiliary freq.

1: (－) negative sign

Preset freq. is the result of main freq. minus auxiliary freq.

Note：

When the inputting mode of auxiliary reference frequency is the same with that of main reference frequency, the auxiliary reference frequency setting is invalid.

F0.04 Ke ypad 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 Digita l auxiliary frequency	Range：0.00～650.00Hz【0.00Hz】

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

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

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】

Please refer f_H and f_L in Figure 5-6

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 بsrated】

The max frequency refers to the allowed max output frequency of the inverter. Refer to the f_{max} in Figure 5-6;

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 5-6 as f_b

Max output voltage is the inverter بsoutput voltage when the inverter outputs base frequency, as shown in Figure 5-6 as V_{max}. This corresponds to the rated voltage of the inverter

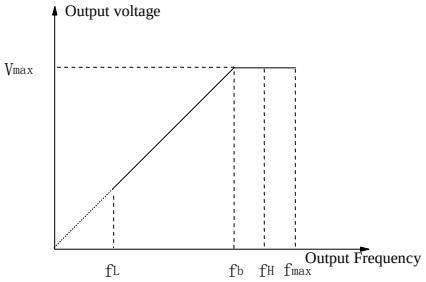


Figure 5-6 Characteristic parameters definition

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 directions	Range：0、1 【0】

The function applies only to keypad control, but not serial port control, not terminal control mode.

0：Forward

1：Reverse

F0.12 Acc time 1	Range：0.1～3600s（min） 【6.0s/20.0S】
F0. 13 Dec time 1	Range：0.1～3600s（min） 【6.0s/20.0S】

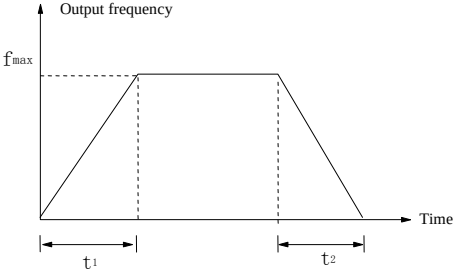


Figure 5-7 Acc/Dec time definition

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 5-7. Dec time is the time taken for the motor to decelerate from maximum frequency (F0.09) to 0 Hz, see t_2 in Figure 5-7.

SINUS VEGA has four pairs of acc/dec time. Here we only introduce acc/dec 1. Please find acc/dec time 2~4 in section 5.9: F8.14~F8.19

F0.14 Anti-reverse setting	range：0、1【0】

0：Reverse allowed

1：Reverse not allowed

7.2 Motor Parameter（F1）

F1.00	

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

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

F1.04 Current without load	Range：0.1～999.9A【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】

Please refer the above parameters to Figure 5-8.

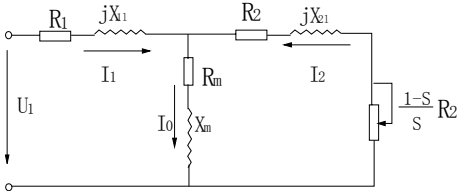


Figure 5-8 Motor's Equivalent Circuit

In Figure 5-8, R1, X1l, R2, X2l, Xm and I0 represent stator's resistance, stator's leakage inductance, rotor's resistance, rotor's leakage inductance, mutual inductance and current without load respectively. The setting of F1.06 is the sum of stator's leakage inductance and rotor's inductance.

The settings of F1.05 ~F1.08 are all percentage. Formula used for calculating stator's resistance or rotor's resistance:：

$$\%R = \frac{R}{V/(\sqrt{3}\cdot I)} \times 100\%$$

R：Stator's resistance or rotor's resistance that is converted to the stator's side;

V：Rated voltage；

I：Motor’s rated current;

Formula for calculating (leakage inductance or mutual inductance);

$$\%X = \frac{X}{V/\left(\sqrt{3}\cdot I\right)}\times 100\%$$

X：The sum of leakage inductance of stator and rotor, or mutual inductance. The rotor’s inductance has been converted to the stator’s side;

V：Rated voltage；

I：Motor’s rated current

If motor’s parameters are available, please set F1.05 ~F1.08 to the values calculated according to the above formula.

If the inverter performs auto-tuning of motor’s parameters, then the settings of F1.04~F1.08 after the auto-tuning process will be updated.

After motor power (setting of F1.02) is changed, the inverter will set F1.03~F1.08 to corresponding parameters.

F1.09 Rated slip frequency	Range：0.00～20.00Hz【2.00Hz】

Motor’s rated slip frequency can be calculated by the motor’s rated speed (on the nameplate):

Rated slip frequency = motor’s rated frequency (i.e. basic operating frequency F0.06) × (motor’s synchronous speed-motor’s rated speed) ÷motor’s synchronous speed. Where: motor’s synchronous speed = motor’s rated frequency × 120÷number of motor’s poles (F1.01)

After setting the slip frequency, the slip compensation will be enabled by F3.09~F3.11.

F1.10 Auto tuning	Range：0～2【0】

FH09 can be used to measure and write-in the motor’s parameters automatically.

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 پF0.0 6 basic operating frequencyپand پF0.07 Max o utput voltageپ correctly according to the motorپsfeature;

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 motorپsload 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 donپt require much on motorپs control performance, you can use stationary auto-tuning or even disable the function. You may input the values on the motorپs nameplate correctly (F1.01~F1.03);

5．If the auto-tuning function is unavailable and there is motorپsparameters 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.

7.3 Start/Brake Parameter（F2）

F2.00 Start mode	Range：0、1、2【0】

F2.00=0：Start at start frequency

The inverter is started at start frequency（F2.01）and in preset time（F2.02）.

F2.00=1：Brake first and then start at start frequency.

DC brake first, refer to F2.03、F2.04, and then start in the manner of F2.00=0

F2.00=2: Rotate speed tracking and then start at start frequency（For power rate lower than SINUS VEGA 0005 4T，F2.00 is reserved）

Tracking motor's rotate speed and directions automatically. Start the motor during rotating smoothly and without any impact. Please refer to Figure 5-a.

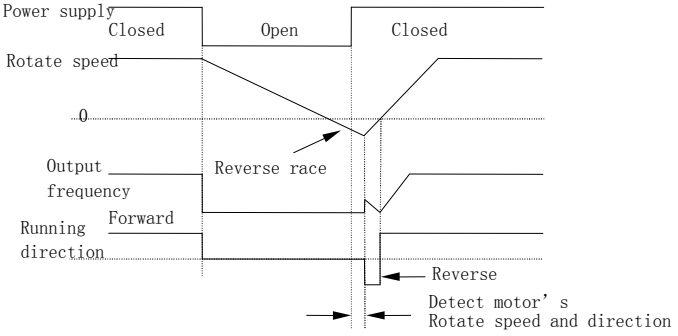


Figure 5—a

Note:

1. Start mode 1 applies to small-inertia motor when the inverter stops, the motor is still rotating. For large-inertia load, do not restart until the motor stops.
2. Start mode 2 applies to large-inertia motor when the inverter stops, the motor is still running.
3. The performance of start mode 2 is related to motor parameters. Please set the parameters of FH correctly.
4. When driving synchronized motor, it is recommended to use start mode 0.

F2.01	Start frequency	Range：0.20～60.00Hz【0.20Hz】
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 5-9 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 5-9 t_1.

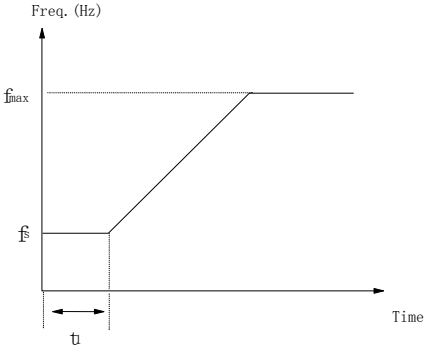


Figure 5-9 Relation of Start Freq. and Start Time

Note：

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

F2.03 DC brake current at startup	Range：Depending on model 【0.0％】
F2.04 DC brake time at startup	Range：Depending on model 【0.0s】

F2.03 and F2.04 are valid only when you set F2.00=1, that is, braking before starting. See Figure 5-10.

DC brake current at startup is determined by inverter model，

4.0KW and below Heavy duty：0～150%；Normal duty：0～130%。

5.5KW and aboveHeavy duty：0～100%；Normal duty：0～80%。

DC braking current start up is relative to the percentage of the rated current of the inverter.

If the brake time at startup is set to 0.0s, no brake process.

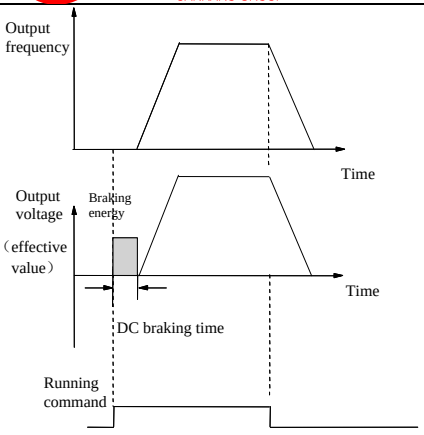


Figure 5-10 Start mode 1

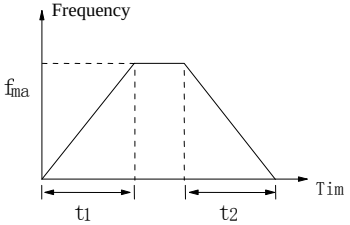
F2.05 Acc/Dec	Range：0、1【0】

F2.05=0：Linear Acc/Dec

The output frequency increase or decrease according to a fixed slope, see Figure 5-11.

F2.05=1：S curve Acc/Dec

The output frequency increase or decrease according to S curve, see Figure 5-12.



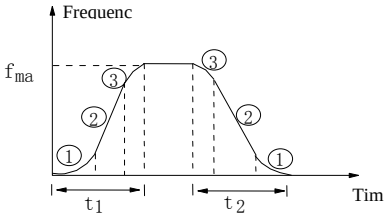


Figure 5-11 Linear Acc/Dec curveFigure 5-12 Acc/Dec S curve

F2.06 S curve start time	Range：10～50%【20.0%】
F2.07 S curve rising time	Range：10～80%【60.0%】

F2.06、F2.07are only valid whenF2.05=1 (S curve mode) and F2.06+F2.07 ≤ 90%.

S curve start time is illustrated in Figure 5-12 as ①, thechange rate of output frequency is increasing from 0.

S curve rising time is illustrated in Figure 5-12 as ②, thechange rate remains the same.

S curve end time is illustrated in Figure 5-12 as ③. Thechange rate decreases to 0.

S curve Acc/Dec is suitable to the start and stop of elevator,conveyer, etc.

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	Range：Depending on model【120.0%/100.0%】
F2.12 DC brake time at stop	Range：Depending on model【0.5s】

DC braking delay time is the period from arriving at frequency threshold (F2.09) to starting braking.

During the period, there is no output from the inverter. This function can prevent current overshoot of high power motor at startup.

For power rate lower than SINUS VEGA 0005 4T:

The braking current is different depending on inverter's model,

Heavy duty: 0~150% of inverter's rated current (max. current among the 3 phases),

Normal duty: 0~130% of inverter's rated current (max. current among the 3 phases).

For power rate higher than SINUS VEGA 0075 4T:

The braking current is different depending on inverter's model,

Heavy duty: 0~150% of inverter's rated current (max. current among the 3 phases), Normal duty: 0~130% of inverter's rated current (max. current among the 3 phases).

If the brake time at stop is set at 0.0s, there is no braking process.

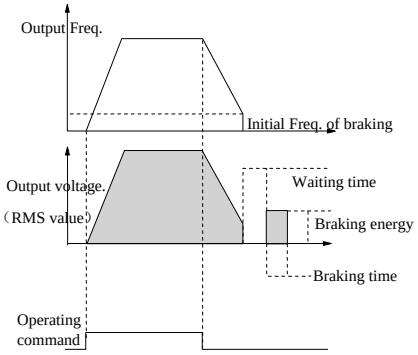


Figure 5-13 Deceleration +DC braking Process

F2.13 Dynamic braking	Range：0，1【0】

0：Disabled

1：Enabled

Note：

Please set this parameter properly according to your needs, otherwise, the control performance will be suffered.

F2.14 Ration of braking time to total operating time	Range：0.0～100.0％【100.0％】

The max. Continuous dynamic braking time is calculated with 100s as a cycle.

Note：

The resistance and power of the braking resistor should be considered.

7.4 Flux vector control parameters（F3）

F3.00 V/F curve setting	Range：0～3【0】
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％】

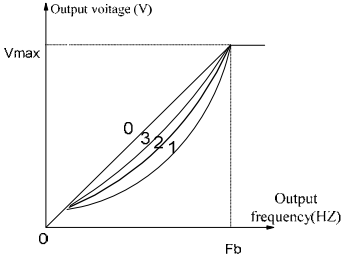
This group of parameters defines the V/F setting modes so as to satisfy the requirements of different loads. Three fixed curves and one user-defined curve can be selected according to the setting of F3.00.

If F3.00 is set to 1，a 2-order curve is selected, as shown in Figure 5-14 as curve 1;

If F3.00 is set to 2，a 1.7-order curve is selected, as shown in Figure 5-14 as curve 2;

If F3.00 is set to 3，a 1.2-order curve is selected, as shown in Figure 5-14 as curve 3.

The above V/F curves are suitable for the variable-torque loads such as fan & pumps. The user can select the curves according to the actual load so as to achieve the best energy-saving effects.

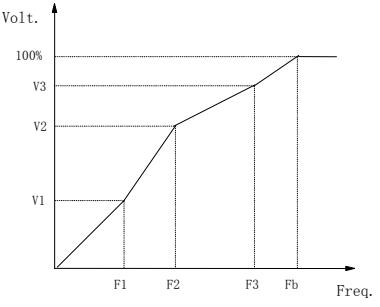


Vmax：Max output voltage(F0.10)
Fb ：Basic operating frequency(F0.06)

Figure 5-14 Torque-reducing curve

If F3.00 is set to 0, you can define a curve by F3.01~F3.06, i.e. a polygonal line defined by 3 points (V1, F1), (V2, F2), (V3, F3), to satisfy the needs of special loads, as shown in Figure 5-15.

The default is a straight line, shown in Figure 5-14 as curve 0.

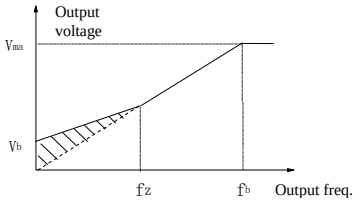


V1~V3: segment 1-3,voltage percentage
F1~F3: frequency segment 1-3
Fb: base frequency F0.06

Figure 5-15 User Defined V/F curve

F3.07 Torque boost	Range：0～30.0%【0.0%】

In order to compensate the torque drop at low frequency, the inverter can boost the voltage so as to increase the torque. If F0.09 is set to 0, auto torque boost is enabled and if set at non-zero, manual torque boost is enabled, as shown in Figure 5-16.



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

Figure 5-16 Torque boost (shadow area: boost value)

Note：

1．Wrong parameter setting can cause overheating of the motor or triggers the over-current protection of the inverter.

2．Refer to F3.08 for definition of fz.

3．When using synchron motor, you should select manual torque boost, and adjust V/F curve according to the motor parameters and application.

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

F3.08 defines the ratio of the cut-off frequency used for manual torque boost to the base frequency (defined by F0.06) , as shown in Figure 5-16 as fz. This cut-off frequency adapts to any V/F curve defined by F3.00.

F3.09	Slip compensation gain	Range：0.0～300.0%【100.0%】
F3.10	Slip compensation limit	Range：0.0～250.0%【200.0%】
F3.11	Compensation time	Range：0.1～25.0s【2.0s】

The change in motor torque will affect motor slip and result in speed change. Through slip compensation, the output frequency can be adjusted according to motor load torque, so as to reduce speed change caused by load change. See Figure 5-17.

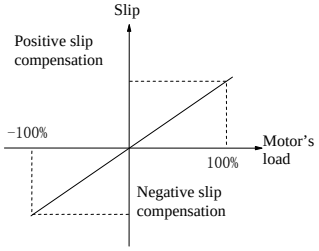


Figure 5-17 Auto slip compensation

Electromotion state: Increase the gain of slip compensation gradually when the actual speed is lower than the reference speed (F3.09)

Power generation state: Increase the gain of slip compensation gradually when the actual speed is higher than the reference speed (F3.09).

Slip compensation range: limit of slip compensation (F3.10) × rated slip (F1.09).

Note:

The value of automatically compensated slip is dependent on the motor's rated slip; therefore the motor's rated slip must be set correctly (F1.09).

F3.12 AVR function	Range：0、1、2【2】

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 Auto energy saving	Range：0、1【0】

0：Disabled

1：Enabled

The inverter can detect load current and adjust voltage accordingly to save energy.

Note:

This function is preferable to the load such as fan and pump.。

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.

For power rate lower than 55kW, the default value is 10；

For power rate higher 55kW, the default value is 20.

7.5 Current vector control parameter（F4）

F4.00 Reserved	-

F4.01 Pre-excitation	Range：0～1【1】

0：Valid

1：Invalid

F4.02 Speed loop proportional gain 1	Range：0～65535【120】

F4.03 Speed loop integral gain 1	Range：0～65535【3】
F4.04 Speed loop proportional gain 2	Range：0～65535【120】

F4.05 Speed loop integral gain 2	Range：0～65535【3】

F4.06 Speed loop switching frequency	Range：0.0%～100.0%【3】

F4.07 D axis current loop proportional gain	Range：0～65535【10000】

F4.08 D axis current loop integral gain	Range：0～65535【2000】

F4.09 Q axis current loop proportional gain	Range：0～65535【10000】

F4.10 Q axis current loop	Range：0～65535【2000】

integral gain	

7.6 Multi-function terminal（F5）

F5.00	Function of multi-function terminal X1	Range：0～43【0】
F5.01	Function of multi-function terminal X2	Range：0～43【0】
F5.02	Function of multi-function terminal X3	Range：0～43【0】
F5.03	Function of multi-function terminal X4	Range：0～47【0】
F5.04	Function of multi-function terminal X5	Range：0～48【0】
F5.05	（Reserved）	
F5.06	（Reserved）	
F5.07	（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 5-3. Take X1~X3 for example in the following description.

Table 5-2 Functions of multi-function terminals

Setting	Functions	Setting	Functions
0	No function	1	MS frequency 1
2	MS frequency 2	3	MS frequency 3
4	Acc/Dec time 1	5	Acc/Dec time 2
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)
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	Reference freq. is input via CCI
26	Reserved	27	Terminal control mode is forcibly enabled

Setting	Functions	Setting	Functions
28	Control mode 1	29	Control mode 2
30	MS close-loop 1	31	MS close-loop 2
32	MS close-loop 3	33	Start traverse operation
34	Reset the travers operation status	35	External stop command
36	Reserved	37	Inverter operation prohibiting
38	Reserved	39	Clear length
40	Clear auxiliary reference frequency	41	Reset PLC stop status
42	Clear counterب s ecord	43	Signal of triggering counter
44	Input the signal of length	45	Pulse input
46	Single phase speed measuring	47	Speed measuring input SM1 （only for X4）
48	Speed measuring input SM2（only for X5）		

The functions are explained as follows:

1~3: MS terminals

If any three of F5.00~F5.02 are set at 1, 2, 3 respectively, Up to 8 segments of speed can be defined through the combination of the ON and OFF state of the 3 terminals.

Table 5-3 MS Speed

X_3	X_2	X_1	Freq.
OFF	OFF	OFF	Common freq.
OFF	OFF	ON	MS freq. 1
OFF	ON	OFF	MS freq. 2
OFF	ON	ON	MS freq.3
ON	OFF	OFF	MS freq.4
ON	OFF	ON	MS freq. 5
ON	ON	OFF	MS freq. 6
ON	ON	ON	MS freq. 7

The MS frequency will be used in MS running and simple PLC operation. e.g.: Set the parameters corresponding to X1, X2 and X3: F5.00=1, F5.01=2,

F5.02=3, then X1, X2 and X3 are used to perform MS running. See Figure 5-18.

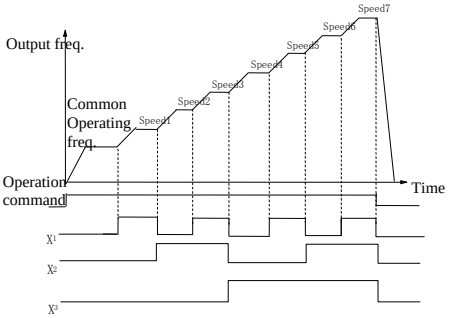


Figure 5-18 MS Running

Figure 5-19 illustrated the wiring of terminal control of MS running. K4 and K5 control the running direction. The combination of K1, K2 and K3 can enable common running or MS running with 1~7 speeds.

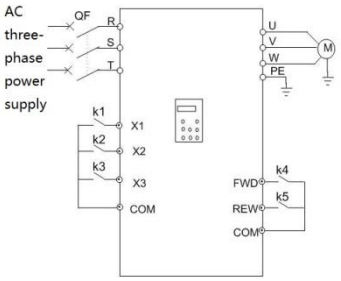


Figure 5-19 Wiring of MS running

4～5：Acc/Dec time terminal

Table 5-4 Acc/Dec Time Selection

X2	X1	Acc/Dec time selection
OFF	OFF	Acc time 1/ Dec time1
OFF	ON	Acc time 2/ Dec time 2
ON	OFF	Acc time 3/ Dec time 3
ON	ON	Acc time 4/ Dec time 4

By combination of the ON/OFF state of Terminal 1 and 2, you can get 4 groups of Acc/Dec time.

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.

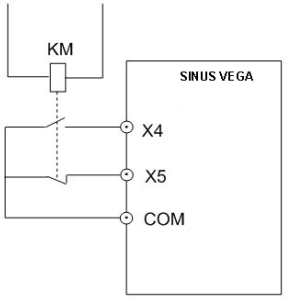


Figure 5-20 Normally-open/close input

In Figure 5-20, 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. Increasing or decreasing rate is determined by F5.09.

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.14 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 5-20 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 5-5 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	Pulse
ON	ON	ON	LED keypad

25: Frequency reference is input via terminal CCI

If the setting is 25, the frequency reference will be input via terminal CCI forcibly. The frequency input will be changed to the previous one if this terminal function is disabled.

26：Reserved

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 5-6 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.

30~32: MS close-loop terminal (3 terminals of X1~X5)

Table 5-7 MS Close-loop Setting Selection

X3	X2	X1	MS close-loop reference
OFF	OFF	OFF	By F5.01
OFF	OFF	ON	MS close-loop setting 1
OFF	ON	OFF	MS close-loop setting 2
OFF	ON	ON	MS close-loop setting 3
ON	OFF	OFF	MS close-loop setting 4
ON	OFF	ON	MS close-loop setting 5
ON	ON	OFF	MS close-loop setting 6

ON	ON	ON	MS close-loop setting 7

The various MS close-loop setting is realized by the combination of ON/OFF state of terminal X1~X3. In the above table, you should set F5.00=30，F5.01=31，F5.02=32

33: Start traverse operation

34: Reset the travers operation status

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: Clear length

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 F6.10 and F6.11 for details.

44:Input the signal of length

45：Pulse frequency input

This function is effective only to multi-function input terminals X4 and X5. The terminal is used to input pulse signal that is used as frequency reference.

Refer to F5 parameters for the relationship between input pulse frequency and the reference frequency.

46: Single-phase speed measuring input

This function is effective only to multi-function input terminalsX4 and X5. See section 3.2.3 for input characteristics. The speed control accuracy is .0.1%. Single-phase speed feedback control can be realized by using this terminal and PG.

47: Speed measuring input SM1

48: Speed measuring input SM2

This function is effective only to multi-function input terminals X4 and X5. See section 3.2.3 for input characteristics. The speed control accuracy is .0.1%. 2-phase speed feedback control can be realized by using this terminal and PG.

Note：

When the inverter is in motor auto-tuning status, No. 44~47 functions of X4 are disabled automatically.

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

K_2	K_1	Command
0	0	Stop
1	0	REV
0	1	FWD
1	1	Stop

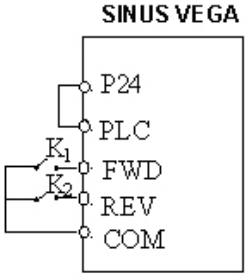


Figure 5-21 2-wire Operation Mode 1

1：2-wire operating mode 2

K_2	K_1	Command
0	0	Stop
1	0	Stop
0	1	FWD
1	1	REV

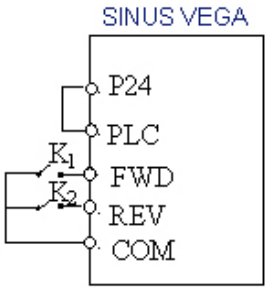


Figure 5-22 2-wire Operation Mode 2

2：3-wire operating mode 1

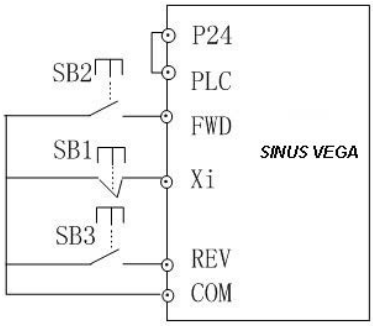


Figure 5-23 3-wire Operation Mode 1

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

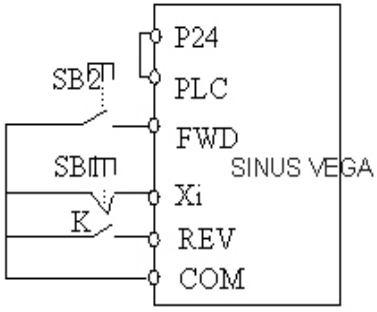


Figure 5-24 3-wire Operation Mode 2

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).

Note：

In terminal control mode, for 2-wire operating mode 1 and 2, although the terminal is effective, the inverter will not run if there is external stop command. If you want to start the inverter, you should activate FWD/REV terminal again, e.g. set any of F5.00~F5.04 at 11 or 35, PLC stop after single cycle, stop after preset length arrival, Stop key pressed (see F9.21). When the inverter stops due to a fault, it will start immediately if the terminal FWD/REV is enabled and the fault is cleared.

F5.09 UP/DN rate	Range：0.01～99.99Hz/s【1.00Hz/s】

To define the increase/decrease rate when using UP/DN terminal to change reference frequency.

F5.10 Freq. Curve selection	Range：000～111【000】
F5.11 Gain of reference frequency selector	Range：0.00～9.99【1.00】
F5.12 Filter constant	Range：0.01～50.00s【0.50s】
F5.13 Max. input pulse freq.	Range：0.1～50.0kHz【10.0kHz】
F5.14 Ratio of Min. input of curve 1	Range：0.0%～F5.16【2.0%】
F5.15 Frequency corresponds to min. input if curve	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 Ratio of Min. input of curve2	Range：0.0%～F5.20【0.0%】
F5.19 Frequency corresponds to min. input	Range：0.0～F0.09【0.00Hz】
F5.20 Ratio of Max. input of curve 2	Range：F5.18～100.0%【100.0%】
F5.21 Frequency corresponds to max. input	Range：0.0～F0.09【50.00Hz】

When selecting VCI and CCI or PULSE input as open loop setting method, the process is shown in Figure 5-25.

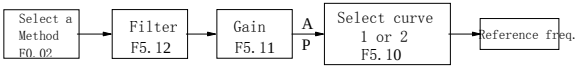
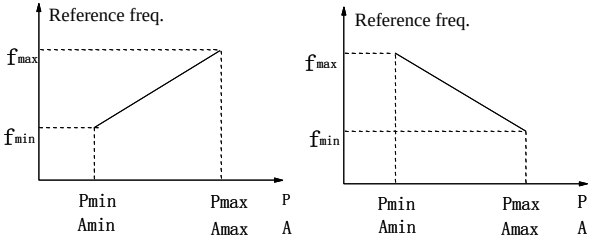


Figure 5-25 The process of setting reference freq.

After the input passes through the filter and gain processor, the relationship of its value and reference frequency is determined by curve 1 or curve 2, which are decided by F5.14~F5.17and F5.18~F5.21 respectively. Both of them can work as positive or negative logic, as shown in Figure5-26.



P: pulse
A: AnalogVCI or CCI
Pmin、Amin: Min reference
Pmax、Amax: Max reference
fmin: Freq. corresponding to Min. reference freq.
fmax: Freq. corresponding To Max.reference freq.

Figure 5-26 Reference freq. curve

When the analog input A is 100%, it is a 10V or 20mA signal and the reference frequency is the maximum; when the pulse input is 100%, it corresponds to F5.13 (max. input pulse frequency).

F5.12 defines the filter time. The longer the time, the stronger the immunity to disturbance, the slower the response, and vice versa.

F5.10 is to select the reference frequency curve of VCI, CCI and PULSE setting method, see Figure 5-27.

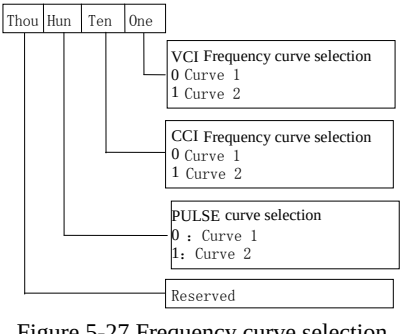


Figure 5-27 Frequency curve selection

Suppose you want to:

①set reference frequency by terminal pulse signal;

③ input signal range: 1kHz~20kHz;

④ 1kHz input for reference frequency 50Hz, 20kHz input for reference frequency 5Hz;

To meet the above requirement, you should set:

①F0.02=5, set terminal pulse mode;

② F5.03=45, input pulse signal from X4;

③F5.10=100, select curve 2;

④F5.13=20.0 kHz, set max. pulse frequency at 20kHz;

⑤ F5.18=1÷20 × 100%=5.0%, to set the ratio of min input of curve 2 (1kHz) to F1.03 (20kHz) ;

⑥ F5.19=50.00Hz; reference frequency corresponds to min. input.

⑦ F5.20=20÷20 × 100%=100.0%, to set the ratio of max. input of curve 2 (1kHz) toF.04 (20kHz);

⑧ F5.21=5.00Hz, to set the reference frequency corresponding to max. input.

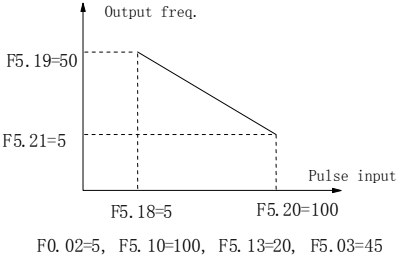


Figure 5-28 Frequency Set By Pulse Signal

7.7 Output terminal control parameters（F6）

F6.00 Y1	Open collector output terminal	Range：0～19【0】
F6.01 Y2	Open collector output terminal	Range：0～32【1】
F6.02	Relay 1 output function	Range：0～19【16】
F6.03	Relay 2 output function	Range：0～19【16】

Refer to section 3.3.2 for the output characteristics of Y1, Y2 and the relay's output terminal. Table 5-8 shows the functions of the above 3 terminals. Note that one function can be selected repeatedly.

F6.01=20~32, Y2 is the output pulse frequency, range: 0~max. pulse frequency (F6.10). The relation between the output pulse frequency and the parameters it presents are shown in 20~32 in the table below. The extended function 2 of host is to control Y2 by serial port directly. The max setting of F6.10 is 65535.

Table 5-8 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	Frequency detection threshold（FDT2）
4	Overload signal（OL）	5	Low voltage 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 counting value arrival	13	Specified counting value arrival
14	Preset length arrival	15	Inverter is ready（RDY）
16	Inverter fails	17	Extended function 1 of host
18	Upper and lower limits of traverse frequency	19	Preset operation time out

Setting	Function	Range
20	Freq. before slip compensation	0～Max. output freq.
21	Freq. after slip compensation	0～Max. output freq.
22	Preset freq.	0～Max. output freq.
23	Output current	0～2 times of inverterبsrated current
24	Output current	0～2 times of inverterبsrated current
25	Output torque	0～2 times of inverterبsrated torque
26	Output voltage	0～1.2 times of inverterبsrated voltage
27	Bus voltage	0～800V

Setting	Function	Range
28	VCI	0～10V
29	CCI	0～10V/0～20mA
30	Output power	0～2 of rated power
31	Extended function 2 of host	0～65535
32	Potentiometer setting(for power rate lower thanSINUS VEGA 0005 4T)	0～10V

The explanation of output signal is shown in Table 5-8.

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: Frequency detection threshold (FDT2)

See F6.16~F6.17.

4: Overload signal (OL)

The signal will be given if the inverter's output current is bigger than the value defined by FL.05 and the overload time is longer than the time defined by FL.06. This function is usually used for overload pre-alarm. See Figure5-78.

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) 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: preset length arrival

The signal is given if the setting of FC.09 (actual length) is bigger than FC.08 (preset length). The length counting terminal is the one whose parameter (F5.03 or F5.04) is set at 44.

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, Y2 or TC is directly controlled by a serial port. Refer to the communication protocol of SINUS VEGA.

18: Upper and lower limits of traverse frequency

19: preset operating time out

The signal is given if the inverterبstotal operating time (FN.01) reaches preset operating time (FN.00).

F6.04 AO1 output function	Range：0～12【0】
F6.05 AO2 output function	Range：0～12【3】
F6.06 Reserved	

AO1 and AO2 are analog output terminals.

Refer to section 3.3.2 for the output characteristics of AO1and AO2.

Refer to Table 5-9 for the function of F6.04 and F6.05.

Table 5-9 Signals from AO1 and AO2

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 inverterبsrated current
4	Output current	0～2 times of motorبs rated

Setting	Function	Range
		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	VCI	0～10V
9	CCI	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

Using extended function 2 of host, AO1 and AO2 output can be controlled by serial port directly, the output of AO1 or AO2 "65535" corresponds to max. analog output 10V (20mA) .

Suppose you want:

AO1 outputs 4~20mA, which means the bus voltage is 0~800V.

You should do the following configuration:

② F6.04=7, output signal presenting bus voltage;

②F6.07=01, AO1 output: 4~20mA;

③P6.08=100%, output gain 100%;

④Select 0/4-20mA of CN4 (J2 OR SW2) jumper.

Note：

When X5 is select as 44～46, Y2 pulse output will be invalid.

F6.07 Analog output range	Range：00～11【00】

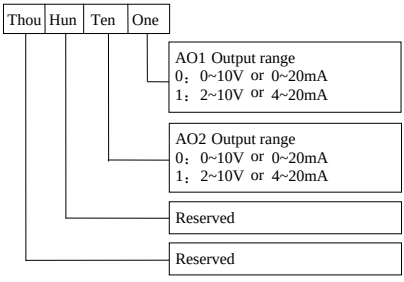


Figure 5-30 Analog Output Type Selection

The parameter is to select the output type, i.e. voltage or current, of AO1 and AO2.

CN4(J2 OR SW2) jumper is for AO1, “I” represents current, “V” represents voltage.

CN5(J3 OR SW3) jumper is for AO2, “I” represents current, “V” represents voltage.

F6.08 AO1 output gain	Range：0.0～200.0%【100.0%】
F6.09 AO2 output gain	Range：0.0～200.0%【100.0%】

You can change the measurement range or calibrate error of AO1 and AO2 outputs by adjusting the output gain.

Note：

The parameter will come into effect immediately while you change it.

F6.10 Y2 Max output pulse freq. of Y2	Range：0.1～50.0kHz【10.0KHz】

It defines the max. pulse frequency from terminal Y2. Refer to P6.11.

F6.11 Preset counting value	Range：F6.11～9999【0】
F6.12 Specified counting value	Range：0～F6.10【0】

F6.11 and F6.12 are complementary to Function No.12 and No.13 in Table 5-9.

When the number of pulses defined by F6.11 are input from Xi, Yi or relay will output an indicating signal.

Suppose F6.11=8, as Figure 5-31 shows, when 8 consecutive pulses are input from Xi, Y1 will output an indicating signal.

When the number of pulses defined by F6.12 are input from Xi, Yi or relay will output an indicating signal which will last until the number of pulses defined by F6.11 are input.

Suppose F6.12=5, 6.11=8, as Figure 5-31 shows, when 5 consecutive pulses are input from Xi, Y2 will output an indicating signal and it holds the signal until the 8th pulse passes. Note that if F6.12 is bigger than F6.11, then F6.12 is invalid.

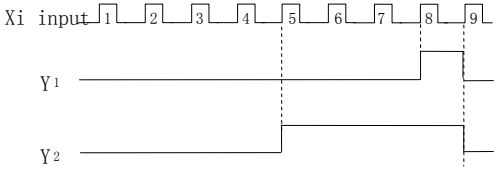


Figure 5-31 Preset counting value and specified counting value

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

As shown in Figure 5-32, if the inverter's output frequency is within the detecting range of preset frequency, a pulse signal will be output. It is complementary to No.1 function in Table 5-8.

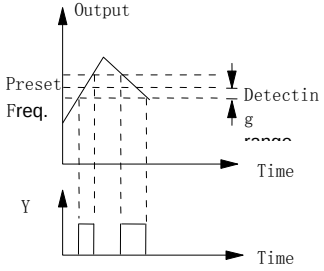


Figure 5-32 Freq. Arrival Signal Output

F6.14 FDT1 level	Range：0.00～650.00Hz【50.00Hz】
F6.15 FDT1 lag	Range：0.00～650.00Hz【1.00Hz】
F6.16 FDT2 level	Range：0.00～650.00Hz【25.00Hz】
F6.17 FDT2 lag	Range：0.00～650.00Hz【1.00Hz】

F6.14~P6.15 is a complement to the No.2 function in Table5-8. F6.16~F6.17 is a complement to the No.3 function in Table 5-8. Their functions are same. Take F6.14~F6.15 forexample: 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 5-33.

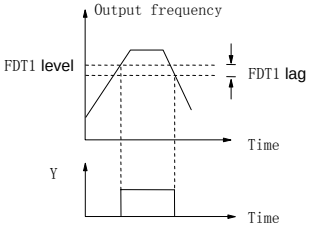


Figure 5-33 Frequency Detection

7.8 Close-loop control（F7）

Usually, the close loop control can be divided into two types: analog close loop and pulse close loop according to feedback. Figure 5-34 and Figure 5-35 are analog and pulse close loop control wiring diagram.

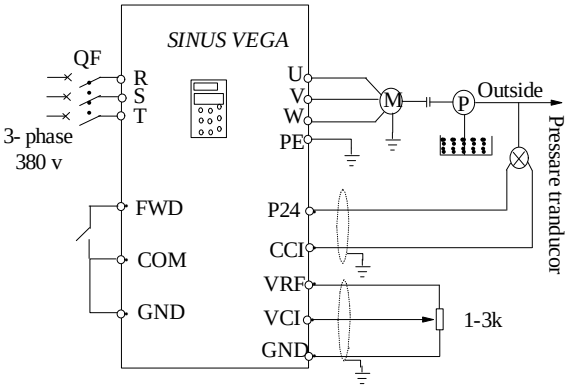


Figure 5-34 Build-in PI Analog Feedback Control

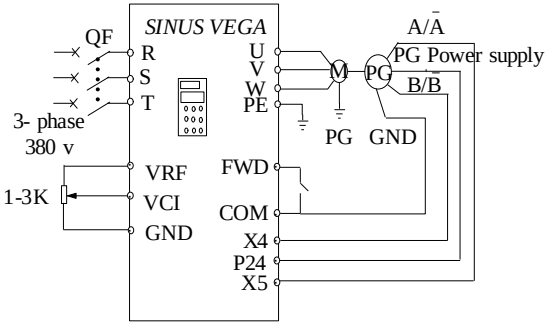


Figure 5-35 PG Speed Close Loop Control System

Analog feedback control system:

An analog feedback control system can be formed by a pressure transducer as the feedback sensor of the internal PI.

As shown in Figure 5-34, pressure reference (voltage signal) is input via terminal VCI, while the feedback pressure value is input to terminal CCI in the form of 0~20mA current signal. The reference signal and feedback signal are detected by the analog channel. The start and stop of the inverter can be controlled by terminal FWD.

The above system can also use a TG (speed measuring generator) as speed close speed-loop control.

PG speed close-loop control:

A speed close-loop control system can be formed by external control terminals X4 and X5, and pulse generator (PG) .

As shown in Figure 5-35, close speed-loop input can come from a potentiometer in the form of voltage signal via terminal VCI, while the

feedback value of the close loop is input by PG in pulse mode via terminal X4 and X5. The start and stop of the inverter can be controlled by terminal FWD.

In Figure 5-35,

A and B are PG's dual phase quadrature output;

P24 is connected to the power source of PG;

Speed reference is the voltage signal of 0~10V. The voltage signal corresponds to synchronous speed n0 which, in turn, corresponds to 0~Max frequency (F0.09) . P is the number of poles of motor (FH.00) .

n0=120 × fmax/P

Refer to function No. 47~48 of F5.00~F5.04 for the functions of input terminals X4, X5.

Note:

1. The reference can also be input via keypad or serial port;
2. Dual-phase input can improve the speed measurement accuracy, while single phase input wiring is simple;
3. Dual-phase pulse can only be input in quadrature mode;
4. If PG is supplied from terminal P24, then the max load current of optical PG must be less than 100mA.

The mechanism of the build-in PI is shown in the figure below:

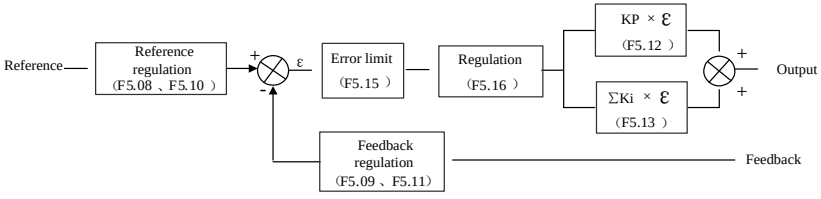


Figure 5-36 PI Working Mechanism

In Figure 5-36, KP: proportional gain. KI: integral, refer to F7.01~F7.15 for the definitions of close-loop reference, feedback, error limit and proportional and Integral parameters.

There are two features of internal PI:

The relationship between reference and feedback can be defined by F7.08~F7.11.

For example: In Figure 5-34, if the reference is 0~10V analog signal, the expected controlled value is 0~1MP, and the pressure signal is 4~20mA, then the relationship between reference and feedback is shown in Figure 5-37.

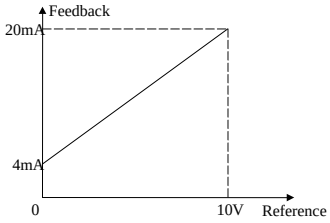


Figure 5-37 Reference (Input) and Feedback

The reference value is based on 10V (i.e. 10V means 100% input); and the feedback value is based on 20mA (20mA corresponds to 100% output).

Close-loop characteristic is selected through F7.16 to satisfy different applications.

In order to meet the control requirements, the motor's speed should be increased with reference speed. This kind of control characteristic is called positive response. If the motor speed is required to be decreased when the reference value is increased, this control characteristic is called negative response.

See Figure 5-38. F7.16 defines the two characteristics.

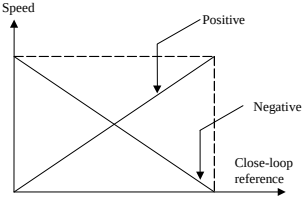


Figure 5-38 Close-loop control Characteristics

After the system type is determined, the following procedures can be used to determine the close loop parameters:

① Determine the close-loop reference and feedback channel (F7.01 and F7.02) ;

②Define the relationship between close-loop reference and feedback value (F7.08~F7.11);

③Determine the speed reference of speed close-loop control and the number of revolutions of PG (F7.06~F7.07) ;

④Determine the close-loop regulation characteristic, that is, if the motor speed decreases while the input reference increases, then the close-loop control characteristic should be set to negative (F5.16=1) ;

⑤Set integral regulation and close-loop frequency (F7.17~F7.19) ;

⑥Adjust close-loop filter time, sampling cycle, bias limit and gain factor (F7.12~F7.15).

F7.00 Close-loop control	Range：0、1【0】

0：Disabled

1：Enabled

F7.01 Reference input method	Range：0～2【1】

0：digital setting

Take the value of F7.05（set analog close-loop feedback, F7.02＝0～5）;

Take the value of F7.06（set pulse close-loop feedback，F7.02＝6）。

1：VCI（0～10V）

2：CCI

Pay attention to the setting of jumper CN7(J1 OR SW1).

3：LED keypad（for power rate lower than SINUS VEGA 0005 4T）

4：PULSE（for power rate lower than SINUS VEGA 0005 4T）

Note：

The motor speed is controlled by pulse feedback. Given analog input 10V (20mA) or max. input frequency F1.04, the output pulse will be max. frequency F0.09, which corresponds to the motor synchronous speed n0 (n0＝120fmax/P) .

F7.02 Feedback method	Range：0～6【1】

0: VCI analog voltage 0～10V

1: CCI analog input

2：VCI+CCI

3：VCI-CCI

4：Min{VCI，CCI}

5：Max{VCI，CCI}

When current input is selected, the signal will be convertedto voltage signal, whose value is determined by the formula:Vout=mA/2;

F7.02=6：Pulse

It can be single-phase or 2-phase PG close loop feedback. Please refer to multi-function input terminal X4, X5 (F7.03~F7.04).

F7.03 Input filter	Range：0.01～50.00s【0.50s】
F7.04 Feedback filter	Range：0.01～50.00s【0.50s】

Both the input signal and feedback signal have some noise signals. These signals can be filtered by setting the time constant of filter (settings of F7.03 and F7.04) . The bigger the time constant, the better the immunity capability, but the response becomes slow. The smaller the time constant, the faster the response, but the immunity capability becomes weak.

F7.05 Digital reference input	Range：0.00～10.00V【0.00】

When analog feedback is selected (F7.02=0~5) , this function allows parameter setting from keypad or serial port.

F7.06 Speed close-loop setting	Range：0～39000rpm【0 rpm】

When PG pulse feedback is selected (F5.02=6) , speed can be set through keypad or serial port.

F7.07 Pulse number per revolution of encoder	Range：1～9999【1024】

Please set this parameter according to the characteristics of the pulse encoder.

F7.08	Min. input	Range：0.0%～F7.10【0.0%】
F7.09	Feedback of min. input	Range：0.0～100.0%【20.0%】
F7.10	Max. input	Range：F7.08～100.0%【100.0%】
F7.11	Feedback of max. input	Range：0.0～100.0%【100.0%】

F7.08~F7.11 define the relation of analog close loop inputand feedback. The values of the above parameters arepercentage of input or feedback value to reference value(10V or 20mA or F5.13) .

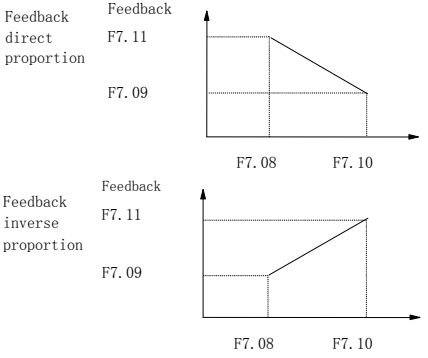


Figure 5-39 Relation of Input and Feedback

F7.12	Proportional gain	Range：0.000～9.999【2.000/0.050】
F7.13	Integral gain	Range：0.000～9.999【0.100/0.050】

F7.14 Sampling cycle	Range：0.01～50.00s【0.10s/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 calculate once in each sampling cycle. The bigger the sampling cycle the slower the response.

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 5-40. 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.

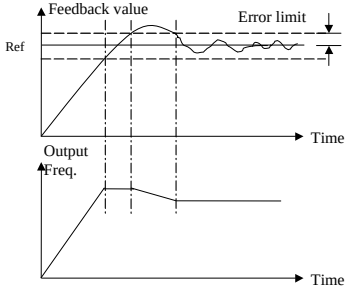


Figure 5-40 Error Limit Schematic Diagram

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

SetF7.16 to 1 if the motor speed is required to decrease with the increase of the reference.

F7.17 Integral regulation	Range：0、1【0】

0: Stop integral regulation when the frequency reaches theupper or lower limits

1: Continue the integral regulation when the frequencyreaches the upper or lower limits

It is recommended to set the parameter at 0 for the system that requires fast response.

F7.18 Preset frequency	Range：0.00～650.00Hz【0.00Hz】
F7.19 Preset frequency hold time	Range：0.0～3600s【0.00s】

The above parameters are helpful for the close loop control to enter stable state quickly.

After close-loop running is started, the inverter will accelerate to the preset frequency F7.18 within the accelerate time, and hold the frequency for a period of time (F7.19) , and then run according to close-loop characteristic.

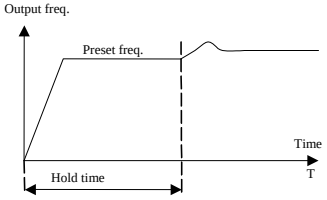


Figure 5-41 Close-loop preset frequency

Note：

If you don’t need preset frequency, just set F7.18 and F7.19 at 0.

7.9 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】

These frequencies will be used in simple PLC operation and multi-speed operation, refer to the introductions of F5.00~F5.04 and group PD parameters.

F8.07 MS close-loop setting 1	Range：0.0～10.00V【0.00V】
F8.08 MS close-loop setting2	Range：0.0～10.00V【0.00V】
F8.09 MS close-loop setting 3	Range：0.0～10.00V【0.00V】
F8.10 MS close-loop setting 4	Range：0.0～10.00V【0.00V】
F8.11 MS close-loop setting 5	Range：0.0～10.00V【0.00V】
F8.12 MS close-loop setting 6	Range：0.0～10.00V【0.00V】
F8.13 MS close-loop setting 7	Range：0.0～10.00V【0.00V】

Besides the 3 close-loop setting methods, the MS close-loop voltage setting F5.20~F5.26 can also be used.

MS close-loop setting 1~7 can be selected through external terminals, please refer to F5.00~F5.04 (function No. 30~32) . It can also used with simple PLC close-loop, see FD parameters.

The MS close-loop setting has priority over the methods defined in F7.01.

F8.14	Acc time 2	Range：0.1～3600s（min）【6.0s/20.0s】
F8.15	Dec time 2	Range：0.1～3600s（min）【6.0s/20.0s】
F8.16	Acc time 3	Range：0.1～3600s（min）【6.0s/20.0s】
F8.17	Dec time 3	Range：0.1～3600s（min）【6.0s/20.0s】
F8.18	Acc time 4	Range：0.1～3600s（min）【6.0s/20.0s】
F8.19	Dec time 4	Range：0.1～3600s（min）【6.0s/20.0s】

Three kinds of Acc/Dec time can be defined, and the inverter's Acc/Dec time 1~4 can be selected by different combinations of control terminals, refer to F5.00~F7.07 for the definitions of terminals used to select Acc/Dec time.

Note：

Acc time 1 and Dec time 1 is defined in F0.12 and F0.13 respectively.

7.10 Enhanced function（F9）

F9.00 FDigital frequency control	Range：00～11 【00】

Valid only when F0.02=0、1、2.

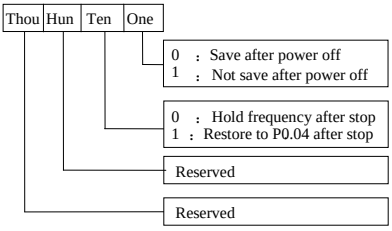


Figure 5-42 F9.00 setting

One's place of F9.00:

0: when the inverter is powered off or at undervoltage state, update F0.04 by the actual frequency at that time.

1: when the inverter is powered off or at undervoltage state,F0.04 remains unchanged.

Ten's place of F9.00:

0: the reference frequency when the inverter stops will besaved.

1: The reference frequency will restore to F0.04 when theinverter stops.

F9.01 FWD/REV transition time	Range：0～3600s【0.0s】

It refers to the time period when the inverter's rotation changes from FWD to REV or REV to FWD, see Figure 5-43 as t_1.

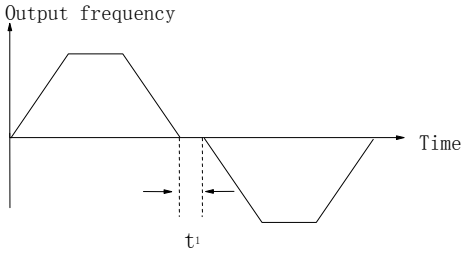


Figure 5-43 Transition time from FWD to REV

F9.02 Carrier wave frequency	Range：0.7～15.0kHz【depending on model】

Table 5-10 Relation of Model and Carrier Freq

Model \ CWF	Max CWF（kHz）	Min CWF（kHz）	Default（kHz）
Heavy duty：0.75kW～4.0KW	15	0.7	8
Heavy duty：5.5kW～15kW Normal duty：7.5kW～18.5kW	15	0.7	8
Heavy duty：18.5kW～45kW Normal duty：22kW～55Kw	10	0.7	4
Heavy duty：55kW～75kW Normal duty：75kW～90kW	6	0.7	3
Heavy duty：90kW and above Normal duty：110kW and above	3	0.7	2

Table 5-11 Carrier Freq. and Performance

Carrier wave Freq.	Decreasing	Increaseing
Motor noise	↑	↓
Leakage current	↓	↑
Interference	↓	↑

Note：

1．To get the best control effect, the ratio of carrier wave frequency to the max. operating frequency of the inverter should be lower than 36.

2．The displayed current might have error when the carrier frequency is lower.

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

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 Motor tone	Range：0～10【0】

If CWF is set under 6 kHz, tuning this parameter can change the tone of operating motor.

If it is set at 0, the function is disabled.

F9.05 Jog frequency	Range：0.10～650.00Hz【5.00Hz】
F9.06 Jog interval	Range：0.0～100.0s【0.0s】
F9.07 Jog Acc time	Range：0.1～60.0s【6.0s/20.0s】
F9.08 Jog Dec time	Range：0.1～60.0s【6.0s/20.0s】

F9.05~F9.08 define parameters related to jog.

As Figure5-44 shows, t1 and t3 are actual jog Acc and Dec time; t2 is jog time; t4 is the interval between jog (F9.06) , F1 is jog frequency (F9.05) .

Actual jog Acc and Dec time are calculated by the formula below:

$$t_1=\frac{F9.05\times F9.07}{F0.09} \qquad t_3=\frac{F9.05\times F9.08}{F0.09}$$

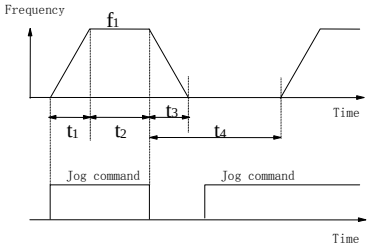


Figure 5-44 Jog Parameters Illustration

Interval of Jog operation (F9.06) is the period between two executed jog commands. The jog command sent during the interval is invalid, and the

inverter continues to operate at zero frequency. If this command exists until the end of the interval, it will be executed.

Note：

1．In Jog operation process, the inverter starts according to starting mode 0 and stops according to stopping mode 0. The unit of Acc/Dec time is second.

2．Jog operation can be controlled by terminals and serial port.

F9.09 Skip freq. 1	Range：0.00～650.00Hz【0.00Hz】
F9.10 Skip freq. 1 range	Range：0.00～30.00Hz【0.00Hz】
F9.11 Skip freq. 2	Range：0.00～650.00Hz【0.00Hz】
F9.12 Skip freq. 2 range	Range：0.00～30.00Hz【0.00Hz】
F9.13 Skip freq. 3	Range：0.00～650.00Hz【0.00Hz】
F9.14 Skip freq.3 range	Range：0.00～30.00Hz【0.00Hz】

F9.09~F9.14 are used to skip the mechanical resonantfrequency of load.

The inverter's preset frequency can skip some frequency as shown in Figure 5-45. Three skip frequency at most can be set.

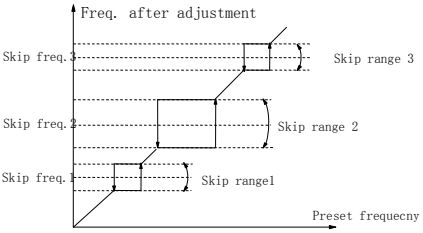


Figure 5-45 Skip Frequency and Its Range

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

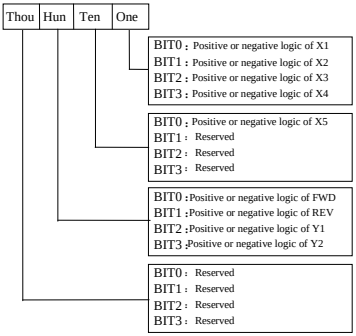


Figure 5-46 Positive or Negative logic of Terminals

The parameter defines the positive or negative logic of terminals, where positive logic refers that the terminal Xi is enabled when it connects with the common terminal and disabled if disconnected; negative logic is the opposite of positive logic.

If the bit is set at “0”, it means positive logic, and “1” for negative logic.

Suppose you require X1~X5 to be positive logic, FWD and REV negative logic, Y1 positive logic and Y2 negative logic, you should set the one’s place at 0, ten’s place at 0, hundred’s place at (1011) 2 , i.e B (Hex) . Therefore, F9.15 should be set at 0B00.

The conversion from binary code to Hex value is shown in Table 5-12.

Table 5-12 Convertion from Binary to Hex

Binary				Hex
BIT3	BIT2	BIT1	BIT0	（LED display）
0	0	0	0	0
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9
1	0	1	0	A
1	0	1	1	B
1	1	0	0	C
1	1	0	1	D
1	1	1	0	E
1	1	1	1	F

Note：

1．Factory setting of all the terminals is positive logic.

2．When Y2 is set to output pulse, i.e. F6.01 is set at 20~32, the logic definition is invalid.

F9.16 operating command bundled with freq. setting method	Range：000～777【000】

This function defines the combination of 3 operating command and 7 frequency setting method, so that they can be switched at the same time.

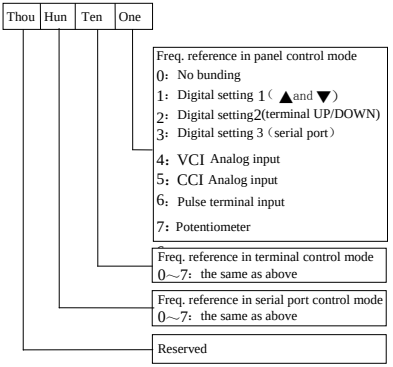


Figure 5-47Operating command bundled with freq. Setting method

The reference frequency setting method is defined by F0.02, see section 5.1 for details.

Different control modes can bundle to one reference frequency setting method.

You may follow the methods below to change control command and frequency setting method simultaneously.

Method 1:Change F0.00;

Method 2: use terminal X1~X5 function No. 28 and 29.

For example: In order to realize remote and local control, it requires that:

① Control modes selection: The control modes can be selected by terminal remotely or by F0.00 locally;

②If keypad (panel) control mode is used, press RUN to run the inverter and press STOP to stop the inverter. The preset frequency can be adjusted by pressing ▲ and ▼.

③If terminal control mode is used, close FWD to run forward and close REV to run reverse. The preset frequency is adjusted via VCI.

④Terminal control mode is enabled after the inverter is switched on.

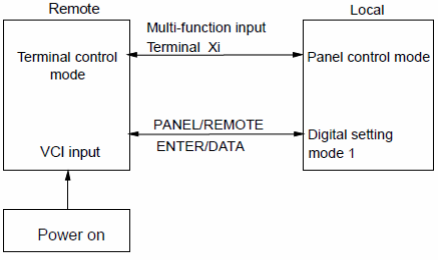


Figure 5-48 Local and remote control

To meet the above requirements：

Set F0.00=1, to select terminal control mode and remotecontrol is enabled after the inverter is switched on;

Set F5.00=28, and F5.01=29 to select multi-function inputterminal X1 and X2 to input operating commands;

Set F5.08=1 to select 2-wire control mode 2. The inverter runforward when FWD is enabled, and run reverse when REV isenabled;

Set F9.16=041, then terminal control mode is bundled to VCIanalog input, and the panel control mode is bundled to digitalsetting 1.

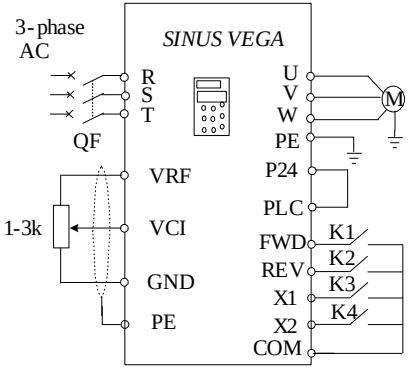


Figure 5-49 Wiring for Remote and Local Control

Note：

If factory setting is 000, no bundling of operating command and frequency setting method.

F9.17 Auxiliary reference factor	Range：0.00～9.99【1.00】
F9.18 Digital auxiliary reference control	Range：000～111【000】

The preset frequency is the final result of the combination of main frequency and auxiliary frequency. F0.03、F0.05、F9.17、F9.18 are for auxiliary frequency. Figure5-50 shows the course of frequency combination.

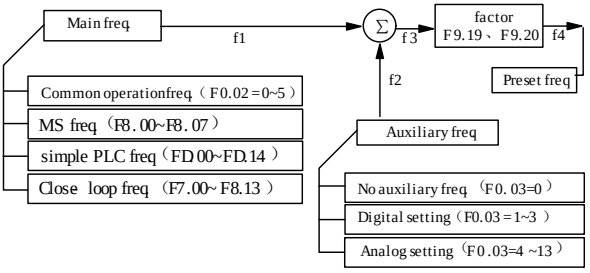


Figure 5-50 Preset Freq. Calculation Method

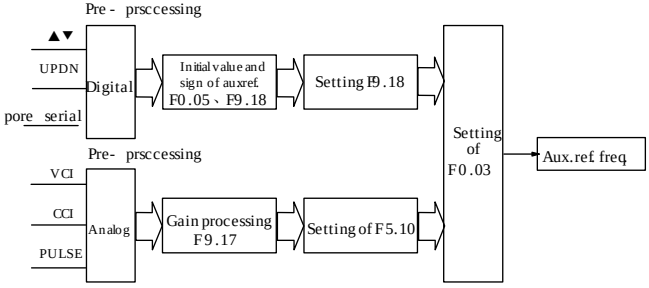


Figure 5-51 Auxiliary Frequency Processing

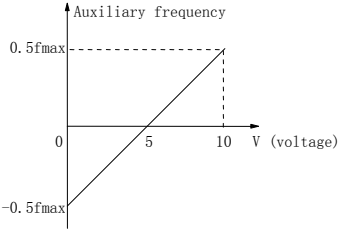
Table 5-13 Auxiliary Freq. Setting Method

Setting	Description	Note
0	No auxiliary freq.	Auxiliary freq.=0
1	Digital setting 1, adjust by ▲ and ▼	Set by F0.05 whether the frequency before power failure will be saved depending the setting of F9.18
2	Digital setting 2，adjust by UP/DN	
3	Digital setting 3，set by serial port	
4	VCI analog setting	Depending on actual input. Refer to F5.10
5	CCI analog setting	
6	Terminal PULSE setting	
7	- VCI analog setting	
8	- CCI analog setting	
9	-Terminal PULSE setting	
10	VCI-5	
11	CCI-5	
12	PULSE-0.5×F5.13	

Setting	Description	Note
13	Potentiometer（For 4.0KW and below）	

Select digital setting 3, you may set F0.05 via serial port to change auxiliary frequency.

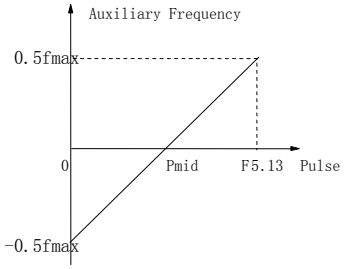
If VCI-5 or CCI-5 is selected, take 5V input as the point corresponding to zero frequency, 0~5V input corresponds to negative output, 5~10V input corresponds to positive output. See Figure5-52.



fmax——frequency corresponding to max. analog value

Figure 5-52 Frequency Setting via VCI-5 or CCI-5

If PULSE-0.5 × F1.03 is taken as auxiliary frequency setting method, one half of F5.13 (max. pulse freq.) as the point corresponding to zero frequency, 0~0.5 times of F5.13 input corresponds to negative output, 0.5~1 times of F5.13 input corresponds to positive output. See Figure5-33:



P mid—1/2*max. input pulse frequency(F5.13)

Fmax—frequency corresponds to max. analog value(F5.17 or F5.21)

Figure 5-53 PULSE-0.5×F5.13 as Frequency Input

F9.17: Analog auxiliary reference factor:

It is valid when F9.03=4~12. The auxiliary reference undergoes F9.17 gain calculation first, and then output according to F5.10.

F0.05: initial value of digital auxiliary reference:

It is valid when F0.03=1~3. It is the initial setting of any of the 3 method.

F9.18: digital auxiliary reference control

It is valid when F0.03=1~3. See Figure 5-54.

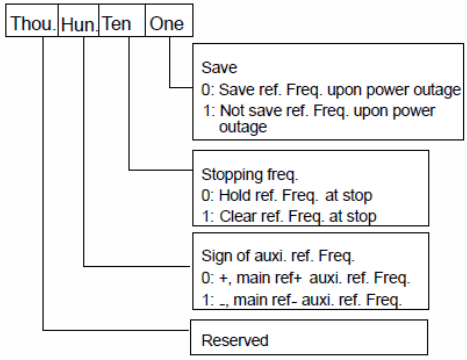


Figure 5-54 Digital Auxiliary Freq. Setting

One's place of F9.18

0: save the auxiliary freq. at power off

The auxiliary frequency will be saved in F0.05, and the sign of the freq. saved in F9.18.

1: not save the auxiliary freq. at power off

Ten's place of F9.18

0: maintain the auxiliary freq. if the inverter stops

1: preset frequency is cleared if the inverter stops

Hundred's place of F9.18: sign of auxiliary freq.

0: (+) positive sign.

Preset freq. is the sum of main freq. and auxiliary freq.

1: (+) negative sign

Preset freq. is the result of main freq. minus auxiliary freq.

Note:

When the inputting mode of auxiliary reference frequency is the same with that of main reference frequency, the auxiliary reference frequency setting is invalid.

F9.19 Preset freq. adjust mode	Range: 0～2【0】
F9.20 Factor for calculating preset freq.	Range: 0.0%～200.0%【100.0%】

F9.19 defines how to calculate the preset frequency. Refer to Figure 5-1.

0: disabled

No additional summing operation to the sum of main freq. and auxiliary freq. See Figure 5-1.

1: regulate based on max. output freq. (F0.09)

Preset freq. f4=f3+F0.09 × (F9.20-100%).

2: regulate based on current output freq.

Preset freq.f4=f3+f3 × (F9.20-100%) =f3 × F9.20.

F9.21 Keypad functions	Range：000～402【000】

This function defines the function of STOP/RESET key and keypad lock selection.

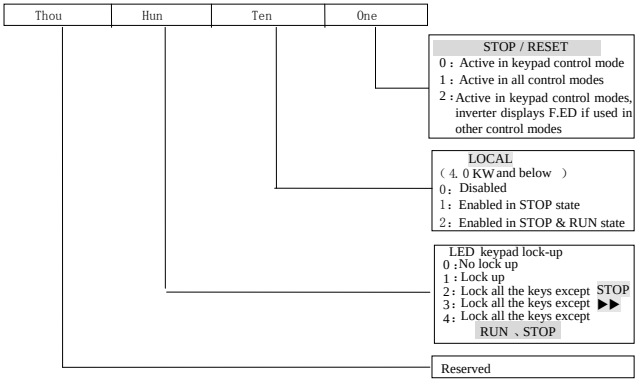


Figure 5-55 Stop/Reset Key's Function and Keypad Lockup

One's place: STOP/RESET key's function

It is to set the usage and function of STOP/RESET key when you want to stop the inverter.

0: effective when keypad control is selected.

1: effective for keypad, terminal and serial port control. Press this key and the inverter will stop in specified manner.

2: effective for keypad, terminal and serial port control. In keypad control mode, press this key and the inverter will stop in specified manner. But in terminal or serial port control mode, pressing this key will trigger "F.Ed" alarm and the inverter will coast to stop.

STOP/RESET can be used to reset a fault in all control modes.

Ten's place: LOCAL functions (for 4.0KW and below).

0：Disabled

1：Enabled in STOP state.

2：Enabled in STOP & RUN state.

Hundred's place: lock up keypad selection

You can select to lock all or part of the keys.

0: not lock the keypad.

1: lock all keys on the keypad.

2: lock all keys on the keypad except STOP/RESET key.

3: lock all keys on the keypad except ▶▶key.

4: lock all keys on the keypad except RUN and STOP key. Keypad locking method: press FUNC/DATA key and PRG key at the same time for 3 seconds.

Unlocking method: press FUNC/DATA key and hold it, press ▼ key three times (within 3 seconds)

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 Acc/Dec time unit	Range：0、1【0】

0：second

1：minute

It is valid for all acceleration or deceleration except jog and traversing operation.

The Acc/Dec time can be as long as 60 hours.

Note：

It is recommended to select Second as time unit.

F9.24 Reserved	

F9.25 High usage of bus voltage	Range：0、1【1】

When the electric network voltage is much lower (under 15% of rated voltage) or the inverter works with a heavy load for long time, it will boost its bus voltage usage rate to increase output voltage.

0: disabled

1: enabled

Note：

If F9.25 is enabled, the output harmonic components will increase slightly.

F9.26 Zero freq. threashold	Range：0.00～650.00Hz【0.00Hz】
F9.27 Zero freq. hysteresis	Range：0.00～650.00Hz【0.00Hz】

The above two parameters are to set zero frequency hysteresis control.

Take analog CCI for example, see Figure5-58:

Startup process:

When the Run command is given out, only after CCI current arrives at Ib and the corresponding frequency reaches fb, does the inverter start and accelerate to the preset frequency.

Stop:

During operation, if CCI current reduces to Ib, the inverter will not stop until it reaches Ia and the corresponding frequency becomes fa, where fa is the threshold of zero frequency defined by F9.12. The difference between fb and fa is zero frequency hysteresis, defined by F9.27.

This function can realize dormancy to save energy. In addition, the frequent start and stop at threshold frequency can be avoided.

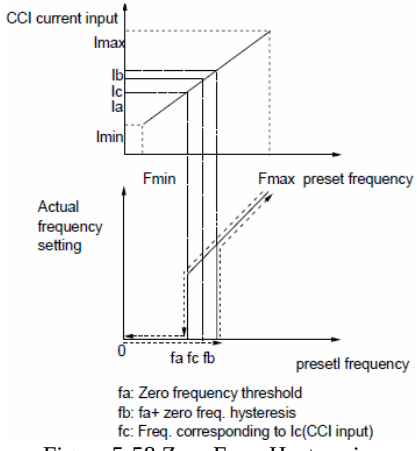


Figure 5-58 Zero Freq. Hysteresis

F9.28 Low voltage compensation (trip free)	Range：0、1【0】
F9.29 Freq. decrease rate during voltage compensation	Range：0.00～99.99Hz/s【10.00Hz/s】

F9.28 is to select whether to enable low voltage compensation in case of voltage drop or undervoltage by reducing output frequency to get energy feedbacked from the load, so that the inverter will not trip.

F9.28=0, disabled

F9.28=1, enabled

If the setting of F9.29 is set too big, the feedback energy of motor will be more than expected and may cause over-voltage protection; if the setting of

F9.29 is set to small, the feedback energy of motor is not enough, hence trip might occur. It is recommended to set F9.29 according to load and its inertia.

F9.30 Conditions of restart after power failure	Range：0、1 【0】
F9.31 Restart delay after power failure	Range：0.0～10.0s 【0.5s】
F9.32 Reserved	

F9.22 and F9.23 are to set how the inverter restarts after power failure given different control mode.

F9.30=0, not auto restart.

F9.30=1, the inverter will auto restart if the Start condition can be satisfied after a period of time specified by F9.31.

In fact, whether to auto restart depends on F9.30, inverter's state at power failure and control mode. Refer to Table 5-14.

Table 5-14 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 5-14 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.

4．When restart is allowed, the inverter will start according to F2.00.

F9.33 Braking unit operating voltage	Range：650~780V 【710V/750V】
F9.34 Term inal filter time	Range：0.5~100.0ms
F9.35 Reserved	Range：
F9.36 Undervoltag e setting	75.0%~135.0%【90.0%】

Reserved

F9.37 Load loss protection	Range：0～1	Default：0

0：Load loss protection valid；

1：Load loss protection invalid；

F9.38 Load loss fault level	Range：0.0～100.0%	Default：30.0%
F9.39 Load loss fault time	Range：0～600.0s	Default：120.0s

Load loss fault level is protection current threshold for action, the set value is percentage of inverter rated current. When the inverter output current is less than F9. 38 (load loss fault level), and beyond the time of F9. 39 (Load loss fault time) , "F.oLL" load loss protection fault will be shown.

F9.40Torque enable in zero speed	Range：0～1	Default：0

0：Torque enable in zero speed valid；

1：Torque enable in zero speed invalid；

F9.41Torque percentage in zero speed	Range：0.0～100%	Default：0.0%

When F2.01 is set as 0.00Hz, and F9.40 is valid, The output torque is bigger if F9.41 setting is higher when inverter runs in 0.00Hz,

7.11 Display Control Parameters（FA）

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

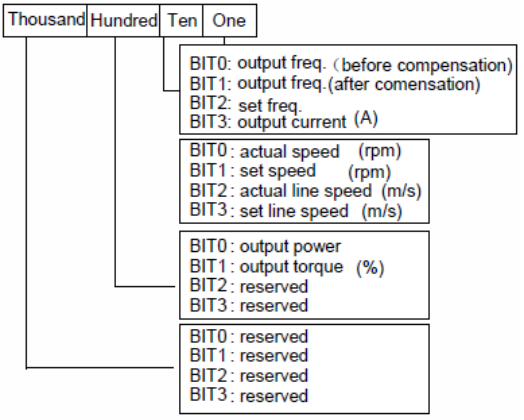


Figure 5-59 LED Displayed Parameter 1 Setting

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 5-12. You may press ▶▶key to scroll through the parameters.

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

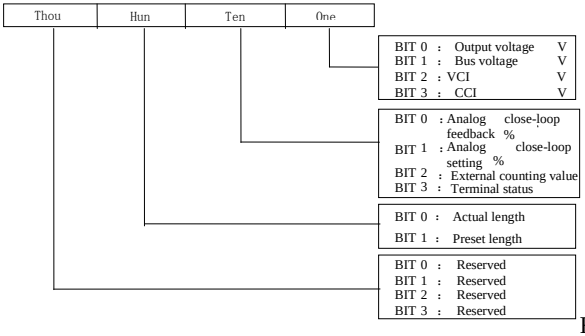


Figure 5-60 LED Displayed Parameter 2 Setting

The displayed terminal information includes status of terminal X1~X5, bi-direction open-collector output terminals Y1 and Y2, and relay output terminal TC. The status of terminals are indicated by the “On” or “Off’ of LED. If the LED turns on, that means the terminal is enabled, and the terminal is disabled if the LED turns off, as shown in Figure5-61:

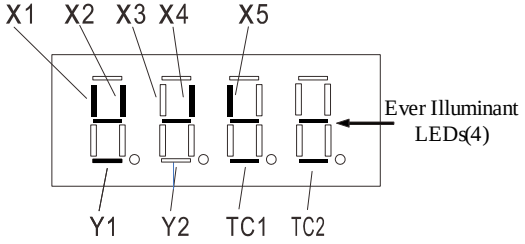


Figure 5-61 Terminal Status Indication

In Figure5-61, X1, X2, X4, X5, Y1 and TC are enabled, X3 and Y2 disabled. There are four LEDs are always illuminate for the convenience of observation。

Note：

1．When the rotating speed and line speed are displayed, these values can be modified by pressing ▲and ▼in real time (no need to shift to frequency display status) .

2．When FA.00 and FA.01 are all set to 0, the frequency before compensation will be displayed.

3. You may press ▶▶key to scroll through the parameters that has been set to display in FA.00 and FA.01 when the inverter is operating.

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

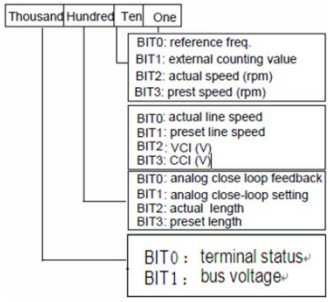


Figure 5-62 Parameter Displayed at Stop State

FA.02 defines the parameter that can be displayed by LED when the inerter is operating.

If BIT is set at 0: the parameter will not be displayed.

If BIT is set at 1: the parameter will not be displayed.

Note：

When the rotating speed and line speed are displayed, these values can be changed by pressing ▲ and ▼ in real time (no need to change to frequency displaying status) .

When the setting of FA.02 is 0, the preset frequency will be displayed.

You may press ▶▶ key to scroll through the parameters that have been set to displayed in FA.02 when the inverter is in stop state.

FA.03 Rotating speed display factor	Range：0.1～999.9%【100.0%】

It is used to calibrate the error of rotating speed display. It has no effect on the actual speed.

FA.04 Line speed factor	Range：0.1～999.9%【1.0%】

It is used to calibrate the error of line speed display. It has no effect on the actual speed.

FA.05Close-loop parameter display factor	Range：0.1～999.9%【100.0%】

It is used to calibrate the error between preset or feedback parameters and the actual ones. It has no effect on close-loop PI regulation.

FA.06	Reversed

7.12 Communication（FB）

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

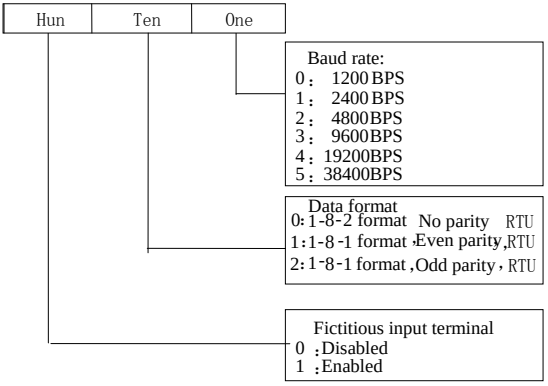


Figure 5-63 Communication Configuration

This parameter sets the communication mode.

Virtual terminal is set by host command to simulate the actual terminal. Each bit of the command represents the state of corresponding terminal.

FB.01 Local address	Range：0～247【1】

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

Note: "127" is the broadcast address. When the address is set to broadcast address, the inverter can receive and execute the command sent by control PC, 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.

7.13 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 5-67.

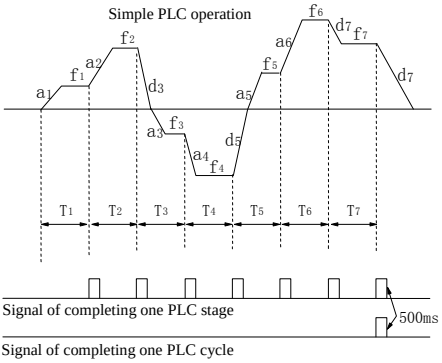


Figure 5-67 Simple PLC Operation

In Figure 5-67, 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】

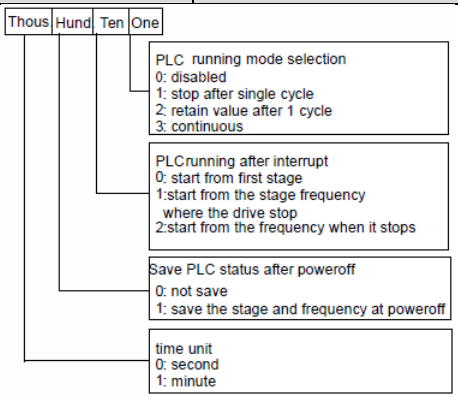


Figure 5-68 Stop After a Single PLC Cycle

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

0: Disabled

The PLC function is disabled.

1: stop after a single cycle

As Figure5-69 shows, the inverter stops after a single cycle automatically. It will start given another Run command.

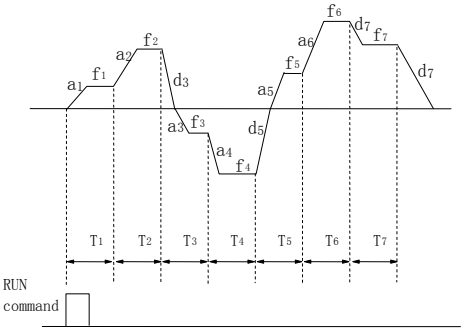


Figure 5-69 PLC Continuous Cycle

2：Maintain value of the last stage after 1 cycle

As Figure 5-70 shows, the inverter holds the frequency and direction of the last stage after single cycle.

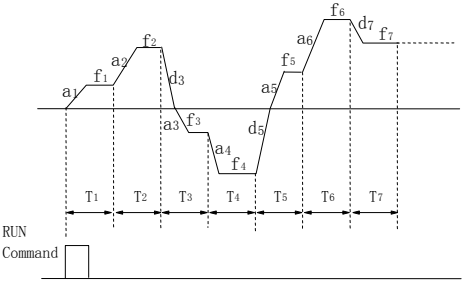


Figure 5-70 Maintain Last Stage After Single Cycle

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

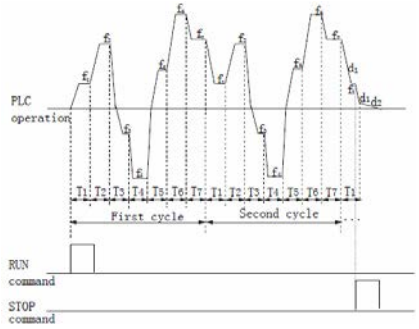


Figure 5-71 PLC Continuous Cycle

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, as Figure 5-72 shows.

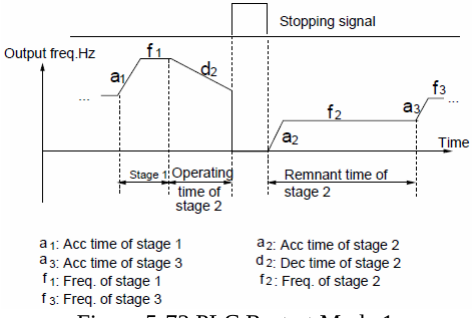


Figure 5-72 PLC Restart Mode 1

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. See Figure 5-73.

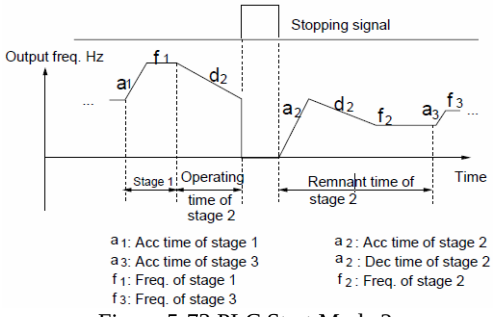


Figure 5-73 PLC Start Mode 2

Note：

The difference between PLC start mode 1 and mode 2 is that in mode 2, the inverter can record the operating frequency when the inverter stops and continue to operate at the recorded frequency after restart.

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.

Note：

1．A stage is ineffective if its run time is set to 0.

2．You can use terminals to pause and disable PLC operation, and clear the memorized parameters. See F5、F6 parameters.

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	Stage 5 setting	Range：000～323【000】
FD.10	Stage 5 run time	Range：0～6500s（min）【20.0s】
FD.11	Stage 6 setting	Range：000～323【000】
FD.12	Stage 6 run time	Range：0～6500s（min）【20.0s】
FD.13	Stage 7 setting	Range：000～323【000】
FD.14	Stage 7 runtime	Range：0～6500s（min）【20.0s】

FD.01、FD.03、FD.05、FD.07、FD.09、FD.11、PFD.13 are to set frequency, direction, Acc/Dec time of PLC stages. See Figure 5-74:

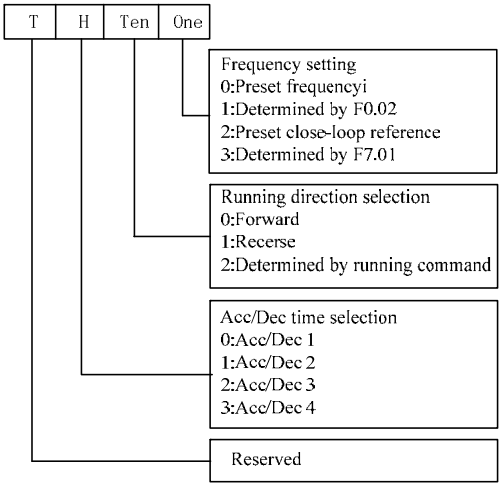


Figure 5-74　PLC Stage i setting（i=1～7）

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

2: MS close loop setting I, e.g. i=2, the frequency of stage 2is MS close loop setting 2. See F8.07~F8.13.

3: Determined by F7.01.

PLC can realize close-loop operation in a certain stage.Close-loop reference selectors can be preset close-loopreference I or determined by parameter F7.01; and thefeedback is determined by F7.02. When the setting methodis

determined by F7.01, the terminals can be selected viaclose-loop input. See F7.00~F7.04 and F8.07~F8.13 fordetails.

Note：

When the PLC operating direction is determined by operatingcommands, the motor's operating direction can be changed byexternal command. For example, Running forward can be orderedby terminal FWD-COM. The direction is decided by runningcommand and if it cannot be determined, the inverter will runs in thedirection of last operating stage.

7.14Constant-pressure water supply(FE)

FE.00 Water supply Mode	Range：0～3	Default：0

0：General Function

No constant-pressure water supply function.

1：Single pump constant-pressure water supply function

One frequency inverter drives one pump for water supply control

2：Simple one inverter with two motors constant-pressure water supply function

Frequency inverter drives one variable-speed pump and a grid-frequency pump by relay output control. When this function required, the original relay function will be invalid. 7.5KW and above inverters only have one relay output to keep the original relay functions in this mode.

3：Simple one inverter with three motors constant-pressure water supply function (5.5KW and belowinverters are reserved)

One frequency inverter drives a variable-speed pump drive and two grid-frequency pumps by relay output control. When this function required, the original relay function will be invalid. When pump added, relay 1acts at first, 2 relay acts then. When reducing pump, relay 2 acts at first, relay 1 acts then.

Note: When you turn on the constant-pressure water supply functions, please setF7.00 to 1 to enter into closed-loop mode. And then set the PID function parameters in F7 groupaccording to real situationto achieve constant-pressure water supply PID control.

FE.01 Sleep Frequency	Range：0.00～upper frequency	Default：25.00HZ
FE.02 Sleep delay time	Range：0～3600s	Default：0s

When the output frequency is not higher than FE.01, after a time ofFE.02, inverter will enter the sleep state.It will follow the stop mode selected by

FE.09.When the set pressure is higher than the feedback pressure, inverter will accelerate to FE.01 (generally slightly higher than this value) according to the acceleration time at first, then the closed-loop regulation.

FE.03 Wake-up pressure percentage	Range：0.0～100.0%	Default：50.0%
FE.04Wake-up delay time	Range：0～3600s	Default：0s

Wake-up pressure percentage = wake-up pressure / target pressure * 100%
When the feedback pressure is less than wake-up pressure, inverter will enter into the awake state after the setting time of FE.0 4.

FE.05 PID feedback disconnection detection threshold	Range：0.0～80.0%	Default：0.0%
FE.06 PID feedback disconnection detection time	Range：0～9999s	Default：0s

FE.05= 0.0%, without feedback disconnection detection.
PID feedback disconnection detection thresholdrepresent by a percentage of full scale feedback.
When the inverter detects a PID feedback signal is less than FE.05, and the inverter frequency has reached the upper frequency limit,feedback disconnection fault will be shown after the setting time ofFE.06.
Note: Please set FE.05 reasonable, and if the value is unreasonable, it will cause unnecessary downtime.

FE.07 increasing pump delay time	Range：0～3600s	Default：10s
FE.08 decreasing pump delay time	Range：0～3600s	Default：10s

FE.07 and FE.08 work only whenFE.00 is 2 or 3.
FE.07 is used to define the delay time when the frequency reaches the upper frequency and need to increase a pump;
FE.07 is used to define the delay time when the frequency reaches the sleep frequency and need to decrease a pump;
Note: FE.07 and FE.08 are reserved in 5.5KW and below models.

FE.09 Sleep mode	Range：0～1	Default：0

To select the stop mode in to sleep of the inverter

0：Deceleration stop sleep

Decelerate to 0 Hz and sleep according to F0.13 deceleration time

1：Free stop sleep

Free stop to 0 Hz and sleep

FE.10 Relay selection for one inverter to drive two pumps	Range：0～1	Default：0

0：Relay 1 to control grid-frequency pump

1：Relay 2 to control grid-frequency pump

One replay keeps original functions.

Note: This parameter is reserved for 5.5KW and below models.

FE.11Reserved		
FE.12Reserved		
FE.13Reserved		
FE.14Reserved		
FE.15Reserved		
FE.16Reserved		
FE.17Reserved		

7.15 Protection（FL）

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

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 5-75.

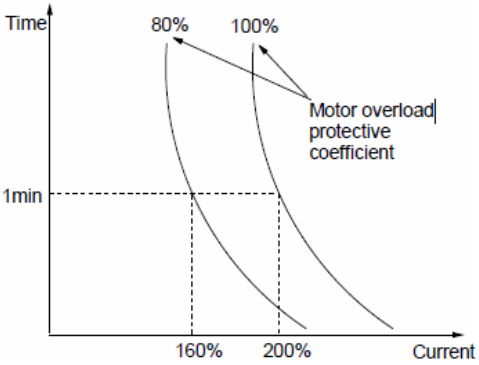


Figure 5-75 Motor's overload protection coefficient

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.

Note：

If the motor's rated current does not match that of the inverter, adjust FL.00~FL.01 to perform overload protection.

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 5-76.

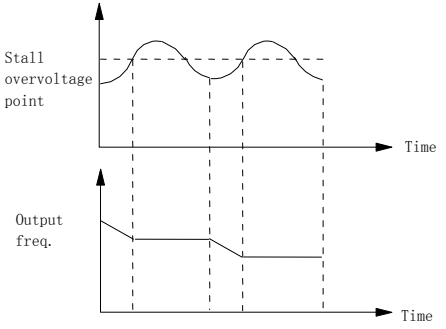


Figure 5-76 Stall Overvoltage

Note：

1. The inverter will alarm and display “F.ED” if it has been in stall over-voltage status for more than 1 minute.
2. If the stall point is set too low, you should prolong the Acc and Dec time properly.
3. If the stall point is set too high, it is useless for overvoltage protection.

FL.04 Overload pre-alarm detection config	Range：000～111【000】
FL.05 Overload pre-alarm detection threshold	Range：depending on model
FL.06 Overload pre-alarm delay	Range：0.0～60.0s【5.0s】

SINUS VEGA has overload protection over motor and inverter. See Table 2-1 for inverter overload protection, and FL.00 and FL.01 for motor overload protection. FL.04~FL.06 can monitor the overload condition before overload protection acts.

FL.04 defines the overload detection mode, action mode and reference current.

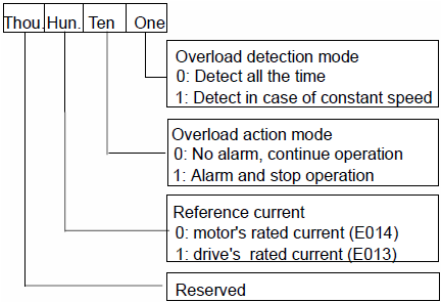


Figure 5-77 Overload Detection Configuration

One's place of FL.04: overload detection mode:

0: the detection is done as long as the inverter is operating.

1: the detection is done only when the inverter works at constant speed.

Ten's place of FL.04: action mode:

0: The overload is ignored, no alarm.

1: During "Overload Alarm Effective Period", the inverter will alarm and stop operation. The "Overload Alarm Effective Period" means the inverter's operating current has exceeds FL.05 and whose duration has exceed overload alarm delay (FL.06) .

Hundred's place of FL.04: reference current :

0: the overload detection threshold (FL.05) is set based on motor's rated current. Fault code F.oL2.

1: the overload detection threshold (FL.05) is set based on inverter's rated current. Fault code F.oL1.

FL.05 defines the threshold for overload alarm. It is a percentage of either inverter's or motor's rated current. Refer to setting of the hundred's place of FL.04. The setting of FL.05 also relates to the type of the inverter. Please refer the table below:

Type	Setting range	Default
Heavy duty	20.0%～200.0%	130.0%
Normal duty	20.0%～130.0%	120.0%

Overload alarm delay FL.06, please refer to Figure 5-78.

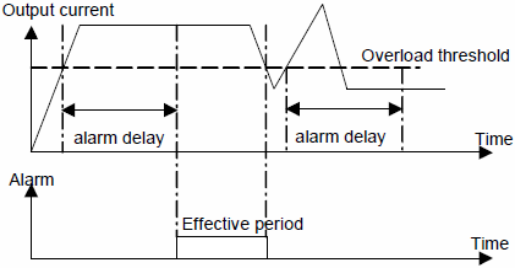


Figure 5-78 Overload Detection and Alarm

Note:

1. Overload detection threshold should be lower than the overload protection threshold;

2. During the overload alarm delay period, if the inverter's current becomes lower than overload detection threshold, no alarm will be triggered.

FL.07 Auto current limiting threshold	Range：depending on model
FL.08 Freq. decrease rate during current limiting	Range：0.00～99.99Hz/s【10.00Hz/s】
FL.09 Action mode of auto current limiting	Range：0～4【depending on model】

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:

Default value for Heavy duty is 150%

Default value for Normal duty 110%

FL.08 defines the decreasing rate of output frequency when the inverter is in auto current limiting status.

If FL.08 is set too small, overload fault may occur. If FL.08 is set too big, the inverter may be in energy generation status for long time that may result in overvoltage protection.

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

FL.09＝0: disabled;

FL.09＝1: auto current limiting is effective during acceleration or deceleration but ineffective at constant speed, no silencing function;

FL.09＝2: effective all the time, no silencing function;

FL.09＝3: reserved;

FL.09＝4: reserved。

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 Auto reset time	Range：0～10【0】
FL.11 Auto reset interval	Range：2.0～20.0s【5.0s】

Auto Reset function can reset a fault according to the preset FL.10 and FL.11. If FL.10 is set to 0, auto reset is disabled. Protective action will be taken if a fault occurs.

Note：

1．Overcurrent protection and external fault (F.Ed) cannot be reset automatically.

2．During the reset interval, the inverter's stops operation and restarts on the fly when the reset is finished.

3．Be careful when using auto-reset function, otherwise human injure or material loss may occur.

FL.12 Protective action mode 1	Range：000～101【000】
FL.13 Protective action mode 2	Range：0000～1211【0000】

The fault alarm and protective action can be prohibited by setting FL.12 and FL.13, so that the inverter can continue working.

FL.12 defines the protective action in case of communication and E^2PROM error.

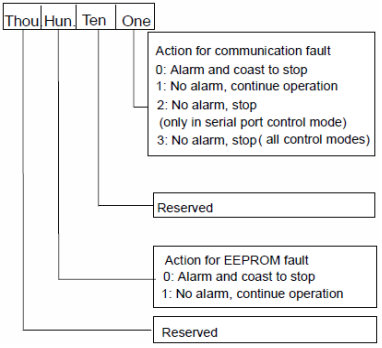


Figure 5-79 Protective action mode setting 1

FL.13 defines the action mode for undervoltage, auto reset interval fault lockup and output phase loss.

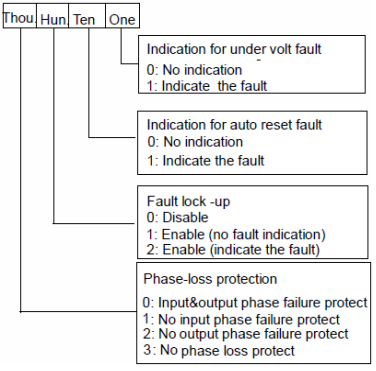


Figure 5-80 Protection action mode setting 2

⚠Attention

Please be careful when using FL.12 and FL.13, otherwise human injure or material loss may occur.

FL.14 Fault type of the first two times	Range：0～24【0】
FL.15 Fault type of the previous time	Range：0～24【0】
FL.16 Fault type of the last time	Range：0～24【0】
FL.17 Bus voltage at the last fault	Range：0～999V【0V】
FL.18 Output current at the last fault	Range：0～999.9A【0.0A】
FL.19 Freq. at the last fault	Range：0.00～650.00Hz【0.00Hz】

SINUS VEGA has 24 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 8 for the detailed introductions to the alarm.

7.16 Operation Time and Temperature of Cooling Fan （FN）

FN.00 Preset operation time	Range：0～65.535kh【0】
FN.01 Total operation time	Range：0～65.535kh【0】
FN.02 Temperature of cooling fan 1	Range：0～100℃【0】
FN.03 Temperature of cooling fan 2	Range：0～100℃【0】

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

FN.02 refers to the temperature of inverter module.

FN.03 refers to the temperature of rectifier module.

Display range：0～100℃；Accuracy：5%

7.17 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.

Note：

The factory setting of FP.01 is 1. If you need modify parameters, FP.01 must be set to 0; and then set it to 1 or 2 after modification to protect these parameters.

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 Reserved	

FP.04 Reserved	

7.18 Factory Default（FU）

FU.00 Password	Set by manufacture

8. Troubleshooting

All the possible faults of SINUS VEGA have been given in Table 6-1. 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 6-1 Fault Information and Diagnosis

Fault code	Display code	Fault description	Possible reasons	Actions
F.oC1		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.
			The rotating motor re-starts after the inverter stops re-starts after the inverter stops instantly	Start when the motor stops
			Low AC supply voltage	Check the inverter's input AC supply
			Inverter power is too small	Select a higher power inverter
F.oC2		Over-current in Dec process	Too short Dec time	Prolong the Dec time
			Negative-torque load or the load inertia is too high	Connect suitable braking device
			Too low inverter's power	Select the inverter with larger capacity
F.oC3		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
			Low AC supply voltage	Check the AC supply voltage
			Too low inverter's power	Select the inverter with larger capacity
F.oU1		Over voltage in Acc process	Abnormal AC supply voltage	Check the AC supply voltage
			Too short Acc/Dec time	Prolong the Acc time
			The inverter is re-started with a rotating motor	Start when the motor stops
F.oU2		Over voltage in Dec process	Too short Dec time (with reference to generated energy)	Prolong the Dec time

Fault code	Display code	Fault description	Possible reasons	Actions
			Negative-torque load or the load inertia is too high	Use suitable dynamic braking device
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		Over voltage of inverter's control power supply	Abnormal AC supply voltage	Check the AC supply voltage or seek service
F.IPL		intput phase loss	Input R、S、T phase loss	Check the wiring and input coltage
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		Module protection	Instant overcurrent	See User's manual
			Interphase shorted or ground shorted	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
			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		Rectifier's 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		Rectifier cooling fan	Ambient temperature is too high	Lower the ambient temperature

Fault code	Display code	Fault description	Possible reasons	Actions
		overtemperature	Fan duct blockage	Clear the fan duct
			Fan damaged	Replace the fan
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		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
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		E^2PROM 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 FL.12

Fault code	Display code	Fault description	Possible reasons	Actions
			Host PC does not work	Check whether the host PC is working or not; Check the wiring
F.Con		Contactor fault	The voltage of power network is too low	Check the power network
			Contactor damaged	Seek service
			Power snubber resistor damaged	Seek service
			Control circuit damage	Seek service
			Input phase loss	Check R、S、T wiring
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
F.rE1		Reserved	Reserved	Reserved
F.rE2		Reserved	Reserved	Reserved
F.CPy		Copy fault	Prameters incomplete Version of the panel is inconsistent with the main control board	Update the data and version, upload parameters first via FP.01=1, then download via FP.03=2/3
			E^2PROM damage	Seek service
F.tU		Tuning fault	Input motor parameters wrong	Re-input motor parameter according to the nameplate
			Tuning overtime	Check motor cables and limit it within 100m.

Table 6-1 Operation Related Faults and Counteractions

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
		Preset length arrives	Clear the actual length value or set FC.08 at 0
		Interruption of the communication between the inverter and host or flush mount faceplate	Check communication cables and FB.02, FB.03, FL.12 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.
	The inverter stops automatically	Auto reset of fault	Check reason of fault and the auto reset function

Phenomena	Conditions	Possible reasons of fault	Actions
	without STOP command. The RUN indicator is still on, zero-frequency running	Simple PLC pause	Check PLC pause function (terminal)
		Interrupt signal feedback from external devices	Check the configuration of external interrupt and faulty external devices
		Stop at zero-frequency	Check F9.12 and F9.13
		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 and F9.06
		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

9. Maintenance

Many factors such as ambient temperature, humidity, dust, vibration, internal component aging, 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.

9.1 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 7-1 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/s^2 (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

9.2 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.

9.3 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 PCBs 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 proceed 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.

9.4 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 abnormal conditions 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.

9.5 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.

9.6 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:

①Damages 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, abnormal voltage and so on;

③Damages 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.

Parameter Set

SINUS VEGA Series inverter's parameters are organized in groups. Each group has several parameters that are identified by"Group No.+ Parameter SN.". Parameter FX.YZ denotes that the parameter belongs to group "X" and its SN is "YZ". For example, "F5.08" belongs to group 5 and its SN is 8. For the convenience of setting the parameters, the group number corresponds to the menu level, 1, parameter number corresponds to menu level 2 and parameters of parameter correspond to the 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.

Explanation of the columns in Parameter Table:

The "LCD display" in third row refers to the parameter's name displayed by LED; The "setting range" in fourth row is the valid ranges of parameter settings; The "minimum unit" is the min. value of the parameter; The "factory setting" in sixth row is the primary factory settings; The "modification" in seventh row is the properties of modification (that is, whether it is allowed to be modified and conditions for modification) :

"O" denotes the parameters can be revised when the inverter isin operating or stop status;

" × " denotes the parameters can not be revised when theinverter is operating;

"*" denotes the parameters are actually detected and can notbe revised;

"—" denotes the parameters that are set by factory and theuser cannot modify it;

(The inverter has already set the "auto-checking" function to the modification property of each parameter, so as to avoid wrong modification by the user)

The inverter provides passwords to protect the parameters against unauthorized modifications. After the user's password is set (that is, the settings of FP.00 are not zero) , the inverter will require you to input the password before the user press the PRG to edit the parameter settings, otherwise you cannot set the parameters. For the parameters set by factory, you can only set the parameters after inputting factory password (you should not change the settings of the parameters set by factory because the inverter may operate abnormally or may be damaged if the parameters are not set correctly).

After setting the password, please don't press the keys within 5 minutes so as to enable the password. If the password is input correctly and the keys have not been pressed for longer than 5 minutes, the inverter will be locked by the password again. The user's password can be changed any time if the password protection is not locked up. The password that is input last time is valid.

The user's password can be disabled by setting FP.00 to 0. If FP.00 is not set to 0, then the parameters will be protected by the password.

CAUTION
It is defaulted that no parameters except F0.04 are allowed changing. If you need change them, please first set FP.01 (parameter write-in protection) from 1 to 0.

Appendix 1：Parameters set

F0：Basic parameters					
Code	Name	Range	Min. unit	Default	Modification
F0.00	Command channel	0：LED keypad 1：Terminal control 2：Serial communication port	1	0	○
F0.01	Control mode	0: V/F control 1：Vector control	1	0	×
F0.02	Frequency source setting	0：Digital setting 1(set by ▲or▼key) 1：Digital setting 2(set by terminal UP/DN) 2：Digital setting 3(set by serial communication port) 3：VCI 4：CCI 5：Terminal pulse setting 6: Keypad Potentiometer Setting（for power rate lower than 4.0KW）	1	0	○

F0：Basic parameters					
Code	Name	Range	Min. unit	Default	Modification
F0.03	Auxiliary reference frequency	0：Invalid 1：Keypad UP/DOWN (set by F0.05) 2: Terminal UP/DOWN(set by F0.05) 3:Serial communication port(set by F0.05) 4：VCI 5：CCI 6：PULSE 7：-VCI 8：-CCI 9：-PULSE 10：VCI-5 11：CCI-5 12：PULSE-1/2*Max input pulse frequency 13：Potentiometer（for power rate lower than 4.0KW）	1	0	○
F0.04	Keypad digital setting	Lower limit of frequency～Lower limit of frequency	0.01Hz	50.00Hz	○
F0.05	Digital auxiliarysetting	0.00～650.00Hz	0.01Hz	0.00Hz	○
F0.06	Base frequency	1.00Hz～650.00Hz	0.01Hz	50.00Hz	×
F0.07	Upper limit of freq.	Upper limit～Max output freq.	0.01Hz	50.00Hz	×
F0.08	Lower limit of freq.	0～Upper limit of freq.	0.01Hz	0.00Hz	×
F0.09	Max output frequency	Upper limit～650.00Hz	0.01Hz	50.00Hz	×
F0.10	Max output voltage	1～480V	1V	Inverter’s rated	×
F0.11	Running directions	0：Forward 1：Reverse	1	0	○

F0：Basic parameters					
Code	Name	Range	Min. unit	Default	Modification
F0.12	Acc time 1	0.75KW ～ 22.0KW:0.1 ～ 3600s	0.1	6s	○
		30.0KW ～ 110.0KW:0.1 ～ 3600s	0.1	20s	○
F0.13	Dec time 1	0.75KW ～ 22.0KW:0.1 ～ 3600s	0.1	6s	○
		30.0KW～110.0KW:0.1～3600s	0.1	20s	○
F0.14	Anti-reverse setting	0：Reverse allowed 1：Reverse not allowed	1	0	×

F1：Motor Parameter					
Code	Name	Range	Min unit	Default	Modification
F1.00	Reserved				×
F1.01	Motor’s poles	2～14	2	4	×
F1.02	Rated power	0.4～999.9Kw	0.1KW	Depending on model	×
F1.03	Rated current	0.1～999.9A	0.1A	Depending on model	×
F1.04	Current without load	0.1～999.9A	0.1A	Depending on model	×
F1.05	Stator resistance	0.0～50.00%	0.01%	Depending on model	○
F1.06	Leakage inductance	0.0～50.00%	0.01%	Depending on model	○
F1.07	Rotor resistance	0.0～50.00%	0.01%	Depending on model	○

F1：Motor Parameter					
Code	Name	Range	Min unit	Default	Modification
F1.08	Mutual inductance	0.0～2000.00%	0.1%	Depending on model	○
F1.09	Rated slip frequency	0.00～20.00Hz	0.01Hz	2.00Hz	○
F1.10	Auto tuning	0：Auto-tuning is disabled 1：tationary auto-tuning 2：Rotating auto-tuning	1	0	×

F2：Start/Brake Parameter					
Code	Name	Range	Min unit	Default	Modification
F2.00	Start mode	0：Start at start frequency 1：Brake first and then start at start frequency 2：Rotate speed tracking and then start at start frequency（it is reserved for power rate lower than 4.0KW）	1	0	×
F2.01	Start frequency	0.20～60.00Hz	0.01Hz	0.2Hz	○
F2.02	Start frequency hold time	0.0～10.0s	0.1s	0.0s	○

F2：Start/Brake Parameter					
Code	Name	Range	Min unit	Default	Modification
F2.03	DC brake current at startup	Heavy duty power rate lower than 4.0KW：0.0～150.0% inverter rated current Normal duty：0.0～130.0% rated current Heavy duty power rate larger than 5.5KW 0.0～100.0% rated current Normal duty: 0.0～80.0% rated current	0.1%	0.0%	○
F2.04	DC brake time at startup	For power rate lower than 4.0KW：0.0 disabled 0.1～60.0s For power rate larger than 5.5KW：0.0 disabled 0.1～30.0s	0.1s	0.0s	○
F2.05	Acc/Dec	0：Linear Acc/Dec 1：S curve Acc/Dec	1	0	×
F2.06	S curve start time	10.0～50.0%(Acc/dec time) F2.06+F2.07<90.0%	0.1%	20.0%	○
F2.07	S curve rising time	10.0～80.0%(Acc/dec time) F2.06+F2.07<90.0%	0.1%	60.0%	○
F2.08	Stop mode	0：Decelerate to stop 1：Coast to stop 2：Deceleration + DC braking	1	0	×
F2.09	Frequency threshold of DC braking	0.00～60.00Hz	0.01Hz	1.00Hz	○
F2.10	DC brake delay time	0.00～10.00s	0.01s	0.00s	○

F2：Start/Brake Parameter					
Code	Name	Range	Min unit	Default	Modification
F2.11	DC brake current	Heavy duty power rate lower than 4.0KW：0.0～150.0% inverter's rated current Normal duty: 0.0～130.0% rated current Heavy duty power rate higher than 5.5KW: 0.0～100.0% rated current Normal duty: 0.0～80.0% rated current	0.1%	120.0% 100.0%	○
F2.12	DC brake time at stop	For power rate lower than 4.0KW：0.0 disabled 0.1～60.0s For power rate high than 5.5KW：0.0 disabled 0.1～30.0s	0.1s	0.5s	○
F2.13	Dynamic braking	0：Disabled 1：Enabled	1	0	×
F2.14	Ration of braking time to total operating time	0.0～100.0%	0.1%	100.0%	×

F3：Flux vector control parameters					
Code	Name	Range	Min unit	Default	Modification
F3.00	V/F curve setting	0：User defined V/F curve 1: curve1, a 2-order curve 2: curve 2, a 1.7-order curve 3: curve 3, a 1.2-order curve	1	0	×
F3.01	V/F freq. F3	F3.03～F0.06	0.01Hz	0.00Hz	×

F3：Flux vector control parameters					
Code	Name	Range	Min unit	Default	Modification
F3.02	V/F voltage V3	F3.04～100%	0.1%	0.0%	×
F3.03	V/F freq. F2	F3.05～F3.01	0.01Hz	0.00Hz	×
F3.04	V/F voltageV2	F3.06～F3.02	0.1%	0.0%	×
F3.05	V/F freq. F1	0.00～F3.03	0.01Hz	0.00Hz	×
F3.06	V/F voltageV1	0～F3.04	0.1%	0.0%	×
F3.07	Torque boost	0.0%～30.0%	0.1%	0.0%	○
F3.08	Manual torque boost cutoff point	0.0%～50.0%	0.1%	10%	○
F3.09	Slip compensation gain	0.0～300.0%	0.1%	100.0%	○
F3.10	Slip compensation limit	0.0～250.0%	0.1%	200.0%	○
F3.11	Compensation time	0.75 KW～4.0KW:0.1～25.0s	0.1s	0.1s	×
		5.5KW～110.0KW:0.1～25.0s	0.1s	0.5s	×
F3.12	AVR function	0：Disabled 1：Always enabled 2：Disabled during decelerating	1	2	×
F3.13	Auto energy saving	0：Disabled 1：Enabled	1	0	×
F3.14	Motor stabilization factor	0～255	1	Depending on model	○

F4：Current vector control parameter（11）					
Code	Name	Range	Min unit	Default	Modification
F4.00	Reserved	-	-	-	*

F4：Current vector control parameter（11）					
Code	Name	Range	Min unit	Default	Modification
F4.01	Pre-excitation	0：Valid 1：Invalid	1	1	○
F4.02	Speed loop proportional gain 1	0～65535	1	120	○
F4.03	Speed loop integral gain 1	0～65535	1	3	○
F4.04	Speed loop proportional gain 2	0～65535	1	120	○
F4.05	Speed loop integral gain 2	0～65535	1	3	○
F4.06	Speed loop switching frequency	0.0%～100.0%	0.1%	0	○
F4.07	D axis current loop proportional gain	0～65535	1	10000	○
F4.08	D axis current loop integral gain	0～65535	1	2000	○
F4.09	Q axis current loop proportional gain	0～65535	1	10000	○
F4.10	Q axis current loop integral gain	0～65535	1	2000	○

F5：Multi-function terminal（22）					
Code	Name	Range	Min unit	Default	Modification
F5.00	Function of multi-function terminal X1	0：No function 1：MS frequency 1 2：MS frequency 2 3：MS frequency 3 4：Acc/Dec time 1 5：Acc/Dec time 2 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) 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	1	0	×
F5.01	Function of multi-function terminal X2				
F5.02	Function of multi-function terminal X3				

F5：Multi-function terminal（22）					
Code	Name	Range	Min unit	Default	Modification
F5.03	Function of multi-function terminal X4	22：Frequency setting method 1 23：Frequency setting method 2 24：Frequency setting method 3 25：Reference freq. is input via CCI 26：Reserved 27：Terminal control mode is forcibly enabled 28：Control mode 1 29：Control mode 2 30：MS close-loop 1 31：MS close-loop 2 32：MS close-loop 3 33：Start traverse operation 34：Reset the traverse operation status 35：External stop command 36：Reserved 37：Inverter operation prohibiting 38：Reserved 39：Clear length 40：Clear auxiliary reference frequency 41：Reset PLC stop status 42：Clear counter’s record 43：Signal of triggering counter 44：Input the signal of length 45：Pulse input 46：Single phase speed measuring 47：Speed measuring input SM1（only for X4） 48：Speed measuring input SM2（only for X5）			
F5.04	Function of multi-function terminal X5				
F5.05	Reserved	-	-	-	*
F5.06	Reserved	-	-	-	*

F5：Multi-function terminal（22）					
Code	Name	Range	Min unit	Default	Modification
F5.07	Reserved	-	-	-	*
F5.08	Terminal control mode	0：2-wire operating mode 1 1：2-wire operating mode 2 2：3-wire operating mode 1 3：3-wire operating mode 2	1	0	×
F5.09	UP/DN rate	0.01～99.99Hz/s	0.01Hz/s	1.00Hz/s	○
F5.10	Freq. Curve selection	One's place of F5.10: VCI curve selection 0：curve 1 1：curve 2 Ten's place of F5.10: CCI curve selection 0：curve 1 1：curve 2 Hundred's place of F5.10: PULSE curve selection 0：curve 1 1：curve 2	1	000	○
F5.11	Gain of reference frequency selector	0.00～9.99	0.01	1.00	○
F5.12	Filter constant	0.01～50.00	0.01s	0.50s	○
F5.13	Max. input pulse freq.	0.1～50.0kHz	0.1k	10.0kHz	○
F5.14	Ratio of Min. input of curve 1	0.0%～F5.16	0.1%	2.0%	○

F5：Multi-function terminal（22）					
Code	Name	Range	Min unit	Default	Modification
F5.15	Frequency corresponds to min. input if curve	0.00～F0.09	1	0.00Hz	○
F5.16	Ratio of Max. input of curve1	F5.14～100.0%	0.1%	100.0%	○
F5.17	Frequency corresponds to max. input of curve 1	0.00%～F0.09	1	50.00Hz	○
F5.18	Ratio of Min. input of curve2	0.0%～F5.20（	0.1%	0.0%	○
F5.19	Frequency corresponds to min. input	0.00～F0.09	1	0.00Hz	×
F5.20	Ratio of Max. input of curve 2	F5.18～100.0%	0.1%	100.0%	○
F5.21	Frequency corresponds to max. input	0.00～F0.09	1	50.00Hz	○

F6：Output terminal control parameters（18）					
Code	Name	Range	Min unit	default	Modification
F6.00	Open collector output terminal Y1	0：Inverter running signal（RUN） 1：Frequency arrival signal（FAR） 2：Frequency detection threshold（FDT1） 3：Frequency detection threshold（FDT2） 4：Overload signal（OL） 5：Low voltage 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 counting value arrival 13：Specified counting value arrival 14：Preset length arrival	1	0	×
F6.01	Open collector output terminal Y2		1	1	×
F6.02	Relay 1 output function		1	16	×

F6：Output terminal control parameters（18）					
Code	Name	Range	Min unit	default	Modification
F6.03	Relay (for power rate lower than)	15：Inverter is ready（RDY） 16：Inverter fails 17：Extended function 1 of host 18：Upper and lower limits of traverse frequency 19：Preset operation time out 20: Freq. before slip compensation 21：Freq. after slip compensation 22：Preset freq. 23：Output current（0～2 times of inverter's rated current） 24：Output current（0～2 times of motor's's rated current） 25：Output torque（0～2 times of motor's rated torque） 26：Output voltage（0～1.2 times of inverter's rated voltage） 27：Bus voltage（0～800V） 28：VCI（0～10V） 29：CCI（0～10V/0～20mA） 30：Output power（0～2times rated power） 31：Extended function 2 of host（0～65535） 32：Potentiometer setting Note：20～32 for the Y2 proprietary 0: Output frequency before slip compemsation (0～Max. output frequency)			

F6：Output terminal control parameters（18）					
Code	Name	Range	Min unit	default	Modification
F6.04	AO1 output function	0 ： Output freq. before compensation 1 ： Output freq. after compensation 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：VCI（0～10V） 9：CCI（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）	1	0	○
F6.05	AO2 output function		1	3	○
F6.06	Reserved	-	-	-	*

F6：Output terminal control parameters（18）					
Code	Name	Range	Min unit	default	Modification
F6.07	Analog output range	LED one's place：AO1 output range 0：0～10V or 0～20mA 1：2～10V or 4～20mA LED ten's place：AO2 output range 0：0～10V or 0～20mA 1：2～10V or 4～20mA	1	00	○
F6.08	AO1 output gain	0.0～200.0%	0.1%	100.0%	○
F6.09	AO2 output gain	0.0～200.0%	0.1%	100.0%	○
F6.10	Max output pulse freq. of Y2	0.1～50.0kHz	0.1	10.0kHz	○
F6.11	Preset counting value	F6.12～9999	1	0	○
F6.12	Specified counting value	0～F6.11	1	0	○
F6.13	Freq. arrival detection range (FAR)	0.00～650.0Hz	0.01Hz	2.50Hz	○
F6.14	FDT1 level	0.00～650.0Hz	0.01Hz	50.00Hz	○
F6.15	FDT1 lag	0.00～650.0Hz	0.01Hz	1.00Hz	○

F6：Output terminal control parameters（18）					
Code	Name	Range	Min unit	default	Modification
F6.16	FDT2 level	0.00～650.0Hz	0.01Hz	25.00Hz	○
F6.17	FDT2 lag	0.00～650.0Hz	0.01Hz	1.00Hz	○

F7：Close-loop control					
Code	Name	Range	Min unit	Default	Modification
F7.00	Close-loop control	0：Disabled 1：Enabled	1	0	×
F7.01	reference input method	0：digital setting（when F7.02=6, it refers to F7.06，the rest refer to F7.05） 1：VCI 2：CCI 3：LED keypad（for power rate lower than 4.0KW） 4：PULSE（for power rate lower than 4.0KW）	1	1	○
F7.02	Feedback method	0：VCI 1：CCI 2：VCI+CCI 3：VCI-CCI 4：MIN(VCI,CCI) 5：MAX(VCI,CCI) 6：Pulse	1	1	○
F7.03	Input filter	0.01～50.00s	0.01s	0.5s	○

F7：Close-loop control					
Code	Name	Range	Min unit	Default	Modification
F7.04	Feedback filter	0.01～50.00s	0.01s	0.5s	○
F7.05	Digital reference input	0.00～10.00V	0.01	0.00	○
F7.06	Speed close-loop setting	0～39000RPM	1	0	○
F7.07	Pulse number per revolution of encoder	1～9999	1	1024	○
F7.08	Min. input	0.0%～F7.10	0.1%	0.0	○
F7.09	Feedback of min. input	0.0～100.0%	0.1%	20.0%	○
F7.10	Max. input	F7.08～100.0%	0.1%	100.0%	○
F7.11	Feedback of max. input	0.0～100.0%	0.1%	100.0%	○
F7.12	Proportional gain	0.75 KW～4.0KW:0.000～9.999	0.001	2.000	○
		5.5KW～110.0KW:0.000～9.999	0.001	0.050	○
F7.13	Integral gain	0.75 KW～4.0KW:0.000～9.999	0.001	0.100	○
		5.5KW～110.0KW:0.000～9.999	0.001	0.050	○
F7.14	Sampling cycle	0.75 KW～4.0KW:0.01～50.00s	0.01s	0.10s	○
		5.5KW～110.0KW:0.01～50.00s	0.01s	0.50s	○
F7.15	Error limit	0.0～20.0%	0.1%	2.0%	○
F7.16	Close-loop regulation characteristics	0：Positive logic 1：Negative logic	1	0	×

F7：Close-loop control					
Code	Name	Range	Min unit	Default	Modification
F7.17	Integral regulation	0：Stop integral regulation when the frequency reaches theupper or lower limits 1：Continue the integral regulation when the frequencyreaches the upper or lower limits	1	0	×
F7.18	Preset frequency	0.00～650.0Hz	0.01Hz	0.00Hz	○
F7.19	Preset frequency hold time	0.0～3600s	0.1s	0.0s	×

F8：MS parameters（20）					
Code	Name	Range	Min unit	Default	Modification
F8.00	MS freq. 1	lower limit～upper limit	0.01Hz	5.00Hz	○
F8.01	MS freq. 2			10.00Hz	○
F8.02	MS freq. 3			20.00Hz	○
F8.03	MS freq. 4			30.00Hz	○
F8.04	MS freq. 5			40.00Hz	○
F8.05	MS freq. 6			45.00Hz	○
F8.06	MS freq. 7			50.00Hz	○
F8.07	MS close-loop setting 1	0.00～10.00V	0.01 V	0.00V	○
F8.08	MS close-loop setting2				
F8.09	MS close-loop setting 3				
F8.10	MS close-loop setting 4				
F8.11	MS close-loop setting 5				
F8.12	MS close-loop setting 6				

F8：MS parameters（20）					
Code	Name	Range	Min unit	Default	Modification
F8.13	MS close-loop setting 7				
F8.14	Acc time 2	0.1～3600s	0.1	＜ 55G:6.0s ＞ 3G:20.0s	○
F8.15	Dec time 2				
F8.16	Acc time 3				
F8.17	Dec time 3				
F8.18	Acc time 4				
F8.19	Dec time 4				

F9：Enhanced function					
Code	Name	Range	Min unit	Default	Modification
F9.00	Digital frequency control	LED one's place： 0：save after power off 1：Not save after power off LED tem's place： 0：hold freq. after stop 1：restore to F0.04 after stop	1	00	○
F9.01	FWD/REV transition time	0～3600s	0.1s	0.0s	○
F9.02	Carrier wave frequency	0.7kW～4.0KW：0.7 kHz～15.0kHz 5.5kW～15kW：0.7kHz～15.0kHz 18.5kW～45kW：0.7kHz～10.0kHz 55kW～75kW：0.7kHz～6.0kHz 90kW and above：0.7kHz～3kHz	0.1kHz	Depending on model	×

F9：Enhanced function					
Code	Name	Range	Min unit	Default	Modification
F9.03	CWF auto adjustment	0：Disabled 1：Enabled	1	1	○
F9.04	Motor tone	0～10	1	0	○
F9.05	Jog frequency	0.10 Hz～F0.07	0.01Hz	5.00Hz	○
F9.06	Jog interval	0.1～100.0s	0.1s	0.0s	○
F9.07	Jog Acc time	0.7kW～22.0KW：0.1～60.0s	0.1	6s	○
		30.0kW～110.0kW：0.1～60.0s	0.1	20s	○
F9.08	Jog Dec time	0.7kW～22.0KW：0.1～60.0s	0.1	6s	○
		30.0kW～110.0kW：0.1～60.0s	0.1	20s	○
F9.09	Skip freq. 1	0.00～650.0Hz	0.01Hz	0.00Hz	×
F9.10	Skip freq. 1 range	0.00～30.00Hz	0.01Hz	0.00Hz	×
F9.11	Skip freq. 2	0.00～650.0Hz	0.01Hz	0.00Hz	×
F9.12	Skip freq. 2 range	0.00～30.00Hz	0.01Hz	0.00Hz	×
F9.13	Skip freq. 3	0.00～650.0Hz	0.01Hz	0.00Hz	×
F9.14	Skip freq.3 range	0.00～30.00Hz	0.01Hz	0.00Hz	×

F9：Enhanced function					
Code	Name	Range	Min unit	Default	Modification
F9.15	Positive or negative logic of terminal	Binary setting： 0：breakover enabled 1：disconnect enabled LED one's place： Bit0～Bit3: X1～X4 LED ten's place： Bit0：X5 Bit1～Bit3: reserved LED hundred place： Bit0 ～ Bit3: FWD,REV,Y1,Y2	1	000	○
F9.16	operating command bundled with freq. setting method	LED one's place：keypad control 0：No bunding 1：digital setting 1(▲ and ▼) 2: digital setting 2(terminal UP/DN) 3：digital setting 3(serial port) 4：VCI analog input 5：CCI analog input 6：Pulse terminal input 7：Potentionmeter（for power rate lower than 4.0KW） LED ten's place：terminal control 0：No bunding 1：digital setting 1(▲ and ▼) 2: digital setting 2(terminal UP/DN) 3：digital setting 3(serial port) 4：VCI analog input 5：CCI analog input 6：Pulse terminal input	1	000	○

F9：Enhanced function					
Code	Name	Range	Min unit	Default	Modification
F9.16	operating command bundled with freq. setting method	7: potentiometer（for power rate lower than 4.0KW） LED hundred place：serial port control 0：No bunding 1：digital setting 1(▲ and ▼) 2: digital setting 2(terminal UP/DN) 3：digital setting 3(serial port) 4：VCI analog input 5：CCI analog input 6：Pulse terminal input 7：potentiometer（for power rate lower than 4.0KW）	1	000	○
F9.17	Auxiliary reference factor	0.00～9.99	0.01	1.00	○
F9.18	Digital auxiliary reference control	LED one's place：save control 0：save after power off 1：not save after power off LED ten's place 0：hold reference frequency at stop 1：clear reference frequency at stop LED hundred place：sign of auxiliary freq. 0：(+) positive sign 1：(－) negative sign	1	000	○
F9.19	Preset freq. adjust mode	0：disabled 1：regulate based on max. output freq. (F0.09) 2：regulate based on current output freq.	1	0	○

F9：Enhanced function					
Code	Name	Range	Min unit	Default	Modification
F9.20	Factor for calculating preset freq.	0.0～200.0%	0.1%	100.0%	○
F9.21	Keypad functions	LED one's place：STOP/RESET key's function 0：effective when keypad control is selected 1：effective for keypad, terminal and serial port control 2：it will display "F.Ed" alarm and the inverter will coast to stop when the inverter is not in panel control mode LED ten's place：LOCAL functions (for 4.0KW and below) 0：disabled 1：Enabled in STOP state 2：Enabled in STOP & RUN state LED hundred place：lock up keypad selection 0：not lock the keypad 1：lock all keys on the keypad 2：lock all keys on the keypad except STOP/RESET key 3：lock all keys on the keypad except ▶▶key 4：lock all keys on the keypad except RUN and STOP key	1	000	×

F9：Enhanced function					
Code	Name	Range	Min unit	Default	Modification
F9.22	Cooling fan	0：Auto-stop mode 1：cooling fan keeps running upon power on	1	0	×
F9.23	Acc/Dec time unit	0：second 1：minute	0	0	×
F9.24	Droop control	0.00～10.00Hz	0.01Hz	0.00Hz	○
F9.25	High usage of bus voltage	0：disabled 1：enabled	1	1	×
F9.26	Zero freq. threashold	0.00～650.0Hz	0.01Hz	0.00Hz	○
F9.27	Zero freq. hysteresis	0.00～650.0Hz	0.01Hz	0.00Hz	○
F9.28	Low voltage compensation (trip free)	0：disabled 1：enabled	1	0	×
F9.29	Freq. decrease rate during voltage compensation	0.00～99.99Hz/s	0.01Hz/s	10.00Hz/s	○
F9.30	Conditions of restart after power failure	0：disabled 1：enabled	1	0	×
F9.31	Restart delay after power failure	0.0～10.0s	0.1s	0.5s	○
F9.32	Reserved	-	-	-	*
F9.33	Braking unit operating voltage	0.7kW～4.0KW：650～780V	1	710V	○
		5.5kW～160.0KW：650～780V	1	750V	○
F9.34	Terminal filter time	0.5~100.0ms	0.1ms	7.5ms	○

F9：Enhanced function					
Code	Name	Range	Min unit	Default	Modification
F9.35	Reserved				
F9.36	undervoltage setting	75.0%～135.0%	0.1%	90.0%	×
F9.37	Load loss protection	0～1	1	0	○
F9.38	Load loss fault level	0.0～100.0%	0.1%	30.0%	○
F9.39	Load loss fault time	0～600.0s	0.1s	120.0	○
F9.40	Torque enable in zero speed	0～1	1	0	○
F9.41	Torque percentage in zero speed	0.0～100%	0.1%	1.0%	○

FA：Display Control Parameters					
Code	Name	Range	Min unit	Default	Modification
FA.00	LED displayed parameter selection 1	Binary setting： 0： not be displayed 1：displayed LED one's place： Bit0 ： output freq.(before compensation, Hz) Bit1 ： output freq.(after compensation,Hz) Bit2：reference frequency(Hz fliker) Bit3：output current(A) LED ten's place： Bit0：actual speed(RPM) Bit1：preset speed(RPM) Bit2：actual line speed(m/s) Bit3：preset line speed(m/s) LED hundred's speed： Bit0：output power Bit1：output torque（%）	1	00D	○

FA：Display Control Parameters					
Code	Name	Range	Min unit	Default	Modification
FA.01	LED displayed parameter selection 2	Binary setting： 0：not be displayed 1：displayed LED one's place： Bit0：output voltage(V) Bit1：bus voltage Bit2：VCI(V) Bit3：CCI(V) LED ten's place： Bit0：analog close-loop feedback(%) Bit1：analog close-loop setting(%) Bit2：external counting value Bit3：terminal status LED hundred's place： Bit0：actual length Bit1：preset length	1	000	○

FA：Display Control Parameters					
Code	Name	Range	Min unit	Default	Modification
FA.02	Displayed parameter at stop state	Binary setting： 0： not be displayed 1： displayed LED one's place： Bit0：reference freq.(Hz) Bit1：external counting value Bit2：actual speed (RPM) Bit3：preset speed(RPM) LED ten's place： Bit0：actual line speed(m/s) Bit1：preset line speed(m/s) Bit2：VCI(V) Bit3：CCI(V) LED hundred's place： Bit0：analog close-loop feedback(%) Bit1：analog close-loop setting(%) Bit2：actual length Bit3：preset length LED thousand's place： Bit0：terminal status Bit1：bus voltage	1	2001	○
FA.03	Rotating speed display factor	0.1～999.9%	0.1%	100.0%	○
FA.04	Line speed factor	0.1～999.9%	0.1%	1.0%	○
FA.05	Close-loop parameter display factor	0.1～999.9%	0.1%	100.0%	○

FA：Display Control Parameters					
Code	Name	Range	Min unit	Default	Modification
FA.06	Language	0：Chinese 1：English	1	0	*
FB：Communication					
Code	Name	Range	Min unit	Default	Modification
FB.00	Communication configuration	LED one's place：Baud rate 0：1200bps 1：2400bps 2：4800bps 3：9600bps 4：19200bps 5：38400bps LED ten's place：data format 0：1-8-2-N format，RTU 1：1-8-1-E format，RTU 2：1-8-1-O format，RTU LED hundred's place：fictitious input terminal 0：disabled 1：enabled	1	4	×
FB.01	Local address	0～247，0 is the broadcast address	1	1	×
FB.02	Communicate timeout detect	0.0～1000s When it is set at 0, the inverter will not detect the signals at the serial port	0.1	0.0s	×
FB.03	Response delay	0～1000ms	1	5ms	×

FC：Traverse Parameters 1（15）					
Code	Name	Range	Min unit	Default	Modification
FC.00	Traverse function selection	0：disabled 1：enabled	1	0	×
FC.01	Taverse mode	LED one's place：transfer mode 0：auto 1：manually LED ten's place：amplitude control 0：varied amplitude 1：fixed amplitude LED hundred's place：start/stop mode 0：start to the state before stop 1：just restart, no other requirement LED thousand's place：save traverse state upon powerfailure 0：save 1：not save	1	0000	×
FC.02	Preset traverse frequency	0.00～650.0Hz	0.01Hz	0.00Hz	○
FC.03	Preset traverse frequency hold time	0.0～3600.0s	0.1s	0.0s	○
FC.04	Traverse amplitude	0.0～50.0%	0.1%	0.0%	○
FC.05	Step freq.	0.0～50.0%	0.1%	0.0%	○

FC：Traverse Parameters 1（15）					
Code	Name	Range	Min unit	Default	Modification
FC.06	Traverse cycle	0.1～999.9s	0.1s	10.0s	○
FC.07	Rise time of triangular wave	0.0～100.0%	0.1%	50.0%	○
FC.08	Preset length	0.000～65.535km	0.001(km)	0.000(km)	○
FC.09	Actual length	0.000～65.535km	0.001(km)	0.000(km)	○
FC.10	Length factor	0.001～30.00	0.001	1.000	○
FC.11	Length calibrate	0.001～1.000	0.001	1.000	○
FC.12	Shaft circumference	0.01～100.0cm	0.01cm	10.00cm	○
FC.13	Pulse per revolution	1～9999	1	1	○
FC.14	Reserved	-	-	-	*

FD：PLC parameters					
Code	Name	Range	Min unit	Default	Modification
FD.00	Simple PLC mode	LED one's place：PLC running mode selection 0：Disabled 1：stop after a single cycle 2：Maintain value of the last stage after 1 cycle 3：Continuous cycle LED ten's place：Restart mode after PLC interruption 0：start from the first stage 1：continue from the stage frequency where the inverter stops 2：Start from the frequency where it stops LED hundred's place：Save PLC state after poweroff 0：not save 1：save LED thousand's place：Selection of time unit 0：Second 1：Minute	1	0000	×

FD：PLC parameters					
Code	Name	Range	Min unit	Default	Modification
FD.01	Stage 1 setting	LED one's place： 0：MS frequency 1(F8.00) 1：determined by F0.02 2：MS close loop setting 1(F8.07) 3：Determined by P7.01 LED ten's place： 0：FWD 1：REV 2：Determined by running command LED hundred's place： 0：Acc/Dec time 1 1：Acc/Dec time 2 2：Acc/Dec time 3 3：Acc/Dec time 4	1	000	○
FD.02	Stage 1 run time	0.0~6500 s(min)	0.1	20.0s	○

FD：PLC parameters					
Code	Name	Range	Min unit	Default	Modification
FD.03	Stage 2 setting	LED one's place： 0：MS frequency 2(F8.01) 1：determined by F0.02 2：MS close loop setting 2(F8.08) 3：Determined by F7.01 LED ten's place： 0：FWD 1：REV 2：Determined by running command LED hundred's place： 0：Acc/Dec time 1 1：Acc/Dec time 2 2：Acc/Dec time 3 3：Acc/Dec time 4	1	000	○
FD.04	Stage 2 run time	0.0~6500 s(min)	0.1	20.0s	○

FD：PLC parameters					
Code	Name	Range	Min unit	Default	Modification
FD.05	Stage 3 setting	LED one's place： 0：MS frequency 3(F8.02) 1：determined by F0.02 2：MS close loop setting 3(F8.09) 3：Determined by F7.01 LED ten's place： 0：FWD 1：REV 2：Determined by running command LED hundred's place： 0：Acc/Dec time 1 1：Acc/Dec time 2 2：Acc/Dec time 3 3：Acc/Dec time 4	1	000	○
FD.06	Stage 3 run time	0.0~6500 s(min)	0.1	20.0s	○

FD：PLC parameters					
Code	Name	Range	Min unit	Default	Modification
FD.07	Stage 4 setting	LED one's place： 0：MS frequency 4(F8.03) 1：determined by F0.02 2：MS close loop setting 4(F8.10) 3：Determined by F7.01 LED ten's place： 0：FWD 1：REV 2：Determined by running command LED hundred's place： 0：Acc/Dec time 1 1：Acc/Dec time 2 2：Acc/Dec time 3 3：Acc/Dec time 4	1	000	○
FD.08	Stage 4 run time	0.0~6500 s(min)	0.1	20.0s	○

FD：PLC parameters					
Code	Name	Range	Min unit	Default	Modification
FD.09	Stage 5 setting	LED one's place： 0：MS frequency 5(F8.04) 1：determined by F0.02 2：MS close loop setting 5(F8.11) 3：Determined by F7.01 LED ten's place： 0：FWD 1：REV 2：Determined by running command LED hundred's place： 0：Acc/Dec time 1 1：Acc/Dec time 2 2：Acc/Dec time 3 3：Acc/Dec time 4	1	000	○
FD.10	Stage 5 run time	0.0~6500 s(min)	0.1	20.0s	○

FD：PLC parameters					
Code	Name	Range	Min unit	Default	Modification
FD.11	Stage6 setting	LED one's place： 0：MS frequency 6(F8.05) 1：determined by F0.02 2：MS close loop setting 6(F8.12) 3：Determined by F7.01 LED ten's place： 0：FWD 1：REV 2：Determined by running command LED hundred's place 0：Acc/Dec time 1 1：Acc/Dec time 2 2：Acc/Dec time 3 3：Acc/Dec time 4	1	000	○
FD.12	Stage 6 run time	0.0~6500 s(min)	0.1	20.0s	○

FD：PLC parameters					
Code	Name	Range	Min unit	Default	Modification
FD.13	Stage 7 setting	LED one's place： 0：MS frequency 7(F8.06) 1：determined by F0.02 2：MS close loop setting 7(F8.13) 3：Determined by F7.01 LED ten's place： 0：FWD 1：REV 2：Determined by running command LED hundred's place： 0：Acc/Dec time 1 1：Acc/Dec time 2 2：Acc/Dec time 3 3：Acc/Dec time 4	1	000	○
FD.14	Stage 7 runtime	0.0~6500 s(min)	0.1	20.0s	○

11 parameters have reserved for FE

FL：Protection					
Code	Name	Range	Min unit	Default	Modification
FL.00	Motor overload protection load	0：disabled 1：Common motor (with low speed compensation) 2：Variable frequency motor (without low speed compensation)	1	0	×

FL：Protection					
Code	Name	Range	Min unit	Default	Modification
FL.01	Motor overload protection factor	20.0～110%	0.1%	100.0%	×
FL.02	Stall overvoltage	0：disabled 1：enabled	1	1	×
FL.03	Stall overvoltage point	120.0～150.0%	0.1%	140.0%	×
FL.04	Overload pre-alarm detection config	LED one's place：overload detection mode 0：detect all the time 1：detect in the case of constand speed LED ten's place：overload action mode 0：No alarm 1：Alarm LED hundred's place：reference current 0：motor's rated current 1：inverter's rated current	1	000	×
FL.05	Overload pre-alarm detection threshold	20.0～200.0%	0.1%	130.0%	×
FL.06	Overload pre-alarm alarm delay	0.0～60.0s	0.1s	5.0s	×

FL：Protection					
Code	Name	Range	Min unit	Default	Modification
FL.07	Auto current limiting threshold	20.0～200.0%	0.1%	G:150.0% P:110.0%	×
FL.08	Freq. decrease rate during current limiting	0.00～99.99Hz/s	0.01Hz/s	10.00Hz/s	○
FL.09	Action mode of auto current limiting	0：disabled 1：enabled 2：effective all the time, no silencing function 3：Reserved 4：Reserved	1	Less than or equal to 4.0kw：2 Greater than or equal to 5.5kw：1	×
FL.10	Auto reset time	0～10	1	0	×
FL.11	Auto reset interval	2.0～20.0s	0.1s	5.0s	×

FL：Protection					
Code	Name	Range	Min unit	Default	Modification
FL.12	Protective action mode 1	LED one's place： action for communication fault 0：alarm and coast to stop 1： no alarm, continue operation 2：no alarm, stop （only in serial port control mode） 3：no alarm, stop （all control modes） LED ten's place： action for contactor fault （it is reserved for power rate lower than 4.0KW） 0：alarm and coast to stop 1： No alarm, continue operation LED hundred's place：action for EEPROM fault 0：alarm and coast to stop 1： No alarm, continue operation	1	001	×

FL：Protection					
Code	Name	Range	Min unit	Default	Modification
FL.13	Protective action mode 2	LED one's place：indication for under voltage fault 0：no indication 1：indicate the fault LED ten's place：indication for auto reset fault 0：no indication 1：indication the fault LED hundred's place：fault lock-up 0： disabled 1： enabled（no fault indication） 2： enabled（indicate the fault） (for power rate higher than 5.5KW Heavy duty)LED thousand's place：phase-loss protection 0 ： input/output phase-loss protection 1：no input phase-loss protection 2：no output phase-loss protection 3：no phase-loss protection (for power rate lower than 4.0KW) LED thousand's place：phase-loss protection 0：enabled 1：disabled	1	0000	×

FL：Protection					
Code	Name	Range	Min unit	Default	Modification
FL.14	Fault type of the first two times	0：no fault record 1：Over-current in Acc process(F.oC1) 2：Over-current in Dec process (F.oC2) 3：Over-current in constant speed	1	0	*
FL.15	Fault type of the previous time		1	0	*

FL：Protection					
Code	Name	Range	Min unit	Default	Modification
PL.16	Fault type of the last time	operation (F.oC3) 4：Over voltage in Acc process (F.oU1) 5：Over voltage in Dec process (F.oU2) 6：Over voltage inconstant-speed operating process(F.oU3) 7：Over voltage of inverter's control power supply (F.PoU) 8：intput phase loss (F.IPL) 9：Output phase loss (F.oPL) 10：Module protection (F.FAL) 11：Rectifier's heatsink overheat (F.oH1) 12：Rectifier cooling fan overtemperature (F.oH2) 13：Inverter overload (F.oL1) 14：Motor overload (F.oL2) 15：Emergency stop or external equipment fails (F.Ed) 16：E2PROM R/W fault (F.EEP) 17：RS485 communication failure (F.485) 18：Contactor fault (F.Con) 19：Current detection circuit is faulty 20：System disturbance（F.CPU） 21：Reserved 22：Reserved 23：Copy fault（F.CPy） 24：Tuning fault（F.tU）	1	0	*

FL：Protection					
Code	Name	Range	Min unit	Default	Modification
FL.17	Bus voltage at the last fault	0～999V	1V	0V	*
FL.18	Output current at the last fault	0.0～999.9A	0.1A	0.0A	*
FL.19	Freq. at the last fault	0.00Hz~650.0Hz	0.01Hz	0.00Hz	*

FN：Operation Time and Temperature of Cooling Fan					
Code	Name	Range	Min unit	Default	Modification
FN.00	Preset operation time	0～65.535 kh	0.001kh	0	○
FN.01	Total operation time	0～65.535 kh	0.001kh	0	*
FN.02	Temperature of cooling fan 1	0.0～100.0℃	0.1	0℃	*
FN.03	Temperature of cooling fan 2	0.0～100.0℃	0.1	0℃	*

FP：Protection of Parameters					
Code	Name	Range	Min unit	Default	Modification
FP.00	User password	0000～9999	0	0000	○
FP.01	Write-in protection	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	1	0	○

FP：Protection of Parameters					
Code	Name	Range	Min unit	Default	Modification
FP.02	Parameter initialization	0：disabled 1：clear fault record 2：restore to factory defaults	1	0	×
FP.03	Reserved				×
FP04	Reserved				*

FU：Factory Default					
Code	Name	Range	Min unit	Default	Modification
FU.00	Password	****	1	Set by manufacture	-

10. Communication Protocal

10.1 Communication Mode

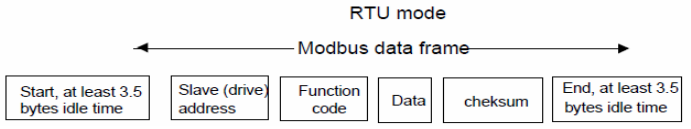
1. The protocol is Modbus protocol. Besides the common register Read/Write operation, it is supplemented with commands of parameters management.

2. The inverter is a slave in the network. It communicates in 'point to point' master-slave mode. It will not respond to the command sent by the master via broadcast address.

3. In the case of multi-inverter communication or long-distance transmission, connecting "GND"in parallel with the master signal line will help to enhance the immunity to interference.

10.2 Protocol Format

Modbus protocol supports both RTU mode. The frame format is illustrated as follows:



Modbus adopts "Big Endian" Representation for data frame.

This means that when a numerical quantity larger than abyte is transmitted, the most significant byte is sent first.Under RTU mode, the idle time between frames is decidedby the bigger value between parameter setting by FF.03 andthe Modbus minimum idle time. The minimum Modbus idletime between frames should be no less than 3.5 bytes. Thechecksum adopts CRC-16 method. All data exceptchekcsum itself sent will be counted into the calculation.Please refer to section: CRC Check for more information.Note that at least 3.5 bytes of modbus idle time should bekept, and the start and end idle time need not be summed upto it.

The table below shows the data frame of reading parameter 002 from Inverter No. 1.

Address	Code	Register address		Quantity of inputs		Checksum	
0x01	0x03	0x00	0x04	0x00	0x01	0xC5	0xCB

The table below shows the reply frame from Inverter No. 1:

Address	Code	Reply bytes	Register content		Checksum	
0x01	0x03	0x02	0x13	0x88	0xB5	0x12

Different respond delay time can be set through inverter's parameters to adapt to different needs. For RTU mode, the respond delay time should be no less than 3.5 bytes interval.

10.3 Protocal function

The main functions of Modbus is to read and write parameters. The Modbus protocol supports the following function code:

Function code	Function
0x03	Read inverter's parameter and operation status parameters
0x06	Modify single inverter's parameter or control parameters. Not save them upon power-off.
0x08	Serial line diagnosis
0x10	Modify several inverters' parameter or control parameters. Not save them upon power-off.
0x41	Modify single inverter's parameter or control parameters. Saving them upon power-off.
0x42	Parameter management

All inverter's parameters, control and status parameters are mapped to Modbus R/W Register. The R/W properties of the parameters and their setting ranges are specified in the user manual. The group number of the inverter's parameter maps to the most significant byte of the register address, and the index number of the parameter in the group maps to the least significant byte. The control and status parameters of the inverter are virtually taken as parameter group. The relationship of group number of the parameters and the most significant byte of register address is listed below:

F0 group: 0x00; F1 group: 0x01: F2 group: 0x02; F3 group: 0x03; F4 group: 0x04; F5 group: 0x05; F6group: 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 parameter group: 0x32; Inverter status parameter group: 0x33.

E.g. the register address of F3.02: 0x302, register address of FB.01: 0xB01.

The above shows the format of the frame. Now we will introduce the Modbus function code and data unit for different function in details, which is called protocol data unit for simplicity. Also MSB stands for the most significant byte and LSB stands for the least significant byte for the same reason. The description below is data format in RTU mode. The length of data unit in ASCII mode should be doubled.

Protocol data unit format of reading parameters:

Request format:：

Protocol data unit	Data length (bytes)	Range
Function code	1	0x03
Initial register address	2	0x0000~0xFFFF
Register number	2	0x0001~0x0004

Response format:

Protocol data unit	Data length (bytes)	Range
Function code	1	0x03
Number of bytes read out	1	2*Register Qty.
Contents	2*Register Qty.	

If the operation fails, error code and exception code forming the protocol data unit will be replied. The error code is (Parameter+0x80) . The exception code denotes reason of the error; see the table below.

Table 1 Exception Code Meaning:

Exception code	Meaning
0x1	Invalid parameter.
0x2	Invalid register address.
0x3	Data error, exceeding upper or lower limit
0x4	Inverter operation failure, including invalid data, although within upper and lower limit.
0x5	Valid command, processing, mainly used in storing data into involatile memory
0x6	Inverter busy, please try later. Mainly used in storing data into involatile memory.
0x18	Information frame error, including data length or checksum error.
0x20	Parameter cannot be modified
0x22	Parameter protected by password.

Protocol data unit format of modifying single Inverter's parameter:

Request format:

Protocol data unit	Data length (bytes)	Range
Parameter	1	0x06
Register Address	2	0x0000~0xFFFF
Register content	2	0x0000~0xFFFF

Request format:

Protocol data unit	Data length (bytes)	Range
Parameter	1	0x06
Register Address	2	0x0000~0xFFFF
Register content	2	0x0000~0xFFFF

If the operation fails, error code and exception code will be replied. The error code is (Parameter+0x80) . The exception code denotes reason of the error; see Table below. Protocol data unit format of serial line diagnosis:

Request format:

Protocol data unit	Data length (bytes)	Range
Parameter	1	0x08
Sub-function code	2	0x0000~0x0030
Data	2	0x0000~0xFFFF

Response format:

Protocol data unit	Data length (bytes)	Range
Parameter	1	0x08
Sub-function code	2	0x0000~0x0030
Data	2	0x0000~0xFFFF

If the operation fails, error code and message code will be replied. The error code is 88H. The exception code denotes reason of the error; see Table below.

Sub-function of line diagnosis:

Sub-function code	Data (request)	Data (respond)	Meaning
0x0001	0x0000	0x0000	Initialize the communication, disable no-reply mode
	0xFF00	0xFF00	Initialize the communication, disable no-reply mode
0x0003	"newframe tail" and "00" occupy the MSB and LSB	"new frame tail" and "00" occupy the MSB and LSB	It will replace the old line feed character. It will not be saved upon power-off. Note: it must not be greater than 0x7F, nor equal to 0x3A.
0x0004	0x0000	No response	To set no-response mode, so the Inverter respond only to "initialize communication" request. It is to isolate the faulty Inverter.
0x0030	0x0000	0x0000	Inverter not respond to error or invalid command
	0x0001	0x0001	Inverter responds to error or invalid command

Protocol data unit format of modifying several inverter's parameter and status parameters:

Response format:

Protocol data unit	Data length (bytes)	Range
Function code	1	0x10
Initial register address	2	0x0000~0xFFFF

Register Qty.	2	0x0001~0x0004
Register bytes number	1	2* Register Qty.
Register contents	2* Register Qty.	

Response format：

Protocol data unit	Data length (bytes)	Range
Function code	1	0x10
Initial Register Address	2	0x0000~0xFFFF
Register Qty.	2	0x0001~0x0004

Parameter 0x41 is to modify single inverter's parameter or control parameter and save it in an involatile memory. The format is similar with that of 0x06. The only difference is that 0x41 parameter is saved upon power failure, while 0x06 not. Since some of the control parameters cannot be saved in the involatile memory, the two commands in this case have the same effect. Those parameters will be introduced later. The management of parameters includes reading out the upper and lower limit of the parameters, parameters properties, max. index number of a parameter group, next or previous parameter group number, currently displayed status parameter index, or display the next status parameter. Parameter property includes R/W property, parameter unit, scaling, etc. These commands are helpful to provide information about parameter's range and properties etc., which are necessary for modifying parameters remotely. The protocol data unit of parameter management is as follows:

Request format:

Protocol data unit	Data length (bytes)	Range
Function code	1	0x42
Sub-function code	2	0x0000~0x0007
Data	2	It depends on inverter's type

Response format:

Protocol data unit	Data length (bytes)	Range
Function code	1	0x42
Sub-function code	2	0x0000~0x0007
Data	2	0x0000~0xFFFF

If the operation fails, error codes and exception code will be replied. The exception code is shown in Table below. Sub-function of parameter management.

Sub-function code	Data (request)	Data (respond)	Meaning
0x0000	Parameter group number and index within a group occupy the MSB and LSB.	Upper limit of a parameter.	Read the upper limit of a parameter
0x0001	Parameter group number and index within a group occupy the MSBand LSB.	Lower limit of a parameter	Read the lower limit of a parameter
0x0002	Parameter group number and index within a group occupy the MSBand LSB.	Parameter property, see description below	Read out Parameter property
0x0003	Parameter group number occupies the MSB and the LSB is “00”.	Max. index within a parametergroup	Read max. index within a parameter group
0x0004	Parameter group number occupies the MSB and the LSB is “00”.	Next parametergroup number takes the higher byte and lower byte is “00”.”	Read next parameter group number
0x0005	Parameter group number occupies the MSB and the LSB is “00”.	Last Parametergroup numberoccupies the MSB and the LSB is “00”.	Readprevious parameter group number
0x0006	0x3300	Currently displayed status parameter index	Read currently Displayed status parameter index
0x0007	0x3300	Next status parameter index	Display next status parameter

The status parameter group cannot be modified nor support upper or lower limit read-out operation.

Parameter property is 2 bytes in length. The definitions of its bits are as follows:

Parameter property (Bit)	Value	Meaning
Bit2~Bit0	000B	No decimal part
	010B	One digit of decimal
	011B	Two digits of decimal
	100	Three digits of decimal
	Others	Reserved
Bit3	Reserved	
Bit5~Bit4	00B	Modification step is “1”
	Others	Reserved
Bit7~Bit6	01B	Modifiable
	10B	Cannot be modified during running
	11B	Set by factory, cannot be modified
	00B	Actual parameters, cannot be modified
Bit11~Bit8	0000B	No unit
	0001B	Unit: HZ
	0010B	Unit: A
	0011B	Unit: V
	0100B	Unit: r/min
	0101B	Unit:（m/s）
	0110B	Unit:（%）
	Others	Reserved
Bit12	1	Upper limit is active every nibble
	0	Upper limit is active as a whole word
Bit15~Bit13	Reserved	

Inverter control parameters cover the inverter start/stop, frequency setting, etc. Through the status parameters, present frequency, output current, output torque, etc. can be retrieved. The control and status parameters are listed below:

Inverter’s Control Parameters Index

Register Address	Parameter name	Save upon power-off
0x3200	Control command word	N
0x3201	Main reference freq.	Y

0x3202	Reference Frequency	Y
0x3203	Digital close loop setting	Y
0x3204	Pulse close loop setting	Y
0x3205	Analog output AO1 setting	N
0x3206	Analog output AO2 setting	N
0x3207	Digital output DO setting	N
0x3208	Freq. proportion setting	N
0x3209	Virtual terminal control setting	N
0x320A	Acc time 1	Y
0x320B	Dec time 1	Y

SINUS VEGAInverter Status Parameters Index

Register Address	Parameter Name
0x3300	Operation status word 1
0x3301	Actual value of the current main setting
0x3302	Inverter model
0x3303	Inverter type
0x3304	Software version
0x3305	Present actual frequency
0x3306	Output current
0x3307	Output voltage
0x3308	Output power
0x3309	Actual rotating speed
0x330A	Actual line speed
0x330B	Analog close loop feedback
0x330C	Bus voltage
0x330D	External counter
0x330E	Output torque
0x330F	Digital value I/O terminal status:：(for power rate lower than 4.0KW,TC2is for NC) BIT0~15=X1~X5, NC,NC,NC,Y1, Y2, TC1,(TC2), FAN, BRAKE, FWD, REV
0x3310	Actual length
0x3311	Frequency after compensation
0x3312	First fault in operation
0x3313	Second fault in operation
0x3314	Third fault (latest) in operation

0x3315	Frequency setting
0x3316	Rotation speed setting
0x3317	Analog close loop setting
0x3318	Line speed setting
0x3319	VCI
0x331A	CCI
0x331B	Preset length
0x331C	Preset Acc time 1
0x331D	Preset Dec time 1
0x331E	Command sending method: 0: Keypad 1: Terminal 2: Serial port
0x331F	Inverter status word 2
0x3320	Frequency setting method: 0: digital setting 1, by ▲, ▼key 1: digital setting 2, by UP/DN terminal 2: digital setting 3, serial port 3: VCI analog setting 4: CCI analog setting 5: terminal PULSE setting

Bit Definition of Inverter Control Word:

Control word (bit)	Value	Meaning	Function
Bit2、1、0	111B	Operation command	Start the inverter
	110B	Mode 0 stop	Stop as preset Dec time
	101B	Mode 1 stop	Coast to stop
	011B	Mode 2 stop	Reserved
	100B	External fault stop	Coast to stop. External fault message will be displayed
	Others	No command	
Bit3	1	Reverse	Running direction when operation command valid, invalid for jog operation
	0	Forward	
Bit4	1	Jog forward	
	0	Jog forward stop	

Control word (bit)	Value	Meaning	Function
Bit5	1	Jog reverse	
	0	Jog reverse stop	
Bit6	1	Acc/Dec allowed	Reserved
	0	Acc/Dec prohibited	
Bit7	1	Serial port control valid	Current control word from serial port valid
	0	Serial port control invalid	Current control word from serial port invalid
Bit8	1	Main setting valid	Enable main setting
	0	Main setting invalid	Disable main setting
Bit9	1	Fault reset valid	
	0	Fault reset invalid	
Bit15~Bit10	000000B	Reserved	

Note: The jog operation setting (Bit4, Bit5) and Bit0~Bit2 must not be valid at the same time.

Bit Definition of Inverter Status Word 1：

Status word	Value	Meaning	Note
Bit0	1	Inverter running	
	0	Inverter stops	
Bit1	1	Inverter reverse running	
	0	Inverter forward running	
Bit2	1	Main setting arrived	
	0	Main setting not arrived	
Bit3	1	Communication control allowed	
	0	Communication control prohibited	

Bit7~4	0000B	Reserved	
Bit15~8	00~0xFF	Fault code	0 0:inverter normal others: inverter is faulty, see fault code in user manual. E.g., the fault code of motor overload is 0x0E

Bit Definition of Inverter Status Word 2：

Note

1、The communication will be interrupted during restoring to default parameters or auto-tuning, and resume to normal after them.

2、The parameter F1.10、FP.03 cannot be modified through communication

3、FP.00 (password) can be verified through WRITE command.

4、If several multi-function terminals are set to the same function, error will occur. Please avoid it when modifying them using MODBUS protocol.

10.4 Application

The command of starting 1# inverter, running forward, 50.00Hz (write as 5000 in the command)：

	Address	Function code	Initial register address	Quantity of registers	Bytes of registers content	Content of register	Checksum
Request	0x01	0x10	0x3200	0x0002	0x04	0x01C7,0x1388	0x0399
Response	0x01	0x10	0x3200	0x0002	none	none	0x4F70

Read the operation frequency of 1# inverter, the respond operation frequency is 50.00HZ:

	Address	Function code	Initial register address	Bytes of registers content	Content of register	Checksum
Request	0x01	0x03	0x3301	0x0001	None	0xDA8E
Response	0x01	0x03	None	0x02	0x1388	0xB512

Modify 1# inverter Acc time 1 (Parameter F0.12) to 10.0s, not save upon power-off.

	Address.	Function code	Initial register address	Content of register	Checksum
Request	0x01	0x06	0x000C	0x0064	0x4822
Response	0x01	0x06	0x000C	0x0064	0x4822

Read 1# inverter output current, the replay is 30.0A.

	Address	Function code	Initial register address	Bytes of registers content	Content of register	Checksum
Request	0x01	0x03	0x3306	0x0001	None	0x6B4F
Response	0x01	0x03	None	0x02	0x012C	0xB809

Modify1#inverter operating frequency to 35.00HZ：

	Address	Function code	Register address	Register content	Check sum
Request	0x01	0x06	0x3202	0x0DAC	0x225F
Response	0x01	0x06	0x3202	0x0DAC	0x225F

Read1#inverter DC bus voltageinverter response DC Bus voltage is 541V：

	Address	Function code	Register address	Bytes of registers content	Register content	Check sum
Request	0x01	0x03	0x330C	0x0001	Null	0x4B4D
Response	0x01	0x03	Null	0x02	0x021D	0x792D

Modify1# inverter deceleration time（function code F0.13）change to 14.0s,no paramter save after power off

	Address	Function code	Register address	Register content	Check sum
Request	0x01	0x06	0x000D	0x008C	0x19AC
Response	0x01	0x06	0x000D	0x008C	0x19AC

Read the operating status of 1#inverter:

	Address	Function code	Register address	Bytes of registers Content	Register content	Check sum
Request	0x01	0x03	0x3300	0x0001	Null	0x8B4E
Response	0x01	0x03	Null	0x02	0x0001	0x7984

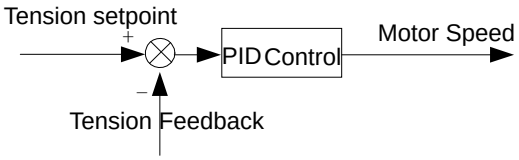
Modify the multi-stage frequency of 1# inverter(function code isF8.00） to 10.00HZ：

	Address	Function code	Register address	Register content	Check sum
Request	0x01	0x06	0x0800	0x03E8	0x8B14
Response	0x01	0x06	0x0800	0x03E8	0x8B14

10.5 Scaling

A) Frequency scaling: 1:100
If the inverter is expected to run at 50Hz, the main setting should be 0x1388 (5000) .
B) Time scaling: 1:10
If the inverter acceleration time is expected to be 30S, the parameter should be set at 0x012c (300) .
C) Current scaling: 1:10
If the feedback current is 0x012c, the present current is 30A.
D) The output power is an absolute value
E) Others, such as terminal input or output, please refer to user manual.

Closed-loop tension speed control



Drive works at speed mode, set process PID regulator to control the speed in order to control tension, PID set point is the tension set point, PID feedback is tension sensor voltage.

Closed-loop tension speed control with feed-forward

Under the speed control mode of the inverter, it controls the motor speed to keep the cable (belt) constant tension. Motor speed contains 2 parts:

1）Convert the cable (belt) line speed to motor speed

$$n_1 = \frac{v \cdot i}{\pi \cdot D}$$

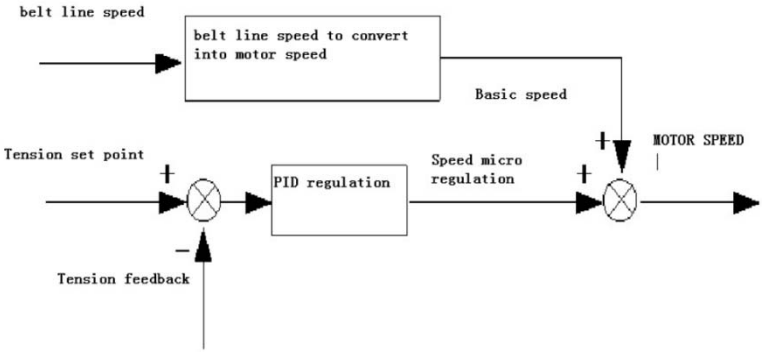
v：current belt line speed;

i：Mechanical transmission ratio;

D：Current volume diameter

2）Δn: Speed micro regulation from result PID closed control (tension set point and tension feedback)

Under speed control mode, can achieve constant line-speed via detected line speed and current rolling diameter (no need tension feedback), can also achieve simple process PID control via tension set point and tension feedback (no need detect speed). Also can get the speed command $n_1 + \Delta n$ via line speed detection and tension feedback.


belt line speed
belt line speed to convert into motor speed
Basic speed
MOTOR SPEED
Tension set point
PID regulation
Speed micro regulation
Tension feedback

Speed Mode

SANTERNO
CARRARO GROUP

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Airi ASSOCIAZIONE ITALIANA PER LA RICERCA INDUSTRIALE

CE

ANIE PEDERAZIONE

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