HSD2000 Series Servo Drive

Operation Manual

V1.2

HNC Electric Limited

Forward

Welcome to purchase HSD2000 high performance vector control servo drive produced by HNC Automation limited.

HSD2000 adopts advanced strategy to achieve real high precise flux vector torque control. Either PG operation or no PG operation has reached advanced industrial level. Since the synchronous motor drive and induction motor drive will be integration; the torque control, speed control and position control shall be integration. The HSD2000 has become rare parts of high control performance integrated drive. The integrated will meet high performance demands of customers. At the same time, HSD2000 has advanced anti-tripping performance and abilities to fit bad power, temperature, humidity and dust. It will improve reliability of products greatly.

HSD2000 is designed by module. In addition to meet common demand of customers, the expand design will meet individual and industrial needs of customers. It meets applicable trend of drive industry. The following internal configuration will meet complex high-precision drive requirements: PG interface; strong speed control, torque control, servo function; practical process closed-loop control; simple PLC; flexible input and output terminals; given pulse frequency; power fault and downtime parameter selection; binding of both given frequency channel and operation command channel; zero frequency hysteresis control; main and auxiliary given control; swing frequency control. It will meet various complicated high precise drive requirements. The high integrated solution will be provided to equipments manufacture customers. The equipments are applicable for reducing system cost and improving system reliability.

According to optimize PWM control technology and electromagnetic compatibility overall design, HSD2000 will meet low noise, low electromagnetic interference requirements of site.

The manual may provide user installation wiring, parameter setting, fault diagnosis and troubleshooting, daily maintenance. For installation and operation of HSD2000 serial servo drive, read the manual carefully before installed to develop excellent performance. The manual shall be saved carefully and delivered to operators.

OBA (open box audit) Precautions

After open the box, the following items shall be audited:

1. Check package box for fitting the packing list;
2. Inspect for the damage of servo drive in transportation (damage or gap on machine);
3. Check servo drive nameplate for purchased products;
4. Ensure the optional accessories for purchased;

If damage of servo drive or optional accessories, contact dealer as soon as possible.

Content

Chapter I Safety Information

Safety Definitions

Safety precaution in the manual is divided into the

    following two parts:

⚠ **Danger**

Danger

No required operation will cause serious injuries or even death.

⚠ **Attention**

Attention

No required operation will cause moderate, minor injury or equipments damage.

1.1   Safety Precaution

Before installation:

⚠ **Danger**

Danger

Damage and servo drive lacking parts servo drive will cause injury!

Above B degree insulated motor shall be used to prevent electric shock!

In installation:

⚠ **Danger**

Danger

Please install to flame retardant objects to get away from combustibles.

Otherwise, the fire alarm will be occurred.

⚠ **Attention**

Attention

When two or more servo drives are placed in the same cabinet, the installation position (refer to chapter III in installation) shall be noted to ensure cooling effects.

Conductor head or screw shall not fall into servo drive to prevent servo drive damage!

In connection:

⚠ **Danger**

Danger

Electrical personnel construction may prevent electric shock!

Breaker shall be used for separation between servo drive and power to prevent fire!

Before wiring, power shall be ensured shutdown to prevent electric shock!

Ground terminal shall be grounded to prevent electric shock!

⚠ **Attention**

Attention

The power line shall be not connected to output terminal U, V, W to prevent servo drive damage!

The connection path shall be ensured to meet EMC requirements and related safety standard. The used conductor diameter shall refer to manual recommendation to prevent accident!

The braking resistor shall be not connected between + and –terminal of DC bus, otherwise it may cause fire!

Before power up:

⚠ **Danger**

Danger

The power voltage degree shall be ensured to be consisted with servo drive rated voltage. The input and output wiring position shall be correct. Inspect for short circuit of peripheral circuits and circuit fastening to prevent servo drive damage!

Servo drive shall not power up before cover the plate. Otherwise the electric shock will be occurred!

⚠ **Attention**

Attention

Servo drive does not need to implement withstand test. The test has been implemented before factory. Otherwise the accident would be occurred.

All the peripheral accessories shall be wired as circuit provided by the manual. Otherwise the accident would be occurred!

After power up:

⚠ **Danger**

Danger

Cover plate shall be not opened after power up. Otherwise the electric shock will be occurred!

Don't touch servo or surround circuit by wet hands. Otherwise electric shock will be occurred!

Don't touch servo drive terminals (including control terminal). Otherwise electric shock will be occurred!

At the beginning of power up, servo drive would inspect external strong electrical circuit automatically. At this time, U, V, W wiring terminals shall be not touched to prevent electric shock!

⚠ **Attention**

Attention

During parameter identification (if necessary), be careful to the rotary motor for hurt someone. Otherwise it will cause accidents!

Don't changing servo drive factory parameter freely. Otherwise the equipments will be damaged!

In operation:

Danger

When select restart function, we shall not close to mechanical equipments to prevent personal injury!

Don't touch cooling fan and discharge resistor. Otherwise burn injury will be occurred.

The signal in operation shall be inspected by professionals. Otherwise personal injury or equipment damage would be occurred.

Attention

During servo drive operation, the dust shall be avoided to fall into equipments. Otherwise equipments damage will be occurred!

Start and stop of servo drive shall be not controlled by contactor on and off. Otherwise equipments damage will be occurred!

In maintenance:

Danger

The equipments shall be not maintained or repaired by electric. Otherwise electric shock will be occurred!

After ten minutes of power cut, servo drive may be maintained and repaired when positive or negative bus terminal voltage is less than 36V. Otherwise the residual charge will hurt people!

Maintenance shall be implemented by professionals. Otherwise personal injury or equipment damage would be occurred!

1.2   Precautions

Motor insulation inspection

Motor insulation inspection shall be implemented in: before reuse of primary placing at long time; regular inspection. The insulation inspection will prevent servo drive from damage caused by motor winding insulation fault. During insulation inspection, the motor wire will be separated from servo drive. The 200V voltage mega meter is suggested to use. The measured insulation resistor shall be not less than 5TΩ.

Motor thermal protection

When rated capacity of selected motor is different from servo drive, especially when the servo drive rated power is greater than motor rated power. The servo drive inside motor related

parameters shall be adjusted; or the thermal relay shall be assembly in front of motor to protect motor.

Operation above power frequency

The servo drive may provide 0Hz～1000Hz output frequency. When operate in greater than 50Hz condition, tolerance of mechanical device shall be considered.

Machinery vibration

Servo drive may meet mechanical resonance points of loading device in certain output frequency. The mechanical resonance points may be avoided by setting servo drive inside jump frequency parameters.

Motor heat and noise

Since the servo drive output voltage (PWM wave) contains certain harmonic wave; the motor temperature, noise and vibration are greater than power frequency.

Output end contains voltage dependent devices or electric capacity (improve power factor)

Servo drive output is PWM wave. When electric capacity of improving power factor or lightning voltage dependent resistors is installed, servo drive instantaneous over current or servo drive damage will be caused.

When the servo drive installs contactor, the contactor shall be not used to control start and stop of servo drive. If necessary, the interval of contactor controlling servo drive starting and stop shall be not less than one hour. Charging or discharging frequently will reduce electric capacity service life in servo drive. When the contactors install between output end and motor, on-off operation of servo drive shall be implemented in no output. Otherwise module in servo drive will be damaged.

Using other than rated voltage

The servo drive shall be not used in other than manual allowance working voltage range. Otherwise parts of servo drive will be damaged. If necessary, related pressure lifting or relief device shall be used in pressure treatment.

Three-phase input changes into two-phase input

Three-phase servo drive of the serial shall be not changed into two-phase. Otherwise servo drive fault or damage will be caused.

Lightning surge protection

The serial servo drive is equipped with over current protective device. The device is equipped with certain ability for self-protection in lighting. For lightning occurs frequently, customers shall install protection in front of servo drive.

Altitude height and derating using

In area of higher than 1000M of thin air, the cooling effects will be worse. The derating using will be implemented. If applicable, consult our company.

Special using

During using, if customers need to use methods other than wiring diagram of the manual (such as common DC bus), please consult to our company.

Servo drive scrapped precautions

1) Electrolysis electric capacity in servo drive will be exposed in burning.

2) Plastics, Rubber on servo drive will generate hazardous, toxic gas in burning. Be careful in burning.

3) Treat servo drive as industrial waste

Adaptive motor

1) The standard adaptive motor shall be four-grade squirrel-cage asynchronous induction motor. If not the motor above, the motor rated current shall be applied to select servo drive. When drive the PMSM, please consult to our company.

2) Cooling fan and rotor shaft of non-inverter motor are connected in the same shaft. The fan cooling effects will reduce when rotational speed reduces. Thus the motor overheating may install fan or change into inviter motor.

3) Servo drive has set adaptive motor standard parameters inside. According to specified, the parameter identification or personalized defaults shall be implemented to conform actual value as much as possible. Otherwise operation effects and protective performance will be influenced.

4) Since short circuit of cable or motor will cause servo drive alarms or explosion, the insulation short circuit testing will be implemented to primary installation motor and cable. The testing may be implemented in daily maintenance. During the testing, servo drive and tested part shall be broken.

Before operating the servo drive, please read the manual carefully. The contents shall be learned to operate correctly.

The manual is attachment configured with machine. After using, it shall be saved carefully for view at any time.

Chapter II Product Introduction

The chapter shows basic products information of HSD2000 serial products specification, model and structure.

2.1. General Specification

Table 2-1 Common Specification

Item		Item description
Input	Rated voltage; frequency	Three-phase, 380V～480V; 50Hz/60Hz; voltage unbalance rate: ＜3％; frequency: ±5％
Output	Rated frequency	380V, 400V, 415V, 440V, 460V, 480V
	Frequency	0Hz～1000Hz
	Overload	G: 150％ rated current in 2 minutes，200％ rated current 0.5 seconds
Main control performance	Control mode	magnetic flux vector control without PG(SVC), magnetic flux vector control with PG(VC), servo control, V/F control, V/F control with PG
	Modulation mode	Space vector PWM modulation
	Speed range	1: 200 (magnetic flux vector control without PG), 1: 5000 (magnetic flux vector control with PG, servo control)
	Start torque	150％ rated torque@0Hz (magnetic flux vector control without PG), 200％ rated torque@0Hz (magnetic flux vector control with PG)
	Operational rotational speed steady-status accuracy	≤±0.2％ rated synchronous speed (magnetic flux vector control without PG), ≤±0.02％ rated synchronous speed (magnetic flux vector control with PG, servo control)
	Speed fluctuations	≤±0.3％ rated synchronous speed (magnetic flux vector control without PG) ≤±0.1％ rated synchronous speed (magnetic flux vector control with PG、servo control)
	Positioning accuracy	±1 pulse
	Torque response	≤10ms (magnetic flux vector control with PG, servo control); ≤20ms (magnetic flux vector control without PG)
	Torque control	Support magnetic flux vector control without PG, magnetic flux vector control with PG, servo control
	Frequency accuracy	Digital setting: maximum frequency×±0.01％; analog setting: maximum frequency×±0.2％
	Frequency resolution	Digital setting: 0.01Hz; analog setting: maximum frequency×0.05％
	Torque boost	Automatic torque boost, manual torque boost 0.1％～30.0％
	V/F curve	Four types: one user setting V/F curve and 3 reduced torque curves (2.0 order, 1.7 order, 1.2 order)
	Acceleration and deceleration curves	Two types: linear acceleration and deceleration, S curve acceleration and deceleration; Four Acc/Dec time, Time units (minutes / seconds) optional, maximum to 60 hours
	DC braking	Initial frequency of DC injection braking process: 0.00 Hz～60.00Hz; Braking time: 0.0s～30.0s; Braking current: 0.0％～100.0％
	Automatic Voltage Regulation (AVR)	When grid voltage changes, the output voltage keeps constant automatically.
	Automatic current limiting	Limit current in operation automatically to prevent overcurrent fault tripping frequently.
	Automatic carrier wave adjustment	According to loading characteristics, the carrier wave frequency may be adjusted automatically; optional
Customization capabilities	Textile traverse frequency	Textile traverse frequency control, achieve adjustable traverse frequency function of center frequency
	Bundling function	Free bundling and synchronous switching may be implemented between command channel and given frequency channel.
	Jog	Jog frequency range: 0.00Hz～50.00Hz;Jog acceleration and deceleration time 0.1s～60.0s may best; jog interval can be set
	Multi-speed operation	Multi-speed operation will be achieved by inside PLC or control terminals.
	built-in process closed loop control	Form closed loop control system
Operation function	Operation command channel	Operation panel control , terminal control, Sci control, and may be switched by variety of methods.

Item		Item description
	Given frequency channel	Digital given, analog voltage, analog current, pulse, serial port may be switched by variety of methods.
	Given auxiliary frequency	Achieve flexible auxiliary frequency fine tuning, frequency synthesis
	Pulse output termianl	0～100kHz pulse signal output, achieve output of setting frequency, output frequency.
	Analog output terminal	2analog signals output, 0/4～20mA or 0/2～10V may be selected separately. Achieve output of setting frequency, output frequency.
operation panel	LED display	Display 20 types of parameters such as setting frequency, output frequency, output voltage and output current .
	LCD dislay	Optional, Chinese / English prompts content
	Parameter copy	Operation panel may be used to achieve rapid copy of parameters
	Key lock and function selection	Achieve parts or all locking functions pf keys. Define function range of part key to prevent error operation.
Protective function		lack-phase protection (optional) , over current protection, over voltage protection, under-voltage protection, over-thermal protection, overload protection, off-load protection
Environment	Condition	Indoor, without sunlight, dust, corrosive gases, flammable gas, mist, water vapor, dripping or salt.
	Altitude height	Derating above 1000 meters, derating 10％ in each 1000 meters lifting
	Ambient temperature	－10℃～＋40℃ (ambient temperature between 40℃～50℃, derating)
Environment	Humidity	5％～95％RH, without condensing
	Vibration	Less than 5.9m/s^2 (0.6g)
	Storage temperature	－40℃～＋70℃
Structure	Protective degree	IP20
	Cooling method	Air-cooled with fan control

2.2. Product Serial Introduction

2.2.1. HSD2000 Servo Drive Model

Table 2-2 Servo Drive serial

Servo drive model	Rated capacity (KVA)	Rated input current (A)	Rated output current (A)	Adaptive motor (kW)
HSD2000-4T-1R5	3.0	5.0	3.7	1.5
HSD2000-4T-2R2	4.0	5.8	5.0	2.2
HSD2000-4T-004	6.3	10.0	9.0	4
HSD2000-4T-5R5	8.5	15.5	13.0	5.5
HSD2000-4T-7R5	11.0	20.5	17.0	7.5
HSD2000-4T-011	17.0	26.0	25.0	11
HSD2000-4T-015	21.0	35.0	32.0	15
HSD2000-4T-018	24.0	38.5	37.0	18.5
HSD2000-4T-022	30.0	46.5	45.0	22
HSD2000-4T-030	40.0	62.0	60.0	30
HSD2000-4T-037	50.0	76.0	75.0	37
HSD2000-4T-045	60.0	92.0	90.0	45
HSD2000-4T-055	72.0	113.0	110.0	55
HSD2000-4T-075	100.0	157.0	152.0	75
HSD2000-4T-090	116.0	180.0	176.0	90
HSD2000-4T-110	138.0	214.0	210.0	110
HSD2000-4T-132	167.0	256.0	253.0	132
HSD2000-4T-160	200.0	307.0	304.0	160
HSD2000-4T-185	230.0	355.0	350.0	185
HSD2000-4T-200	250.0	385.0	380.0	200
HSD2000-4T-220	280.0	430.0	426.0	220
HSD2000-4T-250	309.0	488.0	470.0	250
HSD2000-4T-280	342.0	525.0	520.0	280
HSD2000-4T-315	388.0	605.0	590.0	315

HSD2000-4T-355	427.0	667.0	650.0	355
HSD2000-4T-400	454.0	701.0	690.0	400
HSD2000-4T-450	510.0	789.0	775.0	450
HSD2000-4T-500	566.0	877.0	860.0	500
HSD2000-4T-560	625.0	982.0	950.0	560
HSD2000-4T-630	724.0	1184.0	1100.0	630
HSD2000-4T-800	921.0	1500.0	1400.0	800

2.2.2.   HSD2000 Servo Drive Serial Model and Nameplate

HSD2000 servo drive models description is shown in figure 2-1. The nameplate description is shown in figure 2-2.
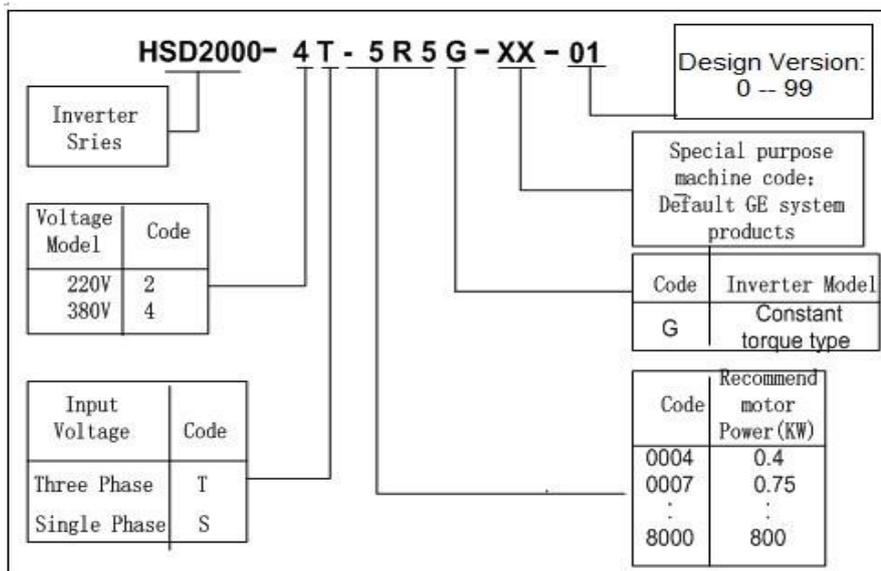
Figure 2-1 HSD2000 Servo Drive Nameplate
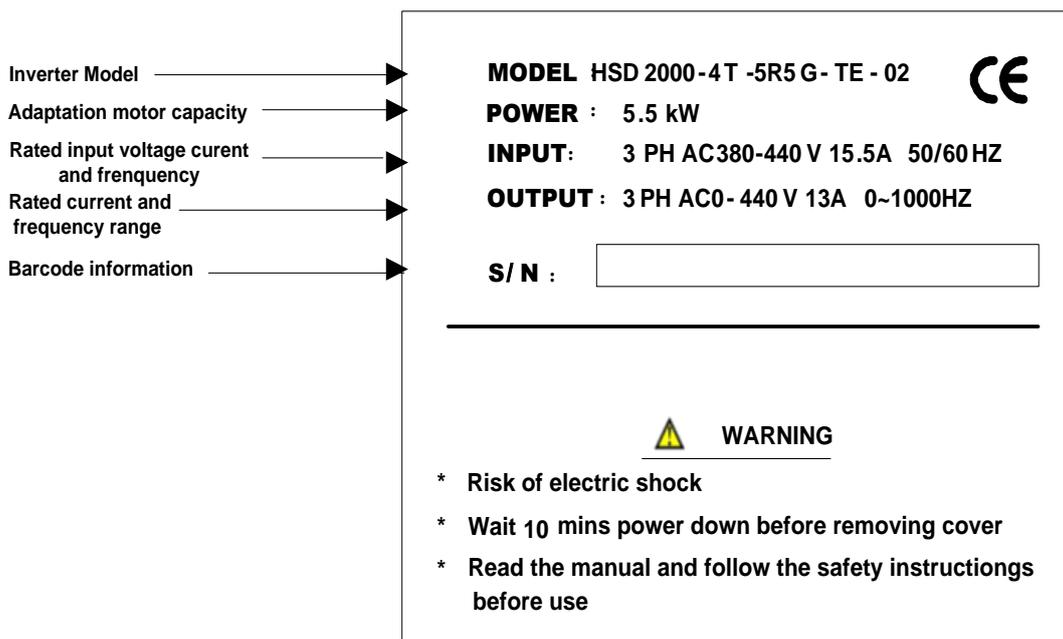
Figure 2-2 HSD2000 Servo Drive Model

2.3.   Dimension and Gross Weight

2.3.1.   Dimension and Net Weight of Servo Drive

Dimension of servo drive is shown as figure below:
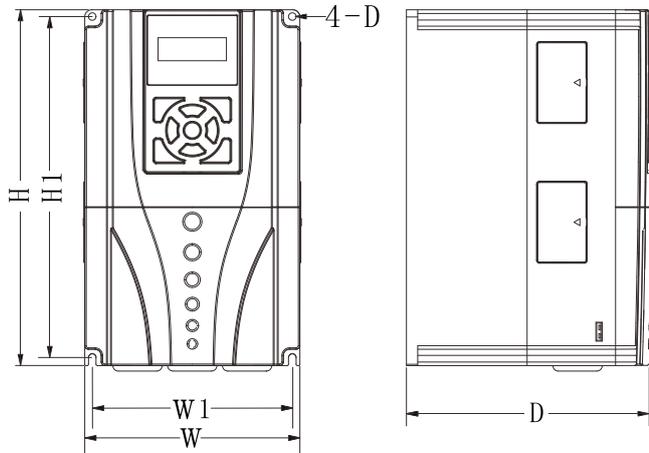
Figure 2-3 HSD2000-4T-1R5～HSD2000-4T-7R5
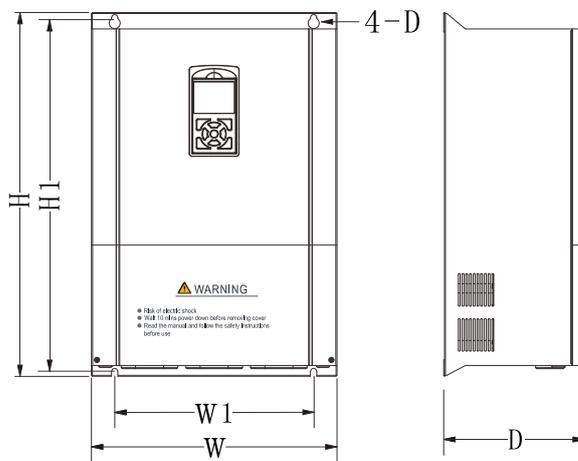
Figure 2-5 HSD2000-4T-018～HSD2000-4T-055
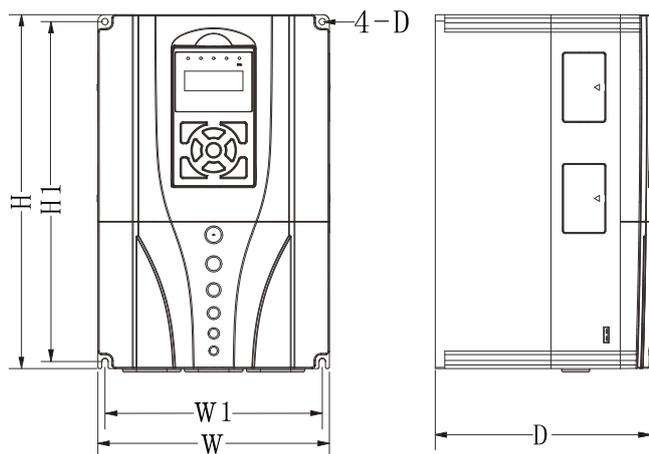
Figure 2-4 HSD2000-4T-011～HSD2000-4T-015
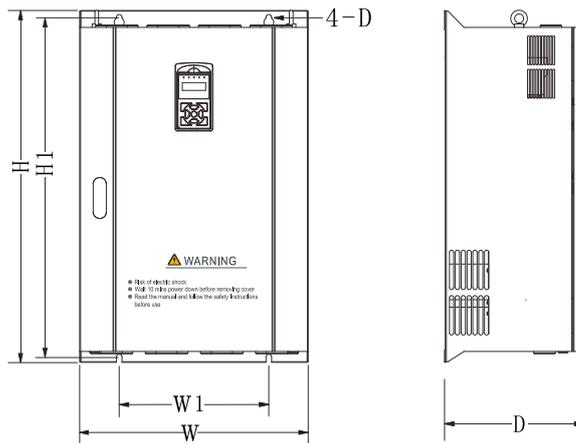
Figure 2-6 HSD2000-4T-075～HSD2000-4T-280
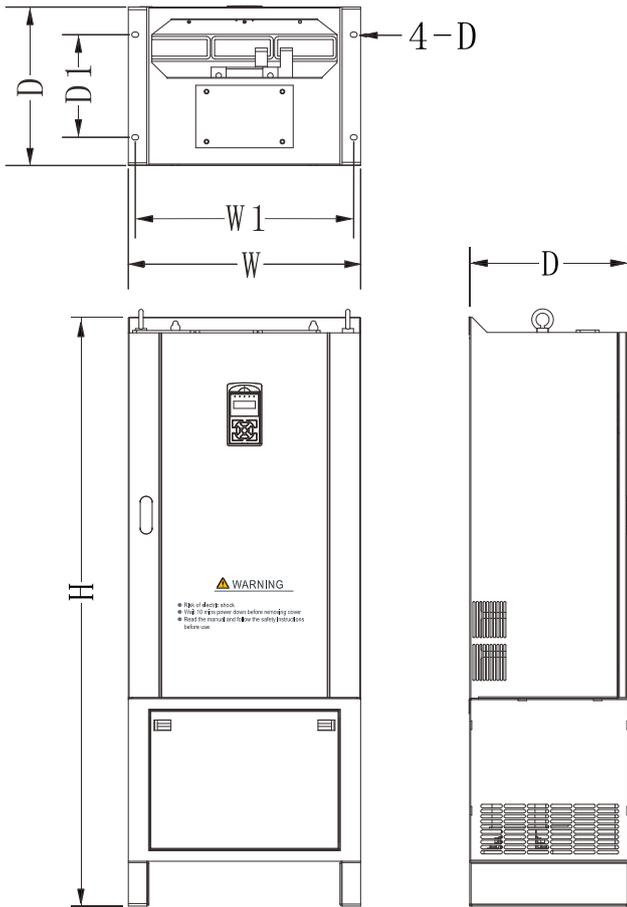
Figure 2-7 HSD2000-4T-315～HSD2000-4T-560
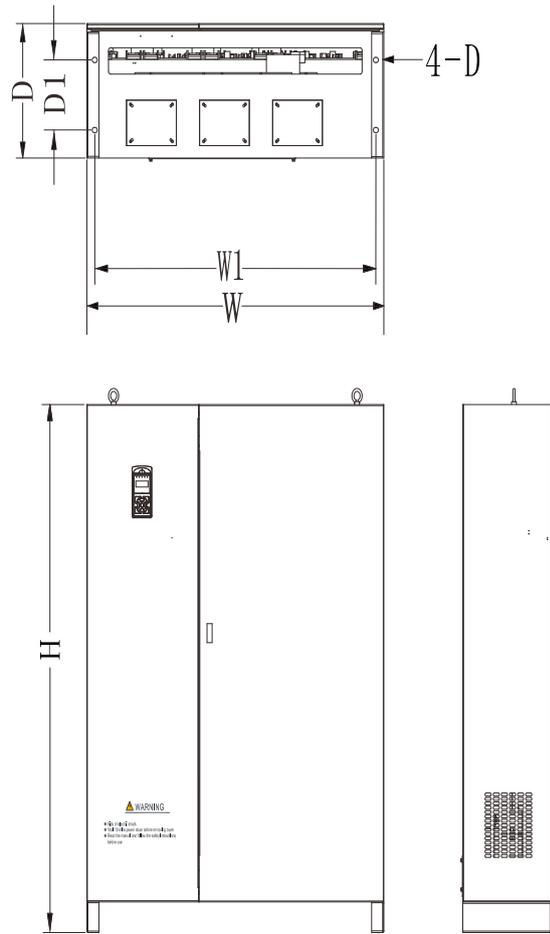
Figure 2-8 HSD2000-4T-630~4T-800

Table 2-3 HSD2000 Serial Servo Drive Dimension table 1 (mm)

Servo drive model	D	W1	H1	H	W	Outline Drawing No.	Installation hole diameter	Gross weight (kg)	Installation method
HSD2000-4T-1R5	175	127	200	215	140	Figure2-3	5	3.5	Hanging
HSD2000-4T-2R2									
HSD2000-4T-004									
HSD2000-4T-5R5	181	146	251	262	157	Figure2-3	5.5	5	Hanging
HSD2000-4T-7R5									
HSD2000-4T-011	181	180	288	305	198	Figure2-4	5.5	8	Hanging
HSD2000-4T-015									
HSD2000-4T-018	220	230	424.5	438	276	Figure2-5	7.0	18	Hanging
HSD2000-4T-022									
HSD2000-4T-030									
HSD2000-4T-037	231.5	320	571	589	395	Figure2-5	10.0	45	Hanging
HSD2000-4T-045									
HSD2000-4T-055									
HSD2000-4T-075	298	320	733	759	489	Figure2-6	12.0	75	Hanging
HSD2000-4T-090									

HSD2000-4T-110									
HSD2000-4T-132	370	320	898	927	539	Figure2-6	12.0	125	Hanging and cabinet
HSD2000-4T-160									
HSD2000-4T-185		507	898	1377	539	Figure2-6		142	
HSD2000-4T-200									
HSD2000-4T-220	373	280	1022	1054	704	Figure2-6	12.0	160	Hanging and cabinet
HSD2000-4T-250		672	1022	1500	704	Figure2-6		181	
HSD2000-4T-280									

Table 2-4 HSD2000 Serial Servo Drive Dimension table 2 (mm)

Servo Drive Model (G: constant torque loading; P: fan pump loading)	D	W1	D1	H	W	Shape Figure No.	Hole diameter	Estimated weight (kg)	Installation means
HSD2000-4T-315	400	924	240	1684	960	Figure2-7	14.0	365	Cabinet
HSD2000-4T-355									
HSD2000-4T-400									
HSD2000-4T-450									
HSD2000-4T-500									
HSD2000-4T-560									
HSD2000-4T-630	460	1386	240	1808	1464	Figure2-8	18.0	*	Cabinet
HSD2000-4T-800									

2.3.2. Operation Panel and Installation Box Dimension
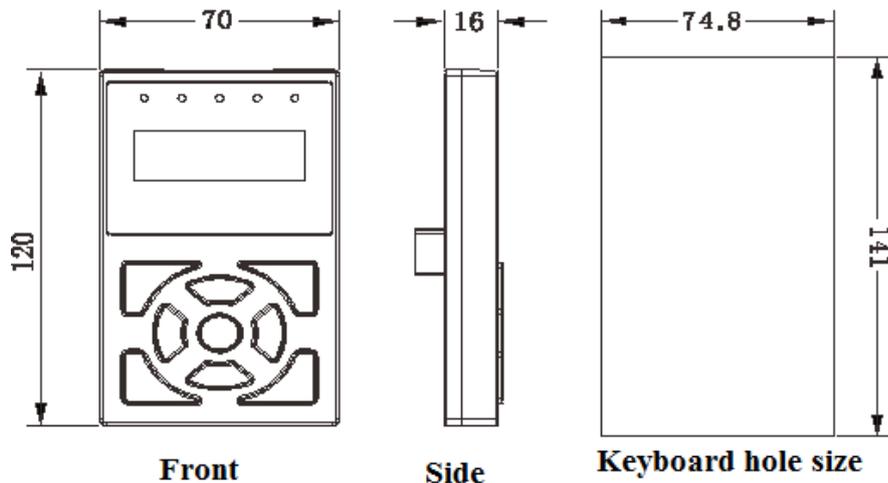
Front	Side	Keyboard hole size

Figure2.9 Keyboard Appearance and Installation Dimension

2.4. Optional Accessories

The following optional accessories may be ordered to our company (if necessary)

Accessories name	Option range	Specification	Remark
Brake unit	See table 2-4	See table 2-4	
Keyboard tray	Option	74.7×141	Hole size
Keyboard extension cable	Option	2m、3m	Network cable
Cabinet base	132KW~200KW option	539*370*485	132KW~280KW installation may be compatible hanging with cabinet
	220KW~280KW option	704*366*480	

Accessories name	Option range	Specification	Remark
DC reactor	132KW~800KW option	-	-

2.4.1. Braking Resistor and Brake Unit Option Recommendation

Energy consumption braking requirements, braking resistor or braking unit may refer to table 2-4. Braking resistor wiring specification, wiring specification between brake unit and servo drive may refer to table 3-2.

Table 2-4   Braking Resistor and Brake Unit Option Recommendation Table

Servo Drive Model	Braking Resistor Recommended Resistor Value	Braking Resistor Recommended Power	Brake Unit Recommended Model	Remark
HSD2000-4T-1R5	200-300Ω	200W	Built-in Standard Configuration	
HSD2000-4T-2R2	100-250Ω	250W		
HSD2000-4T-004	100-150Ω	300W		
HSD2000-4T-5R5	80-100Ω	500W		
HSD2000-4T-7R5	60-80Ω	700W		
HSD2000-4T-011	40-50Ω	1.0KW		
HSD2000-4T-015	30-40Ω	1.5KW		
HSD2000-4T-018	25-30Ω	2.0KW		
HSD2000-4T-022	20-25Ω	2.5KW	Built-in Standard Configuration	
HSD2000-4T-030	15-20Ω	3.0KW		
HSD2000-4T-037	15-20Ω	3.5KW		
HSD2000-4T-045	10-15Ω	4.5KW		
HSD2000-4T-055	10-15Ω	5.5KW		
HSD2000-4T-075	8～10Ω	7.5 KW	BU4R150	External option
HSD2000-4T-090	8～10Ω	9 .0KW		
HSD2000-4T-110	6～8Ω	11 .0KW		
HSD2000-4T-132	6～8Ω	13.5KW	BU4R250	
HSD2000-4T-160	4～6Ω	16 .0KW		
HSD2000-4T-185	4～6Ω	18.5 KW		
HSD2000-4T-200	4～6Ω	20.0 KW		
HSD2000-4T-220	6～8*2Ω	11.0*2 KW	BU4R250*2	
HSD2000-4T-250	6～8*2Ω	12.5*2 KW		
HSD2000-4T-280	4～6*2Ω	14*2 KW		
HSD2000-4T-315	4～6*2Ω	16*2 KW		
HSD2000-4T-355	4～6*3Ω	11*3 KW	BU4R250*3	
HSD2000-4T-400	4～6*3Ω	14*3 KW		
HSD2000-4T-450	4～6*3Ω	17*3 KW		
HSD2000-4T-500	4～6*3Ω	21*3 KW		
HSD2000-4T-560	4～6*3Ω	25*3 KW		
HSD2000-4T-630	*	*		
HSD2000-4T-800	*	*		

Note: Resistance value and power of braking resistor shall be not less than recommended minimum resistance and power of table above. Otherwise the brake unit will damage.

Attached: braking resistor calculation method

In braking, almost all renewable energy of motor consumes on the braking resistor. Where:

U×U/R=Pb

U－Brake voltage of system table brake (U value is different in different systems, 380Vac system takes 700V);

Pb － Brake power

Braking resistor power selection

In theory, braking resistor power is consisted with braking power. Considering 70% of derating, where:

$0.7 \times Pr = Pb \times D$

Pr －Resistor power;

D －Braking frequency, percentage between renewable process and overall process.

Common applications, elevator, uncoiling and reel, centrifuge, accidental braking load, general situation

common applications	Elevator	Uncoiling and reel	Centrifuge	Accidental braking load	General situation
Braking frequency value	20% ~30%	20 ~30%	50%~60%	5%	10%

Table 2-4 shows the guide data. Users may select different resistance value and powers as actual situation. (Resistance shall be not less than recommended value in table, power may be greater.) Braking resistor selection shall be ensured by motor power in actual applicable system. The braking resistor is related with system inertia, deceleration time and potential energy load. It shall be selected by actual situation of customers. The greater of system inertia, the shorter of the deceleration time, the more frequent braking. The greater of braking resistor selected power, the smaller of resistance value.

2.4.2.   Expanded PG Card Introduction

Function Introduction

1．Encoder interface PG1, support differential ABZ and UVW signal as speed feedback or position feedback.

2．PG1 pulse frequency division output is used for speed or position synchronization.

3．PG2 is used for pulse reference interface. Pulse instruction may be received from external device. The instruction may be used for speed or position synchronization.

Terminal Introduction

PG Card Side Figure is shown below:
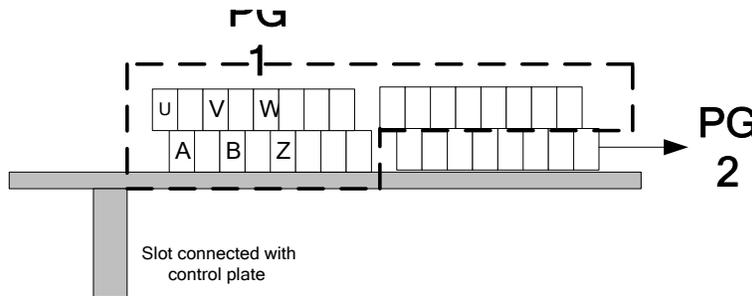
Slot connected with control plate

PG1 and PG2 terminal arrange are shown below:

U+	U−	V+	V−	W+	W−	5V	GND
A+	A−	B+	B−	Z+	Z−	GND	PE

PAO+	PAO−	PBO+	PBO−	PZO+	PZO−	5V	GND
2A+	2A−	2B+	2B−	2Z+	2Z−	GND	PE

The terminal function description is shown below:

Terminal name	Signal description	Terminal name	Signal description
A+	Encoder A signal	PAO+	Encoder frequency division output PAO+
A-	Encoder A-signal	PAO-	Encoder frequency division output PAO-
B+	Encoder B+signal	PBO+	Encoder frequency division output PBO+
B-	Encoder B-signal	PBO-	Encoder frequency division output PBO-
Z+	Encoder Z+signal	PZO+	Encoder frequency division output PZO+
Z-	Encoder Z-signal	PZO-	Encoder frequency division output PZO-
U+	Encoder U+signal	2A+	Pulse instruction A+
U-	Encoder U-signal	2A-	Pulse instruction A-
V+	Encoder V+signal	2B+	Pulse instruction B+
V-	Encoder V-signal	2B-	Pulse instruction B-
W+	Encoder W+signal	2Z+	Pulse instruction Z+
W-	Encoder W-signal	2Z-	Pulse instruction Z-

5V	5V output		5V	5V output
GND	Ground		GND	Ground
PE	Shielding layer		PE	Shielding layer

Resolver PG card function introduced

If the user selects the rotating transformer as feedback speed, should choose Resolver PG card . Resolver PG card profile drawing is shown below ：

For the detail of terminal blocks, please see the table below:

Signal screen printing	Signal definitions
T1	Motor temperature detection 1
GND	Ground
T2	Motor temperature detection 2
EXC+	Rotary Transformer REF+ Signal l
EXC-	Rotary Transformer REF - Signal
SIN+	Rotary Transformer SIN + Signal
SIN-	Rotary Transformer SIN - Signal
COS+	Rotary Transformer COS + Signal
COS-	Rotary Transformer C0S - Signal

Dial switch description：

Signal screen printing	Functional Description	Factory value
HX1 HX2 （Move it up is 1 Move it down is 0）	Pole number selection： 00：×1 01：×2 10：×3 11：×4	11
HF1 HF2 （Move it up is 1 Move it down is 0）	Rotary transformer excitation signal frequency selection： 00：10KHz 01：2.5KHz 10：5KHz 11：5KHz	00

Fault indicating lamp and Failure reset instruction：

When the rotating transformer signal abnormalities, PG card fault indicator will light up, at this time can use SW6 fault reset button.

Chapter III Installation Environment and Part Disassembly

The chapter shows installation environment requirements and parts disassembly methods of servo drive.

3.1 Servo Drive Installation Environment

It shall be installed indoor and good ventilated with vertical installation.

The following shall be noted in selecting installation environment:

Ambient temperature shall be -10℃～40℃. When the temperature is greater than 40℃, external forced cooling or derating shall be implemented.

- When temperature requires lower than 95％, no condensation;
- Install in fields of less than 5.9m/s^2 (0.6g) vibration;
- Direct sunlight fields are avoided in installation;
- Servo drive is usually installed in cabinet to prevent unauthorized personnel touch. The pollution degree shall be no worse than grade 2 of IEC60664-1.
- When without cabinet, the servo drive shall be installed in limit area of no unauthorized personnel touch. The pollution degree shall be no worse than grade 2 of IEC60664-1.

The special installation requirements shall be consulted and ensured before.

Installation interval and distance requirements are shown as Figure3-1 and Figure3-2.
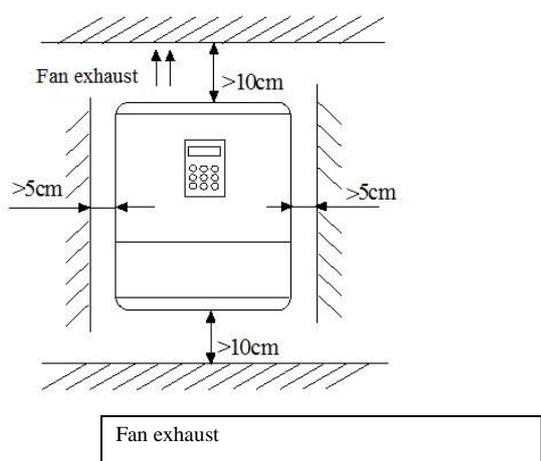
Figure 3-1 Installation Interval Distance (55kW and lower)
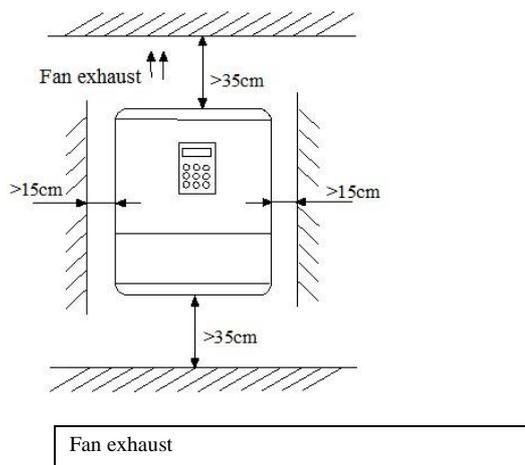
Figure 3-2 Installation Interval Distance (75kW and lower)

When install two servo drives, baffle plate shall be used in the middle. It is shown in Figure3-3.

Servo drive
Servo drive
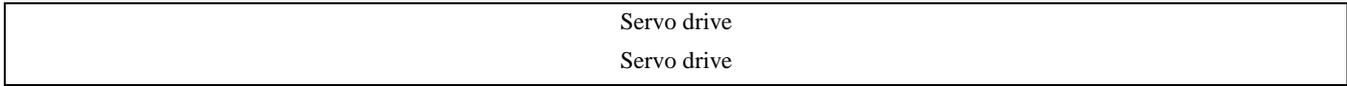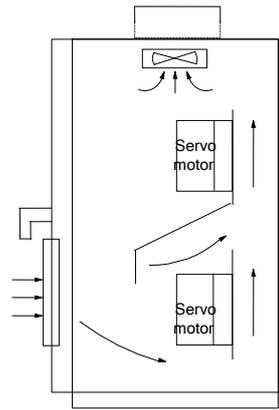
Figure 3-3 Installation of two servo drives

Chapter IV Servo Drive Connection and EMC Installation Instructions

The chapter shows connection and wiring of servo drive, the question of meeting EMC requirements.

⚡ Danger
Servo drive cover plate shall be not opened until cutting servo drive power supply and waiting for at least 10 minutes.
Servo drive internal wiring work shall be implemented by trained and authorized qualified professionals.
·When connect emergency stop or safety circuit, wiring shall be inspected carefully before and after operation.
·Before energize, the servo drive voltage degree shall be inspected carefully. Otherwise the casualties and equipments damage will be occurred.

⚠ Attention
·Before using, the servo drive rated input voltage shall be checked to consist with AC power supply voltage.
·Before factory, servo drive has passed the puncture test. Puncture test shall be not implemented on servo drive.
·External braking resistor or braking unit shall refer to chapter II.
·Don't connect the power supply lines with U, V, W.
·The ground wires are usually copper wire above 3.5mm diameters. The ground resistance shall be less than 10Ω.
·Current leakage is happened in servo drive. The specified value shall be determined by using condition. Servo drive and motor shall be grounded for safety. RCD is required to install with B type. The current leakage current setting value shall be 300mA.
·For input over current protection and power out maintenance, the servo drive shall connect to power by air switch or fuse switch.

During pilot running, connection as Figure4-1 may be used:
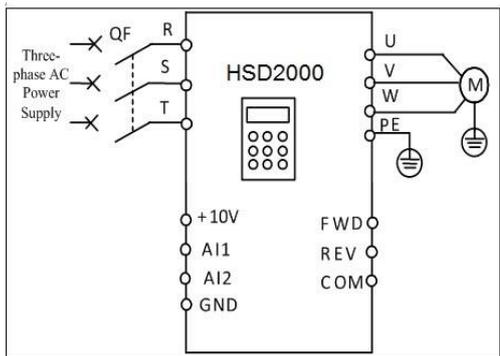
Figure 4-1 Main Circuit Simple Connection Figure

4.1 Main Circuit Terminal Connection and Configuration

4.1.1 Main Circuit Input and Output Terminal Type

Main circuit terminal includes four types with different servo drive models. Refer to below:

Terminal Type 1

Applicable machine: HSD2000-4T-1R5~HSD2000-4T-004. Terminal logo may be seen below:

PE	R	S	T	(+)	(-)	PB	U	V	W
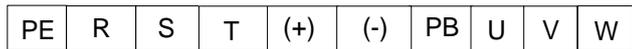
Terminal Type 2

Applicable machine: HSD2000-4T-5R5~HSD2000-4T-015. Terminal logo may be seen below:

R	S	T	P1	(+)	PB	(-)	U	V	W

| ⏚ | | ⏚ | | | | | | | |
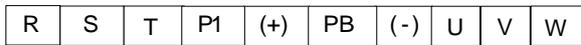
Terminal Type 3

Applicable machine: HSD2000-4T-018~HSD2000-4T-055. Terminal logo may be seen below:

R	S	T	P1	(+)	PB	(-)	U	V	W	PE

Terminal type 1~terminal type 3 logos shall refer to table 4-2.

Table 4-2 Main Circuit Terminal Description

Terminal name	Function description
R, S, T	Three-phase AC input terminal
P1, (+)	DC reactor connection terminal, copper

Terminal name	Function description
	short circuit when factory
(+), PB	Braking resistor connection terminal
(+) (-)	DC power supply input terminal
U, V, W	Three-phase AC output terminal
⏚ , PE	Grounded terminal

Terminal type 4

Applicable machine: Terminal logo above HSD2000-4T-075 may be seen below:

Input terminal
(Machine top)

PE	R	S	T

output terminal
(Machine bottom)

PE	U	V	W	P1	(+)	(-)

Input terminal (top of the machine)
Output terminal (bottom of machine)
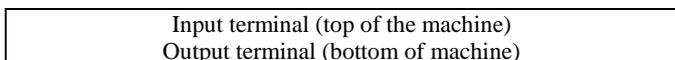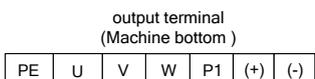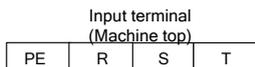
Table 4-3   Main Circuit Terminal Description

Terminal name	Function description
R, S, T	three-phase ACinput terminal
P1, (+)	DC reactor connects to terminal，copper short circuit when factory
(+), (-)	DC power supplu input terminal; external brake unit DC output terminal
U, V, W	Three-phase AC output terminal
PE	Grounded terminal

4.1.2 Connect servo drive and optional accessories
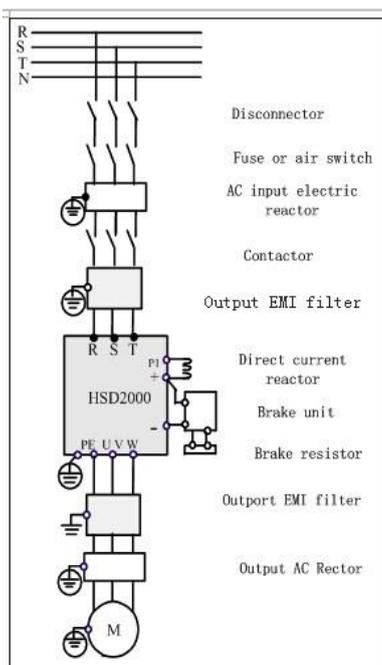
Figure 4-2 Servo Drive and Optional Accessories Connection

1．Obvious breaking device (such as disconnect switch) shall be installed between grid and servo drive to ensure personal safety in equipment maintenance.

2．When contactor is used for power supply control, it shall be not used for control power up and down of servo drive.

3．DC Reactor

For prevent servo drive influence from power supply, protect servo drive and higher harmonic wave; the DC reactor may be configured in the following conditions.

● When the same power node supplied to servo drive is equipped with switching electric capacity reactive power compensation device screen or controlled silicon phased load, the electric capacity device screen wsitch shifting may cause reactive transients causing mutations net pressure. The phased load will cause harmonic wave and grid waveform gap. Above will damage input rectifier circuit of servo drive.

● When imbalance in the servo drive power of three-phase power supply is not greater than 3％;

● When power factor of servo drive input end is required to be improved to greater than 0.93;

● When servo drive accesses large-capacity transformer, input power circuit current may damage rectifier circuit. In general, when servo drive power supply capacity is greater than 550kVA; or the power supply capacity is 10 times greater than servo drive capacity; DC reactor will be configured in servo drive.

4．AC Input Reactor

The AC input reactor may be equipped in the following conditions: when grid waveform distorts seriously; when higher harmonic wave influences between servo drive and power supply can't meet requirements (DC reactor is equipped on servo drive). AC input reactor may improve power factor of servo drive input.

5．AC Output Tractor

When wiring between servo and motor exceeds 80 meters, it is suggested to use bunch wire and install AC output reactor restricted high frequency oscillation. Motor insulation, too large leakage current and servo drive frequently protection are avoided.

6．Input EMI

EMI wave filter may be used to restrict high-frequency noise from servo drive power line.

7．Output EMI wave filter

EMI wave filter may be used to restrict interference noise and leakage current conductors from servo drive output.

8．Safety ground wire

Leakage current exists in servo drive. Servo drive and motor shall be grounded for safety. The ground resistance shall be less than 10Ω. The ground wire shall be as short as possible. The wire diameter shall meet standard of table 4-4.

Note: Value in the table will be correct when the same metal uses in both conductors. If not, section area of conductor protection shall be ensured by equivalent conductivity coefficient in table 4-4.

Table 4-4 Section area of conductor protection

Phase conductor section area in installation S (mm^2)	The minimum section area of related protection conductor Sp (mm^2)
S≤16	S
16＜S≤35	16
35＜S	S/2

 Note

1**. Input (output) EMI wave filter shall be installed to close to servo drive as much as possible. The installation method shall refer to Optional Accessories Installation of 4.3.**

２．**Technical parameters of optional accessories may refer to Optional Accessories of 2.4.**

３．**Servo drive output: it is suggested to use #6 cable, wiring terminal (RNBS14-6), heat shrink tubing (φ18.0, black, 125 ℃, 600V). The specific process may refer to table 4-4.**

4.1.3Basic Operation Connection Connection

Basic operation connection connection is shown as figure below:
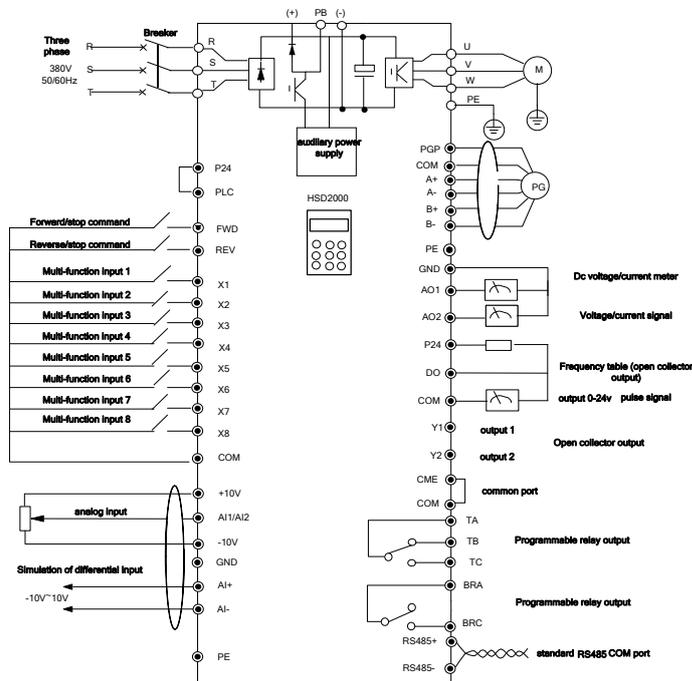
Figure 4-3 basic connection Figure

4.2Control Circuit Connection and Configuration

4.2.1Relative position and function introduction of jumper

Before servo drive puts into use, terminal connection shall be implemented correctly. Function description of jumper switch and slot may refer to table 4-6.
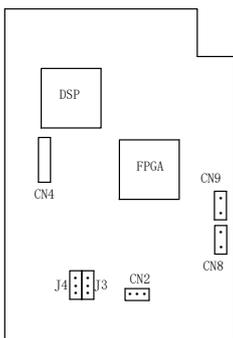
Figure 4-4: Jumper Switch Position Figure of Control Plate

Table 4-6: Jumper Switch and Slot Function of User

Number	Function
CN2	Encoder of 5V and 12V jump
J3, J4	Encoder of 5V and 12V jump
CN8, CN9	Expansion Card 24V Power Supply
CN4	Expansion PG Card Slot

J3, J4 and CN2 jump shall be used coordinately. Jump using method of 5V encoder is shown in the figure below:

Jump using method of 12V encoder is shown in the figure below:

4.2.2 Control circuit terminal wiring

Before servo drive puts into use, terminal connection shall be implemented correctly. Function description of jumper switch and slot may refer to table 4-6.

Table 4-6: Control Circuit Terminal Function

Number	Function
CN5~7，CN13~15	Analog input and output port, RS485 communication port, switch input and output port, encoder input signal terminal
CN16	Two relay output ports

📖　**Note**

It is suggested to use wiring of greater than 1mm^2 as connect wire of control circuit terminal.

Terminal arrangements of control circuit terminal CN5~7, CN13~15 are shown as figure below:

+10V	GND	AI+	AI-	AI1	AI2	GND	A+	A-	PGP	COM	PLC	P24	COM	CME	Y1	Y2	DO
-10V	AO1	AO2	485+	485-	PE	B+	B-	FWD	REV	X1	X2	X3	X4	X5	X6	X7	X8
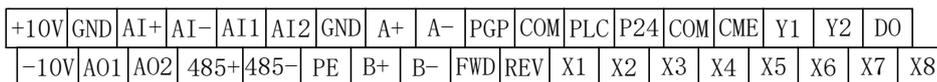
Figure 4-5: CN5~7, CN13~15 Terminal Arrangement Figure

Terminal arrangements of control circuit terminal CN16 is shown as figure below:

TA	TB	TC
	BRA	BRC

Figure 4-6: CN16 Terminal Arrangement Figure

Terminal function description may be shown in table 4-7 and table 4-8.

Table 4-7: Interface Board Terminal CN5~7, CN13~15 Function Table

Type	Terminal screen printing	Name	Terminal function description	Specification
Shield	PE	Shield ground	Ground of terminal wiring shielding layer; analog signal wire, 485 communication wire; shielding layer of motor cable may be connected to the terminal.	Internal connect with main circuit wiring terminal PE
Power supply	+10	+10V power supply	External supply ＋10V reference power supply	Maximum allowable output current 5mA
	-10	-10V power supply	External supply-10V reference power supply	Maximum allowable output current 5mA
	GND	+10V-10V power ground	Analog signal＋10V, -10V power supply reference	Internal separated with COM and CME
Analog input	AI1	Analog single-ended input AI1	Acceptable analog voltage or current single-ended input, voltage/current input shall be selected by function code P11.00 （reference ground: GND)	Input voltage range: －10V～10V (input impedance: 45kΩ)，resolution: 1/4000 input current range: 0mA～20 mA，resolution: 1/2000
	AI2	Analog single-ended input AI2	Acceptable analog voltage or current value single-endedinput, voltage/ current input shall be selected by function code P11.00 （reference ground: GND)	
Analog input	AI+	Analog voltage differential inputAI+ or single-ended input	When accept analog voltage values differential input, AI+ will be the forward phase input end. AI- will be reverse input end; when accept analog voltage values single-ended input, AI+ will be signal input end，AI-will be connected to GND (reference ground: GND).	Input voltage range: －10V～10V (input impedance: 15kΩ), resolution: 1/4000
	AI-	Analog voltage differential inputAI- or single-ended input		

Type	Terminal screen printing	Name	Terminal function description	Specification
Analog output	AO1	Analog output1	When provide analog voltage/ current values output, 25 types of values may be represented; output voltage, current may be selected by function code P11.16. The factory default shall be output voltage. See the function code P11.17 description (reference ground: GND)	Voltage output range: 0/2～10V current output range: 0/4～20mA
	AO2	Analog output2	When provide analog voltage/ current values output, 25 types of values may be represented; output voltage, current may be selected by function code P11.1. 6. The factory default shall be output voltage. See the function code P11.21 description. (reference ground: GND)	Voltage output range: 0/2～10V current output range: 0/4～20mA
Communication	RS485+	RS485 communication port	485 difference signal positive end	Standard RS485 communication port may use twisted-pair wire or shield wire
	RS485-		485 difference signal negative end	
Encoder	A+，A-	Encoder A phase signal	encoder A Phase difference inputsignal	Input maximum frequency≤100kHz
	B+，B-	Encoder B phase signal	Encoder B phase difference inputsignal	
	PGP	Encoder power supply	Provide power supply to external encoder (reference ground : COM)	Output voltage : 12V Maximum output current: 250mA
Operation control terminal	FWD	Forward operation command terminal	The forward and reverse switch command may refer to P10.08 two-wire three-wire control function description	Optocoupler isolation input input impedance: R＝3.3kΩ; maximum input frequency: 200Hz input voltage range: 20V～30V
	REV	Reverse operation command terminal		
Multi-function input terminal	X1	Multi-function input terminal 1	The programmable may be defined as multifunction switch values input terminal. See the *6.1.11 switch value input and output terminal parameters (P10 group)* of P10.00～P10.07 input terminal function introduction	
	X2	Multi-function input terminal 2		
	X3	Multi-function input terminal 3		
	X4	Multi-function input terminal 4		
	X5	Multi-function input terminal 5		
	X6	Multi-function input terminal 6		
	X7	Multi-function input terminal7		
	X8	Multi-function input terminal 8	In addition to be X8 ordinary multi-function terminal (as X1～X7), the program may be implemented as high speed pulse input end. See the *6.1.11 switch value input and output terminal parameters (P10 group)* of P10.00～P10.07 input terminal function introduction.	Optocoupler isolation input equivalent figure is shown above input impedance: R＝2kΩ Maximum input frequency: 100kHz input voltage range: 20～30V
Multi-function output terminal	Y1	Bidirectional open-collector output terminal 1	The programmable may be defined as multifunction switch values output terminal. See the *6.1.11 switch value input and output terminal parameters (P10 group)* of P10.18 and P10.19 output terminal function introduction (common terminal: CME)	Optocoupler isolation output maximum working voltage: 30V maximum output current: 50mA the method may refer to P10.18～P10.19 description
	Y2	Bidirectional open-collector output terminal 2		
	DO	Open-collector pulse output terminal	The programmable may be defined as multifunction pulse signal output terminal. See the *6.1.11 switch value input and output terminal parameters (P10 group)* of P10.32 output terminal function introduction (common terminal: CME)	Output frequency range: determined by P10.33. the maximum of 100kHz
Power supply	P24	＋24V power supply	External supply＋24V power supply	Maximum output current: 200mA
Common terminal	PLC	Multi-function input common terminal	Multi-function input terminal common terminal (short circuit with P24 when factory)	X1～X8, FWD, REV common terminal, PLC will be isolated with P24 internal
	COM	＋24V power supply common terminal	Three public terminals. Using together with other terminals.	COM and CME、GND internal isolation
	CME	Y1, Y2output common terminal	Multi-functionoutput terminal Y1, Y2 common terminal (short circuit with COM by manufacturer)	COM is isolated with CME and GND
Shield	PE	Shield ground	Shielding layer ground terminal	Internal connects with main circuit terminal PE

Table 4-8: Interface Board Terminal CN16 Function Table

Type	Terminal screen printing	Name	Terminal function description	Specification
Relay output terminal1	TA	Relay output	The programmable may be defined as multifunction pulse signal output terminal. See the *6.1.11 switch value input and output terminal parameters (P10 group)* of P10.21 output terminal function introduction.	TA-TB: normally close，TA-TC: normally open Contact capacity : 250Vac/2A (COSΦ＝1) 250Vac/1A (COSΦ＝0.4) 30Vdc/1A The method may refer to P10 description. Relay output terminal input over voltage is class II.
	TB			
	TC			
Relay output terminal2	BRA	Relay output	The programmable may be defined as multifunction pulse signal output terminal. See the *6.1.11 switch value input and output terminal parameters (P10 group)* of P10.20 output terminal function introduction.	BRA-BRC: normally open Contact capacity: 250Vac/2A (COSΦ＝1) 250Vac/1A (COSΦ＝0.4) 30Vdc/1A The operation method may refer to P10 instruction. Relay output terminal input over voltage is class II.
	BRC			

   Note

"AI＋,AI－"is function code AI3 in P11.

Analog input terminalconnection

1) AI1,AI2 terminal acceptable analog voltage or current value single-ended input,voltage/current input will be selected by function code P11.00. The connection method is shown below:
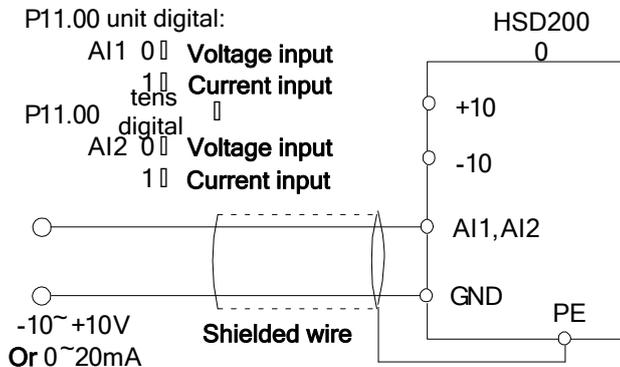
Figure 4-7: AI1，AI2 Terminal connection Figure

2) AI+, AI-terminal accepts analog voltage differential input or analog voltage single-ended input. The connection method is shown below:
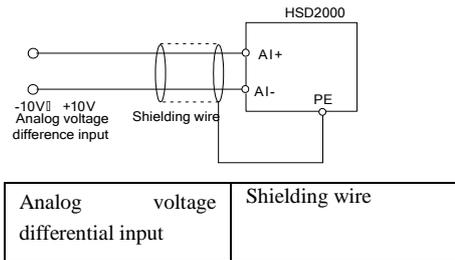
Figure 4-8: AI+, AI-terminal Differential Voltage Input connection Figure
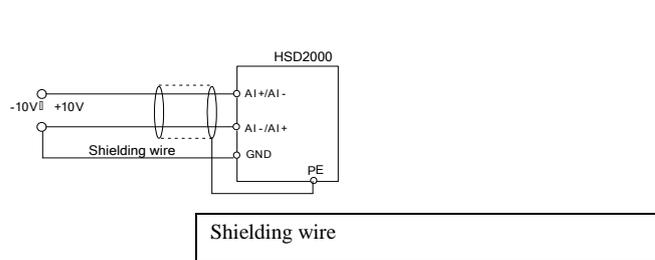
Figure 4-9: AI＋，AI-terminal Single-ended Voltage Input connection Figure

Analog Output Terminal Connection Method

Analog output terminal AO1 and AO2 external analog gauge may show variety of physical values. The function code P11.16 will select output current (0/4～20mA) and voltage (0/2～10V). Terminal connection method is shown below:
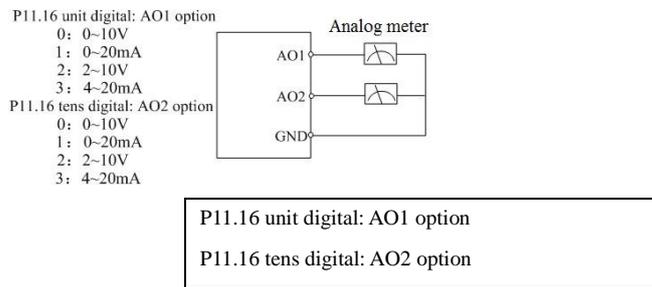
Figure 4-10: Analog Output Terminal Connection

📖 **Note:**

1．When using analog input, wave filter electric capacity or common mode choke may be installed between input signal and GND.

2．Voltage of analog input signal is not suggested to exceed 15V.

3．Analog input and output signal is easy to be disturbed by external. Shield cable with good ground shall be used in connection. Length of connection shall be as short as possible.

4．The maximum voltage of analog output terminal is 15V.

Communication Port Connection

HSD2000 servo drive provides RS485 serial communication port to users. The following connection method may composite single master/multi-slave system or single slave/multi master system. The host(PC computer or PLC controller) software may be used to achieve real time monitor of network. Remote control, automatic control may be finished and achieve complicated motion control (such as unlimited multi segment PLC operation).

1．Servo drive connects with host with RS485 interface:
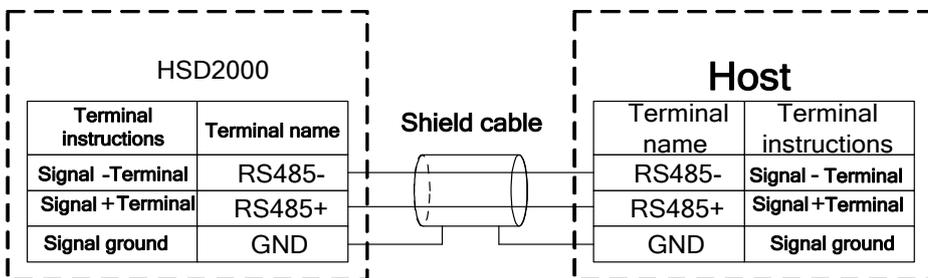
Figure 4-11: RS485-RS485 Communication connection

2．Servo drive connects with upper computer with RS232 interface:
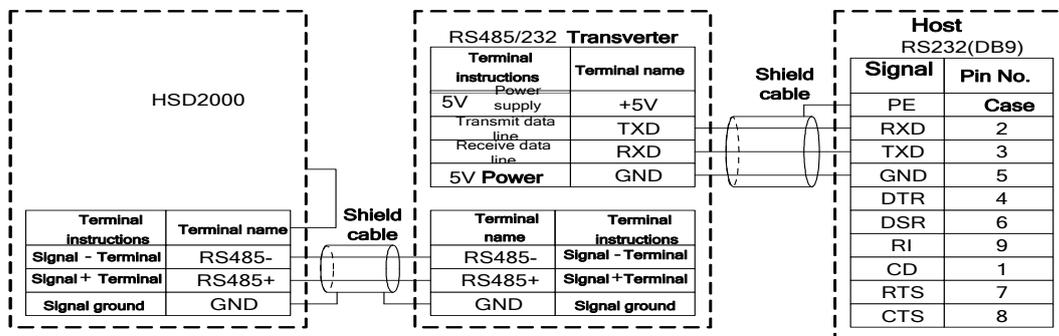
Figure 4-12: RS485- (RS485/232) -RS232 Communication connection

3．Servo drive connects remotely with host by MODEM:
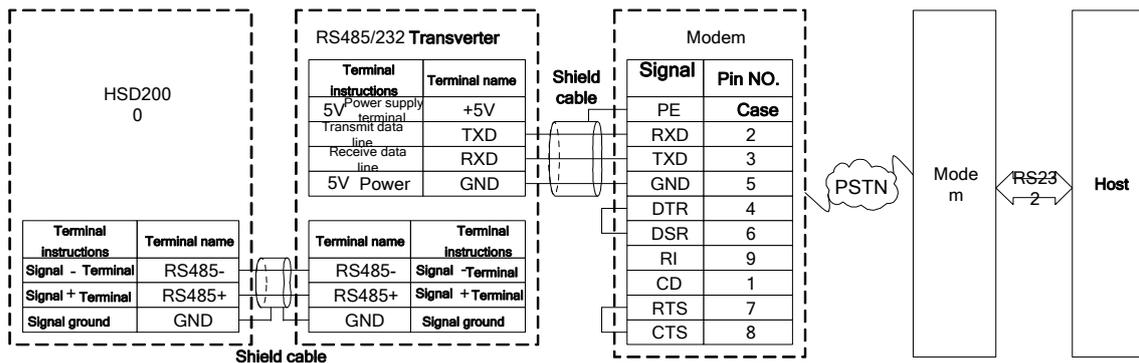
Figure 4-13: RS485- (RS485/232) - (Modem-Public Network-Modem) -RS232 Communication connection

In the figure above, if the interface connected with modern is RS485, the RS232/RS485 converter shall be used to connect.

4．Connect wire hang in the same RS485 system of certain servo drives:

When certain servo drives hang in the same system RS485, the communication disturb will be added. The connection becomes very important. We suggest users to wire as the following methods:

RS485 Cable
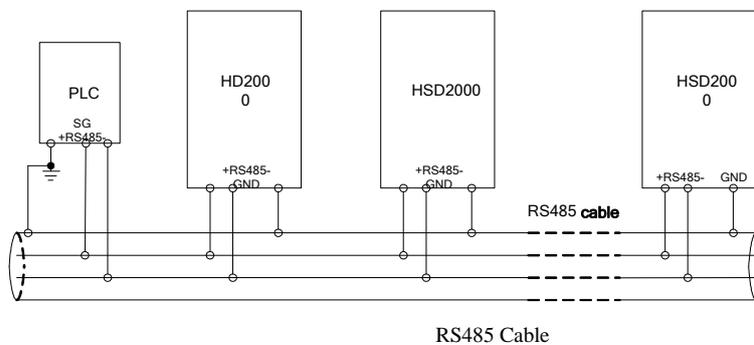
Figure 4-14: PLC and Servo Drive Recommended Connection (servo drive and motor well grounded)

If the above connection could not communicate in normal, the following measures may be implemented:

1） Single supply to PLC (or upper computer) or separate power supply. In heavy external disturb field, the communication wire shall be isolated.

2） The RS485/RS232 convert module shall be separate power supply.

3） Use magnetic ring on communication wire;

4） If applicable, the servo drive carrier frequency may be lowered.

📖　**Note**

1．RS485 converter with isolation shall be used in larger disturb field.

2．RS485 cannot afford voltage above30V.

Multi-function Input Terminal and Operation Control Terminal Connection

HSD2000 multi-function input terminal is equipped with full bridge rectifier circuit as shown in figure 4-15. PLC is public terminal of X1～X8, FWD, REV. Current through PLC terminal will be either source current or sink current. Interface of external with X1～X8, FWD, REV shall be flexible. The typical wiring method shall be as follows:

1．Dry Contact Method

1） Internal 24V power supply in servo drive shall be used. The wiring is shown in figure 4-15.
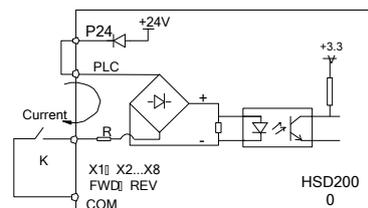
Figure 4-15: Internal 24V Power Supply Wire Connection

2） External power supply wiring (power supply shall meet UL CLASS 2 standard, 4A fuse is required to install between power supply and interface) is shown as figure 4-16 (wiring between

PLC and P24 terminal shall be removed).
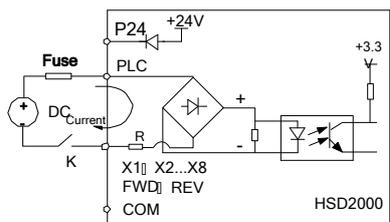
Figure 4-16:   External 24V Power Supply Wire Connection

2．   Source (Drain) Mode

1) The servo drive internal + 24V power supply shall be used. The external controller connection mode is NPN common emitter output. It is shown in figure 4-17:
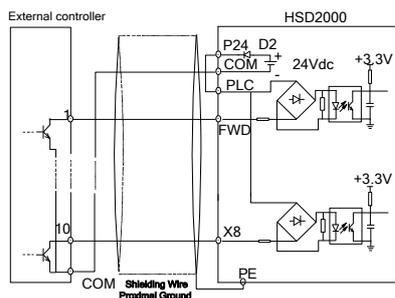
Figure 4-17: Internal +24V Power Supply Servo Drive Source Connection

2）   The servo drive internal + 24V power supply shall be used. The external controller connection mode is NPN common emitter output. It is shown in figure 4-18: (wiring between PLC and P24 terminal shall be removed).
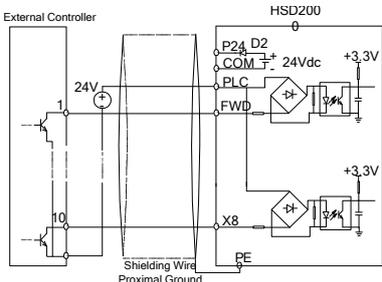
Figure 4-18: Internal +24V Power Supply Servo Drive Drain Connection

3) External power supply source connection shall be used: (wiring between PLC and P24 terminal shall be removed)
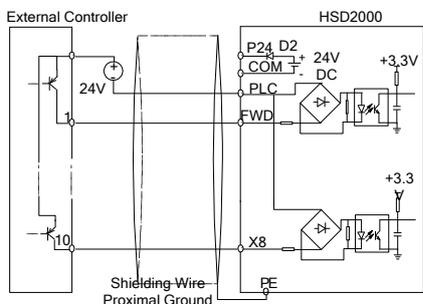
Figure 4-19: External Power Supply Source Connection

4) External power supply drain connection shall be used: (wiring between PLC and P24 terminal shall be removed).
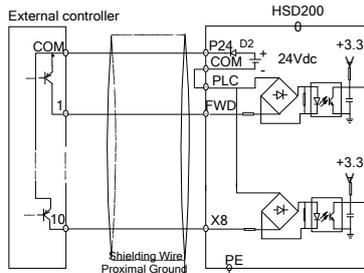
Figure 4-20: External Power Supply Drain Connection

Multi-function output terminalconnection

1．Multi-function output terminalY1, Y2 may use servo drive internal 24V power supply. The wiring may refer to 0.
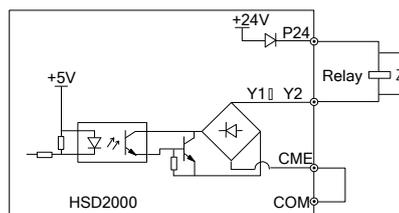
Figure 4-21: Multi-function Output Terminal Connection 1

2．Multi-function output terminalY1, Y2 may use external power supply. The wiring may refer to 0.
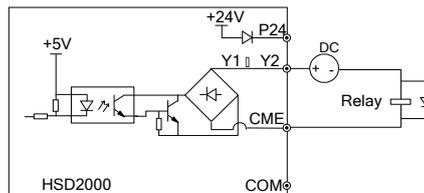
Figure 4-22: Multi-function Output Terminal Connection 2

3．Digital pulse frequency output DO may use servo drive internal 24V power supply. The wiring may refer to Figure 4-23.
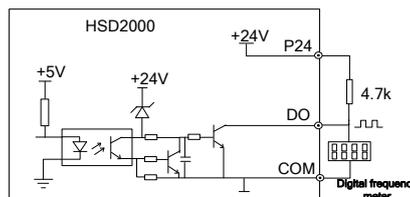
Figure 4-23: Output Terminal DO Connection 1

4．Digital pulse frequency output DO may use external power supply. Wiring may refer to Figure 4-24.
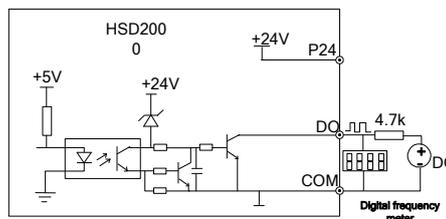
Figure 4-24: Output Terminal DO Connection 2

Relay Output Terminal TA, TB, TC Connection

The surge voltage absorbing circuit may be installed on driving inductive load (electromagnetic relay, contactor). When the RC absorbs circuit (the current leakage shall be less than keep current

of controller or relay), voltage dependent resistor, freewheeling diodes (used in DC electromagnetic Loop; polarity shall be noted in installation); the circuit absorb parts shall be installed both ends of contactor of both ends in relay or contactor.

📖 **Note**

1．The short circuit shall be not between P24 terminal and COM terminal. Otherwise the control plate will be damaged.

2．The control terminal shall be connected by multi-core shield cable or twisted wire (1mm² more).

3．When using the shield cable, close end of cable shielding (close to servo drive) layer shall be connected to ground terminal PE of servo drive.

4．When wiring arrangement, the control cable shall be more than 20cm far away from main circuits and high voltage lines (power supply line, motor line, relay line, contactor connection line). The placement shall be avoided. The vertical arrangement is suggested to prevent servo drive error action caused by disturb.

5．For not 24V relay of Figure 4-21 and Figure 4-22, applicable resistor shall be selected as relay parameters. Serial shall be implemented in relay loop.

6．Digital output terminal cannot bear voltage of 30V.

Encoder Wiring Precautions

Encoder (PG) signal line shall be separated with main circuit and other power lines. Close parallel wiring shall be avoided. Encoder wiring shall be shield wire. Shielding layer closed to servo drive shall connect PE terminal.

1．PG output signal shall be collector open circuit signal. Connection with interface board terminal is shown as figure 4-25: (dotted line in figure is voltage output encoder)
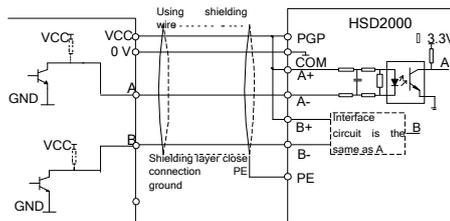
Figure 4-25: Collector Open Circuit Signal PG Wiring Schematic Diagram

2．PG output signal is push pull signal. Connection with interface board terminal is shown as figure 4-26 below:
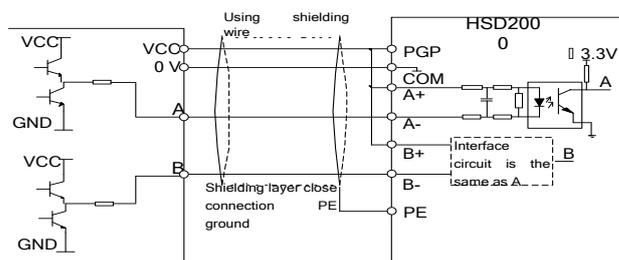
Figure 4-26: Push Pull Signal PG Wiring Schematic Diagram

4.3 Optional Accessories Installation

Optional accessories of HSD2000 servo drive is connected through servo drive control plate. Optional accessories terminal base arrangement on control plate is shown in figure below:

Figure 4-27: Optional Accessories Terminal Base Position Schematic Diagram

Table 4-9: Interface Board Terminal CN4 Menu

Number	Function
CN4	Expansion PG Card Interface*
Note: For detailed description of expansion PG card, refer to *2.4.2 expansion PG card introduction.*	

4.2 Installation Instructions Met EMC Requirement

Work principle of servo drive determines the production of noise. The EMC problem will be brought. For reducing or avoiding external disturb of servo drive, the chapter shows EMC installation method from noise restriction, site connection, ground, leakage current and power supply wave filter. The introduction may be used as site installation.

4.4.1 Noise Suppression

Noise from servo drive working may influence near equipments. The influence degree is related with servo control system, equipment noise immunity, wiring environment, place distance and ground methods.

Noise type

Figure 4-28: Noise Classification

Noise Spread Path
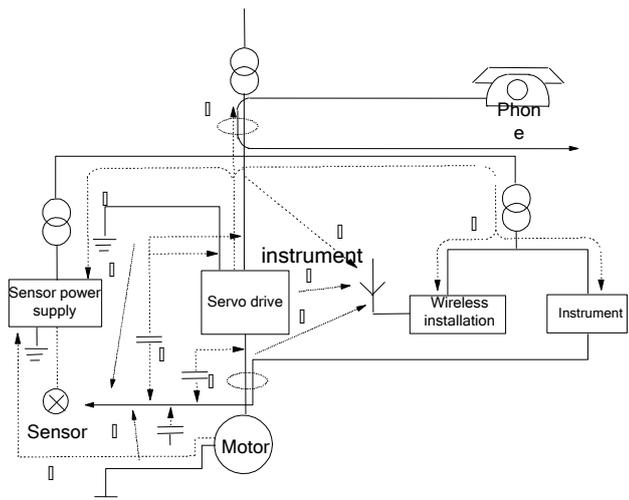
Figure 4-29: Noise Spread Path Schematic Diagram

Noise Suppression Basic Strategies

Table 4-10: Noise Suppression Strategies

Noise spread path	Strategies of reducing influence
②	When peripheral equipments form closed loop by servo drive wiring, the error action will be produced when current leakage of servo drive. Error action will be reduced when the equipment is not grounded.
③	When power supply of peripheral equipments and servo drives us the same system, the noise inverse power supply wire spread of servo drive will produce error action to equipments of the same system. The following measures may be used to prevent: install noise wave filter on input end pf servo drive; isolation transformer or power supply wave filter is used to isolate noise.
④⑤⑥	Process measuring instrument, radio device, sensor and signal wires. If the devices are in the same cabinet with servo drive and closing wiring, it may be influenced by space noise. The following strategies will be used: (1) For equipments and signal wires easy to be influenced, its installation shall be far away from servo drive. The signal wire shall be shielding. The shielding layer shall be grounded. The signal wire cable shall be in metal tube and far away from servo drive, input and output wire. When the signal cable passes through power cable, the two device shall be orthogonal. (2) Radio noise wave filter and a linear noise wave filter (Ferrite Common Mode Chokes) shall be installed on input and output of servo drive to restrain radiated noise of power wire. (3) The motor cable wire shall be placed in barrier of larger thickness. It may be placed in larger thickness (2mm more) tubes or buried in cement tanks. The power wire shall be set into metal tube with shield ground (4 core cable is used in motor cable; the one is grounded on servo drive side; another is connected to motor shell).
① ⑧	When the signal wire wiring parallel or binding with power wire: since the electromagnetic induction noise and electrostatic induction noise, the noise may be spread in signal wire. The error action may be occurred sometimes. The wiring above shall be avoided. The related equipments shall be far away from input and output wire of servo drive.

30

Noise spread path	Strategies of reducing influence
	When signal wire and power wire use shield wire, they shall be set into metal tube respectively for better effects. Distances between metal tube shall be at least 20cm.

4.4.2 Site Connection Requirement

For avoid coupling of disturb, the control cable, power supply cable and motor cable shall be installed respectively. In general, enough distance shall be ensured. When the cable installs parallel with long extension distance. Vertical pass through shall be implemented when signal cable passes through power supply cable.
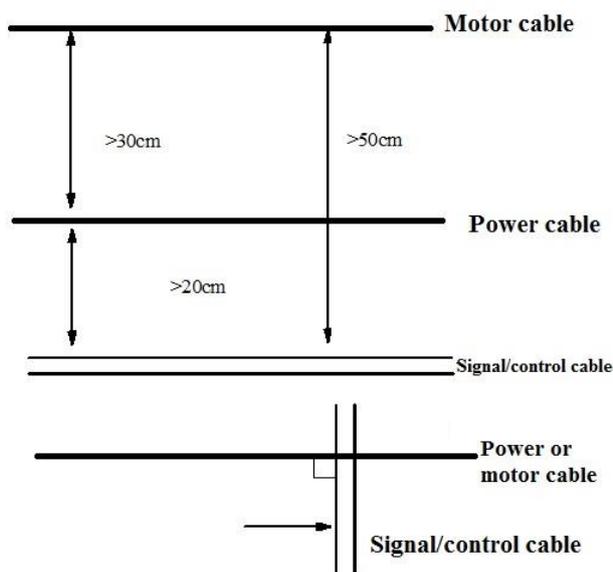
Figure 4-30: System connection

When the motor cable is larger or the cable section area is larger, derating shall be implemented. Since the larger of cable section area, the greater electric capacity to ground, the greater leakage current to ground. When using the cable of larger section area, the output current shall be lowered. When area increases once, the current will be lowered by about 5％.

Shield/armored cable: the high frequency low impedance shield cable shall be used. Such as braided copper wire, aluminum wire mesh or barbed wire. In general, the control cable shall be shield cable. The shield metal wire mesh shall be connected to metal cabinet of servo drive through cable clips of both sides.
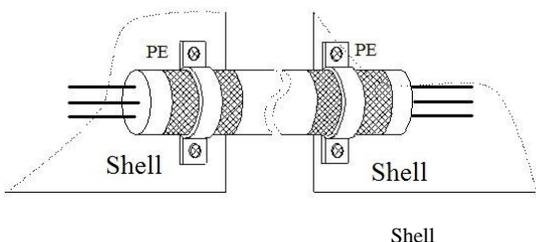
Figure 4-31: Correct Shield Ground Method
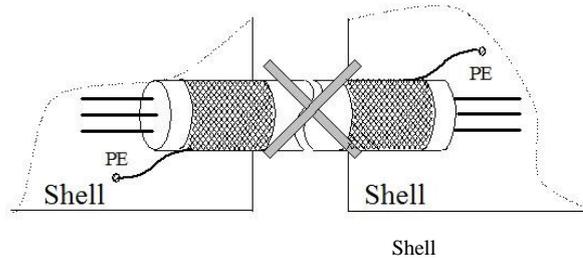
Figure 4-32: Wrong Shield Ground Method

4.4.3 Ground

Specified Earth Electrode (best)
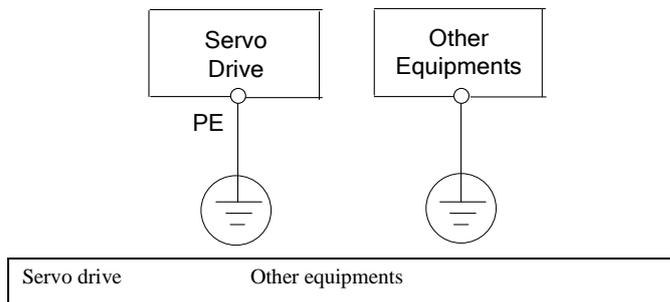
Figure 4-33: Ground Schematic Diagram 1

Common Earth Electrode (possible)
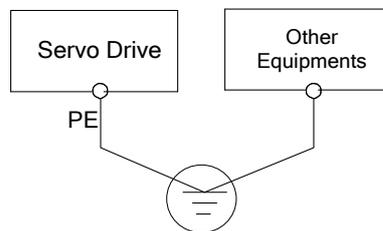
Figure 4-34: Ground Schematic Diagram 2

Common Ground wire (not allow)
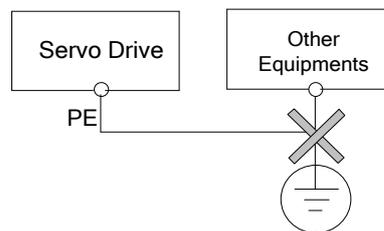
Figure 4-35: Ground Schematic Diagram 3
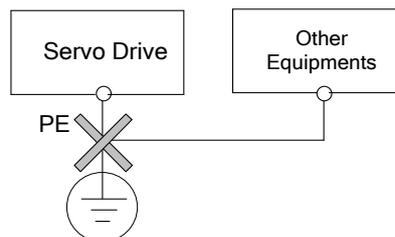
Figure 4-36: Ground Schematic Diagram 4

In addition, the following shall be noted:

- For possible low of different ground system impedances, the maximum ground cable standard size shall be used. The flat cable is used well. For cable of the same section area, high frequency impedance of flat conductor is smaller than round conductor.

- One wire of 4 core motor cables shall be grounded on servo drive side. The other side shall be connected to motor ground. If motor and servo drive have specific earth electrode with good effects.

- When all the ground ends of system connects together, the leakage current will be noise source to influence equipments. The ground ends of servo drive, other audio devices, sensor and computer shall be isolated.

- For lower high frequency impedance, fixed screw of equipments may be as high frequency terminal connected to rear cabinet. The insulation paint of fixed point shall be removed.

- The ground cable shall be as short as possible. The ground point shall close to servo drive.

- The ground cable shall be far away from connection of I/O in noise-sensitive devices. The ground wire shall be as short as possible.

4.4.4 Installation Requirements of Relay, Contactor and Electromagnetic Brake

Relay, contactor and electromagnetic brake shall be equipped with surge suppressors including installation outside servo drive cabinet.
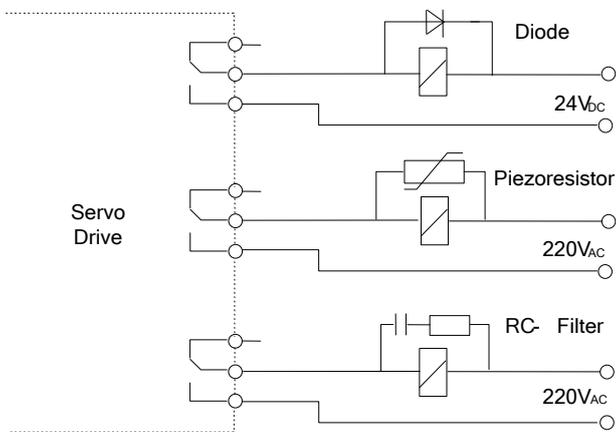
Figure 4-37: relay, contactor and electromagnetic brake

4.4.5 Leakage Current and Strategies

Leakage current passes through servo drive input and output electric capacity and motor electric capacity. Its capacity is determined by wiring electric capacity and carrier wave frequency. The leakage current includes earth leakage current and wiring leakage current.
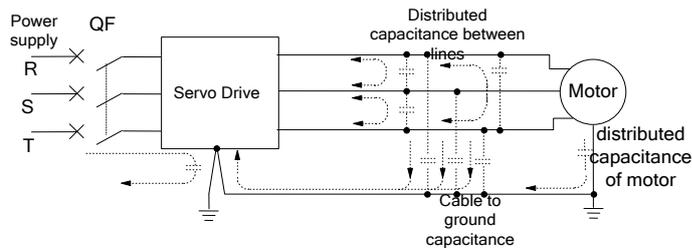
Figure 4-38: Leakage way

Earth Leakage Current

The leakage will flow into either servo drive system or other equipments (by earth wire). The leakage current may cause error action of leakage breaker, relay or other equipments. The higher of servo drive carrier wave frequency, the greater leakage current. The larger the motor cable, the greater of leakage current.

Restrain Measures:

- Reduce carrier wave frequency. The motor noise will be increased.
- The motor cable shall be as short as possible.
- The leakage breaker designed for leakage of high harmonic wave/surge shall be used for servo drive system and other systems.

Wiring Leakage Current

Leakage current of electric capacity flowed to servo drive output cable. The higher harmonic wave may cause error action of thermal relay, especially for small capacity (7.5kW less) servo drive. When the connection is larger (50m more), the leakage current will be relative increased. The error action of external thermal relay may be caused.

Restrain measures:

- Reduce carrier wave frequency. The motor noise will be increased.
- Install reactor in output side.

For motor protection, the temperature sensor is recommended to use for monitoring motor temperature. The overload protection function (electric thermal relay) of servo drive may replace external thermal relay.

4.4.6 Correct EMC Installation of Servo Drive

Partition Principle

In the driving system made up by servo and motor, the servo drive, control device and sensor shall be in the same cabinet. The noise emitted outside shall be restricted on main connection point. The radio noise wave filter and line reactor shall be installed in cabinet. The cabinet internal shall meet electromagnetic compatibility requirements.

During mechanical/system design phase, the isolate noise source in space and noise receiver shall be considered. The measure is the most effective and the most expensive measure. In the driving system made up by servo and motor, the servo drive, control device and sensor shall be the noise source. The noise receiver shall be automatic device, encoder and sensor.

According to electrical characteristics, the mechanical/system shall be divided into different EMC areas. It is suggested to place device in the area as shown in figure 4-39.
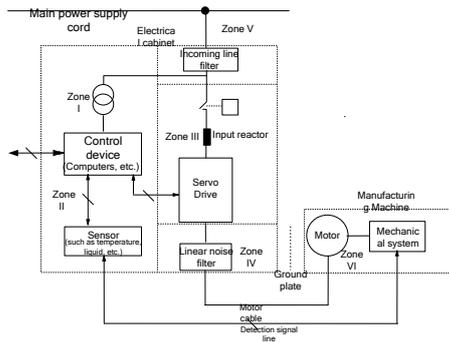
Figure 4-39: servo drive EMC schematic diagram

Description:

Ⅰ area: Control power supply transformers, control systems and sensors.

Ⅱ area: Signal and control cable interface parts，certain immunity shall be required.

Ⅲarea: Line reactor, servo drive, brake unit, contactor;

Ⅳarea: Output noise wave filter and connection parts;

Ⅴ area: Power supply (including radio noise wave filter connection);

Ⅵarea: Motor and cable

● Space of areas shall be isolated to achieve electromagnetic decoupling.

● The minimum distance of areas shall be 20cm.

● Decoupling of areas shall be implemented by plate. Cables in different areas shall be put into different cable tubes.

● Wave filter shall be installed in areas interface.

● All the communication cables (such as RS485) shall be introduced from cabinet. All the signal cables shall be shield.

Servo Drive Electrical Installation Schematic Diagram
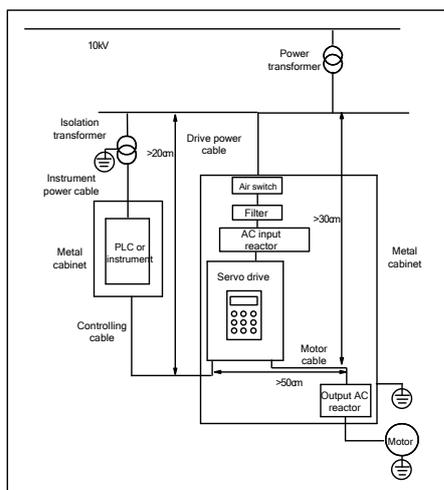
Figure 4-40: servo drive schematic diagram

The ground wire of motor cable shall be grounded on servo drive side. The motor and servo drive had better ground respectively.

Motor cable and control cable shall use shield or armored. The internal shield metal wire mesh shall connect both sides of ground wire. Metal wire mesh ends shall be avoided to be twisted to pigtails. The shield effects in high frequency will be influenced. The cable clip shall be used.

The good conductivity of installation plate, screw and servo drive metal cabinet shall be ensured. Tooth broken washer and conductive mounting plates shall be used.

When individual sensitive equipment is in site, power supply wave filter shall be installed in sensitive equipment side to reduce cost.

4.4.7Power Supply Wave Filter User Guide

The power supply wave filter may be used for equipments which generate strong interference and sensitive to external disturb. Wave filter of the power supply wire shall be bi-directional low-pass wave filter. It allows DC or 50Hz power frequency current. The high frequency EMI current is not allowed to pass.

Wave Filter Action of Power Supply Wire

The equipments may meet conducted emissions and conducted susceptibility requirements of electromagnetic compatibility standards. It may restrain radiation emission of equipments.

The electromagnetic interference generated from equipments may be prevented into power supply wire. The interference on power supply wire is prevented into equipments.

Power Supply Wire Wave Filter Installation Common Error

1．Power supply input wire is longer.

Wave filter in cabinet shall be installed near outlet of power supply wire. Power supply input of wave filter in cabinet shall be as short as possible.

2．Input and output wires of power supply wire are too close.

When the wires are too close, the high frequency interference signal will be coupled by input and output wires of wave filter. Wave filter of power supply will be out of action when remove the side path.

3．Wave filter ground bad

Shell of wave filter shall be connected with metal cabinet. Specific grounded terminal is usually used in filter of wave filter. If the wave filter connects to shell by one conductor wire, it is useless to high frequency interference signal. Impedance (non-resistance) of long wire in high frequency is longer，effective side affection shall be not acted. The correct installation method shall be: close the wave filter shell to metal chassis conducting plane directly. The insulation paint shall be removed.

4.4.8Servo Drive Radiation Emission

The run principle of servo drive determines inevitable of servo drive radiation emission. The servo drive is placed in metal cabinet. Instruments outside metal cabinet shall take less influence of radiation emission in servo drive. The external connection cable is the main emission source. Cable wiring shall be based on

requirements of the chapter. It may restrain radiation emission of cable.

When the servo drive is in the same metal cabinet with other control device, the partition principle above shall be considered in cabinet designing. Isolation, cable wiring, shield and lap shall be considered.

Chapter V Servo Drive Rapid Operation Guide

The chapter shows the production information, operation procedure and method of servo drive operation.

5.1 Servo Drive Operation Panel

5.1.1 Operation Panel Appearance and Key Function Description

Operation panel is the main command accepting parameter display unit of servo drive which includes LED and LCD. Dimension and operation of LED and LCD are almost the same. The LCD operation panel equips with text information of English and Chinese, explanation of data type. LED operation panel shall be standard configuration. The LCD operation panel may be selected as actual demands. To facilitate the description, the LED operation panel is described as an example below. See the figure 5-1:
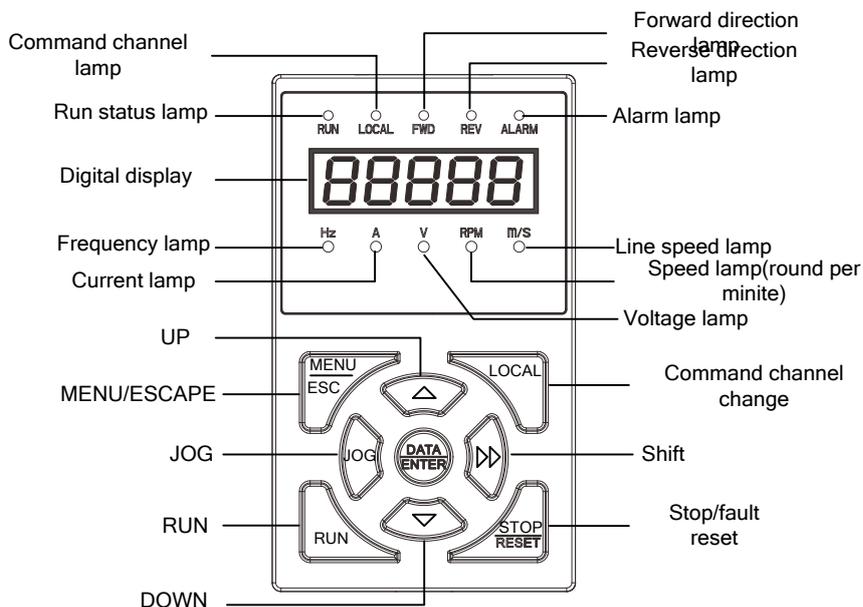
Table 5-1: LED operation panel schematic diagram

There are 9 keys on servo drive operation panel. Function of each key is defined as the table 5-1:

Table 5-1: Operation Panel Menu

Key	Name	Function
MENU/ESC	Programming / Exit key	Enter or exit programming status
DATA/ENTER	Function/Data key	Enter next menu or data identification
▲	Increment key	Increment of data or function code
▼	Decrement key	Decrement of data or function code
	Displacement key	Under editing, the modified position of setting data may be selected. Under other status, the status parameter may be displayed shifted.
LOCAL	Operation command channel shifting key	Select operation command channel in order, press the DATA/ENTER key to ensure
JOG	Jog key	Under operation panel, press the key for jog operation
RUN	Operation key	Under operation panel, press the key for operation
STOP/RESET	Stop/Reset key	Stop or fault reset

   Note

Functions of RUN, STOP/RESET, and LOCAL are limited by function code P00.06.

5.1.2 LED Digital and Indicator Description

Five positions and 8 segments LED digital tube, 5 unit indicators and 5 status indicators are equipped on servo drive LED operation panel. As shown in figure 5-1. The digital display tube may display status parameters, function code parameters and fault alarm code of servo drive. 5 unit indicators correspond to 5 units indicates respectively. LCD operation panel is equipped with LED display screen and 5 status indicators.

5 status indicators: status indicator is located on the display of digital tube. From left to right as operation indicator, operation command channel indicator, forward indicator, reverse indicator and warning indicator. The meaning of indication, see table 5-2.

Table 5-2: Status Indicator Description

Indicator	Status display	Indicate servo drive current status
Operation status indicator	Extinguish	Stop status
	Light	Operation status
Operation command channel indicator	Light	Operation panel control status
	Extinguish	Terminal control status
	Flash	Serial port control status

5.1.3 Operation Mode of Operation Panel

The servo drive may be operated through operation panel. The followings are common operation modes. The specified function code structure description shall refer to chapter VIIII—the function code table.

Example 1: Operation Panel Self Inspection

Before using the operation panel, self inspection of HSD2000 operation panel shall be used to inspect digital tube, indicator display and key function for normal. The following procedures shall be referred:

1．Under stop status, press the DATA/ENTER key for long time, then press STOP/RESET key to enter self inspection status.

During self inspection, all the 5 LED digital tubes of operation panel indicators shall be lighted. Then all the indicators are lighted, the LED will display "00000".

2．Press DATA/ENTER key, LOCAL key, ▶▶key, ▲key, JOG key, RUN key, ▼ key and STOP/RESET key in order.

In normal, press the DATA/ENTER, the LED will shift from "00000" to "11111". With pressing key, the changing will be happened. The "88888" will be displayed when press STOP/RESET key.

3．Press MENU/ESC key, the LED will back to stop parameter display status. The self inspection will be finished.

Operation procedures above may refer to the figure below:
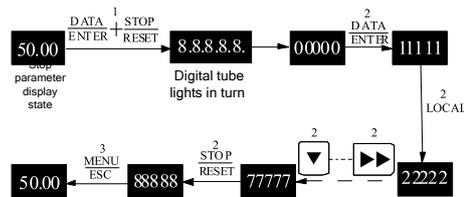
Figure 5-2: LED operation panel

  📖 **Note**

1．When functions of all the keys are normal, the servo drive will exit self inspection status automatically after self inspection finishes. Otherwise the self inspection status will keep to full power-down of servo drive.

2．During self inspection, the key pressing order shall follow the procedure 2. Otherwise the servo drive has no response.

3．When the key locking function is set, the operation panel shall be locked automatically after self inspection.

Operation panel self inspection operation shall be implemented under parameter display. Self inspection shall be not realized under function code editing status.

Example 2: Setting Function Code Parameter

Example: change the function code P02.04 from 50.00Hz to 49.99Hz.

1．Under data display status, press the MENU/ESC key to enter a level P00.00.

2．Press▶▶key to select the second highest position.

3．Press ▲ key to change P00.00 into P02.00.

4．Press▶▶key to select unit digit.

5．Press ▲ key to change P02.00 into P02.04.

6．Press DATA/ENTER to enter B level menu.

7．Press▼ key to change 50.00 into 49.99.

8．Press DATA/ENTER key to identify modification. Return to A level menu to finish. The above operation procedures may refer to figure below:
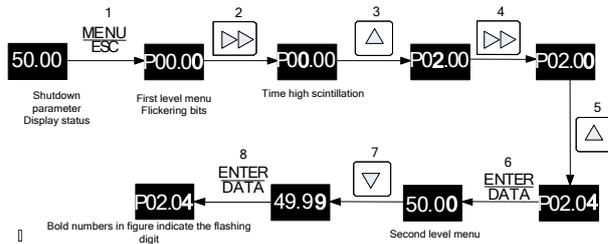
Figure 5-3: function code parameter

Under function parameter display status, the function code shall be not modified until parameter flashes. The possible reasons include:

1．The function parameter shall be not modified. Such as actual inspection parameter, operation record parameters, etc.

2．The function code shall be not modified in operation. It shall be not modified until stop.

3．Protection of parameter: when the function P00.03 is 1 or 2, the function shall be not modified for avoiding error

operation. When editing the function code parameter, the P00.03 shall be set as 0 first.

Note: function code number and function code parameters are displayed in the same line. Press DATA/ENTER to enter from function code number to function code parameter. When the function parameter shall be not edited, no cursor is displayed. Since no response in pressing▼and▲key, press MENU/ESC key to back to function code display status.

Example 3: Switch Display Status Parameter

Servo drive parameters of operational panel displayed under stop status may be set by function code P17.02, such as setting frequency, bus voltage (refer to P17 group function code detailed description). After setting parameters displayed under servo drive stop status, the status parameters may be referred by ▶▶ key of operational panel. Figure5-4 shows status parameter display example of P17.02 FFF in drive stop.
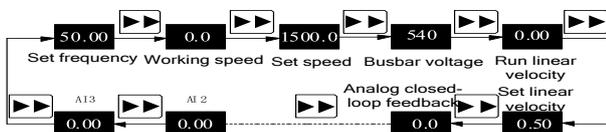
Figure 5-4: stop status parameter operation

Operation switching status method is implemented as above.

Example 4: Adjust Setting Frequency of Ordinary Operation

After power up of servo drive, ▼ and ▲ key may be used to modify setting frequency.

     Note

When the operation panel display parameters are operation rotational speed, setting rotational speed , operation line speed, setting line speed, press▼and▲key to modify setting rotational speed or line speed value.

Example: change the setting frequency from 50.00Hz to 40.00Hz.

Under any status of servo drive powers up (AI1 voltage displays in the example), press▼key to modify setting frequency from (long time press may adjust rapidly) 50.00to 40.00. The modification has finished.

Operation procedures above may refer to the following figure:

2.1.1.3.
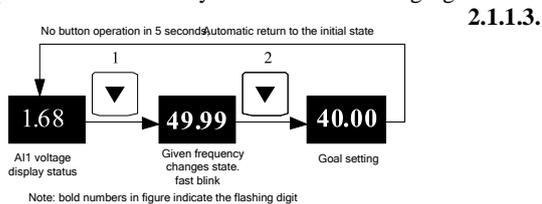
Figure 5-5: setting frequency

After modification, the LED will return to AI1 voltage display status (display status before modify) after 5 seconds of no operation.

Example 5: Switch Operation Command Channel

Before operation, the P00.06 shall be set as xx1x (stop switching effective) or xx2x (stop, operation switching effective).

Press LOCAL key, the LOCAL indicator will light when select operation command channel. The LOCAL indicator will be off when select terminal operation command channel. The LOCAL indicator will flash when select serial port operation command channel. The LOCAL indicator will flash in switching. The channel switching will be not finished until DATA/ENTER keys ensure in 3 seconds. Otherwise the LOCAL indicator will return to original status in 3 seconds.

Example 6: User Password Authentication Unlock

Servo drive provides password protection function for parameter protection. After setting the user password, user shall input user password correctly to enter function code editing status after entering MENU/ESC key. Factory password shall be entered correctly in factory setting parameter area.

     Note

Don't try to modify factory setting parameter. When parameter setting is not applicable, the servo drive is easy to be abnormal or destroy.

The function code P00.02 may be used to set user password. Specified may refer to 6.11 system management (P00 group).

It is assumed that the user in force is "1368". The servo drive has been locked without any operation. The following operation may be used to enter user password and finish user unlock.

1．Press MENU/ESC key under locking state of servo drive. LED will enter password verification status 0000.

2．Modify the 0000 into 1368.

3．Press DATA/ENTER key to ensure, the password verification will pass. The LED displays P00.03.

Operation procedures above may refer to figure below:
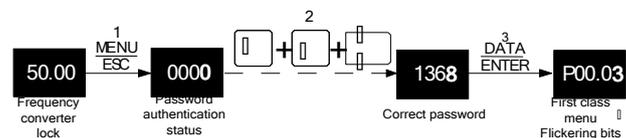
Figure 5-6: User password removal

The servo drive may be implemented by password verification.

     Note

After entering user passwords, the password protection will be locked when 5 minutes no key operation.

Example 7: Locking Operation Panel

The operation panel may be locked by function P00.06. The specific refer to *6.1.1 system management (P00 group)*.

Example: locking all keys of operation panel

1. Under stop parameter status displayed, press MENU/ESC key to enter A-level menu P00.00.

2．Press ▲key to select function code P00.06.

3．Press DATA/ENTER key to enter B level menu.

4．Press ▶▶key, select hundred of digits.

5．Press ▲ key to modify hundred from 0 to 1.

6．Press DATA/ENTER key to ensure and return to A-level menu.

7．Press MENU/ESC key to return to stop parameter display state.

8．Press DATA/ENTER key and keep, then press MENU/ESC key to lock operation panel.

The procedures above may refer to figure below:
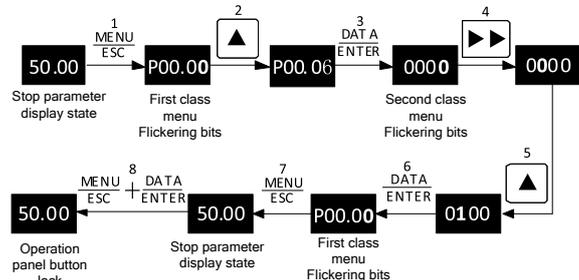
Figure 5-7: operation panel key lock

Example 8: Unlock Operation Panel Key

When all the operation panel keys are locked, the following operation may be implemented to unlock: press DATA/ENTER key and keep, then click ▼key for three times.

   Note

However setting of P00.06, the operation panel shall be unlock status after servo drive powers up.

5.2 Servo Drive Operation Mode

In the following chapters, terminologies of servo control, operation and status will be referred. Please read the chapter carefully to understand and use the following functions.

5.2.1 Servo Drive Operation Command Channel

Servo drive operation command channel specifies servo drive to accept operation command: physical channels in start and stop, jog. The operation command channels include three types: **2.1.1.4.**

1．Operation panel: control by RUN, STOP and JOG keys of operation panel.

2．Control terminal: control by control terminal FWD, REV, COM (Two-wire), Xi (Three-wire).

3．Serial port: control start and stop by upper computer.

The command channel shall be selected by function code P02.02, LOCAL key and DATA/ENTER key of operation panel, multi-function input terminal (P10.00～P10.07 selects number 27-29 functions).

   Note

Before switch command channel, the switch debugging shall be implemented. Otherwise equipments damage and personal injury will be occurred!

5.2.2 Servo Drive Run Status

HSD2000 run status include stop status, operation status, motor parameter auto-tuning status.

1．Stop status: after initialization of servo drive powers up, the servo drive will enter stop status when: no operation command input; implement stop command in operation.

2．Operation status: after receive operation command. The servo drive will enter operation status.

3．Motor parameter auto-tuning status: operation command sends after function parameter P03.11 (or P04.11) sets as 1 or 2, the motor parameter identification status will be entered. After identification, the stop status will be entered.

5.2.3 Servo Drive Control and Operation Mode

Control Mode

HSD2000 servo drive has 4 control types which determined by function code P02.00.

1．No PG vector control: zero speed sensors without installation of PG. At the same time, the high control performance is equipped to control speed and torque of motor accurately. The low frequency high torque and high speed accuracy may achieve high accuracy torque control and speed control. It may be used in fields of no meeting V/F control mode and high robustness requirements.

2．PG vector control: the PG shall be installed to ensure the control performance is installed on controlled motor shaft. It is applicable for fields of faster torque response and higher torque and speed control accuracy. As feedback, the PG may finish high accuracy position control—servo control function.

3．No PG V/Control: it is used for fields: lower requirements for normal performance requirements; single servo drive controls multi motors.

4．PG V/F control: PG shall be installed to improve V/F speed control accuracy.

Operation Mode

Operation modes of HSD2000 servo drive vector control include the following three types:

1．Speed control: Control motor speed accuracy. Related function code of P07 and P08 groups shall be configured.

2．Torque control: Control torque speed accuracy. Related function code of P07 and P08 groups shall be configured.

3．Position control: it is only effective in PG vector controls. Motor position shall be controlled accuracy to achieve motor position synchronous function. The P09 group function code shall be set.

HSD2000 servo drive supports online switch of the operation modes.

5.2.4Servo Drive Frequency, Torque, Position Given Channel

1．Frequency Given Channel under Speed Control Mode

Operation modes of HSD2000 servo drive in speed control include 5 types. According to priority, the order shall be: jog operation, process closed-loop operation, PLC operation, multi-segment speed operation and common operation. As shown in figure below:
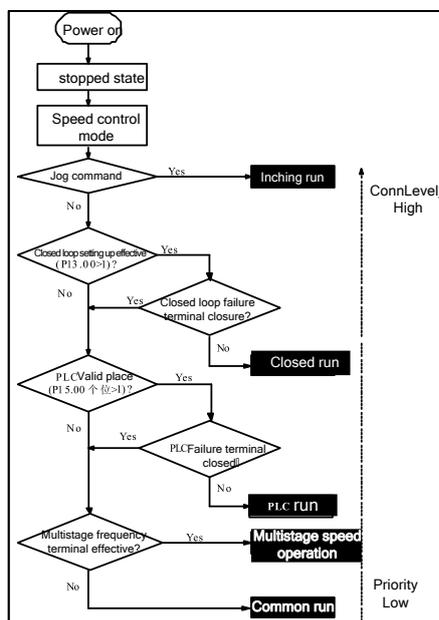
Figure 5-8:   speed control mode

5 operation modes may provide 5 basic frequency sources. In addition to "jog operation" frequency, other 4 frequency sources may implement auxiliary frequency overlay, frequency adjustment. The "PLC operation", "multi-segment operation", "ordinary operation" shall be adjusted by swing frequency. The operation modes details are shown below:

1) Jog operation: when servo drive receives jog operation command (such as press operation panel JOG key) in stop status, operation may follow jog frequency (see function code P02.16, P02.17～P02.19).

2) Process closed-loop operation: the process closed-loop selection function is effective (P13.00＝1). Servo drive will select process closed-loop operation mode. The closed-loop shall be adjusted as given and feedback values (see P13 group function code). The multi-function terminal (number-21 function) may be used to fail process closed-loop operation mode. It shall be switched to lower degree operation mode.

3) PLC operation: PLC function selection is effective (P15.00 unit is not 0). Servo drive will select PLC operation mode. The servo drive will be operated as pre-set operating mode (see P15 function code description). The multi-function terminal (number-22 function) may be used to fail process closed-loop operation mode. It shall be switched to lower degree operation mode.

4) Multi-segment speed operation: according to ON / OFF combination of multi-function terminal (number 1, 2, 3, 4 function), the multi-segment frequency1～15 (P16.00～P16.14) shall be selected to implement multi-speed operation. Three terminals shall not in OFF status. Otherwise it will be ordinary operation mode.

      Note:

For specific given channel of operation mode frequency in speed control mode, see chapter VI of function code detailed decryption:

2．Torque Given Channel under Torque Control Mode

HSD2000 is equipped with 4 torque given channels in torque control mode:

1) AI analog given
2) Terminal PULSE given
3)   Serial port communication given
4)   Process closed-loop output

For specific, refer to P08 group function code detailed description of *function code detailed introduction in chapter VI.*

3．Position instruction given source under position control mode

For position instruction given channel of HSD2000 position control mode, refer to refer to P09 group function code detailed description of *function code detailed introduction in chapter VI.*

5.3The First Power up

5.3.1Checking before Power up

The connection connection shall be implemented as technical requirements in *Chapter IV Servo Drive Connection* and EMC Installation Instructions of chapter IV.

5.3.2The First Power Up Operation

When wiring and power supply is correct, close air switch of AC power supply in servo drive input side; charge to servo drive; "8.8.8.8.8." will be displayed on servo drive operation panel; the contactor will be picked closely. When digital tube display symbol is setting frequency, the initialization of servo drive will be finished.

When LED indicator on digital tube of operation panel is ON state, the operation panel is in control state.

The first power up process is shown as figure below:
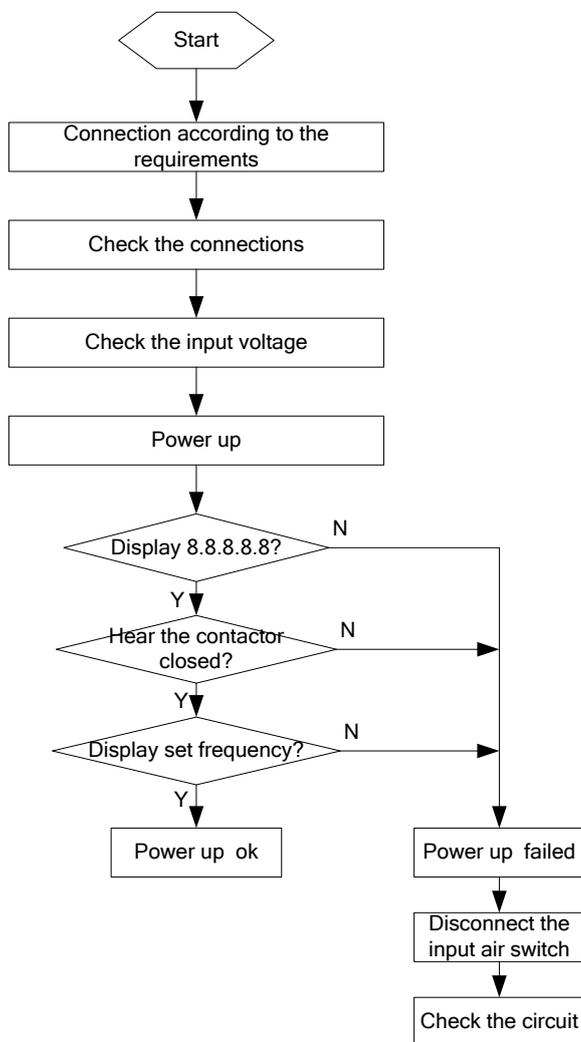
Figure 5-9:   servo drive power up

5.4Pilot running

5.4.1 Sensorless Vector Pilot Running

1．Inspect drive input and output connections. Power up shall be implemented after without error.

2．Enter P03 group to input motor parameter correctly. Set P03.11=2 (remove load) to tune the motor parameters.

3．Set P02.00 as no PG vector control.

4．Running

5.4.2Closed-loop Vector Pilot Running

1．Inspect drive input and output connections. Power up after without error.

2．Enter P03 group to input motor parameter correctly. Set P03.11=2 (remove load) to tune the motor parameters.

3．Set encoder signal feedback source correctly, when expansion PG card is selected as signal feedback, then set P07.00=1. When select local terminal as signal feedback, then set P07.00=0. The P12 group parameter shall be set as selected signal feedback.

4．The control mode set as V/F control mode of P02.00=2. The operation frequency set as P02.04=10.00Hz.

5．Run the motor and observe P01.13 values. When the value closes to 10Hz, it shows that encoder parameter is correct. When the value is negative, it shows direction error of encoder. Exchange any two of the three phase motor wires. When the frequency is 0, it represents that encoder is not connected correctly. Encoder shall use shielding layer and connect to control terminal PE of servo drive. When the frequency is not correct, it represents that the encoder wires or motor rated speed setting error. The related function code shall be changed.

6．The control mode set as closed-loop vector of P02.00=1(induction motor close loop vector control).

7．Set the frequency from 0 to rated frequency. The motor stable and vibration shall be noted, especially around 0. When vibration occurs around 0 frequencies, the encoder low speed wave filter parameter P12.03/P12.14 and speed loop PI parameter P07 group shall be adjusted. It shall be finished until stable operation without vibration in the entire frequency range.

5.4.3Torque Control Pilot Running

1．Do the step 5.4.1(open-loop mode) or 5.4.2(closed-loop mode) to ensure drive normal.

2．The control mode set as torque control P08.00=1.

3．Set torque instruction given of P11.01=8. AI1 is channel of torque instruction.

4．Set speed limit mode, P07.08=1.

5．Set speed limit channel, P07.09=1。

6．Set speed limit instruction, P11.06=4, AI2 is speed limit channel.

7．Applicable set speed/torque switching point P08.04.

5.4.4Servo Control Pilot Running(X7 and X8 terminal pulse serial control as example)

1．The 5.4.2 methods may be used to ensure drive PG closed-loop vector control for normal operation.

2．Set servo function P09.00＝3.

3．Set position given source P09.03＝0; set X7 and X8 terminal function as P10.06＝71, P10.07＝72; The position given is entered by terminalX7 and X8input. The X7 represents direction, X8 represents pulse serial. X7 shall be forward when no conducting. X7 shall be reverse when conducting. The reverse may be taken reverse of X7 by P10.16.

4．Set P10.11 (each pulse number of X8). The follow rotational speed shall be obtained by X8 pulse frequency. The rotational speed value is not related with electronic gear function (P09.10, P09.11).

5．Set P09.10 and P09.11 (electronic gear numerator, denominator). When motor follows pulse serial, relationship between encoder feedback number and pulse serial number shall be electronic gear ratio relationship.

6．Example: the motor shall be 4 degree motor. The encoder shall be 1024-coil. When pulse serial is 100k, the rotational speed of Corresponding motor is required to be 1500rpm. P10.11＝100k*60/1500＝4000 shall be set; electronic gear ratio＝ (1024*1500/60) /100K＝256/1000, P09.10＝256 may be set; P09.11＝1000.

7．Adjust speed loop PI parameter and position loop P parameter P09.26 (position loop Kp1), P09.27 (position loop Kp2), P09.28 (position loop increment switch mode). The pulse serial track process shall be fast without overload. The P09.08 may be set as requirements (pulse instruction wave filter time). The pulse tracking error shall be monitored by function code P01.47 at real time.

8．Before debugging, the P09.34＝0 (position loop output range) may be set. It is speed tracing mode at this time. The speed shall be observed for normal. Then the position loop shall be added to monitor position. The P09.33 (Velocity feed forward gain) shall be set as 100.00％. The parameter value shall be not changed.

5.4.5 Spindle Positioning Pilot Running

1．According to 5.4.2 method, the drive PG closed-loop vector control shall be ensured for normal.

2．The servo operation mode shall be spindle operation, P09.01=2.

3． Set the X1～X5 terminal function as 84, 77, 78, 79, 37. X1 shall be zero origin. X2 shall be spindle position start. X3 and X4 shall be position selection terminal. X5 shall be prohibited running terminal of servo drive.

4．Set unit digital value of positioning mode P09.02. The electric spindle shall equip encoder Z pulse as reference point. The non-electric spindle shall equip close switch. The closing switch shall be used to refer zero point. During operation, the spindle will search reference point automatically. The function code setting is not necessary.

5．When using the X1or X3, X4, the motor will stop after an angle of rotation. The zero position shall be observed for consist. The degree shall be correct.

6．Adjust speed loop PI parameter and position loop P parameter P09.26 (zero servo locking position loop KP), P09.27 (position process position loop KP). The position process shall be fast without overshoot.

5.4.6 Synchronous Motor Pilot Running(Increment   ABZUVW Encoder as Example)

1．Inspect drive input and output wiring; inspect PG card wiring. Power shall be implemented after no error.

2． The control mode shall be set as PG closed-loop   vector; P02.00＝11.

3．Set PG parameter correctly; PG feedback resource P07.00;

4．The motor parameter P03 group shall be set correctly. The tuning P03.23 of motor shall be implemented.

5． When tuning the motor, send the DC first, turn the motor to certain position and low speed rotation. When current is smaller with stable operation, it represents that encoder setting correct with success tuning. When report E025 in tuning process, it represents encoder wiring problem. The encoder shall be connected again. After tuning, the function code P03.25, P03.26 will save initial angular of synchronous machine obtained by tuning. When the initial angle difference is smaller than 5 °(65536 represents 360 °), it represents the tuning in normal.

6． When the tuning is abnormal without E025 fault, P12.16，P12.19，P12.21 shall be observed to determine for encoder   signal problems. Encoder shall be checked to solve problem. When rotate the motor shaft, when P12.19 count value increases, the P12.16 displays the magnetic signal status order of 5, 1, 3, 2, 6, 4. When the count value reduces, the order of magnetic signal shall be reverse. When 0 or 7 be happened in P12.16, magnetic signal UVW wiring of encoder shall be not correct. After one round rotation, Z pulse count value of P12.21 shall be not 0. Otherwise the Z signal has problems.

7． Set the frequency from 0 to rated frequency. The motor stable and vibration shall be noted, especially around 0. When vibration occurs around 0, the encoder low speed wave filter parameter P12.03/P12.14 and speed loop PI parameter P07 group shall be set.

8． During operation, the encoder Z pulse count value P12.21 shall be observed. When the value jumps higher, it shows disturb of encoder. The encoder wiring shall be checked.

📖 **Note**

When P12.08 value is 1, when rotate the motor shaft, if the P12.19 count value reduces, the P12.16 display magnetic signal status order shall be 5, 1, 3, 2, 6, 4. When the count increases, the magnetic signal order shall be reverse.

Chapter VI Function Code Details

6.1 Function Code Description

In the section:

```
PXX.XX   YYYYYYY        N1~N2  [D]
```

- Function code
- Function code name
- Function code range
- Function code default
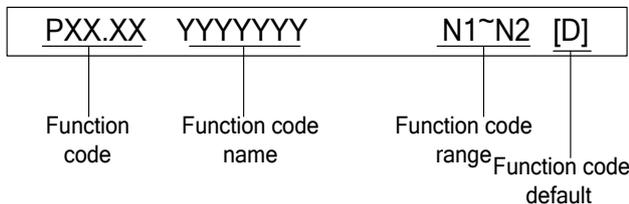
Function code number	Function code name	Function code range	Function code default value

6.1.1 System management (P00 group)

P00.00 Menu mode option	0～4【2】

0: Shortcut menu mode

The parameter related with quick operation servo drive shall be displayed. The servo drive shall be started quickly by modify parameter under menu mode.

1: Basic menu mode

Only the parameters related with basic operation shall be displayed. It doesn't include basic applicable functions of enhanced control parameter, expansion card parameter and customization features parameter.

2: Advanced menu mode

Display all the parameters

3: User menu mode

Only 32 parameters prepared in P98 group of users shall be displayed.

4: Proof menu mode

Only parameters different with factory setting value shall be displayed.

P00.01 LCD display language option	0～4【0】

0: Chinese

1: English

2～4: Reserved

The function is only effective to operation panel configured with LCD.

P00.02 user password	00000～65535【00000】

The user password setting function is used for stop non-authorized personnel from referring and modifying function parameter.

When there is no user password, the function code shall be set as 00000.

When the user password function is needed: first input four digits as user password; press DATA/ENTER key to ensure; password will take effects automatically when without key operation in 5 minutes.

Password modifying:

Press MENU/ESC key to enter password verification status. After input original four digits password to enter parameter editing status, the P00.02 (at this time P00.02＝00000) shall be selected. Input new password; enter DATA/ENTER key to ensure. New password will take effects automatically when without key operation in 5 minutes.

  □　**Note**

Please save setting user password carefully.

P00.03　Parameter protection setting	0～2【0】

The setting of function code determines protective degree of servo drive parameter which includes:

0: All the data may be allowed to modify.

1: Modify is not allowed except main setting frequency digital setting P02.04 and the function code.

2: All the data shall be not allowed to modify except the function code.

When finish modifying parameter, when protect the parameters, the function code shall be set as desired protection degree.

  □　**Note**

P00.03 function code may be displayed at all menu modes.

P00.04 parameter initialization	0～4【0】

0: Parameter modifying status

When the function code saves into parameter 0, all the parameters shall be modified.

1: Clear fault memory information

When the function code saves into parameter 1, zero clearing operation shall be implemented to fault record (P20.21～P20.35).

2: Reset factory setting value

When save the function code into parameter 2, all the function code parameters shall reset factory parameters except: user password (P00.02); servo drive status display parameters (P01 group); motor 1 parameter (P03 group); motor 2 parameter (P04 group); P20.21~P20.35, P97 group and P98 group.

3: Only reset quick start function group

When the function code saves into parameter 3, only the parameters related with quick operation servo drive shall be rested.

4: Only reset customized parameter group

When the function code saves into parameter 4, only the parameter prepared by user of P98 group shall be set.

P00.05 parameter copy	0～3【0】

0: No action

1: Parameter upload

After setting as 1 and ensure, the servo drive will upload all function codes between control panel P00.00 ～ P98.31 to EPPROM of operation panel for storage.

2: Parameter downloading

After setting as 2 and ensure, the servo drive will download all function codes between operation panel P00.00 ～ P98.31 to internal control panel for storage.

3: Parameter downloading (except parameter)

After setting as 3 and ensure, the servo drive will download all function codes between operation panel P00.00 ～ P98.31 to internal control panel for storage (P03 and P04 group motors parameters shall be not downloaded).

📖 **Note**

1．For operation panel, the parameter uploading shall be implemented first. Otherwise the operation panel memory will be empty. When finish one time parameter loading operation, operation panel parameter shall be kept in operation panel memory.

2．Before the parameters download to servo drive, servo drive will inspect integrity and version information of function code parameter in operation panel. In the following conditions, the parameter shall be not modified and the error information will be mentioned to copy: when the memory is empty; parameter is not full; parameter version is not the same as current servo drive software version (different quantities of function codes).

3．After download the parameter, parameter in operation panel memory is still existed. Multi servo drives shall be copied repeatedly.

P00.06 key function option	0000～1422H【0000】
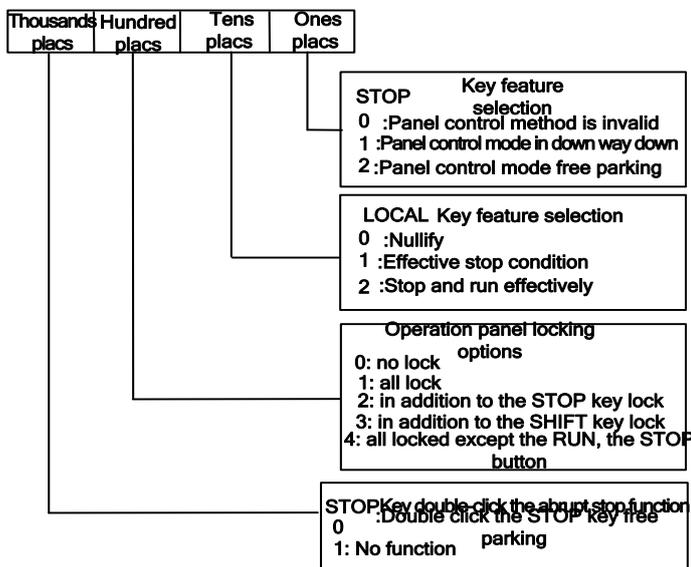
Figure 6-1: operation panel

Unit digit: STOP/RESET key function option

The item is used for setting operation panel STOP/RESET key as working range and run mode in STOP of stop key.

Unit digit	Function	Description
0	Invalid	It is effective for operation panel to run command channel

	non-panel control	
1	Stop of non-panel as stop mode	It is effective in operation panel, terminal, serial port operation command channel. Press the key, the servo drive will stop as P05.05 setting.
2	Non-panel control freewheel	When running command channel on operation panel, press the key, servo drive will stop as mode of P05.05. When the command channel is operated by terminal or serial port, press the key, the servo drive will be freewheel and report E015 fault.

📖 **Note**

STOP/RESET key will be effective in any command channel operation of fault reset key RESET.

Tens digits: LOCAL key function option

The item is used for setting working and range of LOCAL key on operational panel.

Tens digits	Function	Description
0	Invalid	LOCAL key is invalid. The key shall be not used for switch operation command channel.
1	Stop status effective	LOCAL key is only effective in stop status. The key shall be not used for switch operation command channel.
2	Stop operation effective	LOCAL key may switch running command channel under stop status and operation status.

Operation Command Channel Switch Order:

Operation panel running command channel (LOCAL lights) →terminal running command channel (LOCAL off) →serial port running command channel (LOCAL flash) →operation panel running command channel (LOCAL lights)

📖 **Note**

After switch to necessary running command channel by LOCAL key, the DATA/ENTER shall be pressed in 3 seconds for effective.

Hundred digits: operation panel locking function

The item is used for setting locking range option of operation panel keys.

Hundred digits	Function	Description
0	No locking	No locking function, any key shall be not locked.
1	Full locking	Operation panel key shall be locked fully. After the locking function takes effect, any key on operation panel will be invalid.
2	All locking except STOP/RESET key	In addition to STOP/RESET key, other keys are all locked. After the locking function takes effects, only the STOP/RESET key may be used.
3	All locking except SHIFT key	All locking except key. After the locking function takes effect, only key may be used.

4	All locking except RUN, STOP/RESET keys.	In addition to STOP, RUN keys, other keys are all locked. After the locking function takes effects, only the STOP, RUN keys may be used.

After setting the items as demands, the specified operation methods shall be implemented to make locking effective. Refer to *05.1.3Operation Mode* of Operation Panel operation method.

The locking method may refer to *05.1.3Operation Mode of Operation* Panel.

Thousand digits: double click STOP key for emergency stop function

Thousand digits	Function	Description
0	Double click STOP key for freewheel	Double click STOP key for freewheel. During operation, double click STOP key for freewheel and report E015 fault.
1	No function	Double click STOP key for freewheel. During operation, double click STOP key may stop as normal stop.

6.1.2Status Display Parameter (P01 group)

P01 group function code parameters are used for monitoring servo drive and motor status parameters. At the same time, the frequency given channel, the setting frequency, PID given, PID feedback and PID error shall be checked.

P01.00 Main setting frequency channel	0～6 【0】

Monitor the main frequency channel under ordinary operation mode. Non-ordinary operation mode will be displayed as 0.

P01.01 Main given setting frequency	－1000.0～1000.0Hz 【0.00】

Monitor the main setting frequency under ordinary operation mode. Non-ordinary operation mode will be displayed as 0.

P01.02 Auxiliary given set frequency	－1000.0～1000.0Hz 【0.00】

Monitor auxiliary setting frequency under ordinary operation mode. Non-ordinary operation mode will be displayed as 0.

P01.03 Setting frequency	－1000.0～1000.0Hz 【0.00】

Monitor the final frequency through primary and secondary synthesis. The positive value indicates forward; the negative indicates reverse.

P01.04 Acceleration and deceleration frequency instruction	－1000.0～1000.0Hz 【0.00】

Monitor servo drive output frequency through acceleration and deceleration process including frequency direction.

P01.05 Output frequency	－1000.0～1000.0Hz 【0.00】

Monitor servo drive output frequency including frequency direction.

P01.06 output voltage	0～480V 【0】

Monitor servo drive output voltage.

P01.07 output current	0.0～3Ie 【0】

Monitor servo drive output current.

P01.08 torque current	－300.0%～300.0% 【0.0%】

Monitor servo drive percentage of torque current to motor rated current.

P01.09 Flux current	0.0%～100.0% 【0.0】

Monitor percentage of flux current to motor rated current.

P01.10 output torque	－300.0%～300.0% 【0.0】

Monitor percentage of servo drive output torque to motor rated torque.

P01.11 motor power	0.0%～200.0% 【0.0】

Monitor percentage of servo drive output power to power rated power.

P01.12 Motor estimate frequency	－600.00～600.00Hz 【0.00】

Motor rotor frequency estimated under open-loop vector condition

P01.13 motor measured frequency	－600.00～600.00Hz 【0.00】

Actual motor rotor frequency of closed-loop vector condition by encoder

P01.14 Energy consumption in high position	0～65535*10000kwh 【0】
P01.15 Energy consumption in low position	0～9999kwh 【0】

Monitor energy consumption output of servo drive.

P01.16 bus voltage	0～800V 【0】

Monitor servo drive bus voltage.

P01.17 servo drive operation status	0000～FFFFH 【0000】
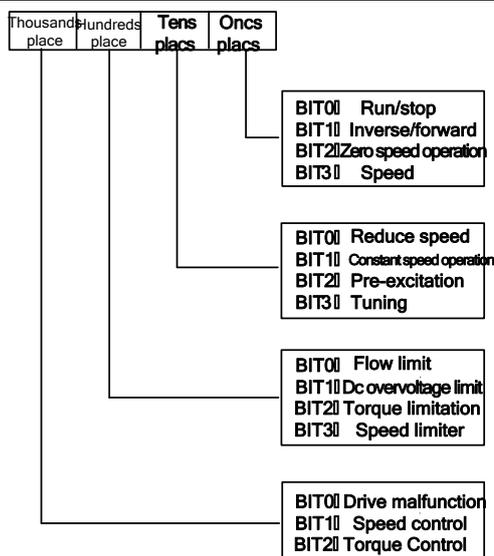
Figure 6-2: servo drive run

LED unit digit BIT0: operation/stop;

When servo drive is in stop status, the BIT0 position shall be 0. Otherwise it will be 1.

LED unit digits BIT1: reverse/forward;

When servo drive forwards, BIT1 position is 0. Otherwise it will be 1.

When meeting condition, other positions may be set as 1.

P01.18 switch input status	000~3FFH【000】
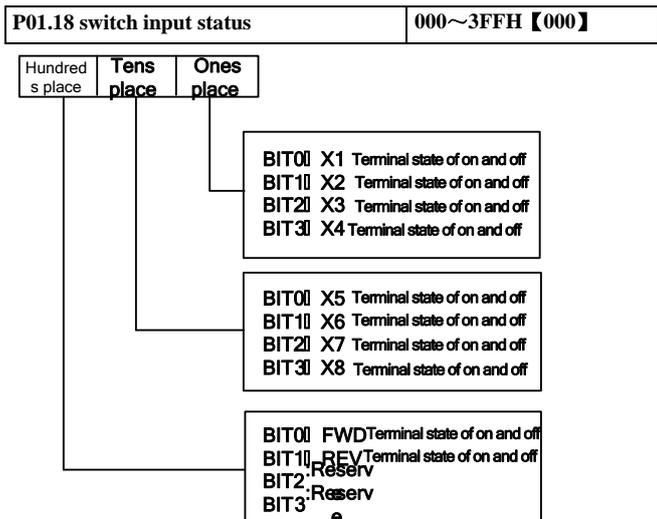
Figure 6-3: Switch input status

The figure shows on-off status of 10 terminals, including X1~X8, FWD, REV. "0" represent the terminal in off status; 1 represents the terminal in close status.

P01.19 Switch output status	0~FH【0】
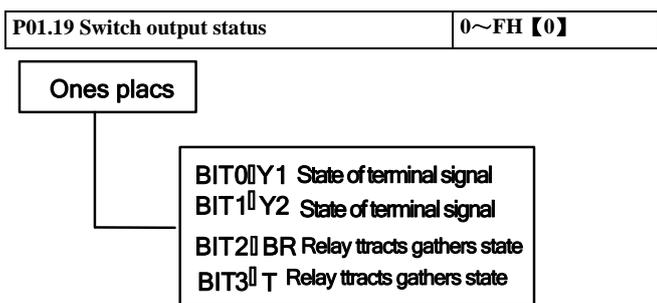
Figure 6-4: Switch output status

Function code P01.19 may display output status of switch terminal Y1, Y2 and relay BR, T. When output signal is implemented, the related position of P01.19 will be set as 1.

For example, when signal output only exists in Y1 terminal, the BIT0 position will be set as 1, the P01.19 display value will be 1. When signal output only exists in relay T, the P01.19 display value will be 8.

P01.20 AI1 input	−10.00~10.00V【0.00】
P01.21 AI2 input	−10.00~10.00V【0.00】
P01.22 AI3 input	−10.00~10.00V【0.00】

P01.20~P01.22 shows analog input signal before adjustment.

P01.23 adjusted AI1 input	−10.00~10.00V【0.00】
P01.24 adjusted AI2 input	−10.00~10.00V【0.00】
P01.25 adjusted AI3 input	−10.00~10.00V【0.00】

P01.23~P01.25 shows the adjusted analog input signal through increment, deviation.

    Note

When analog input is current input, the adjusted AI input range shall be 4~20mA. The corresponding display range shall be 2~10.

P01.26 AO1 output	0.0%~100.0%【0.0】
P01.27 AO2 output	0.0%~100.0%【0.0】

P01.26 and P01.27 show percentage of analog output value to full scale capacity.

For example: when AO1function setting is: output frequency; the maximum frequency is 100Hz; actual operation frequency is 50Hz; then P01.26 shall display 50％.

P01.28	process closed-loop given	−100.0%~100.0%【0.0】
P01.29	process closed-loop feedback	−100.0%~100.0%【0.0】
P01.30	process closed-loop error	−100.0%~100.0%【0.0】
P01.31	process closed-loop output	−100.0%~100.0%【0.0】

P01.28 ~ P01.31 show percentage of P13 group process closed-loop given value, feedback value, error value, output value to full scale capacity.

P01.32 rediator 1 temperature	0.0~150.0℃【0.0】
P01.33 rediator 2 temperature	0.0~150.0℃【0.0】

Radiator 1 temperature shows temperature of inverter module. Different types of inverter modules have different over-temperature protection values.

Radiator 2 temperature shows temperature of rectifier module. Rectifier bridge temperature below 37kW type shall be not inspected.

Temperature display range: 0~150℃; accuracy: 5％

P01.34~P01.35	Reserved

Reserved function

P01.36 charge cumulative time	0~65535 hours【0】
P01.37 operation cumulative time	0~65535 hours【0】
P01.38 fan operation cumulative time	0~65535hours【0】

P01.36 ~ P01.38 shows respectively charge cumulative time, operation cumulative time and fan operation cumulative time of servo drive from factory.

P01.39	Reserved

Reserved function.

P01.40 ASR controller output	−300.0%~300.0%【0.0】

Percentage to motor rated torque, it shows ASR controller output.

P01.41 torque given	−300.0%~300.0%【0.0】

Percentage to motor rated torque, it shows torque given.

P01.42	Reserved

Reserved function.

P01.43 given high position	0000～FFFFH【0000】
P01.44 given low position	0000～FFFFH【0000】
P01.45 feedback high position	0000～FFFFH【0000】
P01.46 feedback low position	0000～FFFFH【0000】

Monitor given position and feedback position under servo control mode.

P01.47 position deviation pulse	－9999～9999【0】

Monitor position deviation pulse under servo control mode.

P01.48~P01.57	Reserved

Reserved function.

6.1.3 Basic Operation Parameter　(P02 group)

P02.00 Motor and mode option	0000～1313H【0002】
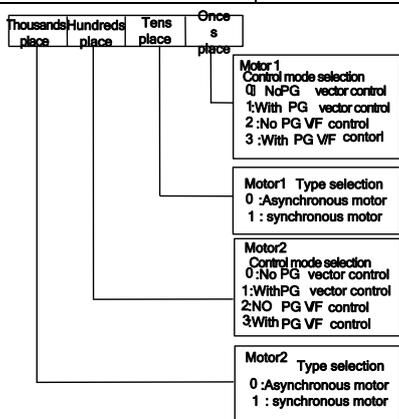
Figure 6-5:　motor and control mode option

Motor control mode

0: No PG vector (open-loop vector) control

The no speed sensor vector control operation mode may be used in field of high-performance general-purpose variable speed drive.

1: PG vector control

The speed sensor vector control operation mode may be used for high control performance requirements fields such as precision speed control, torque control, simple servo control.

2: No PG V/F control mode

It may control voltage/frequency percentage constantly. The speed may be changed. It may be used for field of one servo drive with multi motors. It may improve current governing system.

3: PG V/F control mode

It may be used for simple speed feedback control, especially for the fields of PG not on motor shaft.

📖　**Note**

PG means optical tachometer pulse encoder.

1．When select vector control mode, the motor automatic tuning mode shall be implemented to obtain correct motor parameters before the first operation. When the motor automatic tuning process finishes, the tuning motor parameter will be storage inside of control panel for control operation later.

2．The rotational speed adjuster parameter shall be adjusted to ensure good static, dynamic control performance. For setting and adjusting of rotational speed adjuster, see related description of P07 parameter.

3．When select the vector control mode, one servo drive shall drive only one motor. The difference of capacity between servo drive and motor shall be not larger. Power degree of motor is smaller two-degree (one degree larger) than servo drive. Otherwise the control performance will be lowered; or the control system could not operate in normal.

4．When select PG vector control or PG V/F control, the P12 group PG encoder parameters shall be set correctly.

5．When select V/F control, the V/F control specific function code (P06 parameter group) shall be set correctly.

P02.01 motor option	0～1【0】

0:　motor 1

1:　motor 2

Parameters of motor 1 and motor 2 shall response to function code P03 group and P04 group.

P02.02　operation command channel option	0～3【0】

HSD2000 equips with three types of command channels

0: operation panel operation command channel

Start and stop by RUN, STOP and JOG keys in operation panel.

1: Terminal operation command channel

Start and stop by external controlling terminal FWD, REV, JOG forward and JOG reverse.

2: Serial port operation command channel

Start and stop by serial port.

3: Reserved

📖　**Note**

1．Even in operation process, the following methods may change operation command channel: modify the function code parameter; using external terminal or LOCAL key. It shall be used carefully.

2．When switch the operation command channel to terminal control, ensure REV/FWD terminal invalid before command channel switching.

HSD2000 servo drive setting frequency may be integrated by main setting frequency and auxiliary setting frequency. The P02.08～P02.10, P14.07 are used for define auxiliary frequency. Figure 6-6 shows setting frequency forming process by adjusting main setting frequency and auxiliary setting frequency in percentage.
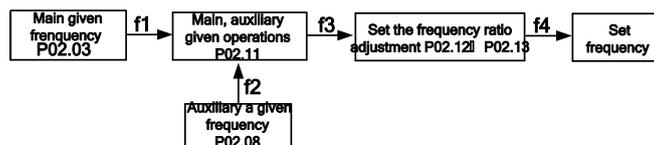
Figure 6-6: setting frequency schematic diagram

P02.03 main setting frequency source option	0～5【0】

0: digit given 1, operation panel▼,▲adjustment

When servo drive powers up, the function code P02.04 value shall be as current setting frequency.

When servo drive is in operation or stop status, the ▼and▲ key of operation panel shall be used to change current setting frequency of servo drive.

1: Digit given 2, terminal UP/DOWN adjustment

Under the mode, function code P02.04 value in servo drive powers up shall be set as current setting frequency of servo drive. By setting external control terminal function, the current setting frequency shall be implemented in operation or stop status of servo drive.

When select the sting mode, the following parameters setting shall be implemented:

1) In parameter P10.00～P10.07, functions of both external control terminals shall be 13, 14.

2) According to function code P10.09, P10.10, the value change rate of UP/DN terminal in frequency setting.

| Select to define both terminals in X1～X8 | 13 | Frequency increment instruction UP | Short as UP terminal below |
| | 14 | Frequency decrement instruction DOWN | Short as DOWN terminal below |

When select digit given-2 mode, the wiring schematic diagram is shown below:
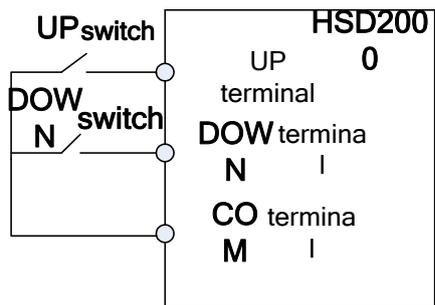
Figure 6-7: Digital setting 2 connection schematic diagram

Under terminal closes, relationship of two external switch statue setting and servo drive current setting frequency is as follows:

External switch status and servo drive current setting frequency

UP terminal switch status	Break		Close	
DOWN terminal switch status	Break	Close	Break	Close
servo drive current setting frequency	Keep	Decrease	Increase	Keep

2: Digit given 3, serial port communication given

The setting frequency shall be changed by serial port frequency setting order.

3: AI analog given

Analog given has three separate physical channels: AI1, AI2 and AI3.

AI is analog signal input channel. When AI inputs as voltage signal, the voltage input range shall be: －10V～0V～＋10V. For adjusted analog input signal (－10V～0V～＋10V), the following regulations:

$0V～＋10V$ segments, forward, response to frequency defined in P11 group function code.

$0V～-10V$ segments, forward, response to frequency defined in P11 group function code.

4: Terminal pulse (PULSE) given

Frequency setting shall be defined by terminal pulse frequency. The input shall be X8. Specified refer to P10 group definition.

5: Reserved

 📖　**Note**

Frequency main given mode of 3 and 4 frequency calculation shall be determined by function code P11.25～P11.41 of relationship curve. When the main frequency given is analog or pulse given, positive and negative polarity of output main setting frequency shall be determined by analog and pulse value. The value is not related with P02.20 function code. In reverse, setting frequency positive and negative polarity of other frequency given modes shall be determined by P02.20.

| P02.04 main setting frequency digital setting | Lower limit frequency～upper limit frequency【50.00Hz】 |

When main setting frequency cannel is defined as digit given (P02.03＝0, 1, 2), the function parameter shall be initial setting frequency of servo drive main setting frequency.

P02.05 maximum output frequency	Max (50.00, P02.06) ～1000.0Hz【50.00Hz】
P02.06 upper limit frequency	Lower limit frequency～ maximum outputfrequency【50.00Hz】
P02.07 lower limit frequency	0～ upper limit frequency【0.00Hz】

Maximum output frequency is the highest frequency allowed by servo drive. As F_{ax} of 0:

Upper limit frequency is the highest frequency allowed by user setting. As F_H of 0:

Lower limit frequency is the lowest frequency allowed by user setting. As F_L in figure 6-8:

F_b in 0 represents the basic operation frequency. It is the response output frequency minimum value of servo drive in V/F output mode.
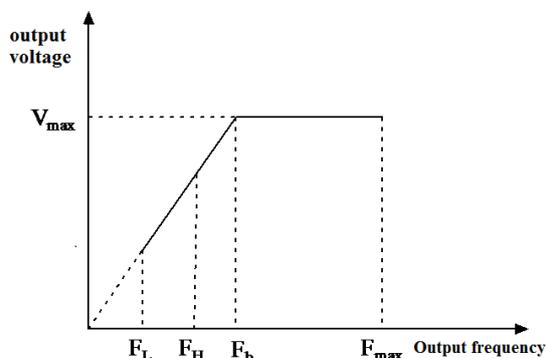
Figure 6-8: Limit frequency parameter　schematic diagram

    Note

1．Maximum output frequency, upper limit frequency and lower limit frequency shall be set carefully as actual controlled motor nameplate parameter and work station demands.

2．Upper limit frequency, lower limit frequency limit range is invalid to jog JOG operation and motor automatic tuning operation.

3．In addition upper limit frequency, lower limit frequency limit, output frequency of servo drive operation is limited by start frequency, stop DC braking start frequency, jump frequency.

4．Relationships of maximum output frequency, upper limit frequency, and lower limit frequency are shown in figure 6-8. The order shall be noted in setting.

5．Upper and lower limit frequency is used to limit frequency output to motor frequency value. When the setting frequency is higher than upper limit frequency, upper limit frequency shall be operated. When setting frequency is lower than lower limit frequency, lower limit frequency shall be operated. When setting frequency is lower than start frequency, the zero frequency shall be operated.

6．Under vector control mode, the maximum output frequency shall be 400Hz.

P02.08 auxiliary setting frequency source option	0～7【0】

0: No auxiliary given

Setting frequency is only made up of main setting frequency. Default value of auxiliary setting frequency shall be zero.

1: Digit given 1，operation panel▼and▲keys adjustment

Auxiliary frequency initial setting value shall be P02.10. It shall be adjusted by operation panel▼and▲keys.

2: Digit given 2，terminal UP/DOWN adjustment

Auxiliary frequency initial value shall be set as P02.10. It shall be adjusted by terminal UP/DOWN.

Terminal UP/DOWN setting may refer to P10 group function code.

3: Digit given 3, serial port communication given

Auxiliary frequency is given by serial port. The frequency setting initial value shall be P02.10. The auxiliary setting frequency shall be changed by setting command.

4: AI analog given

Auxiliary frequency setting is given by AI terminal (AI1, AI2 and AI3).

5: Terminal pulse (PULSE) given

Auxiliary frequency setting is determined by terminal pulse frequency with only X8 input. Specific refer to P10 group of function code definitions.

6: Reserved

7、Process closed-loop output

The process closed-loop output shall be given as auxiliary.

    Note

1．When auxiliary frequency is given by modes of 4 and 5, positive and negative polarity of output auxiliary frequency shall be determined by analog or pulse value. It doesn't matter with P02.20 function code.

2．Main and auxiliary frequency given channel shall be mute (except the AI channel 0).

P02.09 auxiliary given coefficient	0.00～9.99【1.00】

It is only effective to P02.08＝4, 5, 7. The analog and pulse given value shall be calculated as auxiliary frequency of defined curve. Then the P02.09 shall be used for gain calculation.

P02.10 auxiliary given digital setting	0.00～1000.0【0.00Hz】

P02.10 is only effective to P02.08＝1～3. It is also initial value of auxiliary setting frequency in the three types.

P02.11 main and auxiliary given calculation	0～6【0】

0: "＋"

Setting frequency shall be sum of main setting frequency and auxiliary setting frequency.

When the positive and negative polarity integrated frequency is reverse to main setting frequency polarity, the setting frequency shall be zero.

1: "－"

Setting frequency shall be difference of main setting frequency and auxiliary setting frequency.

When the positive and negative polarity integrated frequency is reverse to main setting frequency polarity, the setting frequency shall be zero.

2: "*"

Setting frequency shall be product of main frequency and auxiliary frequency.

When the positive and negative polarity integrated frequency is reverse to main setting frequency polarity, the setting frequency shall be zero.

3: MAX (main setting frequency, auxiliary setting frequency)

Setting frequency shall be maximum absolute value between main setting frequency and auxiliary setting frequency.

When positive and negative polarity of auxiliary setting frequency is reverse to main setting frequency, the setting frequency shall be main setting frequency.

4: MIN (main setting frequency, auxiliary setting frequency)

Setting frequency shall be minimum absolute value between main setting frequency and auxiliary setting frequency.

When the positive and negative polarity integrated frequency is reverse to main setting frequency polarity, the setting frequency shall be zero.

5: Sqrt (main setting frequency) ＋ Sqrt (auxiliary setting frequency)

The setting frequency shall be sum of square root after absolute value between main setting frequency and auxiliary setting.

When auxiliary setting frequency and main setting frequency polarity is reverse, the auxiliary frequency shall be cleared zero. Setting frequency shall be square root of main setting frequency.

6: Sqrt (main setting frequency ＋ auxiliary setting frequency)

The setting frequency shall be sum of square root after absolute value between main setting frequency and auxiliary setting.

When main setting frequency and auxiliary setting frequency sum polarity are reverse to main setting frequency polarity, the setting frequency shall be zero.

  Note

When the P02.08 option 0 auxiliary given is invalid, the main and auxiliary calculation principle P02.11 shall be invalid. The setting frequency is determined by main setting frequency.

P02.12 setting frequency percentage adjustment option	0～2【0】
P02.13　setting frequency percentage adjustment coefficient	0.0%～200.0%【100.0%】

The function determines the adjustment mode of setting frequency (integrated frequency of main setting frequency and auxiliary setting frequency).

0: No action

The main and auxiliary given integrated setting frequency shall be not adjusted. It is P4＝P3.

1: Relative maximum output frequency P02.05 adjustment

setting frequency P4＝P3+P02.05×(P02.13-100％)

2: Relative current frequency adjustment

setting frequency P4＝P3+P3×(P02.13-100％) ＝P3×P02.13

P02.14 acceleration time 1	0.0～3600.0s (min)　【6.0s】
P02.15 deceleration time 1	0.0～3600.0s (min)　【6.0s】

P02.16 Jog frequency	0.01～50.00Hz【5.00Hz】

Set frequency of jog operation.

  Note

Under control panel condition, the jog operation may be achieved by JOG on panel. Press the JOG key to operate. Loss the JOG key, it will implement stop operation of stop mode. Under terminal control condition, the terminal function shall be set for jog operation by jog forward terminal or jog reverse terminal. In addition, the jog operation may be controlled by communication mode.

P02.17 Jog acceleration time	0.1～60.0s【6.0】
P02.18 Jog deceleration time	0.1～60.0s【6.0】
P02.19 Jog interval	0.0～100.0s【0.0】

As shown in Figure 6-9: t_1, t_3 are actual operation jog acceleration and deceleration time; t_2 shall be jog time; t_4 shall be jog interval time (P02.19); P1 shall be jog operation frequency (P02.16).

Actual operation jog acceleration time t_1 shall be determined by the following formula. Similarly, actual operation jog deceleration time t_3 shall be also determined by the formula.

$$t1 = \frac{P02.19 * P02.16}{P02.05}$$
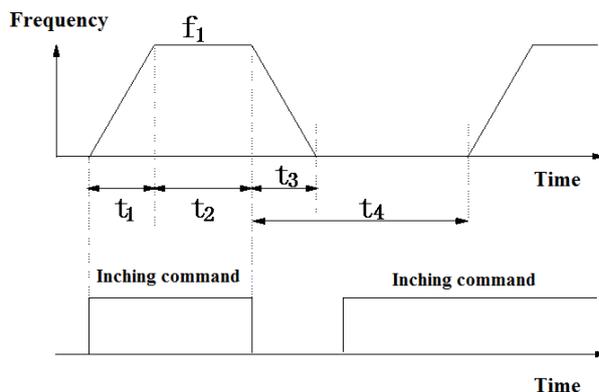
Figure 6-9: jog parameter

Jog interval time (P02.19) shall be: from previous jog command canceling to the next jog command taking effect.

During interval time, the jog command will not make servo drive operate. The servo drive shall be operated as zero frequency of no output. When the jog command exists, the jog command will be started to implement after interval. Jog command after jog interval shall be implemented immediately.

  Note

1．Jog operation starting and stop shall follow start mode 0 and stop mode 0. Time unit of jog acceleration and deceleration shall be second.

2．Operation panel, control terminal and serial port shall implement jog control.

P02.20 operation direction setting	0、1【0】

The function is applicable to operation panel running command channel and serial port running command channel. It is not effective to terminal operation command channel.

0: Forward

1: Reverse

6.1.4 Motor 1 parameter (P03 group)

P03.00 asynchronous motor rated power	0.4～999.9kW【model determination】
P03.01 asynchronous motor rated frequency	0～P97.04
P03.02 asynchronous motor rated current	0.1～999.9A【model determination】
P03.03 asynchronous motor rated frequency	1.00～100.00Hz【model determination】
P03.04 asynchronous motor rated rotational speed	0～60000RPM【1440RPM】
P03.05　asynchronous motor power factor	0.001～1.000【model determination】

Set controlled asynchronous motor parameter.

For control performance, the P03.00～P03.04 value shall be set as asynchronous motor nameplate parameters.

P03.05 is asynchronous motor power factor. The value will be updated automatically after normal operation tuning. User may select to modify P03.05 automatically. The following two conditions may be modified manually: after all tuning finishes; no tuning.

   📖   **Note**

Asynchronous motor and servo drive power class shall meet 等 the configuration. In general, two-class smaller or one class larger of servo drive is allowed. Control performance shall not be ensured when exceeding the range.

P03.06 asynchronous motor stator resistance ％R1	**0.00～50.00％【model determination】**
P03.07 asynchronous motor leakage inductance ％X	**0.00～50.00％【model determination】**
P03.08 asynchronous motor rotor resistance ％R2	**0.00～50.00％【model determination】**
P03.09 asynchronous motor mutual inductance ％Xm	**0.0～2000.0％【model determination】**
P03.10 asynchronous motor load current	**0.1～999.9A【model determination】**

Specific meanings of motor parameter above may refer to figure 6-10.
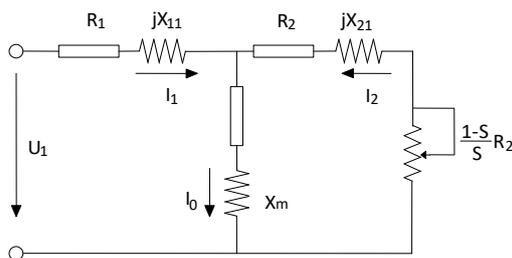
Figure 6-10: Asynchronous Motor Static Equivalent Circuit Figure

In the 0, the R_1, X_{11}, R_2, X_{21}, X_m, I_o represents respectively: stator resistance, the stator leakage inductance, rotor resistance, rotor leakage inductance, mutual inductance, no-load current. The function code P03.07 shall be sum of stator and rotor leakage inductance.

Above P03.06～P03.09 are percentages of asynchronous motor parameters. The formula shall be:

1) Resistor (stator resistance or rotor resistance) formula:

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

R: rotor resistance actual value of stator resistance converted to the stator side;

V: rated frequency;

I: asynchronous motor rated current

2) Inductive reactance (leakage inductance or mutual inductance) formula:

$$\% X = \frac{X}{V /(\sqrt{3} \times I)} \times 100 \quad (2)$$

X: sum (inverted to the stator side) or mutual inductance of basic frequency stator and rotor

V: rated frequency;

I: asynchronous motor rated current

When the asynchronous motor parameters have been known, the calculation value shall be written as formula above P03.06～P03.09. P03.10 is asynchronous motor empty load current. User may input empty load value directly.

When implement self tuning of motor parameter, the P03.06～P03.10 setting values will be changed after the tuning finishes.

After modify the asynchronous motor power P03.00, servo drive will set P03.02 ～ P03.10 parameter as related power asynchronous motor default parameter (P03.01 is asynchronous motor rated frequency value. It is not in asynchronous motor default parameter. It shall be set by users as nameplate).

P03.11 asynchronous motor parameter self tuning	**0～3 【0】**

0: No action

1: Action (asynchronous motor static)

Before self tuning, the nameplate parameters (P03.00～P03.04) of controlled asynchronous motor shall be entered.

When in static tuning, the motor is in state of static. The asynchronous motor tutor resistance (％ R_1), related rated frequency leakage inductance (％X), rotor resistance (％R_2) shall be measured automatically. The measured parameters shall be written into P03.06, P03.07 and P03.08 automatically.

2: Action (asynchronous motor rotates)

Before self tuning, the nameplate parameters (P03.00～P03.04) of controlled asynchronous motor shall be entered.

When in static tuning, the motor is in state of static. The asynchronous motor tutor resistance (％ R_1), related rated frequency leakage inductance (％X), rotor resistance (％R_2) shall be measured automatically. Then the asynchronous motor is in rotation status, the motor mutual inductance (％X_m) and empty load current (I_o) shall be measured automatically. The measured parameters will be written into P03.06, P03.07, P03.08, P03.09 and P03.10 automatically. The P03.05 will be updated after rotate tuning.

After self tuning, the P03.11 setting value shall be set as 0 automatically.

Self tuning procedures:

1) It is suggested for users to set P06.07 (motor 1torque lifting) as 0.

2) Set function code parameter "P03.00 rated power", "P03.01 rated frequency", "P03.02 rated current", "P03.03 rated frequency" and "P03.04 rated rotational speed".

3) Set P02.06 (upper limit frequency). P02.06 setting value shall be not lower than rated frequency。

4) When select P03.11 as 2, remove the motor shaft from loading and ensure its safety. The motor shall not rotate tuning with loading.

5) Set P03.11 as 1 or 2. First press DATA/ENTER key, then press the RUN key for self tuning.

6) When the operation indicator of operation panel is off, the self tuning has been finished.

3: Reserved

  📖 **Note**

1．When set P03.11 as 2, the overvoltage or over current fault may be processed by increasing acceleration and deceleration time (P02.14 and P02.15).

2．When select P03.11 as 2, remove the motor shaft from loading and ensure its safety. The motor shall not rotate tuning with loading.

3．Before start self tuning, the motor shall be ensured shutdown. Otherwise the self tuning shall not operate normally.

4．In conditions of not convenient to rotate or lower motor control performance requirements (such as motor could be not removed from loading), the static tuning or no tuning may be implemented. When the tuning doesn't implement, the motor nameplate parameter shall be entered.

5．When the self tuning couldn't be implemented, the motor parameter has been known by user. The user shall enter correct motor nameplate parameter (P03.00～P03.04). Then the motor parameter calculation value shall be entered as resistor and inductive reactance formula above (P03.06～P03.10). The parameters shall be set correctly.

6．When the self tuning is not success, report E024 fault;

7．When the temperature is higher in motor operation, the tuning shall be implemented as hot status. The stator resistance and rotor resistance parameter shall be increased to optimize the control performance.

P03.12 asynchronous motor overload protection coefficient setting	20.0%～110.0%【100.0%】

For overload protection of different models loading motor, the maximum value of allowed output current in servo drive shall be adjusted. As shown in figure 6-11:
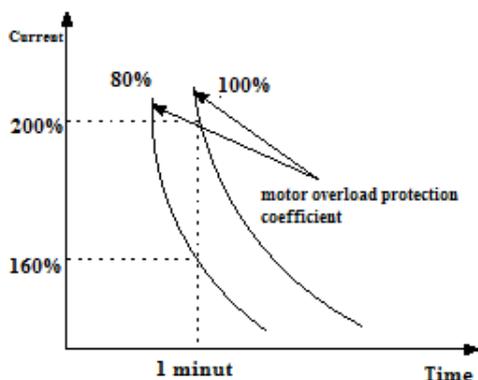
Figure 6-11: motor overload protection coefficient setting

The value may be set as requirements of users. In the similar condition, the P03.12 value shall be set smaller in motor overload faster protection. In reverse, it shall be set larger.

  📖 **Note**

When rated current of loading motor and servo drive is not the same, the motor overload protection may be achieved by setting P03.12 function code parameter value.

P03.13 synchronous motors rated power	0.4～999.9kW【model determination】
P03.14 synchronous motors rated frequency	0～P97.04
P03.15 synchronous motors rated current	0.1～999.9A【model determination】
P03.16 synchronous motors rated frequency	1.00～100.00Hz【model determination】
P03.17 synchronous motors pole pairs	1～40【2】
P03.18 synchronous motors rated rotational speed	0～60000RPM【1500RPM】
P03.19 synchronous motors stator resistance	0.00～50.00%【model determination】
P03.20 synchronous motors direct axis inductance	0.0～999.9mH【model determination】
P03.21 synchronous motors cross-axis inductance	0.0～999.9mH【model determination】
P03.22 synchronous motors back-EMF constant	0～1000【150】

Setting controlled synchronous motors parameter.

For controlling performance, the P03.13～P03.22 value shall be set as nameplate parameter of synchronous motors.

  📖 **Note**

Synchronous motors and servo drive power degree shall be matched. In general, it shall be two-class lower or one class higher than servo drive. Exceeding the range shall not ensure the control performance.

P03.23 synchronous motors position identification	0～1【0】

The function default value is 0. Press RUN key when 0 changes 1. Synchronous motors will mark the position. After identification, the P03.23 may recover to 0 automatically.

P03.24 synchronous motors identify current	0～30【10】

The function code shows synchronous motors identification current result. The rated current range shall be 0～30％.

P03.25 synchronous motors initial angle	0～FFFFH【0】

The function code shows synchronous motors initial angle for control calculation.

P03.26 Z pulse initial angle	0～FFFFH【0】

The function code shows Z pulse initial angle.

P03.27 synchronous motors overload protection coefficient setting	20.0%～110.0%【100.0%】

For overload protection of different models loading motor, the maximum value of allowed output current in servo drive shall be adjusted. As shown in figure 6-11:

The value may be set as requirements of users. In the similar condition, the P03.27 value shall be set smaller in motor overload faster protection. In reverse, it shall be set larger.

6.1.5 Motor 2 parameter　(P04 group)

P04.00 asynchronous motor　rated power	0.4～999.9kW【model determination】
P04.01 asynchronous motor rated frequency	0～servo drive rated frequency (P97.04)
P04.02 asynchronous motor rated current	0.1～999.9A【model determination】
P04.03 asynchronous motor rated frequency	1.00～100.00Hz【model determination】
P04.04 asynchronous motor rated rotational speed	0～60000RPM【1440RPM】
P04.05 asynchronous motor power factor	0.001～1.000【model determination】

Set the controlled asynchronous motor parameter.

For controlling performance, the P04.00～P04.04 value shall be set as nameplate parameter of synchronous motors.

P04.05 is asynchronous motor power factor. The value will be updated automatically after normal operation tuning. User may select to modify P04.05 automatically. The following two conditions may be modified manually: after all tuning finishes; no tuning.

  📖　**Note**

Synchronous motors and servo drive power degree shall be matched. In general, it shall be two-class lower or one class higher than servo drive. Exceeding the range shall not ensure the control performance.

P04.06 asynchronous　motor stator resistance ％R1	0.00～50.00％【model determination】
P04.07 asynchronous　motor leakage inductance ％X	0.00～50.00％【model determination】
P04.08 asynchronous　motor rotor resistance ％R2	0.00～50.00％【model determination】
P04.09 asynchronous　motor mutual inductance ％Xm	0.0～2000.0％【model determination】
P04.10 asynchronous motor empty load current	0.1～999.9A【model determination】

Specific meaning of above motor parameter may refer to figure 6-11.

Function code P04.07 is sum of stator, stator leakage inductance.

Above P04.06～P04.09 are percentage of asynchronous motor parameter. The calculation formula is shown in formula (1) and (2).

When the asynchronous motor parameter has been given, the P04.06～P04.09 shall be written into by formula above. The P04.10 is asynchronous motor empty load current. The user may enter empty load current value directly.

When implement the motor parameter self tuning, the P04.06～P04.10 setting values will be updated after tuning.

After changing asynchronous motor power P04.00, servo drive will set P04.02～P04.10 parameter as related power asynchronous motor default parameter (P04.01 is asynchronous motor rated

frequency value. It is not in synchronous motor default parameter range. It shall be set as nameplate by user.).

P04.11 asynchronous motor parameter self tuning	0～3【0】

0: No action

1: action (asynchronous motor static)

Before implement the self tuning, the nameplate parameter of controllers asynchronous motor shall be entered (P04.00 ～ P04.04).

When in static tuning, the motor is in state of static. The asynchronous motor tutor resistance (％R_1), related rated frequency leakage inductance (％X), rotor resistance (％R_2) shall be measured automatically. The measured parameters shall be written into P04.06, P04.07 and P04.08 automatically.

2: Action (asynchronous motor rotates)

Before self tuning, the nameplate parameters (P04.00～P04.04) of controlled asynchronous motor shall be entered.

When in static tuning, the motor is in state of static. The asynchronous motor tutor resistance (％R_1), related rated frequency leakage inductance (％X), rotor resistance (％R_2) shall be measured automatically. Then the asynchronous motor is in rotation status, the motor mutual inductance (％X_m) and empty load current (I_o) shall be measured automatically. The measured parameters will be written into P04.06, P04.07, P04.08, P04.09 and P04.10 automatically. The P04.05 will be updated after rotate tuning.

After self tuning, the P04.11 setting value shall be set as 0 automatically.

3: Reserved

 Self tuning procedure:

1) Set the P06.19 torque as 00.0 (if user could not enter P06 group, the function code parameter value of P00.06 shall be modified to0200. Press the DATA/ENTER key, then implement function code operation. The P06 function code group may be entered.)

2) Set function code parameter "P04.00 rated power", "P04.01rated frequency", "P04.02rated current" and "P04.03 rated frequency".

3) Set P02.06 (upper limit frequency)，P02.06 setting value shall be not lower than rated frequency.

4) When select P04.11 as 2, set acceleration time (P02.14) and deceleration time (P02.15). Remove the motor shaft from loading and ensure its safety.

5) When set P04.11 as 1 or 2, press the DATA/ENTER. The self tuning will be started when press RUN key. 　。

6) When indicator on operation panel is off, the self tuning is finished.

  📖　**Note**

1．When select P04.11 as 2, when overvoltage or over current fault happens in self tuning, the acceleration and deceleration shall be increased.

2．When set the P04.11 as 2 in rotate tuning. The motor shall remove the loading. The motor shall not rotate tuning with loading.

3．Before start self tuning, the motor shall be ensured shutdown. Otherwise the self tuning shall not operate normally.

4．N conditions of not convenient to rotate or lower motor control performance requirements (such as motor could be not removed from loading), the static tuning or no tuning may be implemented. When the tuning does not implement, the motor nameplate parameter shall be entered (P04.00 ～ P04.04).

5．When the self tuning couldn't be implemented, the motor parameter has been known by user. The user shall enter correct motor nameplate parameter (P04.00～P04.04). Then the motor parameter calculation value shall be entered as resistor and inductive reactance formula above (P04.06～ P04.10). The parameters shall be set correctly.

6．When the self tuning is not success, report E024 fault;

7． When the temperature is higher in motor operation, the tuning shall be implemented as hot status. The stator resistance and rotor resistance parameter shall be increased to optimize the control performance.

P04.12 asynchronous motor overload protection coefficient setting	20.0%～110.0%【100.0%】

For effective overload protection to loading motors in different types, the servo allowed output current maximum value shall be adjusted. As shown in figure 6-11.

The value may be set as requirements of users. In the similar condition, the P04.12 value shall be set smaller in motor overload faster protection. In reverse, it shall be set larger.

  📖 **Note**

When rated current of loading motor and servo drive is not the same, the motor overload protection may be achieved by setting P04.12 function code parameter value.

P04.13 synchronous motors rated power	0.4～999.9kW【model determination】
P04.14 synchronous motors rated frequency	0～P97.04
P04.15 synchronous motors rated current	0.1～999.9A【model determination】
P04.16 synchronous motors rated frequency	1.00～100.00Hz【model determination】
P04.17 synchronous motors pole pairs	1～40【2】
P04.18 synchronous motors rated rotational speed	0～60000RPM【1500RPM】
P04.19 synchronous motors stator resistance	0.00～50.00%【model determination】
P04.20 synchronous motors direct axis inductance	0.0～999.9mH【model determination】
P04.21 synchronous motors cross-axis inductance	0.0～999.9mH【model determination】

P04.22 synchronous motors back-EMF constant	0～1000【150】

Set controlled synchronous motors parameter.

For control performance, the P04.13～P04.22 values shall be set as nameplate parameter of synchronous motors.

  📖 **Note**

Synchronous motors and servo drive power degree shall be matched. In general, it shall be two-class lower or one class higher than servo drive. Exceeding the range shall not ensure the control performance.

P04.23 synchronous motors position identification	0～1【0】

The function default value is 0. Press RUN key when 0 changes 1. Synchronous motors will mark the position. After identification, the P04.23 may recover to 0 automatically.

P04.24 synchronous motors identification current	0～30【10】

The function code shows synchronous motors identification current result. The rated current range shall be 0～30％.

P04.25 synchronous motors initial angle	0～FFFFH【0】

The function code shows synchronous motors initial angle for control calculation.

P04.26 Z pulse initial angle	0～FFFFH【0】

The function code shows Z pulse initial angle.

P04.27 synchronous motors overload protection coefficient setting	20.0%～110.0%【100.0%】

For overload protection of different models loading motor, the maximum value of allowed output current in servo drive shall be adjusted. As shown in figure 6-11:

The value may be set as requirements of users. In the similar condition, the P04.27 value shall be set smaller in motor overload faster protection. In reverse, it shall be set larger.

P04.28 motor 2 PI parameter option	0～1【0】

The function code shows parameter option function code of PI adjuster in motor 2.

0: it is the same option with PI adjuster of motor 1.

1: it takes P04.29～P04.32 function code value.

P04.29 motor 2 ASR-P	0.1～200.0【20.0】
P04.30 motor 2 ASR-I	0.010～1.000s【0.200s】

P04.29 and P04.30 function codes shall be P and I coefficient of motor 2 ASR.

P04.31 motor 2 ACR-P	1～5000【1000】
P04.32 motor 2 ACR-I	0.5～100.0ms【8.0ms】

P04.30 and P04.31 function codes shall be P and I coefficient of motor 2 ACR.

P04.33 motor 2 encoder option	0～1【1】

The function code shall be encoder of select motor 2.

0: select local encoder

1: select expansion encoder

When P04.33 selects 1, the HSD2000 specified PG expansion card shall be configured.

6.1.6 Start and Stop Parameter　(P05 group)

P05.00 Starting mode	0, 1, 2【0】

0: start from start frequency

The starting shall be implemented as setting start frequency (P05.01) and keeping time (P05.02).

1: Brake and star

Fisted DC brake (refer to P05.03, P05.04), then start as 0 mode.

2．Rotational speed tracing and start

Trace the rotational speed and direction of motor. The rotate motor starting shall be smooth. As shown in figure 6-12:
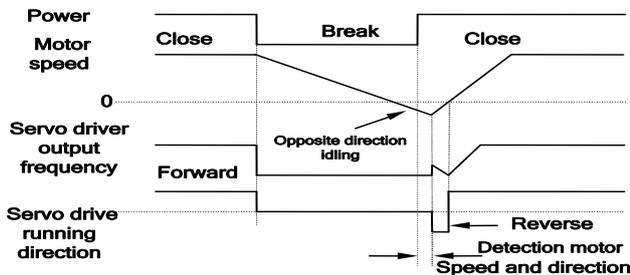
Figure 6-12: rotational speed track startup　schematic diagram

 　Note

1．Start mode is applicable for small inertia load of forward and reverse in motor of servo drive stop status. The larger large inertia load of high speed delivery shall be not applicable for start mode 1.

2．Start-2 mode is applicable for momentary power outage startup for large inertia load of forward and reverse in motor of servo drive stop status.

3．Start performance of start mode-2 is related with motor parameter. The parameters related with P03 or P04 group shall be set correctly.

4．When select start mode 2, the V/F curve shall be straight line.

5．When driving synchronous motors, the start mode shall be 0.

P05.01 start frequency	0.00～60.00Hz【0.00Hz】
P05.02 start frequency keep time	0.00～10.00s【0.00s】

Start frequency represents the initial frequency of servo drive starts, such as f_S in figure 6-13. The start frequency keep time represents keep operation time for servo drive in start process. Such as t_1 in figure 6-13:
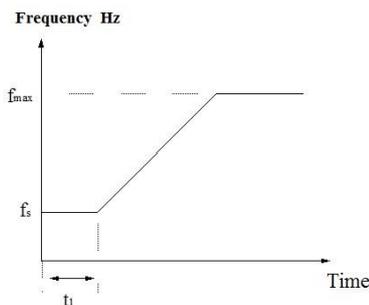
Figure 6-13:　start frequency and start schematic diagram

 　Note

Start frequency is not limited by lower limit frequency.

P05.03 start DC brake current	0.0～100.0%【0.0%】
P05.04 start DC brake time	0.00～30.00s【0.00s】

P05.03, P05.04 may be effective in "first braking then starting" mode (P05.00＝1). As shown in figure 6-14:

Start DC brake current is percentage relative to servo drive rated current. When start DC brake time is 0.0s, there is no DC braking process.
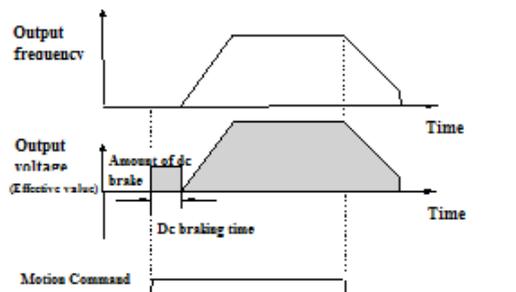
Figure 6-14：　start 1 indication

P05.05 stop mode	0, 1, 2【0】

0: Deceleration stop

When the servo drive receives the stop command, the output frequency shall be reduced as deceleration time. Stop shall be implemented after the frequency is 0.

1: Freewheel

After receiving the stop command, servo drive shall stop output immediately. The loading shall stop as mechanical inertia.　。

2：Deceleration stop＋DC brake

When the servo drive receives the stop command, the output frequency shall be reduced as deceleration time. When reach initial frequency of stop brake, the DC brake shall be started.

Stop DC brake related function may refer to P05.06～P05.09 definitions:

P05.06 Stop DC brake start frequency	0.00～60.00Hz【0.00Hz】
P05.07 Stop DC brake interval time	0.00～10.00s【0.00s】
P05.08 Stop DC brake current	0.0～100.0%【0.0%】
P05.09 Stop DC brake time	0.00～30.00s【0.00s】

Stop brake interval time: during deceleration stop, from operation frequency reaches the brake initial frequency (P05.06) time, to time of start adding DC brake values.

No output is allowed in stop brake interval time. The time setting may prevent over current in brake starting for larger power motor.

Stop DC brake current setting is percentage to servo driver acted current. When the stop brake time is 0.0s, there is no DC brake process.
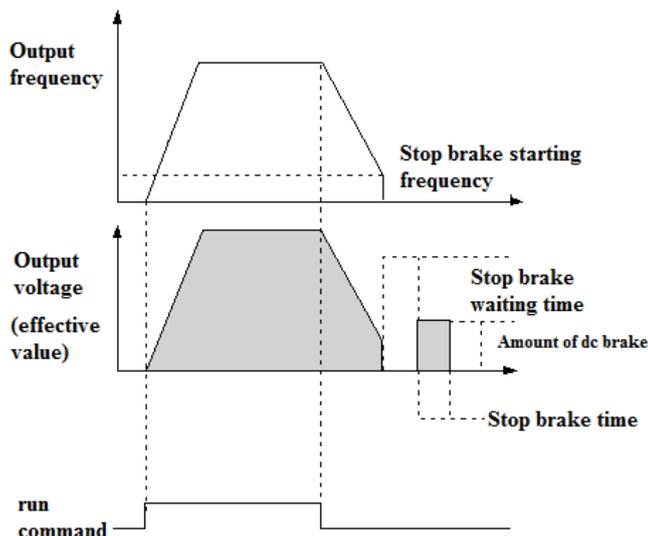
Figure 6-15: deceleration stop +DC brake schematic diagram

  Note

Percentage of stop brake current (P05.08) to relative servo drive rated current.

P05.10 Restart after power fault	0、1【0】
P05.11 Wating time for restart after power fault	0.0～10.0s【0.0s】

After this function to achieve servo drive is powered down, when then power up, under different operating command channel, servo drive shall automatically start running and interval time before the automatic operation.

The P05.10 shall be set as 0. The servo drive will not operate automatically after the power outage powers up.

P05.10 to 1 when the power outage after power up, if the conditions of the servo drive to meet the start waiting P05.11-defined time, automatically.

The function code is set, the power-down time running, power up state control commands moment servo drive joint decision whether to run automatically after power up, see table 6-1.

Table 6-1: power outage and then start condition feature

P05.10 setting	Status before power down	Operation panel	Serial port	Terminal three-wire 1, 2	Terminal two-wire 1, 2	
		No	No	No	No	No
0	Stop	0	0	0	0	0
	Operation	0	0	0	0	0
1	Stop	0	0	0	0	1
	Operation	1	1	1	0	1

  Table 6-1 for the various combinations of conditions, after power up operation when servo drive is in 0: enter standby mode; 1: start automatically. No: power up time without run command; has: power up time has run command.

  Note

1．When stopped from operation panel, serial port, terminal controlled by a three-wire, 2 for pulse-type command mode, power up time without running the command.

2．The stop command shall be priority.

3．Re-start when power outage valid, if not completely run-down and re-power up (i.e., servo drive LED display Proof process), then re-start operation in accordance with rotational speed tracking mode automatically start; If full power-down (i.e. after the operation panel LED is completely off) re-power up, then re-start the way P05.00 accordance start is set up start.

P05.12 anti-reverse option	0、1【0】

0: allow reverse

1: Not allow reverse

  Note

The function is effective to command channels.　(Operation panel operation command channel, terminal operation command channel and serial port operation command channel).

P05.13 forward-reverse dead time	0～3600s【0.0s】

servo drive forward run by the transition to the reverse operation, or the transition from forward to reverse operation during the operation, the output transition time waiting at zero frequency,as　t1　shown　in　figure　6-16.
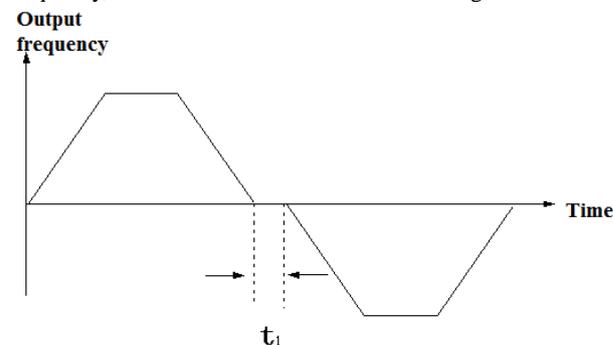
Figure 6-16: Normal/adverse area time

P05.14 reversible switching mode	0、1【0】

0: Zero-frequency switching

1: over start frequency switching

P05.15 stop speed	0.00～150.00Hz【0.10Hz】

When setting the speed detection value stop detection methods see function code P05.16.

  Note

The speed stopping is only valid in P05.05=0 mode.

P05.16 stop speed detection method	0, 1【0】

0: speed setting value

Only the mode may be used in V/F control mode.

1: Speed inspection value

P05.17 stop latency	0～10.00s【0.05s】

During motor deceleration, when the motor speed reaches the stop speed, motor stop running after the delay time. As shown in Figure6-17, t_d represents stop speed delay time.
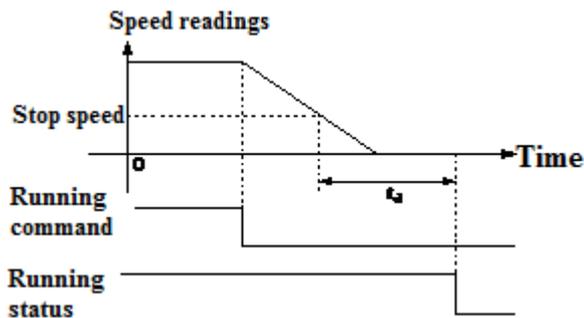
Figure 6-17: Stop speed test

  Note

Stop speed delay time for V / F control mode is invalid and must be stopped when the speed of detection speed detection value (P05.16 = 1) is valid.

P05.18 energy consumption brake option	0, 1【0】

0: no use energy consumption brake

1: use energy consumption brake

  Note

Be sure to use according to the actual situation, this feature is set correctly parameter. Otherwise it will affect the control characteristics.

P05.19 brake utilization	0.0～100.0%【80.0%】

It is effective to braking unit built-in model.

  Note

The function setting shall consider resistance value and power of braking resistor.

6.1.7 V/F Control Parameter　(P06 group)

P06.00 motor 1V/F curve setting	0～3【0】
P06.01 motor 1V/Ffrequency value P3	P06.03～P02.05【0.00Hz】
P06.02 motor 1V/F voltage value V3	P06.04～100.0%【0.0%】
P06.03 motor 1V/Ffrequency value P2	P06.05～P06.01【0.00Hz】
P06.04 motor 1V/F voltage value V2	P06.06～P06.02【0.0%】
P06.05 motor 1V/Ffrequency value P1	0.00～P06.03【0.00Hz】
P06.06 motor 1V/F voltage value V1	0.0～P06.04【0.0%】

The group function code defines the V / F setting mode HSD2000 motor 1, in order to meet the needs of different load characteristics. According to the definition P06.00 can choose three kinds of fixed curves and a custom curve.

- When P06.00 Option 1, is 2.0 times the power down torque characteristics; such as in Figure6-18 curve.

- When P06.00 select 2, 1.7 power down torque characteristics; such as in Figure6-18 curve 2.

- When P06.00 Option 3, is 1.2 times the power down torque characteristics; such as in Figure6-18 curve 3.

These curves apply to variable torque fan and pump loads, the user can adjust the load characteristics to achieve optimal energy savings.
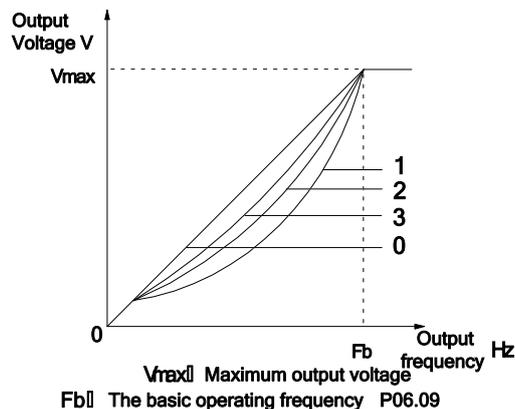
Figure 6-18: De-torque curve

When P06.00 select 0, users can customize by P06.01 ~ P06.06 V / F curve, as shown in Figure6-19. By increasing (V1, F1), (V2, F2), (V3, F3) three points define a line V / F curve to apply to specific load characteristics.

The factory default user-defined V / F is a straight line, curve, see Figure6-18 curve 0.
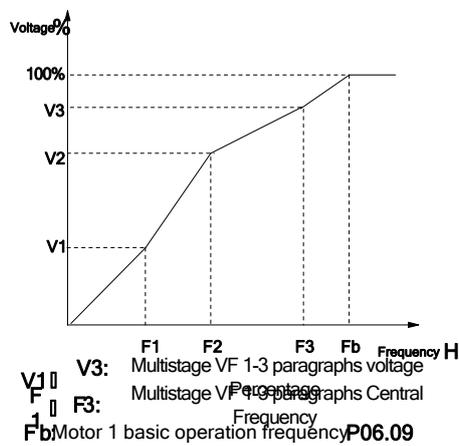
Figure 6-19: Users set curve of V/F general form

P06.07 motor 1torque lifting	0.0～30.0%【0.0%】

To compensate for low frequency torque characteristics, can enhance the output voltage to make some compensation. The function code is the maximum output voltage relative terms, is set to 0 when there is no torque upgrade; set to non-zero when manual torque boost mode, such as Figure6-20.
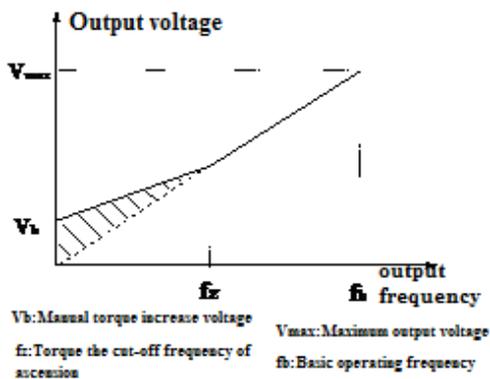
Figure 6-20: torque rise (rise: shadow)

  Note

1．This parameter setting can lead to improper motor heat or over current protection.

2．See the definition of fz function code P06.08.

3．When driving synchronous motors, torque recommended to be used to enhance and adjust V / F curve according to motor parameter and use the occasion.

4．The maximum output voltage Vmax corresponds to the motor rated frequency, and thus need to set P03 or P04 group set motor rated frequency correctly according to the selected motor.

P06.08 motor 1 torque lifting cut-off point	0.0%～50.0%【10.0%】

This function defines the percentage of manual torque cutoff frequency relative to enhance the basic operation frequencyP06.09, see Figure6-20 in fz. The cutoff frequency determined by any applicable P06.00 V / F curve.

P06.09 motor 1 base frequency	1.00～1000.0Hz【50.00Hz】

The basic operation is the minimum frequency when the servo drive output highest frequency voltage corresponding to the motor is generally rated frequency. As in Figure6-18 fb:

P06.10 Reserved	Reserved

Reserved function.

P06.11 motor 1 stability factor	0～255【10】

This function is used to suppress the natural oscillation with servo drive and motor generated. If the output current constant load changes repeatedly, on the basis of the factory parameter adjusting the function code size can eliminate oscillation motor running smoothly.

P06.12 motor 2V/F curve setting	0～3【0】
P06.13 motor 2V/Ffrequency value P3	P06.15～P02.05【0.00Hz】
P06.14 motor 2V/F voltage value V3	P06.16～100.0%【0.0%】
P0615 motor 2V/Ffrequency value P2	P06.17～P06.13【0.00Hz】
P0616 motor 2V/F voltage value V2	P06.18～P06.14【0.0%】
P06.17 motor 2V/Ffrequency value P1	0.00～P06.15【0.00Hz】
P06.18 motor 2V/F voltage value V1	0.0～P06.16【0.0%】

The group function code defines the HSD2000 motor 2 for V / F set way to meet the needs of different load characteristics. See detailed description of function code, in P06.00 ~ P06.06:

P06.19 motor 2 torque lifting	0.0～30.0%【0.0%】
P06.20 motor 2torque lifting cut-off point	0.0%～50.0%【10.0%】
P06.21 motor 2 base frequency	1.00～1000.0Hz【50.00Hz】
P06.22 motor 2 maximum output voltage	0～480V
P06.23 motor 2 stability factor	0～255【10】

Refer to P06.07～P06.11 description.

P06.24 AVR function	0～2【1】

0: no action

1: action

2: only no action in deceleration

AVR is automatic voltage adjusting.

When the input voltage deviates from rated value, the function can be maintained by constant output voltage, so under normal circumstances should AVR action, especially in the input voltage is higher than the rated value when.

When the deceleration stop, select AVR does not operate, deceleration time is short, but running current is slightly larger; choose AVR always action, smooth motor deceleration, running current is small, but the deceleration time longer.

6.1.8Speed Control Parameter (P07 group)

P07.00 Speed Feedback Option	0, 1【0】

HSD2000 has two speed feedback channel options.

0: local PG feedback channel

It is applicable for PG feedback of asynchronous motor.

1:   Expansion PG feedback channel

It is suitable for both synchronous and asynchronous motor PG feedback in setting P07.00 = 1, the need to use PG expansion card.

In with PG vector control, with PG V / F control mode, you need to set the correct speed feedback channels, otherwise motor cannot operate normally.

  Note

P07.00 function code parameter only for the default choice of motor 1, if you select the motor 2 (P02.01 to 1), it should be selected by function code P04.33 encoder.

P07.01 ASR1-P	0.1～200.0【20.0】
P07.02 ASR1-I	0.000～10.000s【0.200s】
P07.03 ASR1output wave filter	0～8【0】
P07.04 ASR2-P	0.1～200.0【20】
P07.05 ASR2-I	0.000～10.000s【0.200s】
P07.06 ASR2output wave filter	0～8【0】
P07.07 ASR1/2 switching frequency	0～100.0%【10.0%】

Function code P07.00～P07.07 may be effective in control modes of   vector control and   PG V/F control modes.

In vector control mode by setting the speed regulator, proportional gain P and integral time I may change the vector control speed response characteristics.

1．Speed regulator (ASR) constituted as Figure6-21 shows. Figure in KP is the proportional gain P; TI is the integral time I.
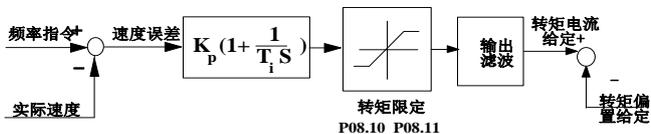
Figure 6-21:　Speed adjustor Figure

The integration time is set 0 (P07.02 = 0, P07.05 = 0) when no integral action, speed loop is a simple proportional regulator.

3． Speed regulator (ASR) P proportional gain and integral time I is tuning.

(a)

(b)
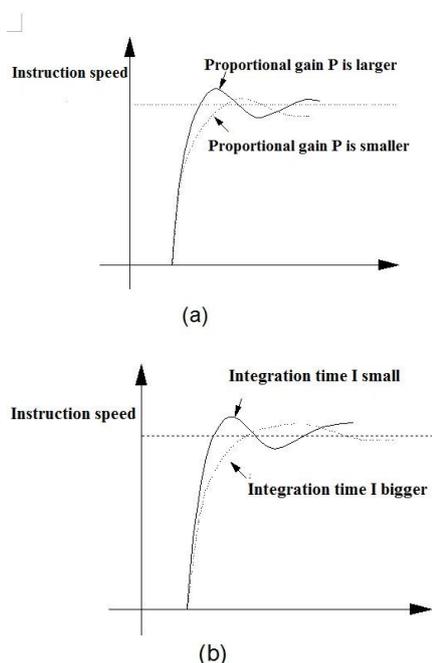
Figure 6-22 speed　(ASR) step response and PI parameter

Increase the proportional gain P, can speed up the dynamic response of the system; But P is too large, the system tends to oscillate.

Reducing the integral time I, can accelerate the dynamic response of the system; But I too small, the overshoot is large and easy to produce oscillations.

Usually first adjust the proportional gain P, to ensure the system does not oscillate maximize the premise P; then adjust the integration time I make the system both fast response without overshoot. Figure6-23 is P, I select a good speed step response time curve (velocity response curve can be analog output terminalAO1, AO2 observation, see P11 parameter group).
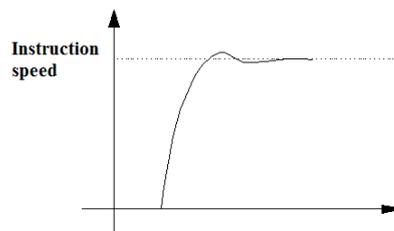
Figure 6-23: Step response with fine dynamic performance

  📖   **Note**

PI parameter was not selected, the system quickly start to the high-speed, over-voltage fault may occur (if no external braking resistor or brake unit), which is due to overshoot in the rate of decline over the medium-range regenerative brake system of the state energy feedback cause. It can be avoided by adjusting PI parameter.

3．Speed regulator (ASR) adjustment PI parameter in high / low speed situations.

If the system is on high and low load operation has a rapid response requirements, you can set ASR switching frequency (P07.07). Usually the system is running at low frequencies, to improve the dynamic response characteristics, can increase proportional gain P and reduce integration time I. Generally in the following order to adjust the speed regulator parameter:

  1) Select the appropriate switch frequency P07.07.

  2) Scaling at high speed and integration time gain P07.01 P07.02, ensure that the system does not occur and the oscillation characteristics of a good dynamic response.

  3) P07.04 proportional gain and integration time adjustment at low speeds P07.05, to ensure that no low-frequency oscillation and good dynamic response characteristics.

4．Speed regulator (ASR) of output after a delay wave filter to obtain a given torque current. P07.03, P07.06, respectively, is the time constant of ASR1 and ASR2outputwave filter.

P07.08 speed limit mode	0～2【0】
P07.09 speed limit channel 1	0～1【0】
P07.10 speed limit channel 2	0～1【0】
P07.11 speed limit value 1	0.0%～100.0%【100.0%】
P07.12 speed limit value 2	0.0%～100.0%【100.0%】

  Function code P07.08 ~ P07.12 only valid in torque control mode, the rest of the control is invalid.

By setting function code P07.08 ~ P07.12 under torque control motor's speed limit value. In torque control mode if the motor rotational speed limit value. Internal torque instruction to switch to the speed regulator (ASR) output, control motor speed is not out of control.

  Speed limit mode:

0: Forward limit value by the speed limit channel 1 (P07.09) setting, reverse limit value by the speed limit channel 2 (P07.10) setting.

1: Reversible limit value is limited by the speed channel 1 (P07.09) setting.

2: Reserved

Speed limit channel:

0: By the function code P07.11 or P07.12 setting value as the speed limit value torque control. by function code P07.11. or

1: By the analog input terminal the value speed limit value as the torque control. AI corresponding velocity relationship, set by the P11 group AI curve. Users need to define AI terminal functionality for speed limit value, to AI1, for example, set function code P11.01 = 4 (or 5), a detailed description of the setting method, see P11 group.

Speed limit value

It is effective in P07.09 (or P07.10) ＝0. Set value of 100% corresponds to the servo drive's maximum output frequency (P02.05).

P07.13 speed deviation (DEV) when detection selection	0～2【2】
P07.14 DEVdetection value	0.0%～50.0%【20.0%】
P07.15 DEVdetection time	0.0～10.0s【10.0s】

In vector control, the relative speed deviation value = (｜ acceleration and deceleration after setting frequency - feedback frequency｜/ servo drive's maximum output frequency) ×100%.

If the relative speed of the set value deviation DEV detection time (P07.15) is greater than the set continuous DEV detection value (P07.14), the detecting operation is selected according to DEV function code P07.13.

DEV Detection Action Option

0: deceleration stops

servo drive stop shall be implemented as deceleration time 。

1: Freewheel, repost E034。

servo drive immediately terminate output, motor stops according to mechanical inertia, and reported DEV deviation is too large fault (E034).

2: Continue to run.

DEV detected no movement, servo drive continues to run.

DEV Detection Value

Set value of 100% corresponds to the servo drive's maximum output frequency (P02.05).

  Note

Speed deviation (DEV) detected only in the speed control mode (P07.00 = 0) under effective.

P07.16 overspeed (OS) when Detection Selection	0, 1, 2【1】
P07.17 overspeed (OS) detection value	0%～130.0%【120.0%】
P07.18 overspeed (OS) detection value	0.0s～2.00s【0.0s】

Relative velocity = (｜ feedback frequency｜/ maximum output frequency) ×100%.

If the relative speed of the set detection time OS (P07.18) is greater than the set continuous OS detection value (P07.17), the detection operation is selected in accordance OS function code P07.16.

OS Action Detection

0: deceleration stops

Servo drive shall as deceleration time stop.

1: freewheel, report E035.

Servo drive will terminate output, motor stops according to mechanical inertia, and reported OS fault E035.

2: Continue to run.

OS detection does not work, servo drive continues to run.

Overspeed (OS) detection value

Set value of 100% corresponds to the servo drive's maximum output frequency (P02.05).

  Note

Over speed (OS) is effective in detecting non-V / F mode.

P07.19 Pre-excitation time	0～10s【0】

Pre-excitation magnetic field is used to build asynchronous motor before start. Pre-excitation time (P07.19) refers to the pre-magnetizing time.

P07.20～P07.22	Reserved

Reserved function

P07.23 weakening control coefficient	500～1200【1024】
P07.24 the minimum value for a given flux	10%～80%【10%】

Function code P07.23, P07.24 for a valid PG vector control mode. Weak magnetic curves are used in areas of weak magnetic field weakening curve correction, the greater the value, the more stable and showed weakening curve.

The minimum flux given value is the minimum flux value at the time of weakening.

P07.25 Reserved	Reserved

Reserved function

6.1.9Torque Control Parameter （P08 group）

P08.00 speed /torque control mode	0、1【0】

0: speed control mode

1: torque control mode

Torque control frame figure:
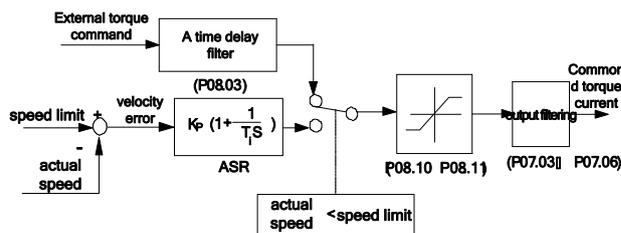
Figure 6-24: Moment control Figure

Set terminal X1 ~ X8 will feature 54. You can switch the speed and torque control.

P08.01 torque instruction option	0～1【0】

0: torque given

The given value shall represent torque percentage.

1: torque current given

To quantify the percentage of torque current size, torque current and torque given differ in weakening area.

P08.02 torque given option	0～4【0】

This feature sets the torque control is given physical channel.

0: torque instruction is set by analog terminal AI.

AI input voltage / current of the maximum value (10V/20mA) corresponding to 300% of the rated torque, and torque AI input correspondence between specific instructions, see the P11 group, AI input corresponding to the positive and negative of the positive and negative torque instruction value.

Users when using this feature, you need to define AI terminal function as torque instruction given to AI1, for example, set the function code P11.01 = 8, the detailed settings see description P11 group.

1: torque instruction is determined by terminal PULSE.

Terminal PULSE input frequency the maximum value corresponds to 300% of rated torque instruction, correspondence between specific pulseinput and torque, refer to the description of P11 group, terminalPULSE given based on pulse center of choice (P10.14) input positive and negative torque instruction value.

2: torque instruction is set by communication

PC servo drive built-in shall be implemented by standard RS485 communication port. Set the current torque instruction servo drive.

Specific programming methods, methods of operation, communication protocols, etc., see the MODBUS protocol.

3: torque instruction is determined by process closed-loop output given.

Process closed-loop output as a torque instruction given. For specific process closed-loop description of the setting method, you can see P13 group.

4: Reserved

📖   **Note**

Motor output torque of direction, and the direction set by the negative decision torque instruction (P02.20) irrelevant.

P08.03 torque given wave filter time	0～65535ms【0】

By torque given channel, the external torque instruction through delayed wave filter filtering. Setting appropriate filter time (P08.03), the torque instruction can be prevented mutations cause motor jitter.

P08.04 speed →torque	0.0%～+300% initial torque

switch point	【100%】
P08.05 speed torque switch delay	0～1000ms【0】

In torque control mode from the machine, the first for speed run, when outputtorque achieve torque switch point P08.04, after speed torque switch delay time P08.05, then cut to the torque control mode.

P08.05 for the torque, rotational speed control mode switches delay time.

📖   **Note**

1．For control terminalX1 ~ X8 conduct speed / torque switch, one set function code P10.00 ~ P10.07 to 54, and set the current control method is vector control.

2．In the PLC, process closed-loop, multi-speed operation, such as a special speed control mode, you can not switch to the torque control.

3．When inputstop command, if the torque current control mode, then automatically switch to control the speed, and then stop.

P08.06 torque limit mode	0～3【3】

0: Restriction is invalid, only the flow

According to P20.15 (servo drive automatically limiting level) for limiting, set torque limit channel (P08.07, P08.08 and P08.09). Out of torque and rotational speed capability relationship as follows:
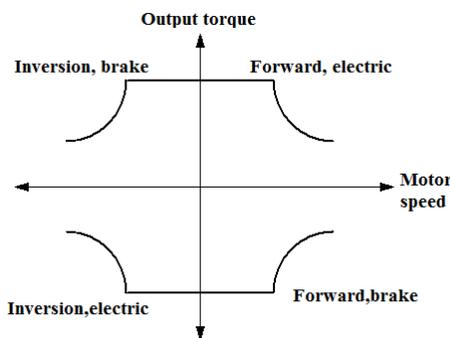
1: Torque limit

According to the set torque limiter value (set by the P08.07 ~ P08.11) of torque limit, then the servo drive output current still P20.15 (servo drive automatically limiting level) limit.
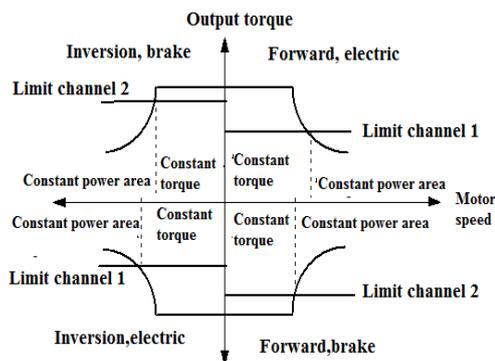
Torque limit value 1, 2 is set by function code P08.07～P08.11.

2: Detailed instruction Reserved

3: Torque current limit

According to the set torque current limiter value (set by the P08.07 ~ P08.11) of torque limit, and a torque limit mode is basically the same, but differ in the field weakening. At this point, servo drive output current still P20.15 (servo drive automatically limiting level) limit.

P08.07 torque limit channel option	0～3 【1】

Channel option of torque limit value.

0: Limit value is taken from the same channel 1 and 4 quadrants

1: Electric (1 and 3 quadrant) taken from Channel 1, power (2 and 4 quadrant) taken from Channel 2

2: Upper limit (1, 2 quadrant) taken from channel 1, lower limit (3, 4) taken from Channel 2 upper limit.

3: The same four quadrants, limiting the choice of channel 1 and 2 by the terminal switch. Terminal function shall select 56.

P08.08 torque limit channel 1	0～3 【0】
P08.09 torque limit channel 2	0～3 【0】

Set torque limit physical channel.

0: torque limit value by the digital setting

P08.10, P08.11 as the torque limit value 1 and 2

1: Torque limit value given by the AI

AI input voltage / current of the maximum value (10V/20mA) can correspond to 300% of rated torque instruction, correspondence between specific Input and output volume, see instructions P11 group.

Users when using this feature, you need to define A terminal function as torque limit value, to AI1, for example, set function code P11.01 = 6 (or 7), detailed settings, see instructions P11 group.

2: torque limit value is given by terminal PULSE

Terminal PULSE input frequency of the maximum value (100k) may correspond to 300% of rated torque instruction, correspondence between the amount of specific pulse input and output instructions, please refer to P11 parameter group.

Torque limit value pulse input terminal X8 only valid, should be defined as the torque limit function X8terminal pulse, users need to set function code P10.07 = 61 or 62.

3: Process closed-loop output

Process closed-loop output shall be as a torque limit given. Set the relevant process closed-loop function code may be seen in section 6.1.14 P13 group function code instructions.

  📖 **Note**

Torque limit value can only be a positive value, if the setting value is negative value, automatically limit is 0.

P08.10 torque limit value 1	0.0%～300.0% initial torque 【180.0%】

P08.11 torque limit value 2	0.0%～300.0% initial torque 【180.0%】

Torque limit value only P08.08 (or P08.09) = 0 is valid. Set the value of 100% corresponds to the servo drive's rated torque.

P08.12 mechanical loss compensation value	−20.0%～+20.0% 【0.0%】

Set the mechanical loss compensation value, under speed control and torque control for torque compensated according to the setting value.

Usually when a large torque loss caused by the mechanical loss of motor mechanical losses should be adjusted, generally do not need to set the value.

Set value of 100% corresponds to the servo drive's rated torque current. Set value of 100% corresponds to the servo drive's rated torque current.

P08.13 torque deviation T1	−300%～+300.0% 【0.0%】
P08.14 torque deviation T2	−300%～+300.0% 【0.0%】
P08.15 torque deviation T3	−300%～+300.0% 【0.0%】

To startup torque deviation, choose two control terminal, defined its function as a torque deviation options to control terminalX6, X7, for example, set P10.05 = 58, P10.06 = 59. By combining X6 and X7terminal can only choose one torque deviation effective, specific parameters see table 6-2.

Torque Deviation Option Table

X7	X6	Torque Deviation Option
OFF	OFF	No startup
OFF	ON	T1
ON	OFF	T2
ON	ON	T3

Set value of 100% corresponds to the servo drive's rated torque current.

  📖 **Note**

Torque deviation may be effective in speed or torque control mode.

P08.16 torque deviation startup delay	0.0～1.0s 【0.0s】

After the torque deviation effective, if P08.16 is not zero, then torque deviation is not immediately given the added torque, but after a certain delay time (P08.16) coupled to a torque current given on.

  📖 **Note**

Torque deviation startup delay P08.16 only AI given time to be effective in torque deviation.

P08.17 over torque / less torque Detection selection	0～8 【0】
P08.18 over torque / less torque detection value 1	0%～300% 【0】
P08.19 over torque / torque detection	0～10s 【0】

time of less than 1	
P08.20 over torque / less torque Detection selection 2	0～8【0】
P08.21 over torque / less torque detection value 2	0%～300%【0】
P08.22 over torque / torque detection time of less than 2	0～10s【0】

Over Torque Determination

If within the detection time (P08.19 or P08.22), continuous greater torque detection value (P08.18 or P08.21), considered detected over torque signal.

Insufficient torque judge:

If the detection time (P08.19 or P08.22), continuous torque is less than the detection value (P08.18 or P08.21), considered insufficient detected torque signal.

Over torque / less torque detection mode selection:

0: over torque / less torque detected invalid

Not conducted torque / insufficient torque detection

1: The only consistent speed, over torque detection continues to run after.

Only detect whether excessive torque during constant speed operation, and checked out the torque servo drive continues to run.

2: After running over torque detection continues to run after

3: The only consistent speed, over torque detection off after only detect whether excessive torque output during constant speed operation, and checked out the torque servo drive stops output, motor coasts to stop.

4: After running through the cut output torque detection

Detected in the course of the entire operation over torque after, servo drive stops output, motor coasts to stop.

5: Only consistent in speed, the less continue to run after the torque detection during constant speed operation only detect whether the lack of torque, and the lack of detectable torque, servo drive continues to run.

6: Continue to run after run less torque detection

After the detection of insufficient torque on the entire operation process, servo drive continues to run

7: After only a consistent speed, the lack of torque detection cut output

Detected only during constant speed operation is insufficient torque, and detection of the lack of torque servo drive stops output, motor coasts to stop.

8: Cut output after running less torque detection

After the detection of insufficient torque on the entire operation process, servo drive stops output, motor coasts to stop.

Over torque / less torque detection value:

In the V / F control mode, set the value for the corresponding servo drive rated current at 100%; in vector control mode, set the value for the corresponding motor when 100% rated torque.

By switching terminalY1 or Y2 can be monitored through the torque / less torque signal output.

🕮 **Note**

Over torque / less torque detection are valid in any control mode.

6.1.10 Servo control parameters (P09 group)

P09.00 Servo control switching option	0～3【0】

0： non-servo control

Under non-servo control, position control is not available.

1： speed/ torque←→ servo control

Current status is speed or torque control, and when switching terminal (function 81) of servo control is valid, it switches to servo control.

2： servo ←→ speed/torque control

Current status is servo control, and when switching terminal (function 81) of servo control is valid, it switches to speed or torque control.

3：Servo control

Under servo control, position control is available and the position given source is selected by P09.03. Control mode must be set as closed loop vector control so as to select servo control.

P09.01Servo run mode option	0～2【0】

0： normal run

It is basic position control mode and special switching of position run mode is not available.

1： Reserved

2： spindle run

The spindle runs first in P09.00 mode, and when the positioning terminal (function 77) of spindle or return-to-zero terminal (function 84) of origin is valid, the spindle is stopped in the specified position.

P09.02 Orientation mode of spindle	0～1131H【0010H】

Ones place: positioning zero option

0： Z-pulse positioning

When Z-pulse is used as spindle zero, the accuracy of position control is high, but the encoder must be installed on the spindle.

1： photoelectric switch positioning

The photoelectric feedback signal of a position on the spindle is used as spindle zero.

Tens place: acceleration/deceleration time option

0～3： acceleration/deceleration time option

Select acceleration/deceleration 1 ～ 4 as the acceleration/deceleration time of the process that spindle slows down to its directional speed.

Hundreds place: motion option after the spindle is stopped in the specified position.

0: hold at the positioning point

Continue position control and hold at the specified stop point.

1: hold within the positioning range

When the position deviation from the specified stop point is within the range set in P09.12, position control is not available; when the deviation is beyond the range, a position loop is available.

Thousands place: calculation mode of position

0: direct position loop control

1: position loop ＋ feedfoward control

P09.03 Position given source	0～4 【0】

0: X8 terminal pulse given

The number of X8 pulses is given as motor position. Users are requested to define X7 terminal function as position pulse direction and define X8 terminal function as position pulse input, and respectively set the function codes: P10.06＝71, P10.07＝72.

1: Reserved

2: expansion PG given

Pulse input on the expansion PG card is set as motor position.

3: setting of position number

The position target of motor is set by the function codes P09.05 and P09.06.

4: Reserved

P09.04 Pulse instruction input mode option	0~1 【0】

The function code defines the expansion PG card as the pulse input mode when the position is given.

0: A/B phase pulse

It is two-phase orthogonal pulse; when A phase is in advance of B phase, motor rotates forward.

1: PLUS+SIGN pulse

It is pulse + direction input mode; A phase represents pulse train and B phase represents direction; when it is high level, motor rotates forward and when it is low level, motor rotates backward.

P09.05 Position given- high position	0～150 【0】
P09.06 Position given- low position	0～65535 【0】

When the position given source is digitally set (P09.03＝3), the function codes P09.05 and P09.06 are valid.

P09.07	Reserved

Reserved function

P09.08 Filtering time constant of position instruction	0～3000.0ms 【10ms】

A position instruction needs to be filtered by a one-delay filter. Filtering time constant of the filter is set by the function code P09.08

P09.09	Reserved

Reserved function

P09.10 Numerator of position instruction ratio	1～65535 【1024】
P09.11 Denominator of position instruction ratio	1～65535 【1024】

A pulse instruction is converted into amount of movement of motor by setting the function codes P09.10 and P09.11, e.g. a pulse represents 10um. It may be controlled without regard to the speed reducing ratio of machinery and pulse number of encoder.

An example is given below:

On the supposition that the encoder is of 2500 lines and absolute position of travel of motor completing one revolution is 5mm, it can be known that 5mm distance corresponds to 10000 (2500×4) pulses.

Now there is a workpiece that needs moving 8mm, so the number of pulses that need moving is $\frac{8}{5} \times 10000$; supposing that instruction unit is 1um, position pulse is directly set as 8000 and electronic gear ratio is set as $\frac{8}{5} \times \frac{10000}{8000} = \frac{2}{1}$.

Therefore, set the function codes: P09.10＝2, P09.11＝1.

P09.12 Range of positioning completion	1～10000 【10】

In the process of servo running, if position deviation is within the set range (P09.12), servo positioning is completed. If any switch output terminal function is defined as positioning completion output, take Y1 as an example, set the function code P10.18＝25, and simultaneously output a positioning completion indication signal.

P09.13 Width of position approach signal	1～32767 【100】

In the process of servo running, if position deviation is within the set range (P09.13), the position approaches. If any switch output terminal function is defined as position approach output, take Y1 as an example, set the function code P10.18 = 26, and simultaneously output a position approach indication signal.

P09.14 Position out-of-tolerance detection range	0～32767 【1000】
P09.15 Position out-of-tolerance alarm option	0～1 【0】

0: valid

1: invalid

In the process of servo running, if position deviation is beyond the set range (P09.14) and position out-of-tolerance alarm option is valid (P09.15＝0), when any switch output terminal function is defined as position out-of-tolerance alarm output, take Y1 as an example, set the function code P10.18＝28, and simultaneously output a position out-of-tolerance alarm indication signal.

P09.16 Spindle transmission ratio	0～30.000 【1.000】

On many occasions, the spindle of spindle motor needs to be controlled by a transmission mechanism. The transmission ratio of the transmission mechanism is set by P09.16.

P09.17～P09.18	Reserved

Reserved function

P09.19 Directional speed of spindle	0～200.00【5.00】

When motor spindle is revolving at a high speed, after spindle orientation is started, the spindle should be first switched to a relatively low speed (P09.19) from the high speed and then positioned. The acceleration/deceleration time from current speed to directional speed is set by P09.02.

P09.20 Starting position of spindle orientation	0～30000【0】
P09.21 Directional deceleration time of spindle	0～3000.0【10.0】
P09.22 Spindle position 1	0～30000【0】
P09.23 Spindle position 2	0～30000【0】
P09.24 Spindle position 3	0～30000【0】
P09.25 Spindle position 4	0～30000【0】

After the spindle is switched to directional speed (P09.19), it runs at the speed and waits for orientation starting position (P09.20); after arriving at the position, orientation starts and the spindle is decelerated to the specified stop point according to the deceleration time set by P09.21, to make it just stop in the set position (one of P09.22～P09.25). P09.21 refers to the time for decelerating to zero from maximum speed.

The positions 1～4 can be selected by means of terminals; for details, see the description of functions "78" and "79" in the P10 group.

P09.26 Position loop gain 1	1～8000【50】
P09.27 Position loop gain 2	1～8000【200】

Proportional gain of position loop regulator is set by P09.26 and P09.27. The greater the gain is, the quicker the position tracking is, but too great gain may easily cause oscillation; the smaller the gain is, the slower the position tracking is. Position gain should be increased properly while it does not cause oscillation.

P09.28 Switching mode of position gain 1 and gain 2	0～4【0】
P09.29～P09.30	Reserved
P09.31 Level of position gain switching deviation	0～10000
P09.32 Smoothing time of gain switching	0～100ms

0： non-switching

Position loop gain 1 (P09.26) is valid.

1： Reserved

2： Reserved

3： Position deviation

When position deviation is smaller than the level of position gain switching deviation (P09.31), after smoothing time of gain switching (P09.32) passes, position gain will be automatically switched to position loop gain 1 (P09.26) from position loop gain 2 (P09.27).

4： external terminal switching

Position gain can be manually switched by means of a terminal. Any one of terminals X1～X8 may be selected and it is defined as function "80"; take X3 as an example, set P10.02＝80 and enable X3, and after switching time of position gain passes, position gain will be switched to 1 from 2.

P09.33 Speed feedforward gain	0～120.00%【100.00%】
P09.34 Output amplitude limit of position controller	0～100.0% maximum frequency 【0.0%】
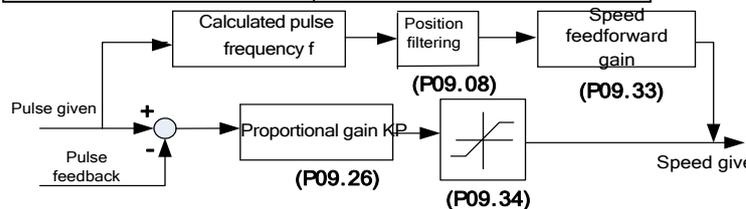
Fig. 6-25 Simplified Diagram of Servo Control with Pulse Given

脉冲给定	Pulse given
脉冲反馈	Pulse feedback
计算脉冲频率 f	Calculated pulse frequency f
位置滤波	Position filtering
速度前馈增益	Speed feedforward gain
比例增益 KP	Proportional gain KP
速度给定	Speed given

In the servo control mode, when the position given source is pulse given at a certain frequency, position feedforward control is required to ensure feedback can quickly track the given pulse.

Output amplitude limit of position controller:

When set value is 100%, it corresponds to maximum output frequency of servo driver (P02.05).

P09.35 Servo stop mode	0～1【0】

In the process of servo control, a stop mode may be selected by P09.35.

0： Emergency stop by torque limit

The frequency of servo driver immediately reduces to 0 according to the instruction and servo driver stops in an emergency.

1： Stop by switching to speed control

Servo driver stops according to the set deceleration curve from current speed after switched to speed control mode from servo control mode.

6.1.11 Switch I/O terminal parameters (P10 group)

P10.00 Function option of multi-function input terminal X1	0～88【0】
P10.01 Function option of multi-function input terminal X2	0～88【0】
P10.02 Function option of multi-function input terminal X3	0～88【0】
P10.03 Function option of multi-function input terminal X4	0～88【0】
P10.04 Function option of multi-function	0～88【0】

input terminal X5	
P10.05 Function option of multi-function input terminal X6	0～88【0】
P10.06 Function option of multi-function input terminal X7	0～88【0】
P10.07 Function option of multi-function input terminal X8	0～88【0】

Multi-function input terminals X1～X8 are functionally rich and a function can be selected easily according to the need, i.e. the functions of X1～X8 can be defined respectively by setting P10.00～P10.07 and set values and functions are as shown in table 6-3 below.

Table 6-3 Multi-Function Input Option Functions

Content	Corresponding function	Content	Corresponding function
0	Non-function	1	Multi-phase frequency terminal 1
2	Multi-phase frequency terminal 2	3	Multi-phase frequency terminal 3
4	Multi-phase frequency terminal 4	5	Acceleration/deceleration time terminal 1
6	Acceleration/deceleration time terminal 2	7	Normally open input of external fault
8	Normally closed input of external fault	9	External reset input
10	Control input of external jog forward-rotation	11	Control input of external jog reverse-rotation
12	Free stop (FRS) input	13	Frequency increase instruction (UP)
14	Frequency decrease instruction (DOWN)	15	Simple PLC pause instruction
16	Acceleration/deceleration disable instruction	17	Three-wire run control
18	Normally open contact input of external interrupt	19	Normally closed contact input of external interrupt
20	Stop DC braking input instruction	21	Closed loop disable
22	PLC disable	23	Main set frequency source option 1
24	Main set frequency source option 2	25	Main set frequency source option 3
26	Main set frequency switching to AI	27	Command switching to terminal
28	Command source option 1	29	Command source option 2
30	Multi-phase closed loop given terminal 1	31	Multi-phase closed loop given terminal 2
32	Multi-phase closed loop given terminal 3	33	Multi-phase closed loop given terminal 4
34	Traverse frequency input	35	Traverse frequency state reset
36	External stop instruction	37	Servo driver run disable
38	Forward rotation disable	39	Reverse rotation disable
40	Reset of auxiliary set frequency	41	Clearing of PLC stop memory
42	Reserved	43	Reserved
44	Reserved	45	Pulse input of main set frequency (set for X8 only)
46	Pulse input of auxiliary set frequency (set for X8 only)	47	PG tach input (set for X8 only)

Content	Corresponding function	Content	Corresponding function
48	Reserved	49	Reserved
50	Reserved	51	Pre-exciting command terminal
52	Reserved	53	Reserved
54	Switching terminal of speed control and torque control	55	Reserved
56	Selection of torque limitation channels 1 and 2	57	Reserved
58	Torque-bias option terminal 1	59	Torque-bias option terminal 2
60	Torque-bias retention	61	Pulse input terminal of torque limitation 1 (set for X8 only)
62	Pulse input terminal of torque limitation 2 (set for X8 only)	63	Pulse input terminal of torque given (set for X8 only)
64	Reserved	65	Reserved
66	Reserved	67	Reserved
68	Reserved	69	Reserved
70	Reserved	71	Position pulse direction (only X7 is valid)
72	Position pulse input (only X8 is valid)	73	Reset of position deviation counter
74	Instruction pulse disable	75	Reserved
76	Reserved	77	Spindle orientation start
78	Position option terminal 1	79	Position option terminal 2
80	Reserved	81	Servo control switching terminal
82	Reserved	83	Position reference point input terminal (only X6,X7 and X8 are valid)
84	Origin return-to-zero	85	Reserved
86	Reserved	87	Reserved
88	Switching terminal of motors 1 and 2		

The functions listed in the above table are described as follows:

1～4： multi-phase frequency option terminals

15-phase speed running curves at most can be defined by selecting the ON/OFF combination of these function terminals.

Table 6-4 Selection of Multi-Speed Run

K$_4$	K$_3$	K$_2$	K$_1$	Frequency setting
OFF	OFF	OFF	OFF	Normal running frequency
OFF	OFF	OFF	ON	Multi-phase frequency 1
OFF	OFF	ON	OFF	Multi-phase frequency 2
OFF	OFF	ON	ON	Multi-phase frequency 3
OFF	ON	OFF	OFF	Multi-phase frequency 4
OFF	ON	OFF	ON	Multi-phase frequency 5
OFF	ON	ON	OFF	Multi-phase frequency 6
OFF	ON	ON	ON	Multi-phase frequency 7
ON	OFF	OFF	OFF	Multi-phase frequency 8
ON	OFF	OFF	ON	Multi-phase frequency 9
ON	OFF	ON	OFF	Multi-phase frequency 10
ON	OFF	ON	ON	Multi-phase frequency 11
ON	ON	OFF	OFF	Multi-phase frequency 12
ON	ON	OFF	ON	Multi-phase frequency 13
ON	ON	ON	OFF	Multi-phase frequency 14
ON	ON	ON	ON	Multi-phase frequency 15

These frequencies will be used in the multi-speed run and simple PLC run. Take multi-speed run as an example to give a description as below:

Control terminals X1, X2, X3 and X4 are respectively defined as below: P10.00＝1, P10.01＝2, P10.02＝3, and P10.03＝4, and then terminals X1～X4 are used to realize multi-speed run, as shown in Fig.6-26 below:
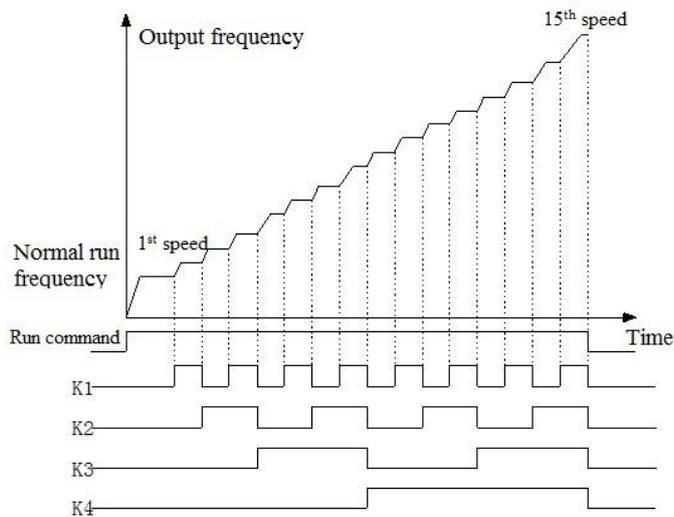
Fig.6-26 Multi-Speed Run Diagram

输出频率	Output frequency
普通运行频率	Normal run frequency
运行命令	Run command
1 速	1st speed
15 速	15th speed
时间	Time

5～6： acceleration/deceleration time terminal option

Table 6-5 Expression of Acceleration/Deceleration Time Option

Terminal 2	Terminal 1	Acceleration/deceleration time option
OFF	OFF	Acceleration time 1/ deceleration time 1
OFF	ON	Acceleration time 2/ deceleration time 2
ON	OFF	Acceleration time 3/ deceleration time 3
ON	ON	Acceleration time 4/ deceleration time 4

Selection of acceleration/deceleration time 1～4 can be realized by the ON/OFF combination of acceleration/deceleration time terminals 1 and 2.

7～8： normally open/normally closed input of external device fault

A fault signal of an external device can be inputted by the terminal, convenient for servo driver to monitor faults of external devices. After servo driver receives a fault signal of an external device, it displays "E015", namely fault alarm of the external device. The fault signal can be inputted in a normally open or normally closed way.
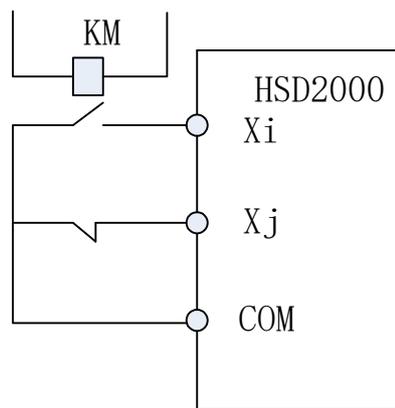
Fig.6-27 Normally Open/Normally Closed Input Diagram of External Device Fault

9： external reset input

When servo driver gives a fault alarm, the fault can be reset by the terminal. The function of the terminal is identical with the function of RESET key on the operating panel.

10～11： control input of external jog run: JOG forward /JOG reverse

It is used for jog run control in the control terminal mode. Jog run frequency, jog interval time and jog acceleration/deceleration time are defined in the P02.16～P02.19.

12： free stop input

The function is the same as the meaning of free running stop defined in the P05.05, but here is realized by a control terminal, to facilitate remote control.

13～14： frequency increase instruction (UP)/decrease instruction (DOWN)

Progressive increase or progressive decrease of frequency is realized by a control terminal, to perform remote control instead of operating panel. It is valid when normal run P02.03＝1, or P02.08＝2 as auxiliary frequency. Increase/decrease rate is set in the P10.09 and P10.10.

15： simple PLC pause instruction：

It is used for pause control of running PLC process. When the terminal is valid, it runs at zero frequency and PLC run is not timed; when the terminal is invalid, automatic speed tracking starts and PLC run continues. For the use method, refer to the functional description of P15.00～P15.30.

16： acceleration/deceleration disable instruction

It is used to keep motor away from any external signal influence (except stop command), to maintain running at current speed.

17： three-wire run control

Refer to the functional description of P10.08 run modes 2 and 3 (three-wire run modes 1 and 2).

18～19： normally open/normally closed contact input of external interrupt

In the running process, when servo driver receives an external interrupt signal, it locks out output and runs at zero frequency. Once the external interrupt signal is cleared, automatic speed tracking of servo driver starts and servo driver resumes running.

External interrupt input has two modes: normally open contact and normally closed contact. As shown in Fig. 6-27, Xi is normally open contact input and Xj is normally closed contact input.

📖 **Attention**

The difference from functions 7～8 is that external interrupt will not cause alarm output of servo driver, and after interrupt signal is cleared, servo driver resumes running.

20： stop DC braking input instruction

DC braking is applied to the motor in the stop process by a control terminal, to realize its emergency stop and accurate positioning. Braking start frequency, braking waiting time and braking current are defined in the P05.06～P05.08; braking time may be the greater value between the time defined in the P05.09 and the effective duration of the control terminal.

21： closed loop fault

It is used for flexible switching between closed loop run mode and low-level run mode. Run mode of HSD2000 by priority level is successively: setting run > jog run > closed loop run > PLC run > multi-speed run > normal run.

It can be switched between closed loop run mode and low-level run mode only in the closed loop run mode (P13.00＝1).

When switched to the low-level run mode, start/stop control, direction and acceleration/deceleration time should comply with setting of the corresponding run mode.

22： PLC disable

It is used for flexible switching between PLC run mode and low-level run mode.

It can be switched between PLC run mode and low-level run mode only in the PLC run mode (P15.00 Ones place ≠0).

When switched to the low-level run mode, start/stop control, direction and acceleration/deceleration time should comply with setting of the corresponding run mode.

23～25： main set frequency source option 1～3

Switching of frequency given channels in table 6-6 can be realized by the ON/OFF combination of frequency given channel option terminals 1, 2 and 3. The relation between terminal switching and setting of function code P02.03 is after-valid.

Table 6-6 Expression of Frequency Given Channel Selection

Option terminal 3 of frequency given channel	Option terminal 2 of frequency given channel	Option terminal 1 of frequency given channel	Selection of frequency given channel
OFF	OFF	OFF	P02.03 setting
OFF	OFF	ON	Operating panel ▲ ▼ given
OFF	ON	OFF	Terminal UP/DOWN given
OFF	ON	ON	Serial port communication given
ON	OFF	OFF	AI analog given
ON	OFF	ON	Terminal PULSE given
ON	ON	OFF	Extended card given
ON	ON	ON	Frequency setting holding

26： AI main set frequency switching to AI

When the function terminal is valid, main set frequency channel is forced to switch to AI given and which AI needs to be set in the AI function in the P11 group. When the function terminal is invalid, the frequency given channel will be restored to the original state.

27： command switching to terminal

When the function terminal is valid, run command channel is forced to switch to terminal run command channel. When the function terminal is invalid, run command channel will be restored to the original state.

28～29： Command source option 1～2

Table 6-7 Selection of Run Command Channels

Option terminal 2 of command source	Option terminal 1 of command source	Run command channel
OFF	OFF	Run command channel holding
OFF	ON	Operating panel run command channel
ON	OFF	Terminal run command channel
ON	ON	Serial port run command channel

Selection of run command channels can be realized by the ON/OFF combination of command source option terminals 1 and 2.

30~33： multi-phase closed loop terminals 1~4

Table 6-8 Selection Expression of Multi-Phase Closed Loop Given

Multi-phase closed loop terminal 4	Multi-phase closed loop terminal 3	Multi-phase closed loop terminal 2	Multi-phase closed loop terminal 1	Selection of multi-phase closed loop given
OFF	OFF	OFF	OFF	Closed loop given depends on P13.01
OFF	OFF	OFF	ON	Multi-phase closed loop given 1
OFF	OFF	ON	OFF	Multi-phase closed loop given 2
OFF	OFF	ON	ON	Multi-phase closed loop given 3
OFF	ON	OFF	OFF	Multi-phase closed loop given 4
OFF	ON	OFF	ON	Multi-phase closed loop given 5
OFF	ON	ON	OFF	Multi-phase closed loop given 6
OFF	ON	ON	ON	Multi-phase closed loop given 7
ON	OFF	OFF	OFF	Multi-phase closed loop given 8
ON	OFF	OFF	ON	Multi-phase closed loop given 9
ON	OFF	ON	OFF	Multi-phase closed loop given 10
ON	OFF	ON	ON	Multi-phase closed loop given 11
ON	ON	OFF	OFF	Multi-phase closed loop given 12
ON	ON	OFF	ON	Multi-phase closed loop given 13
ON	ON	ON	OFF	Multi-phase closed loop given 14
ON	ON	ON	ON	Multi-phase closed loop given 15

Selection of multi-phase closed loop given can be realized by the ON/OFF combination of multi-phase closed loop terminals 1~4.

34： traverse frequency input

When traverse frequency start mode is manually put into service, the terminal is valid and traverse frequency function is valid, see the description of traverse frequency function parameter in the P16 group.

35： traverse frequency state reset

When selecting the traverse frequency function no matter whether it is automatic or manual mode, once the terminal is closed, traverse frequency state information memorized inside servo driver will be cleared. After the terminal is disconnected, traverse frequency restarts. See the function description in the P16 group.

36： external stop instruction

The command is valid to all run command channels. When the function terminal is valid, servo driver will stop according to the mode set in P05.05.

37： servo driver run disable

When the terminal is valid, running servo driver will stop freely and its start-up is disabled in the standby mode. It is mainly used on the occasion when security interaction is required.

38： forward rotation disable

If the terminal is enabled in the process of forward rotation, servo driver will stop freely. First enable the terminal and then run forward, and it will be in zero-frequency running state. Reverse rotation is not affected by this.

39： reverse rotation disable

Contrary to function 38, see the description of function 38.

40： reset of auxiliary set frequency

It is valid only to the digital auxiliary frequency (P02.08＝1, 2, 3). When the function terminal is valid, given value of auxiliary frequency is reset and set frequency completely depends on main given value.

41： clearing of PLC stop memory

In the stop state in PLC run mode, when the function terminal is valid, PLC run phase, run time, run frequency and other information of PLC stop memory will be cleared, see the function description in the P15 group.

42~44： Reserved

45： pulse input of main set frequency (set for X8 only)

It is valid only to input terminal X8, as a mode of main frequency setting together with P02.03＝4. The relation between input signal pulse frequency and set frequency can be adjusted by curve setting in the P11 group.

46： pulse input of auxiliary set frequency (set for X8 only)

It is valid only to input terminal X8, as a mode of auxiliary frequency setting together with P02.08＝5. The relation between input signal pulse frequency and set frequency can be adjusted by curve setting in the P03 group.

47： PG tach input (set for X8 only)

It is valid only to input terminal X8 and the accuracy of speed control is 0.1%. The input port in combination with pulse encoder (PG) can realize feedback control of single-phase pulse speed.

48~50： Reserved

51： pre-exciting command terminal

When the terminal is valid, motor pre-excitation will be started until the terminal becomes invalid.

52～53： Reserved

54： Switching of speed control and torque control

In the vector control mode, the terminal can realize switching of speed control and torque control modes. If P10.16 is set as positive logic, after the terminal is closed, if output torque (observable by P01.10) of servo driver is continuously more than switching torque point P08.04 within the set speed torque switching delay (P08.05), control mode will automatically switch to torque control mode; after the terminal is disconnected, it is speed control mode. The relation between terminal switching and setting of function code P08.00 is after-valid.

55： Reserved

56： selection of torque limitation channels 1 and 2

Selection of torque limitation channels can be realized by the terminal.

57： Reserved

58～59： torque-bias option terminals 1～2

Three torque bias values can be selected by the state combination of the two terminals. Torque bias values can be set by P08.13～P08.15. Combination mode is as shown in table 6-9 below.

Table 6-9 Torque-Bias Selection

Torque-bias option terminal 2	Torque-bias option terminal 1	Torque bias value
OFF	OFF	No torque bias
OFF	ON	Torque bias value1
ON	OFF	Torque bias value 2
ON	ON	Torque bias value 3

60： AI torque-bias retention

When the terminal is valid, AI input at this moment is converted into corresponding torque bias value. It is requested to set the corresponding function as torque bias in the analog input function selection in the P11 group; the torque bias value does not vary with AI input voltage.

  📖 **Attention**

After given AI is changed, if AI torque bias needs to vary with it, the terminal should be enabled again.

61： pulse input terminal of torque limitation 1

The function is set only for terminal X8. Torque limit 1 is determined by external input pulse frequency. When external input pulse frequency reaches maximum input frequency P10.13, the corresponding torque limit 1 is 300%.

62： pulse input terminal of torque limitation 2

The function is set only for terminal X8, similar to function 61.

63： pulse input terminal of torque given

The function is set only for terminal X8. Given value of torque is determined by external input pulse frequency. Pulse input of

functions 61～63 should undergo curve adjustment in the P11 group.

64： Reserved

65～70： Reserved

71： position pulse direction (set for X7 only)

The function is valid only to terminal X7. The direction of position pulse input depends on ON/OFF level of the terminal.

72： position pulse input (set for X8 only)

The function is valid only to terminal X8. When the terminal pulse given in P09.03 is selected, the position instruction given can be determined by inputting the pulse of the terminal.

73： reset of position deviation counter

When the terminal is valid, the error count value of position given and position feedback will be cleared.

74： Instruction pulse disable

When P09.03＝0, 2, if instruction pulse disable terminal is valid pulse input is disabled and position given remains unchanged; when the terminal is invalid, the pulse is inputted normally as position given.

75～76： Reserved

77： spindle orientation start

When spindle directional run is selected in the P09.01 and the terminal is valid, spindle directional run starts.

78～79： position option terminals 1～2

Spindle directional position of P09.22～P09.25 can be selected by the combination of the two terminals.

Select two control terminals from X1～X8 and respectively define its function as position option 1 and 2. Take control terminals X6 and X7 as an example, set P10.05＝78 and P10.06＝79. By the combination of terminals X6 and X7, it is valid to select a set position.

Specific combination is as follows:

Table 6-10 Selection of Spindle Position

Position option terminal 2	Position option terminal 1	Spindle position
OFF	OFF	Spindle position 1
OFF	ON	Spindle position 2
ON	OFF	Spindle position 3
ON	ON	Spindle position 4

80： Reserved

81： servo control switching terminal

When current control mode is speed/torque control (P09.00＝1), the switching terminal can be enabled to switch it to servo control mode.

When current control mode is servo control (P09.00＝2), the switching terminal can be enabled to switch it to speed/torque control mode.

See the description of function codes in the P09 group.

82： Reserved

83： position reference point input terminal

When ones place of P09.02 is equal to 1 and position reference point input terminal is valid, photoelectric switch signal is inputted through the position reference point.

84： origin return-to-zero

In the spindle orientation control mode, when origin return-to-zero terminal is valid, spindle position is 0, or else one of spindle positions 1～4 (P09.22～P09.25) should be selected.

85～87： Reserved

88： switching terminal of motors 1 and 2

When the terminal is valid, switching control of the two motors can be realized.

☐ **Attention**

Only the following function numbers are displayed in the shortcut menu.

0, 7, 8, 9, 10, 11, 12, 13, 14, 17, 18, 19, 20, 26, 27, 35, 37, 45, 46, 47, 48。

P10.08 FWD/REV run mode setting	0～3【0】

The parameter defines four different modes of controlling running of servo driver by an external terminal.

0： 1 two-wire run mode 1
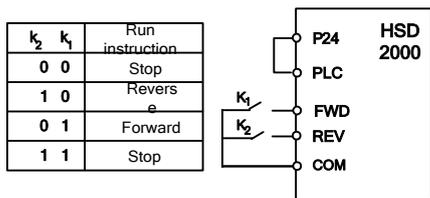
Fig. 6-28 Two-Wire Run Mode 1

运行指令	Run instruction
停止	Stop
反转	Reverse
正转	Forward

1： two-wire run mode 2
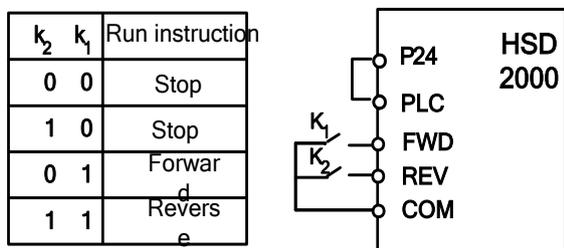
Fig. 6-29 Two-Wire Run Mode 2

运行指令	Run instruction
停止	Stop
反转	Reverse
正转	Forward

2： three-wire run mode 1
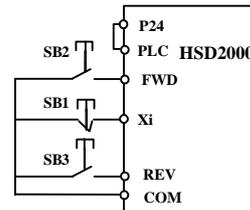
Fig. 6-30 Three-Wire Run Mode 1

In which,

SB1： stop button

SB2： forward button

SB3： reverse button

Xi stands for multi-function input terminals X1～X8 and here the corresponding terminal function should be defined as 17# function "three-wire run control".

3： three-wire run mode 2
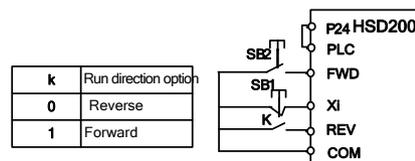
Fig. 6-31 Three-Wire Run Mode 2

运行方向选择	Run direction option
反转	Reverse
正转	Forward

In which,

SB1： stop button

SB2： run button

Xi stands for multi-function input terminals X1～X8 and here the corresponding terminal function should be defined as 17# function "three-wire run control".

P10.09 Terminal UP rate	0.01～99.99Hz/s【1.00Hz/s】
P10.10 Terminal DOWN rate	0.01～99.99Hz/s【1.00Hz/s】

The function code defines the change rate of set frequency modified by the terminal UP/DOWN

P10.11 X8 pulses per revolution	1～9999【1024】

When the terminal X8 selects 47# function "PG tach input", actual speed of PG can be measured by setting the value of P10.11 to be consistent with pulses per revolution of local PG.

P10.12 Terminal filtering time	0～500ms【10ms】

The function code sets filtering time of input terminal detection. When input terminal state changes, if it remains unchanged after the set filtering time has passed, the change of terminal state is

valid, or else it still keeps previous state, to effectively reduce misoperations arising from interference.

P10.13 Maximum input pulse frequency	0.1～100.0kHz【10kHz】

The function code sets maximum input pulse frequency when the terminal X8 is used for pulse input.

P10.14 Pulse given center point option	0～2【0】

The function code defines three different midpoint modes when the terminal X8 is used for pulse input.

0： centerless midpoint, as shown in the figure below:
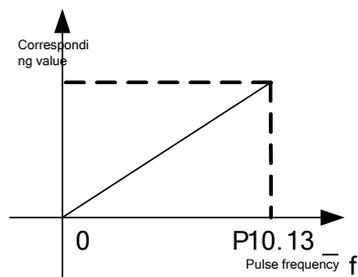
Fig. 6-32 Centerless Midpoint Mode

对应量	Corresponding value
脉冲频率	Pulse frequency

Values corresponding to pulse input frequencies are all positive.

1： center point mode 1
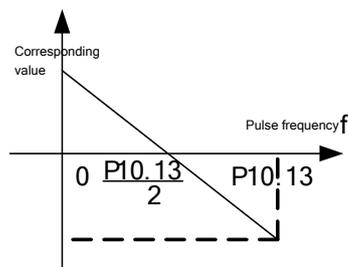
Fig. 6-33 Center Point Mode 1

对应量	Corresponding value
脉冲频率	Pulse frequency

Pulse input has a center point and the center point is half of maximum pulse input frequency P10.13. When input pulse frequency is less than midpoint frequency, corresponding values are positive.

2： center point mode 2

Pulse input has a center point and the center point is half of maximum pulse input frequency P10.13. When input pulse frequency is greater than midpoint frequency, corresponding values are positive.
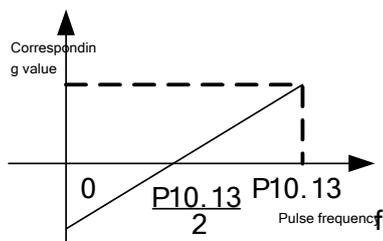
Fig. 6-34 Center Point Mode 2

对应量	Corresponding value
脉冲频率	Pulse frequency

P10.15 Pulse given filtering time	0.00～10.00s【0.05s】

The function code defines filtering time of input pulse. The longer the filtering time is, the lower the change rate of given pulse frequency is.

P10.16 Valid state setting of input terminal	000～3FFH【000H】
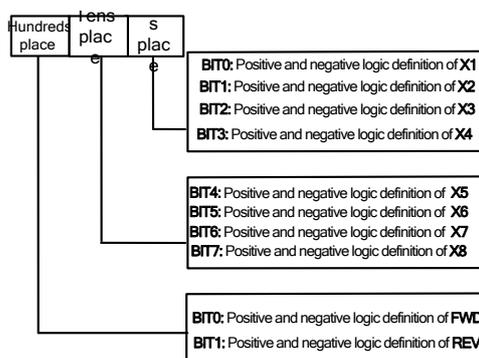
Fig. 6-35 Positive and Negative Logic Setting of Terminals

个位	Ones place
十位	Tens place
百位	Hundreds place
X1 的正反逻辑定义	Positive and negative logic definition of X1
X2 的正反逻辑定义	Positive and negative logic definition of X2
X3 的正反逻辑定义	Positive and negative logic definition of X3
X4 的正反逻辑定义	Positive and negative logic definition of X4
X5 的正反逻辑定义	Positive and negative logic definition of X5
X6 的正反逻辑定义	Positive and negative logic definition of X6
X7 的正反逻辑定义	Positive and negative logic definition of X7

X8 的正反逻辑定义	Positive and negative logic definition of X8
FWD 的正反逻辑定义	Positive and negative logic definition of FWD
REV 的正反逻辑定义	Positive and negative logic definition of REV

The function code defines positive and negative logics of input terminals.

Positive logic: it is valid when an Xi terminal and its corresponding common port are connected and invalid when disconnected;

Negative logic: it is invalid when an Xi terminal and its corresponding common port are connected and valid when disconnected;

When BIT place is 0, it is positive logic and BIT place is 1, it is negative logic.

For example,

If X1～X8 are required to be positive logic and FWD and REV are negative logic, setting is as below:

Logic state of X4 ～ X1 is 0000 and the corresponding hexadecimal system is 0, and LED displays 0 in the ones place; logic state of X8～X5 is 0000 and the corresponding hexadecimal system is 0, and LED displays 0 in the tens place; logic state of REV and FWD is 11 and the corresponding hexadecimal system is 3, and LED displays 3 in the hundreds place; here function code P10.16 should be set as 300 and determination method of set value is as shown in table 6-11 below:

Table 6-11 Correspondence Relation between Binary System Setting and LED Place Display Value

Binary system setting				Hexadecimal system (LED place display value)
BIT3	BIT2	BIT1	BIT0	
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

LED place refers to the thousands place, hundreds place, tens place and ones place displayed by LED on the operating panel.

📖 **Attention**
Factory settings of all terminals are positive logic.

| P10.17 State setting of virtual input terminal | 000～3FFH【000H】 |

The function code is used to set valid state of virtual input terminals of upper computer. For the detailed setting method, see P10.16 description.

P10.18 Output terminal Y1 of open collector	0～35【0】
P10.19 Output terminal Y2 of open collector	0～35【1】
P10.20 Output function option of relay BR	0～35【15】
P10.21 Output function option of relay T	0～35【16】

Output characteristics of Two-way open collector output terminals Y1 and Y2 and relay output terminals are described in Chapter 4. Table 6-12 gives the options of the above four function parameters and it is allowed to repeatedly select the same output terminal function.

Table 6-12 Function Selection of Output Terminals

Content	Corresponding function	Content	Corresponding function
0	Servo driver running signal (RUN)	1	Frequency arrival signal (FAR)
2	Speed non-zero signal	3	Frequency detection signal (FDT1)
4	Frequency detection signal (FDT2)	5	Overload detection signal (OL)
6	Undervoltage lockout (LU)	7	External fault shutdown (EXT)
8	Upper frequency limit (FHL)	9	Lower frequency limit (FLL)
10	Servo driver running at zero speed	11	Completion indication of simple PLC phase run
12	Completion indication of PLC cycle	13	Upper and lower limits of traverse frequency
14	Encoder direction output	15	Servo driver ready for running (RDY)
16	Servo driver fault	17	On-off signal of upper computer
18	Reserved	19	Torque under limitation
20	Magnetic flux detection signal	21	Reserved
22	Analog torque bias valid	23	Over-torque/under-torque output 1
24	Over-torque/under-torque output 2	25	Positioning completed
26	Positioning approach	27	Reserved
28	Position out-of-tolerance alarm	29	Reserved
30	Reserved	31	Reserved
32	Reserved	33	Reserved
34	Forward/reverse running indication of servo driver	35	Indication of motors 1 and 2

The functions listed in table 6-12 are described as follows:

0： servo driver running signal (RUN)

When servo driver is in running state, an indication signal will be outputted.

1： frequency arrival signal (FAR)

Refer to the function description of P10.26.

2： speed non-zero signal

When servo driver is in running state and the speed is greater than P05.15 "stop speed", an indication signal will be outputted. Detection mode of speed non-zero is set by P05.16 "detection mode of stop speed".

  📖   **Attention**

Zero-speed detection is valid in all control modes.

3： frequency detection signal (FDT1)

Refer to the function description of P10.28～P10.29.

4： frequency detection signal (FDT2)

Refer to the function description of P10.30～P10.31.

5： overload detection signal (OL)

When output current of servo driver exceeds P20.10 overload pre-alarm detection level and time is greater than P20.11 overload pre-alarm detection time, an indication signal will be outputted. It is often used for overload pre-alarm.

6： undervoltage lockout (LU)

When DC bus voltage is lower than undervoltage limit level, an indication signal will be outputted and LED will display "P.oFF".

7： External fault shutdown (EXT)

When servo driver gives an external fault trip alarm (E015), an indication signal will be outputted.

8： Upper frequency limit (FHL)

When set frequency is greater than or equal to the upper frequency limit and running frequency reaches the upper frequency limit, an indication signal will be outputted.

9： Lower frequency limit (FLL)

When set frequency is less than or equal to the lower frequency limit and running frequency reaches the lower frequency limit, an indication signal will be outputted.

10： Servo driver running at zero speed

When servo driver is in zero-speed running state, an indication signal will be outputted. Specifically speaking, in V/F mode, when output frequency is 0, an indication signal will be outputted; in non-V/F mode, when feedback frequency is less than P10.37 corresponding frequency, an indication signal will be outputted.

11： completion indication of simple PLC phase run

After simple PLC run in current phase is completed, an indication signal (single pulse signal, width: 500ms) will be outputted.

12： completion indication of PLC cycle

After simple PLC completes a run cycle, an indication signal (single pulse signal, width: 500ms) will be outputted.

13： upper and lower limits of traverse frequency

After the traverse frequency function is selected, if the fluctuation range of traverse frequency calculated based on center frequency exceeds the upper frequency limit P02.06 or is below the lower frequency limit P02.07, an indication signal will be outputted, as shown in Fig.6-36.

Fig. 6-36 Amplitude Limit of Traverse Frequency
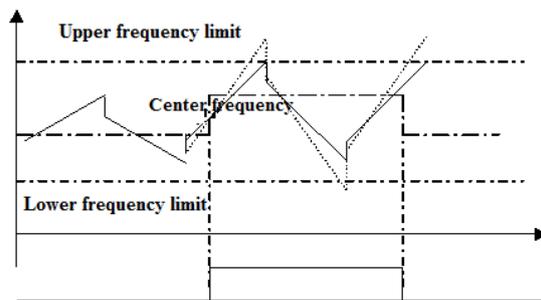
上限频率	Upper frequency limit
摆频中心频率	Center frequency
下限频率	Lower frequency limit
摆频超出上下限阀值	Traverse frequency is beyond the upper and lower thresholds

14： output of encoder frequency division direction

It is indicate the direction signal of frequency division output of current encoder.

15： servo driver ready for running (RDY)

When the signal output is valid, it shows servo driver is fault-free, bus voltage is normal, run disable terminal of servo driver is invalid, and servo driver can receive a start command.

16： servo driver fault

When servo driver breaks down, an indication signal will be outputted.

17： on-off signal of upper computer

Output signals of Y1 and Y2 or BR and T are directly controlled by serial ports. Output is also affected by P10.17.

18： Reserved

19： torque under limitation

When a torque instruction is restricted by torque limit 1 or 2, an indication signal will be outputted.

20： magnetic flux detection signal

When magnetic flux detection value exceeds P10.37, an indication signal will be outputted.

21： Reserved

22： analog torque bias valid

When input terminal function is set as 60 "torque-bias retention" and it is valid, an indication signal will be outputted.

23： over-torque/under-torque output 1

According to setting of P08.17～P08.19, the corresponding indication signal will be outputted.

24： over-torque/under-torque output2

According to setting of P08.20～P08.22, the corresponding indication signal will be outputted.

25： positioning completed

In running state, when position control is selected and position deviation is less than or equal to P09.12, the corresponding indication signal will be outputted.

26： positioning approach

In running state, when position control is selected and position deviation is less than or equal to P09.13, the corresponding indication signal will be outputted.

27： Reserved

28： position out-of-tolerance alarm

In running state, when position control is selected and position deviation is greater than or equal to P09.14 "detection range of position out-of-tolerance" and P09.15 position out-of-tolerance alarm option 0 is valid, the corresponding indication signal will be outputted.

29～33： Reserved

34： forward/reverse running indication of servo driver

The corresponding indication signal will be outputted according to actual running direction of current servo driver.

35： indication of motors 1 and 2

The corresponding indication signal will be outputted according to current selected motor.

📖 **Attention**

Only the following function numbers are displayed in the shortcut menu.

0, 1, 4, 5, 6, 7, 8, 9, 15, 16.

P10.22 Valid state setting of output terminal	0～FH【0H】
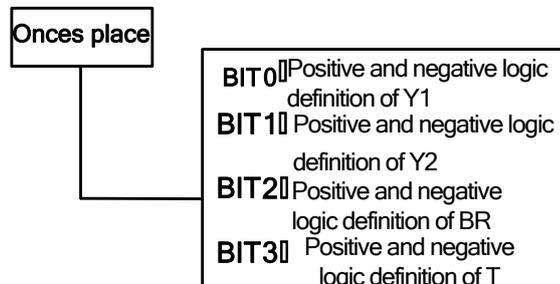
Fig. 6-37 Valid State Setting of Output Terminal

个位	Ones place
Y1 的正反逻辑定义	Positive and negative logic definition of Y1
Y2 的正反逻辑定义	Positive and negative logic definition of Y2
BR 的正反逻辑定义	Positive and negative logic definition of BR
T 的正反逻辑定义	Positive and negative logic definition of T

The function code defines positive and negative logic of output terminal.

When BIT place is 0, it is positive logic (valid when connected and invalid when disconnected); when BIT place 1 is, it is negative logic (invalid when connected and valid when disconnected).

P10.23 Output delay of relay BR	0.1～10.0s【0.1s】
P10.24 Output delay of relay T	0.1～10.0s【0.1s】

The function code defines the time delay from change of relay state to variation of relay output.

P10.25 Frequency arrival (FAR) detection width	0.00～1000.0Hz【2.50Hz】

The parameter is the supplementary definition of 1# function in table 6-12. As shown in Fig.6-38, when output frequency of servo driver is within positive and negative detection width of set frequency, a pulse signal will be outputted.
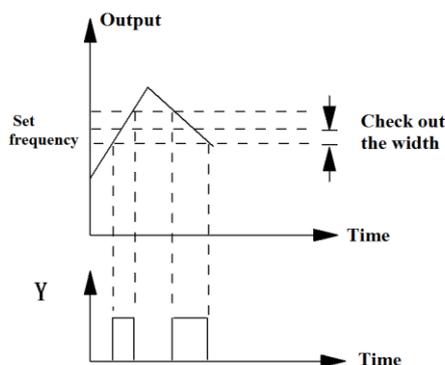
Fig. 6-38 FAR Signal Output Diagram

P10.26 FDT1 detection mode	0～1【0】
P10.27 FDT1 level	0.00～1000.0Hz【50.00Hz】
P10.28 FDT1 lag	0.00～1000.0Hz【1.00Hz】
P10.29 FDT2 detection mode	0～1【1】
P10.30 FDT2 level	0.00～1000.0Hz【25.00Hz】
P10.31 FDT2 lag	0.00～1000.0Hz【1.00Hz】

P10.27～P10.29 are the supplementary definition of 3# function in table 6-12; P10.30～P10.32 are the supplementary definition of 4# function in table 6-12; the usage of both is the same. Take P10.27～P10.29 as an example to give a description below:

Firstly set P10.27 "FDT1 detection mode" to determine the source of set frequency.

0 ： speed setting value (frequency instruction after acceleration/deceleration)

1： speed detection value

When output frequency exceeds the set frequency (FDT1 level), an indication signal will be outputted until output frequency drops down to a certain frequency lower than FDT1 level (FDT1 level-FDT1 lag). As shown in Fig.6-39.
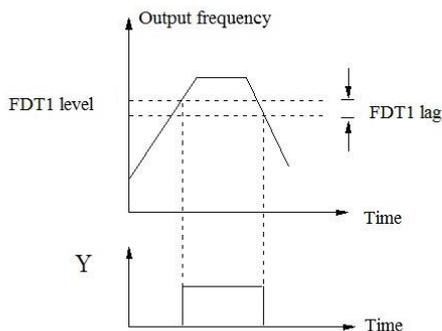
Fig. 6-39 Frequency Detection Diagram

输出频率	Output frequency
FDT1 电平	FDT1 level
FDT1 滞后	FDT1 lag
时间	Time

P10.32 DO terminal output	**0～19【0】**

Output of DO pulse frequency: $0\sim$ maximum output pulse frequency (defined by P10.33).

The linear correspondence relation between DO output and indication range is as shown in table 6-13.

Table 6-13 Indication of Output Terminal

Content	Corresponding function	Indication range
0	Non-function	No
1	Output frequency	0～maximum output frequency
2	Set frequency	0～maximum output frequency
3	Output current Iei	0～2×rated current of servo driver
4	Output current Iem	0～3×rated current of motor
5	Output torque	0～3×rated motor torque
6	Output torque current	0～3×torque current
7	Motor speed	0～ maximum speed
8	Output voltage	0～1.5×rated voltage of servo driver
9	Adjusted AI1 voltage	－10V～10V/4～20mA
10	Adjusted AI2 voltage	－10V～10V/4～20mA
11	Adjusted AI3 voltage	－10V～10V
12	Output power	0～3×rated power
13	Torque limit 1	0～3×rated motor torque
14	Torque limit 2	0～3×rated motor torque
15	Torque bias	0～3×rated motor torque
16	Torque given	0～3×rated motor torque
17	Extended function 1 of upper computer	0～65535
18	Frequency division output of encoder	
19	Reserved	

For extended function 1 of upper computer, DO output is directly controlled by serial port. 65535 corresponds to maximum output frequency of DO, refer to HSD2000 communication protocol.

    Attention

Only the following function numbers are displayed in the shortcut menu.
0, 1, 2, 3, 4, 5, 6, 7, 8.

P10.33 Maximum output pulse frequency	**0.1～100kHz【10.0】**

The function code defines maximum output frequency of DO pulse.

P10.34 Pulse output center point option	**0～2【0】**

The function code defines three different center point modes of DO terminal pulse output.
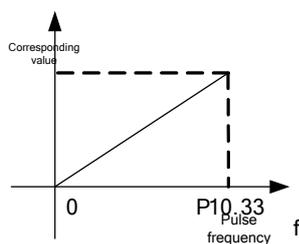
Fig. 6-40 Centerless Midpoint Mode

Values corresponding to pulse output frequencies are all positive.

1： center point mode 1, as shown in the figure below:
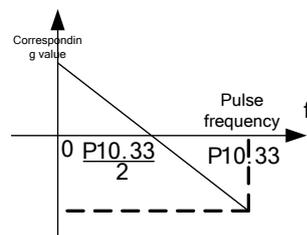
Fig. 6-41 Center Point Mode 1

对应量	Corresponding value
脉冲频率	Pulse frequency

Pulse output has a center point and the center point is half of maximum pulse output frequency P10.13. When output pulse frequency is less than midpoint frequency, corresponding values are positive.

2： center point mode 2

Pulse output has a center point and the center point is half of maximum pulse output frequency P10.13. When output pulse frequency is greater than midpoint frequency, corresponding values are positive.
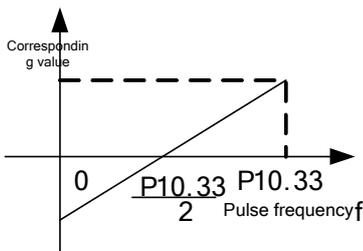
Fig. 6-42 Center Point Mode 2

对应量	Corresponding value
脉冲频率	Pulse frequency

P10.35 Filtering time of pulse output	0.00～10.00s【0.05s】

The function code defines the filtering time of output pulse. The longer the filtering time is, the lower the change rate of output pulse frequency is.

P10.36 Magnetic flux detection value	10.0%～100.0%【100.0%】

It is used in conjunction with 20# function of switch output terminal.

P10.37 Zero-speed threshold	0.0%～100.0%【1.0%】

The function code is relative to maximum output frequency P02.05 and it is used in conjunction with 10# function of switch output terminal.

P10.38 Reserved	

Reserved function

6.1.12 Analog I/O terminal parameters (P11 group)

P11.00 Analog input type option	00～11【00】
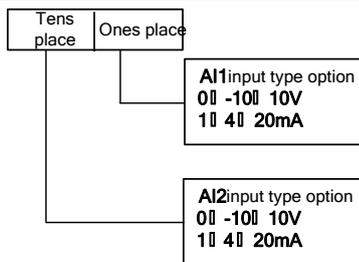
Fig. 6-43 Analog Input Type Option

十位	Tens place
个位	Ones place
AI1 输入类型选择	AI1 input type option
AI2 输入类型选择	AI2 input type option

The function code is used to select analog input type and range of AI1 and AI2.

P11.01 AI1 terminal input function option	0～13【00】

0： non-function

1： main set frequency given

When the function is selected, it is used in conjunction with P02.03 function code. When serving as voltage input, the polarity of analog input affects running direction of servo driver: when analog input is positive, servo driver rotates forward; on the contrary, servo driver rotates reversely. Maximum value (10V/20mA) of analog input corresponds to maximum output frequency of servo driver.

2： auxiliary set frequency given

When the function is selected, it is used in conjunction with P02.08 function code. When serving as voltage input, the polarity of analog input affects the polarity of auxiliary frequency: when analog input is positive, auxiliary frequency is positive; on the contrary, auxiliary frequency is negative. Maximum value (10V/20mA) of analog input corresponds to maximum output frequency of servo driver.

3： torque bias

When the function is selected, AI torque bias retention function should be selected for switch input terminal. When serving as voltage input, $-10～10V$ corresponds to $-100％～100％$ rated motor torque; when serving as current input, $4～20mA$ corresponds to $0～100％$ rated motor torque.

When analog input serves as torque bias, an application example is given as below:

AI1 analog input $4～20mA$ corresponds to $0～100％$ rated motor torque of indication analog given torque bias

Setting is as below:

1） P11.01＝3, input torque bias;

2） P11.00＝01, AI1 input type is $4～20mA$;

3） P11.03＝1.0, input gain is 1;

4） P11.02＝0, zero-bias correction is 0.

5） Select the function 60 of switch input terminal Xi and make the terminal Xi have a switch-off～ switch-on jump (only this way can make analog input torque bias valid, or else analog input given torque bias always remains to be previous analog given value).

📖 **Attention**

AI torque bias is just a part of torque bias and final torque bias also includes setting of P08.12～P08.15.

4： speed limit 1

When the function is selected, it is used in conjunction with P07.09 function code setting. When serving as voltage input, $0～±10V$ corresponds to maximum output frequency of $0～100％$ servo driver; when serving as current input, 20mA corresponds to maximum output frequency of $0～100％$ servo driver

5： speed limit 2

When the function is selected, it is used in conjunction with P07.09 function code setting. The meaning of analog input is the same as speed limit 1.

6： torque limit 1

When the function is selected, it is used in conjunction with P08.08 function code setting. The meaning of analog input is the same as torque bias.

7： torque limit 2

When the function is selected, it is used in conjunction with P08.09 function code setting. The meaning of analog input is the same as torque bias.

8： torque instruction (given)

When the function is selected, it is used in conjunction with P08.02 function code setting. The meaning of analog input is the same as torque bias.

9～11： Reserved

12： V/F output voltage bias

When analog input is voltage signal and analog input terminal function is output voltage bias, the corresponding output voltage bias is as shown in Fig. 6-44.
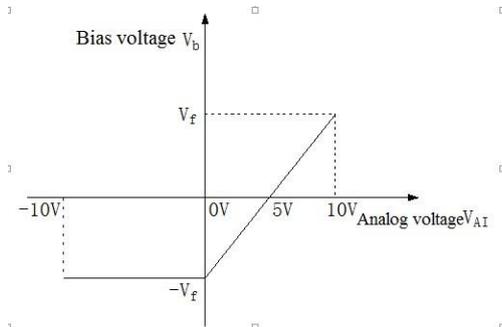
Fig.6-44 Output Voltage Bias

偏置电压	Bias voltage
模拟电压	Analog voltage

Supposing output voltage that set frequency corresponds to in V/F curve is V/F, the relation between input analog signal and bias voltage is as below:

-10V～0V/4mA analog input V_{AI} corresponds to bias voltage -V/F;

10V/20mA analog input V_{AI} corresponds to bias voltage V/F

Output voltage of servo driver: $V_O = V/F + V_b$

📖 **Attention**

Output voltage bias function is valid only in V/F mode.

13： output voltage

When the function is valid in V/F mode, output voltage V_O of servo driver and its output frequency are completely of mutual independence. Output voltage of servo driver is not restricted by V/F characteristic curve in the P06 group and it depends on analog input signal, as shown in Fig.6-45.
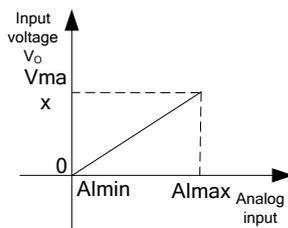
Fig.6-45 Output Voltage Curve

输入电压 V_O	Input voltage V_O
模拟输入	Analog input

In the above figure, horizontal coordinate represents analog input signal after adjusted and vertical coordinate represents output voltage of servo driver. When input analog voltage is less than zero, output voltage is also zero.

P11.02 AI1 zero-bias correction	－100.0～100.0%【0.0%】
P11.03 AI1 input gain	－10.00～10.00【1.00】
P11.04 AI1 input filter	0.01～10.00s【0.05】

Maximum output of AI zero bias is 100％ (10V or 20mA) and both upper and lower translation values are set in percentage.

Take voltage input for example, the relation between zero bias and gain before and after adjusted is as below:

AI input value ＝ input gain ×given analog value ＋ zero-bias correction ×10V

P11.04 defines channel filtering time constant and input signal is filtered; the longer the filtering time is, the higher the interference resistance is, but the response becomes slow; the shorter the filtering time is, the quicker the response is, but the interference resistance becomes weak.

The curve of relation between analog input and gain and the curve of relation between analog input and zero-bias correction are respectively as shown in Fig.6-46 and Fig.6-47.
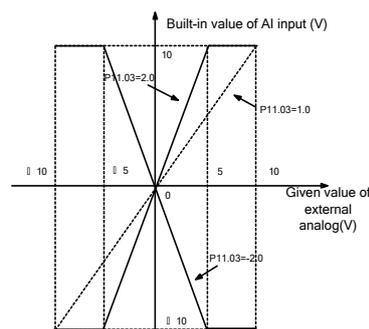
Fig.6-46 Curve of Relation between Analog Input and Gain

AI 输入机内值	Built-in value of AI input
外部模拟给定值	Given value of external analog
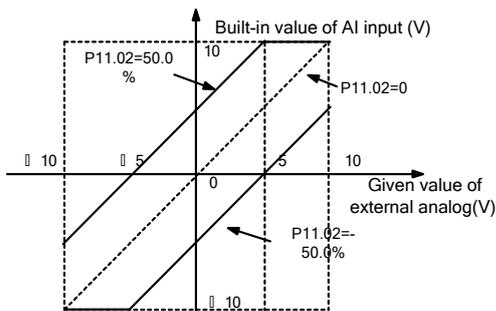
Fig.6-47 Curve of Relation between Analog Input and Zero Bias

AI 输入机内值	Built-in value of AI input
外部模拟给定值	Given value of external analog

P11.05 AI1 zero-bias correction mode	0～3【0】

0： zero bias-centered

1： below zero bias is equal to zero bias

2： above zero bias is equal to zero bias

3： zero bias-centered absolute value

The meanings of the four values are respectively shown as Fig. 6-48, Fig. 6-49, Fig.6-50 and Fig.6-51.
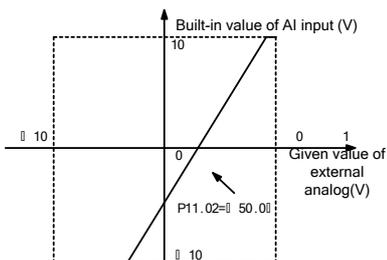
Fig.6-48 *Zero Bias-Centered* Correction Mode

AI 输入机内值	Built-in value of AI input
外部模拟给定值	Given value of external analog
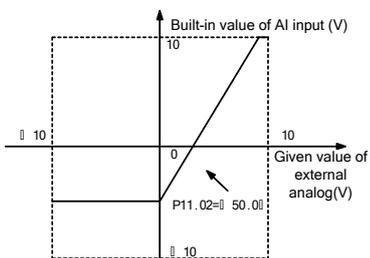
Fig.6-49 *Below Zero Bias Is Equal To Zero Bias* Correction Mode

AI 输入机内值	Built-in value of AI input
外部模拟给定值	Given value of external analog
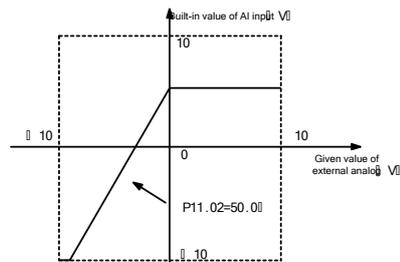
Fig.6-50 *Above Zero Bias Is Equal To Zero Bias* Correction Mode

AI 输入机内值	Built-in value of AI input
外部模拟给定值	Given value of external analog
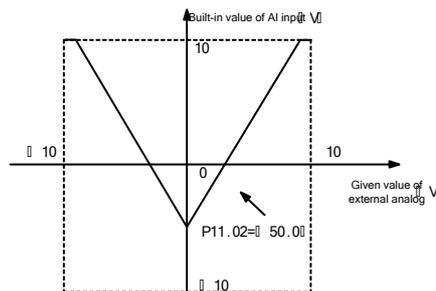
Fig.6-51 *Zero Bias-Centered Absolute Value* Correction Mode

AI 输入机内值	Built-in value of AI input
外部模拟给定值	Given value of external analog

📖 **Attention**

Input gain and zero-bias correction function codes have a real-time influence on analog input in the modification process.

P11.06 AI2 terminal input function option	0～11【00】
P11.07 AI2 zero-bias correction	－100.0～100.0%【0.0%】
P11.08 AI2 input gain	－10.00～10.00【1.00】
P11.09 AI2 input filter	0.01～10.00s【0.05】
P11.10 AI2 zero-bias correction mode	0～3【0】
P11.11 AI3 terminal input function option	0～11【00】
P11.12 AI3 zero-bias correction	－100.0～100.0%【0.0%】
P11.13 AI3 input gain	－10.00～10.00【1.00】
P11.14 AI3 input filter	0.01～10.00s【0.05】
P11.15 AI3 zero-bias correction mode	0～3【0】

Function setting of analog input of AI2 terminal and its meaning are identical with AI1. Function setting and meaning of AI3 terminal as differential voltage input are identical with AI1 as voltage input.

P11.16 Analog output type option	00～33【00】
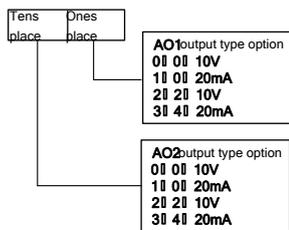
Fig.6-52 Analog Output Type Option

十位	Tens place
个位	Ones place
AO1 输出类型选择	AO1 output type option
AO2 输出类型选择	AO2 output type option

The function code is used to select the analog output range of AO1 and AO2.

P11.17 Output function option of AO1 terminal	0～25【0】

For output characteristics of AO1 and AO2, see *4.2 control circuit wiring and configuration*; analog output range is determined by the function code P11.16.

The linear correspondence relation between AO1 output and indication range is as shown in table 6-14.

Table 6-14 Indication of Analog Output Terminal

Content	Corresponding function	Indication range
0	Output frequency	0～maximum output frequency
1	Set frequency	0～maximum output frequency
2	Set frequency (after acceleration/deceleration)	0～maximum output frequency
3	Motor speed	0～maximum speed
4	Output current	0～2×rated current of servo driver
5	Output current	0～2×rated current of motor
6	Output torque	0～3×rated torque of motor
7	Output torque current	0～3×rated torque of motor
8	Output voltage	0～1.2×rated voltage of servo driver
9	Bus voltage	0～800V
10	AI1	0～maximum analog input
11	AI2	0～maximum analog input
12	AI3	0～10V
13	Output power	0～2×rated power of motor
14	Extended function 2 of upper computer	0～4095
15	Torque limit 1	0～300％rated torque of motor
16	Torque limit 2	0～300％rated torque of motor
17	Torque bias	0～300％rated torque of motor
18	Torque instruction	0～300％rated torque of motor
19	Magnetic flux instruction	0～100％rated magnetic flux of motor
20	Position deviation	0～2048
21	Output torque (bipolarity)	－300～300％rated torque of motor

Content	Corresponding function	Indication range
22	Output torque current (bipolarity)	－300～300％rated torque of motor
23	Torque bias (bipolarity)	－300～300％rated torque of motor
24	Motor speed (bipolarity)	Negative maximum output frequency ～maximum output frequency
25	Reserved	Reserved

For extended function 2 of upper computer, output of AO1 and AO2 is directly controlled by serial port. 4095 corresponds to maximum output 10V (20mA), refer to HSD2000 communication protocol.

For example,

AO1 output 4～20mA corresponds to indicating bus voltage 0～800V.

Setting is as below:

①P11.17＝8, output bus voltage;

②P11.16＝03, AO1 output type is 4～20mA;

③P11.19＝100％, output gain is 100％

④P11.20＝0, zero-bias correction is 0.

🕮 **Attention**

1．When the corresponding function of AO output is unipolarity (P11.17 = 0 ~ 20), absolute value of the corresponding indication of minimum output is minimal and absolute value of the corresponding indication of maximum output is maximal; when the corresponding function is bipolarity (P11.17＝21～24), the corresponding indication of minimum output is minimal and the corresponding indication of maximum output is maximal.

2．When AO output is current, it is suggested that external equivalent resistance should not exceed 400Ω.

P11.18 AO1 output filter	0.0～20.0s【0.1】
P11.19 AO1 output gain	0.0～200.0%【100.0%】
P11.20 AO1 zero-bias correction	－100.0～100.0%【0.0%】

AO1 output filter is used to set the time constant of AO1 analog output filter. The longer the filtering time is, the slower the analog output response is; on the contrary, the response is quicker

For AO1 and AO2 analog outputs, if users need to change the indication range or correct the error of gauge outfit, it can be realized by adjusting output gain.

Maximum output of AO zero bias is 100％ (10V or 20mA) and both upper and lower translation values are set in percentage. Take output voltage for example, the relation before and after adjusted is as below:

AO output value ＝ output gain ×the value before adjusted ＋ zero-bias correction ×10V

The curve of relation between analog output and gain and the curve of relation between analog output and zero-bias correction are respectively as shown in Fig.6-53 and Fig.6-54.
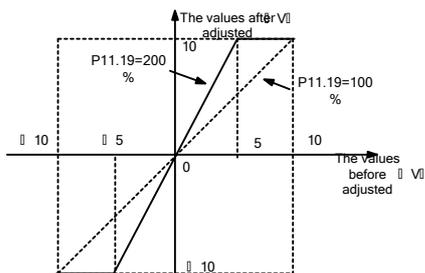
Fig.6-53 Curve of Relation between Analog Output and Gain

调整后的值	The values after adjusted
调整前的值	The values before adjusted
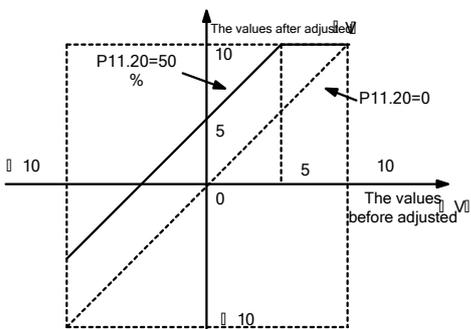
Fig.6-54 Curve of Relation between Analog Output and Zero Bias

调整后的值	The values after adjusted
调整前的值	The values before adjusted

📖   **Attention**

Output gain and zero-bias correction function codes have a real-time influence on analog output in the modification process.

P11.21 AO2 terminal output function option	0～25【0】
P11.22 AO2 output filter	0.0～20.0s【0.1】
P11.23 AO2 output gain	0.0～200.0%【100.0%】
P11.24 AO2 zero-bias correction	－100.0～100.0%【0.0%】

Function setting of analog output of AO2 terminal and its meaning are identical with AO1.

P11.25 Curve option	0000～1111【0000】
P11.26 Maximum given on curve 1	P11.26～100.0%【100.0%】
P11.27 Actual value corresponding to maximum given on curve 1	0.0%～300.0%【100.0%】
P11.28 Inflection point 2 given on curve 1	P11.32～P11.28【100.0%】
P11.29 Actual value corresponding to inflection point 2 given on curve 1	0.0%～300.0%【100.0%】
P11.30 Inflection point 1 given on curve 1	P11.26～P11.30【0.0%】
P11.31 Actual value corresponding to	0.0%～300.0%【0.0%】

inflection point 1 given on curve 1	
P11.32 Minimum given on curve 1	0.0%～P11.28【0.0%】
P11.33 Actual value corresponding to minimum given on curve 1	0.0%～300.0%【0.0%】
P11.34 Maximum given on curve 2	P11.34～100.0%【100.0%】
P11.35 Actual value corresponding to maximum given on curve 2	0.0%～300.0%【100.0%】
P11.36 Inflection point 2 given on curve 2	P11.40～P11.36【100.0%】
P11.37 Actual value corresponding to inflection point 2 given on curve 2	0.0%～300.0%【100.0%】
P11.38 Inflection point 1 given on curve 2	P11.34～P11.38【0.0%】
P11.39 Actual value corresponding to inflection point 1 given on curve 2	0.0%～300.0%【0.0%】
P11.40 Minimum given on curve 2	0.0%～P03.11【0.0%】
P11.41 Actual value corresponding to minimum given on curve 2	0.0%～300.0%【0.0%】

Analog input AI1～AI3 and pulse input can be given as different channels; for function selection of analog input channel, see the setting of function codes in the P11 group; for function selection of pulse input, see the setting of input function of terminal X8. for example, when AI1, AI2, AI3 or pulse frequency (PULSE) input is selected as frequency given channel, the relation between given frequency and set frequency is as shown in Fig.6-55 (AI1 is selected as main frequency given channel).
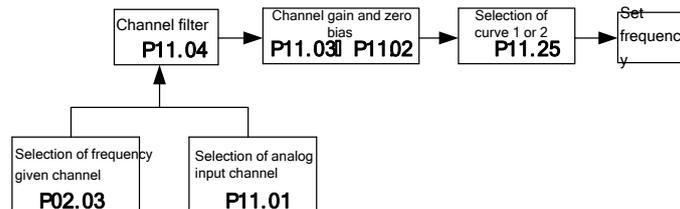
Fig.6-55 Relation between Given Channel Input and Set Frequency

通道滤波	Channel filter
通道增益和零偏	Channel gain and zero bias
曲线 1 或 2 选择	Selection of curve 1 or 2
设定频率	Set frequency
频率给定通道选择	Selection of frequency given channel
模拟输入通道选择	Selection of analog input channel

The relation between set frequency and given analog signal after filter, gain and zero bias processing is determined by curve 1 or curve 2. Curve 1 is defined by P11.26～P11.33 and curve 2 is defined by P11.34～P11.41. Take set frequency for example, both can independently realize positive action characteristic and reverse action characteristic, as shown in Fig. 6-56.

Fig. 6-56 shows the correspondence relation of inflection point setting on the curve determined by maximum and minimum given points. If an inflection point is set additionally, the flexible correspondence relation can be realized; for details, see the example analysis hereinafter.
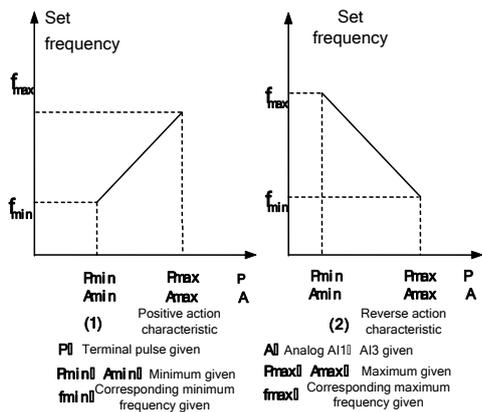
Fig.6-56 Characteristic Curve of Analog Output Frequency

设定频率	Set frequency
正作用特性	Positive action characteristic
反作用特性	Reverse action characteristic
端子 pulse 给定	Terminal pulse given
模拟量 AI1～AI3 给定	Analog AI1～AI3 given
最小给定	Minimum given
最大给定	Maximum given
最小给定对应频率	Corresponding minimum frequency given
最大给定对应频率	Corresponding maximum frequency given

When analog input A is 100%, it corresponds to 10V or 20mA; when pulse frequency P is 100%, it corresponds to maximum input pulse frequency defined by P10.13.

For the channel filtering time constant defined by P11.04 and the gain and zero bias defined by P11.03 and P11.02, refer to the description of function codes in the P11 group.

P11.25 is used for selection of analog input and pulse input curves, see Fig.6-57.
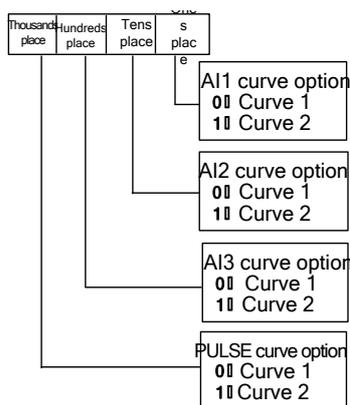
Fig.6-57 Selection of Frequency Given Curve

个位	Ones place
十位	Tens place
百位	Hundreds place
千位	Thousands place

AI1 曲线选择	AI1 curve option
AI2 曲线选择	AI2 curve option
AI3 曲线选择	AI3 curve option
PULSE 曲线选择	PULSE curve option
曲线 1	Curve 1
曲线 2	Curve 2

For example, demand analysis:

1． Use the pulse signal of terminal input to set the set frequency;

2． Input signal 1kHz～20kHz;

3．The corresponding set frequency of 1kHz input signal is 50Hz; the corresponding set frequency of 8kHz input signal is 10Hz; the corresponding set frequency of 12kHz input signal is 40Hz; the corresponding set frequency of 20kHz input signal is 5Hz.

According to the above requirements, parameter setting is as below:

1）P02.03＝4, use terminal PULSE given as main frequency given channel;

2）P10.07＝45, input pulse signal from terminal X8;

3）P11.25＝1000, select curve 2;

4）P10.13＝20.0kHz, set maximum pulse input frequency to be 20kHz;

5）P11.34＝20÷20×100％＝100.0％, set the maximum given on curve 2 as 20kHz-relative-to-20kHz (P10.13) percentage;

6） P11.35 ＝ 5.00Hz÷P02.05*100 ％ , set the set frequency percentage corresponding to maximum given (20kHz pulse signal);

7）P11.36＝12÷20×100％＝60.0％, set the inflection point 2 given on curve 2 as 12kHz-relative-to-20kHz (P10.13) percentage;

8） P11.37 ＝ 40.00Hz÷P02.05*100 ％ , set the set frequency percentage corresponding to inflection point 2 given on curve 2 (12kHz pulse signal);

9）P11.38＝8÷20×100％＝40.0％, set the inflection point 1 given on curve 2 as 8kHz-relative-to-20kHz (P10.13) percentage;

10） P11.39 ＝ 10.00Hz÷P02.05*100 ％ , set the set frequency percentage corresponding to inflection point 1 given on curve 2 (8kHz pulse signal);

11）P11.40＝1÷20×100％＝5.0％, set the minimum given on curve 2 as 1kHz-relative-to-20kHz (P10.13) percentage;

12） P11.41 ＝ 50.00Hz÷P02.05*100 ％ , set the set frequency percentage corresponding to minimum given (1kHz pulse signal).
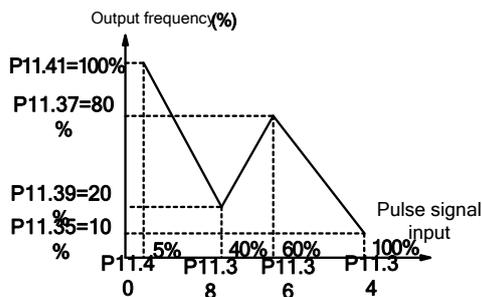
Fig.6-58 Pulse Signal Input Example-Parameter Setting 1

输出频率	Output frequency
脉冲信号输入	Pulse signal input

If demand 3 has no setting of inflection point, the corresponding set frequency of 1kHz input signal should be 50Hz and the corresponding set frequency of 20kHz input signal should be 5Hz. For convenience, here inflection point 1 can be set as the same as minimum given (P11.38＝P11.40, P11.39＝P11.41) and inflection point 2 can be set as the same as maximum given (P11.36＝P11.34, P11.37＝P11.35). The parameter curve is as shown in Fig.6-59.
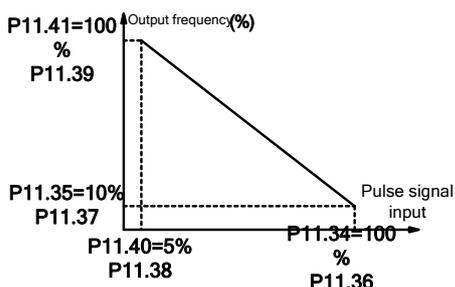
Fig.6-59 Pulse Signal Input Example-Parameter Setting 2

输出频率	Output frequency
脉冲信号输入	Pulse signal input

     Attention

1．If a user sets inflection point 2 given on curve 2 as the same as maximum given (P11.36＝P11.34), it internally compels P11.37＝P11.35, i.e. setting of inflection point 2 is invalid. If inflection point 2 given is the same as inflection point 1 given (P11.38＝P11.36), it internally compels P11.39＝P11.37, i.e. setting of inflection point 1 is invalid. If inflection point 1 given is the same as minimum given (P11.40＝P11.38), it internally compels P11.41＝P11.39, i.e. setting of minimum given is invalid. Setting of curve 1 is by analogy.

2．The range of actual value corresponding to curves 1 and 2 given is 0.0％～300.0％. For torque given, the corresponding range is 0.0 ％ ～ 300.0 ％ ; for frequency given, the corresponding range is 0.0％～100.0％ and setting of more than 100.0％ has the same meaning as 100.0％.

6.1.13 Encoder parameters (P12 group)

Local encoder function in the P12 group is used for vector control of asynchronous motor with PG.

P12.00 Pulses per revolution of local PG	0～10000【1024】

It is set according to the pulses per revolution (PPR) of the selected pulse encoder (PG).

     Attention

When a speed sensor is running, the parameter must be set correctly, or else motor can not run normally.

P12.01 Rotation direction of local PG	0～1【0】

0: A is in advance of B.

1: B is in advance of A.

When motor rotates forward, A is in advance of B; when motor rotates reversely, B is in advance of A. If the direction represented by the sequence of connection between interface board of servo driver and PG matches with the direction represented by the sequence of connection between servo driver and motor, "0" (forward) is selected as setting value, or else "1" (reverse) is selected.

The correspondence relation of connection direction can be adjusted easily by changing the parameter, and reconnection is not needed.

P12.02 Reserved	1～128【1】

The function code is Reserved.

P12.03 Filtering number of encoder signal	0～99【30】

It is used to set the filtering number of feedback speed.

Ones place: high-speed filtering number

Tens place: low-speed filtering number

At a low speed, if there is a current vibration sound, low-speed filtering number can be increased, or else it shall be decreased, to improve the response characteristic of the system.

P12.04 Disconnection detectiontime of local PG	0～10s【0】

It means the detection duration for confirming the disconnection fault of coded disc.

P12.04＝0 represents PG disconnection non-detection and E025 fault can be masked.

P12.05 Disconnection action of local PG	0～1【0】

0：free stop (E025)

In the PG vector control mode and PG V/F control mode, if PG is disconnected, servo driver will give a fault alarm and display E025, and servo driver stops output simultaneously and motor coasts to stop freely.

1：Reserved

Detailed description of P12.06～P12.23 is Reserved.

6.1.14 Process closed loop parameters (P13 group)

The process closed loop control system of HSD2000 servo driver is analog closed loop type. Fig. 6-60 is the connection diagram of analog process closed loop control system of HSD2000 servo driver.
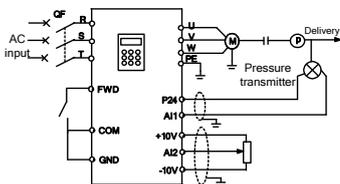
Fig.6-60 Analog Feedback Control System Diagram of Built-in Process Closed Loop

交流输入	AC input
外送	Delivery
压力变送器	Pressure transmitter

Analog feedback control system:

A pressure transmitter is used as feedback sensor of built-in closed loop, to compose an analog feedback control system.

As shown in Fig. 6-60, given value of pressure is set by potentiometer and inputted from AI2 port in the form of voltage; feedback value of pressure is inputted from AI1 port in the form of 4～20mA current; both given value and feedback value can be acquired by analog channel. Start and stop of closed loop operation are realized by terminal FWD.

The above system can also be used for speed closed loop control of TG (tachogenerator).

    Attention

Given can also be digital given by operating panel and serial port given.

The block diagram of working principle of HSD2000 built-in process closed loop is given in Fig. 6-61; KP: proportional gain; Ki: integral gain.

In Fig. 6-61, the definitions of given value, feedback value, deviation limit and proportional integral parameters of closed loop are the same as ordinary closed loop regulation meaning, respectively see P13.01～P13.15 definitions.

Fig.6-61 Schematic Diagram of Process Closed Loop Control

闭环给定量	Given value of closed loop
给定量调整	Adjustment of given value
偏差极限	Deviation limit
闭环调节特性	Closed loop regulating characteristic
反馈量调整	Adjustment of feedback value
闭环输出	Closed loop output
闭环反馈量	Feedback value of closed loop

Built-in closed loop of HSD2000 has the two characteristics as follows:

The relation between given value and corresponding expected feedback value is defined by P13.06～P13.09.

For example, in Fig. 6-62, when given value is analog signal －10～10V, the corresponding expected controlled value is 0～1MP and the corresponding pressure sensor signal is 4～20mA; the relation between given value and expected feedback value is as shown in Fig. 6-62.

Fig.6-62 Given Value and Expected Feedback Value

期望的反馈量	Expected feedback value
给定量	Given value

Determination of given value is based on 10V; determination of feedback value is based on 20mA

That is to say,

The meaning of adjustment of given value and feedback value in Fig. 6-61 is that given value and feedback value adopt internal unified value.

The closed loop characteristics are selected by P13.16, to satisfy different applications.

In order to meet the control requirement in the actual control system, when given value increases, motor speed needs to be increased, and such closed loop characteristic is positive action characteristic; on the contrary, when given value increases, motor speed needs to be decreased, and such closed loop characteristic is reverse position characteristic.

As shown in Fig. 6-63, definition of P13.16 is for meeting the requirements of two closed loop characteristics.
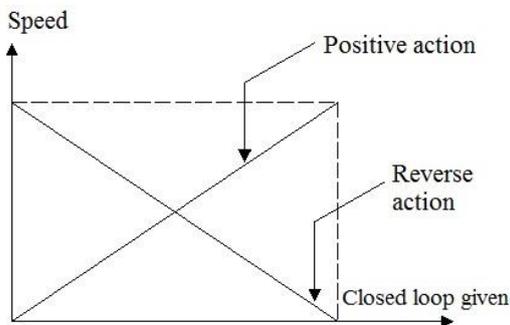
Fig. 6-63 Closed Loop Regulating Characteristic Diagram

转速	Speed
正作用	Positive action
反作用	Reverse action
闭环给定	Closed loop given

After determination of the system, basic steps of closed loop parameter setting are as below:

1）Determine the closed loop given and feedback channel (P13.01、P13.02);

2）For analog closed loop, set the relation between closed loop given and feedback (P13.06～P13.09);

3）Determine the closed loop regulating characteristic; if the relation between given and required motor speed is reverse, set the closed loop characteristic regulation as reverse action (P13.16＝1);

4）Set the integral regulation option and closed loop preset frequency function (P13.17～P13.19);

5）Adjust the closed loop filtering time, sampling period, deviation limit and gain coefficient (P13.10～P13.15).

P13.00 Closed loop run control option	0, 1【0】

0：closed loop run control is invalid.

1：closed loop run control is valid.

P13.01Given channel option	0, 1, 2, 3【1】

0：digital given

Based on the value in P13.05

1：AI1 analog given

2：AI2 analog given

3：AI3 analog voltage given

Analog given input －10～10V (P11.00 digit option 0), 4～20mA (P11.00 digit option 1).

  Attention

Input of analog given AI1 and AI2 can be current or voltage input by the function code P11.00 (digit option); AI3 as differential input can only be voltage input.

P13.02 Feedback channel option	0～5【1】

0：AI1 analog given

1：AI2 analog given

2：AI1+ AI2

3：AI1－AI2

4：Min{ AI1，AI2}

5：Max{ AI1，AI2}

AI input type option is the same as above.

P13.03 Given channel filtering	0.01～50.00s【0.50s】
P13.04 Feedback channel filtering	0.01～50.00s【0.50s】

External given signals and feedback signals often have a certain interference superposition and channels are filtered by setting the filtering time constant in P13.03 and P13.04; the longer the filtering time is, the higher the interference resistance, but the response becomes slow; the shorter the filtering time is, the quicker the response is, but the interference resistance becomes weak.

P13.05 Digital setting of given value	－10.00～10.00V【0.00】

The function is used for digital setting of given value by operating panel or serial port.

P13.06 Minimum given value	0.0%～P13.08【0.0%】
P13.07 Feedback value corresponding to minimum given value	0.0～100.0%【0.0%】
P13.08 Maximum given value	P13.06～100.0%【100.0%】
P13.09 Feedback value corresponding to maximum given value	0.0～100.0%【100.0%】

The relation of given value adjustment in P13.06 and P13.08 in Fig. 6-61 is as shown in Fig. 6-64. When analog input is 6V, if P13.06＝0％ and P13.08＝100％, the converted value after adjustment is 60％; if P13.06＝25％ and P13.08＝100％, the converted value after adjustment is 46.6％.
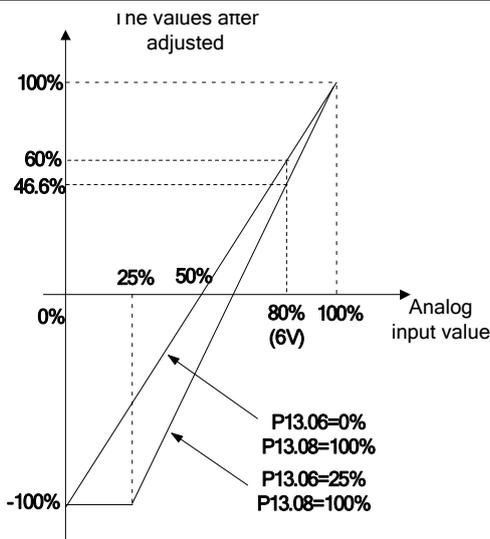
Fig.6-64 Given Value Adjustment Curve Diagram

调整后的量	The values after adjusted
模拟输入量	Analog input value

📖   Attention

1．As shown in Fig. 6-64, scaling analog input of horizontal axis 0％～100％ is －10V～10V; analog input 10V corresponds to 100％ and －10V corresponds to 0％, and 6V corresponds to 80％.

2．If it is analog current input, the range of current input is 4～20mA, so the range of scaling on the horizontal axis is 50％～100％.

3．The values after adjusted can be observed by the function code P01.28.

As shown in Fig. 6-61, the relation curve of feedback value adjustment in P13.07 and P13.09 is relative to the adjustment of given value. The values after adjusted can be observed by the function code P01.29.

P13.10 Proportional gain KP	0.000～10.000【2.000】
P13.11 Integral gain Ki	0.000～10.000【0.100】
P13.12	Reserved
P13.13 Sampling period T	0.01～50.00s【0.50s】

The greater the proportional gain KP is, the quicker the response is, but if KP is excessively great, it may cause oscillation easily.

The deviation can not be eliminated completely only by proportional gain KP adjustment. In order to eliminate residual deviation, integral gain Ki can be adopted to compose the closed loop control. The greater the Ki is, the quicker the response to varying deviation is, but if Ki is excessively great, it may cause oscillation easily.

Sampling period T is the sampling period of feedback value and the closed loop regulator operates once within a sampling period. The greater the sampling period is, the slower the response is.

P13.14 Output filtering time	0.01～10.00【0.05】

Output filtering time is the filtering time of closed loop output (frequency or torque). The greater the output filtering time is, the slower the output response is.

P13.15 Deviation limit	0.0～20%【2.0%】

System output value is relative to maximum deviation permitted by given value of closed loop; as shown in Fig. 6-65, when feedback value is within the range, closed loop regulator will stop regulation. Appropriate setting of the function is helpful to give consideration to both accuracy and stability of system output.
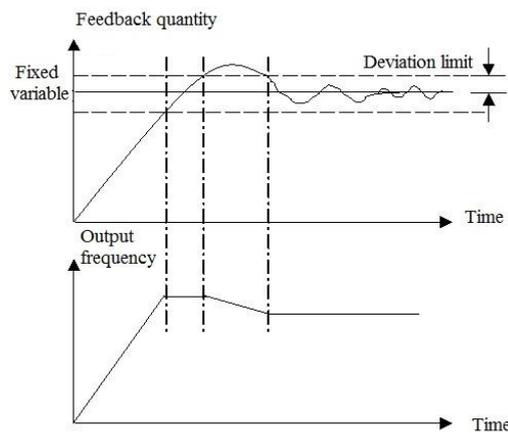
Fig.6-65 Deviation Limit Diagram

P13.16 Closed loop regulating characteristic	0, 1【0】

0： positive action

When given value increases, it is used if requiring increasing motor speed.

1： reverse action

When given value increases, it is used if requiring decreasing motor speed.

P13.17 Integral regulation option	0, 1【0】

0： when the frequency reaches the upper and lower limits, stop integral regulation;

1： when the frequency reaches the upper and lower limits, continue integral regulation.

For the system that requires quick response, it is suggested that continuing integral regulation should be cancelled.

P13.18 Closed loop preset frequency	0.00～1000.0Hz【0.00Hz】
P13.19 Holding time of closed loop preset frequency	0.0～3600.0s【0.0s】

The function code can make closed loop regulation quickly enter into steady stage.

After closed loop run starts, the frequency first increases to the closed loop preset frequency P13.18 according to the acceleration time, then it runs for a period of time P13.19 on the frequency point, and finally runs according to the closed loop characteristic.
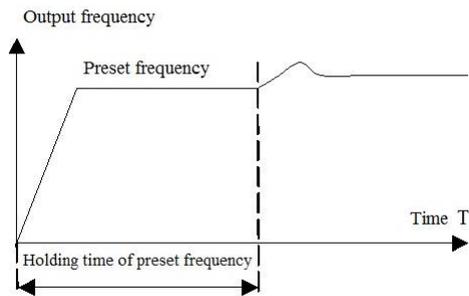
Fig.6-66 Run Diagram of Closed Loop Preset Frequency

输出频率	Output frequency
预置频率	Preset frequency
预置频率保持时间	Holding time of preset frequency
时间	Time

📖 **Attention**

If the closed loop preset frequency function is not needed, preset frequency and holding time should be set as 0.

P13.20 Multi-phase closed loop given 1	－10.00～10.00V【0.00V】
P13.21 Multi-phase closed loop given 2	－10.00～10.00V【0.00V】
P13.22 Multi-phase closed loop given 3	－10.00～10.00V【0.00V】
P13.23 Multi-phase closed loop given 4	－10.00～10.00V【0.00V】
P13.24 Multi-phase closed loop given 5	－10.00～10.00V【0.00V】
P13.25 Multi-phase closed loop given 6	－10.00～10.00V【0.00V】
P13.26 Multi-phase closed loop given 7	－10.00～10.00V【0.00V】
P13.27 Multi-phase closed loop given 8	－10.00～10.00V【0.00V】
P13.28 Multi-phase closed loop given 9	－10.00～10.00V【0.00V】
P13.29 Multi-phase closed loop given 10	－10.00～10.00V【0.00V】
P13.30 Multi-phase closed loop given 11	－10.00～10.00V【0.00V】
P13.31 Multi-phase closed loop given 12	－10.00～10.00V【0.00V】
P13.32 Multi-phase closed loop given 13	－10.00～10.00V【0.00V】
P13.33 Multi-phase closed loop given 14	－10.00～10.00V【0.00V】
P13.34 Multi-phase closed loop given 15	－10.00～10.00V【0.00V】

Among the closed loop given channels except the three kinds of channels defined by P13.01, the voltage value of multi-phase closed loop given defined by P13.20～P13.34 can also be used as closed loop given.

Voltage options of multi-phase closed loop given 1～15 can be switched flexibly by external terminals, see P10.00～P10.07 terminal functions 30～33. it can also be used in conjunction with simple PLC closed loop section, see the description of function codes in the P11 group.

The priority level of multi-phase closed loop given control is higher than the given channel defined in P13.01.

P13.35 Closed loop output reversion option	0, 1【0】

0： closed loop output is negative and servo driver runs at zero frequency.

1： closed loop output is negative and servo driver runs reversely, but if anti-reversion option disables reverse running, servo driver runs at zero frequency, see the description of P05.12 function code.

P13.36 Closed loop feedback loss action option	0, 1, 2 【0】

0： closed loop feedback loss detection is not available;

1： closed loop feedback loss detection is available; when detected, continue running and display the alarm A021;

2： closed loop feedback loss detection is available; when detected, stop freely and display the fault E021;

When displaying an alarm to continue running, running frequency is described as P20.04 function code.

P13.37 Detection value of closed loop feedback loss	0.0～100.0% 【50.0%】
P13.38 Detection time of closed loop feedback loss	0.0～20.0s 【1.0s】

Detection value of closed loop feedback loss is 100％ as reference value; within the detection time, if closed loop feedback value is lower than detection value, servo driver will operate according to setting of P13.36 function code. The time sequence diagram of closed loop feedback loss detection is as shown in Fig. 6-67.
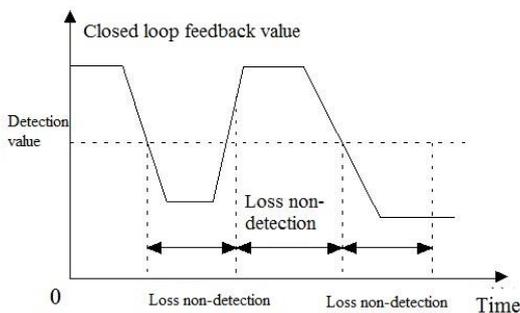
Fig.6-67 Time Sequence Diagram of Closed Loop Feedback Loss Detection

闭环反馈值	Closed loop feedback value
检出值	Detection value
丢失不检出	Loss non-detection
丢失检出	Loss detection
时间	Time

6.1.15 Extended function code parameters (P14 group)

P14.00 Carrier frequency	2.0～15.0kHz 【8kHz】

Table 6-15 Carrier Frequency of PWM Wave Outputted by Servo Driver

Carrier frequency / Model	Maximum carrier frequency (kHz)	Minimum carrier frequency (kHz)	Factory setting (kHz)
1.5kW～15kW	15.0	2.0	8.0
18.5kW～45kW	10.0	2.0	4.0
55kW～75kW	6.0	2.0	3.0
Above 90kW	3.0	2.0	2.0

     Attention

1． **Carrier frequency will affect the running noise of motor and it is usually set at 3～5kHz. In the place requiring silent running, carrier frequency is usually set at 6～8kHz.**

2． **When running at above factory set carrier frequencies, servo driver should be derated by 5％ for use with an increase of 1kHz.**

3． **In the vector control mode, P14.00 minimum carrier frequency is 3kHz.**

P14.01 PWM mode optimization	000～111 【001】
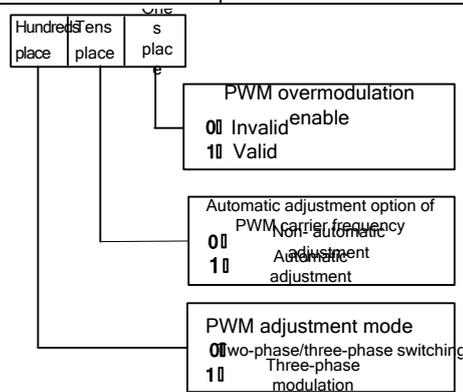
Fig.6-68 PWM Mode Optimization Option

百位	Hundreds place
十位	Tens place
个位	Ones place
PWM 过调制使能	PWM overmodulation enable
无效	Invalid
有效	Valid
PWM 载波频率自动调整选择	Automatic adjustment option of PWM carrier frequency
不自动调整	Non- automatic adjustment
自动调整	Automatic adjustment
PWM 调整方式	PWM adjustment mode
两相/三相切换	Two-phase/three-phase switching
三相调制	Three-phase modulation

Ones place: overmodulation enable

The function decides whether to enable V/F control overmodulation function. Vector control overmodulation is enabled all the time.

0： invalid

V/F control overmodulation function is disabled.

1： valid

V/F control overmodulation function is enabled.

Tens pace: automatic adjustment option of carrier frequency

0： non-operating

1： operating

When automatic adjustment option of carrier frequency is "operating", servo driver can automatically adjust the carrier frequency according to internal temperature. Here actual maximum run frequency of servo driver is restricted by the carrier frequency set by function code (P14.00).

Hundreds place: modulation mode

0： two-phase/three-phase switching

1： three-phase modulation

P14.02 cooling fan control	0～1【1】

0： automatic run

Servo driver automatically starts internal temperature detection program when it is running, to determine running and stop of fan according to the module temperature. Before servo driver stops, if the fan is running, the fan will continue running 3min when servo driver stops, and then internal temperature detection program is started.

1： power-on fan is always running

After servo driver is electrified, the fan is always running.

P14.03 ACR-P	1～5000【1000】
P14.04 ACR-I	0.5～100.0ms【8.0ms】

P14.03 and P14.04 are PI regulator parameters of electric current loop. Increasing electric current loop KP or reducing I can accelerate dynamic response of system torque; reducing KP or increasing I can strengthen the stability of the system.

📖　**Attention**

For most purposes, it is needless to adjust PI parameters of electric current loop, so it is suggested that users should not change this group of parameters at will.

P14.05 Reserved	0～65535【0】

P14.06 Main set frequency control	00～11【00】

It is valid only in case of P02.00＝0, 1, 2.
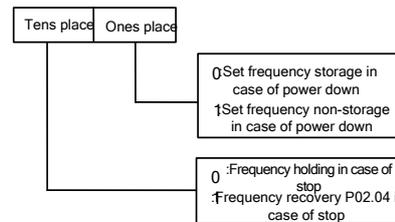
Fig.6-69 LED Setting of Digital Frequency Control

个位	Ones place
十位	Tens place
设定频率掉电存储	Set frequency storage in case of power down
设定频率掉电不存储	Set frequency non-storage in case of power down
停机频率保持	Frequency holding in case of stop
停机频率恢复 P02.04	Frequency recovery P02.04 in case of stop

Ones place:

0： set frequency storage in case of power down

When servo driver is power-down or under-voltage, P02.04 is refreshed automatically according to the set value of current actual frequency.

1： set frequency non-storage in case of power down

When servo driver is power-down or under-voltage, P02.04 remains unchanged.

Tens place:

0： set frequency holding in case of stop

When servo driver stops, set value of frequency is final modified value.

1： set frequency recovery P02.04 in case of stop

When servo driver stops, set value of frequency is automatically restored to P02.04.

P14.07 Auxiliary set frequency control	00～11【00】

P14.07： digital auxiliary frequency control is valid only when P02.08＝1～3, as shown in Fig. 6-70.
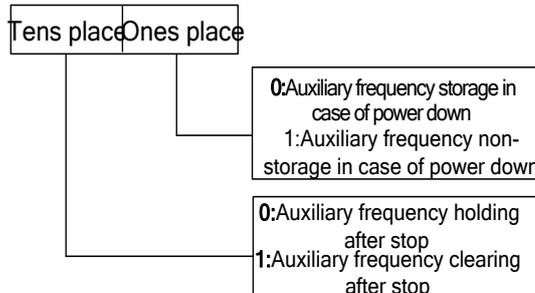
Fig.6-70 Setting of Digital Auxiliary Frequency Control

Ones place
Tens place
Auxiliary frequency storage in case of power down
Auxiliary frequency non-storage in case of power down
Auxiliary frequency holding after stop
Auxiliary frequency clearing after stop

Ones place: power-down storage option

0： auxiliary frequency storage in case of power down

Auxiliary frequency will be stored in the P02.10 in case of power down

1： auxiliary frequency non-storage in case of power down

Auxiliary frequency will not be stored in case of power down.

Tens pace: frequency processing after stop

0： auxiliary frequency holding after stop

Auxiliary frequency remains unchanged after stop.

1： auxiliary frequency clearing after stop

Auxiliary frequency is cleared after stop

P14.08 Acceleration/deceleration mode option	0～1【0】

0： linear acceleration/deceleration

Output frequency increases or decreases by degrees according to a constant gradient, as shown in Fig.6-71.
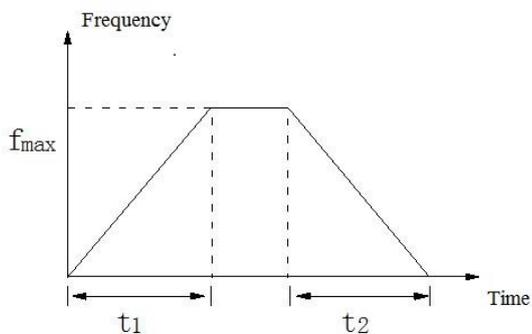
Fig.6-71 Linear Acceleration/ Deceleration

频率	Frequency
时间	Time

1： S-curve acceleration/deceleration

Output frequency increases or decreases by degrees according to an S-curve, as shown in Fig.6-72.
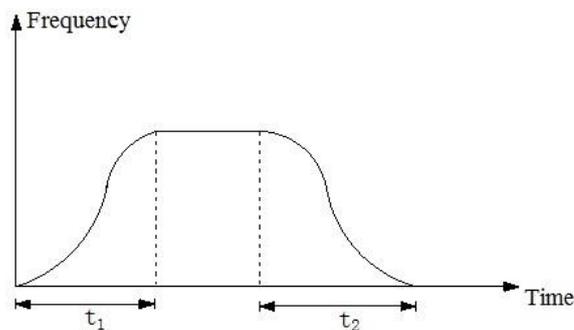
Fig.6-72 S-Curve Acceleration/Deceleration

频率	Frequency
时间	Time

When acceleration starts and speed arrives and when deceleration starts and speed arrives, make the set value of speed in S-curve state. This way can make acceleration/ deceleration act smoothly and have little impact. S-curve acceleration/ deceleration mode is suitable for start and stop of load handling and transfer, e.g. elevators and conveyor belts, etc.

P14.09 Acceleration/ deceleration time unit option	0～2【1】

0： 0.1s

1： s

2： min

The function is used to determine all acceleration/ deceleration time units except jog run.

P14.10 Acceleration time 2	0.0～3600.0s (min)【6.0s】
P14.11 Deceleration time 2	0.0～3600.0s (min)【6.0s】
P14.12 Acceleration time 3	0.0～3600.0s (min)【6.0s】
P14.13 Deceleration time 3	0.0～3600.0s (min)【6.0s】
P14.14 Acceleration time 4	0.0～3600.0s (min)【6.0s】
P14.15 Deceleration time 4	0.0～3600.0s (min)【6.0s】

Acceleration time refers to the required time (t_1 in Fig.6-71) of servo driver accelerating to maximum output frequency (P02.05) from zero frequency. Deceleration time refers to the required time (t_2 in Fig.6-71) of servo driver decelerating to zero frequency from maximum output frequency (P02.05.)

Total four kinds of acceleration/ deceleration time are defined for HSD2000 servo drivers and acceleration/ deceleration time 1～4 in the running process of servo driver can be selected by different combination of control terminals, see the definition of acceleration/deceleration time terminal function in the P10.00～P10.07. They can also be defined as the acceleration/deceleration time when running frequency in each phase switches in the simple PLC run mode, see the description of P15 parameter group.

    Attention

1． Second and minute can be selected as the unit of acceleration/ deceleration time 1～4 by P14.09 and factory default unit is second.

2．Factory set value of acceleration/deceleration time of 1.5～22kW servo drivers is 6.0s; factory set value of acceleration/deceleration time of 30～45kW servo drivers is 20.0s; factory set value of acceleration/deceleration time of other servo drivers is 30.0s.

P14.16 Time in the S-curve acceleration start section	10.0%～50.0%【20.0%】
P14.17 Time in the S-curve acceleration end section	10.0%～80.0%【20.0%】
P14.18 Time in the S-curve deceleration start section	10.0%～50.0%【20.0%】
P14.19 Time in the S-curve deceleration end section	10.0%～80.0%【20.0%】

P14.16 ～ P14.19 are valid only when S-curve acceleration/deceleration mode (P04.00 = 1) is selected, and P14.16+P14.17≤90 %， P14.18+P14.19≤90 %， as shown in Fig.6-73 below.
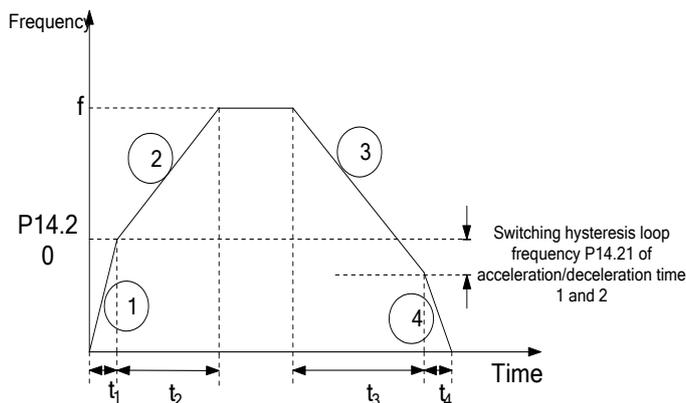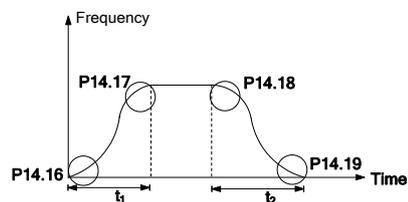
Fig.6-73 Acceleration/Deceleration Start and End Time

频率	Frequency
时间	Time

P14.20 Switching frequency of acceleration/deceleration time 1 and 2	0.00～1000.0Hz【0.00】
P14.21 Switching hysteresis loop frequency of acceleration/deceleration time 1 and 2	0.00～655.35Hz【1.00】

Fig.6-74 Switching Diagram of Acceleration/Deceleration Time 1 and 2

频率	Frequency
时间	Time
加减速时间 1 和 2 切换滞环频率	Switching hysteresis loop frequency P14.21 of acceleration/deceleration time 1 and 2

P14.21	

As shown in Fig. 6-74, at the time of acceleration, it first runs by acceleration time 1, as shown in curve ①, and acceleration time $t_1=\frac{P14.20 \times P02.14}{P02.05}$. When output frequency increases to the switching point P14.20, acceleration time will switch to P14.10 from P02.14, as shown in curve ②, and acceleration time $t_2=\frac{(f-P14.20) \times P14.10}{P02.05}$. At the time of deceleration, it first runs by deceleration time 2, as shown in curve ③, and $t_3=\frac{(f-P14.20) \times P14.11}{P02.05}$. When output frequency decreases to a frequency (P14.20－P14.21) lower than P14.20, deceleration time 2 will switch to deceleration time 1, as shown in curve ④, and $t_4=\frac{(P14.20-P14.21) \times P02.12}{P02.05}$.

P14.22 Binding of run command channels and frequency given channels	000～666【000】

The function defines the binding combination of three kinds of run command channels and six kinds of frequency given channels, to realize synchronous switching easily.
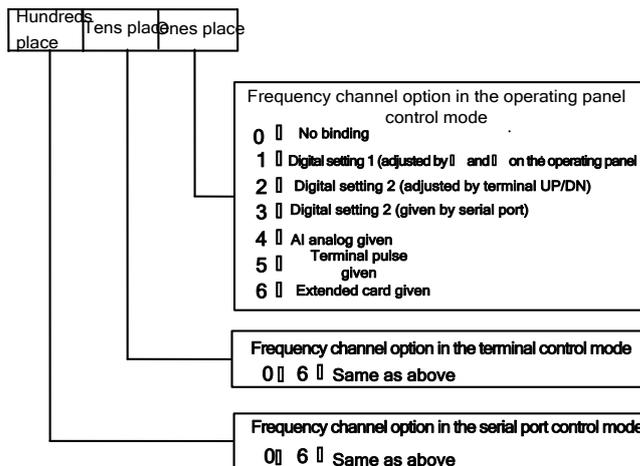
Fig.6-75 Binding of Run Command Channels and Frequency Given Channels

个位	Ones place
十位	Tens place
百位	Hundreds place
操作面板控制方式下频率通道选择	Frequency channel option in the operating panel control mode
无捆绑	No binding
数字设定 1（操作面板▲、▼调节）	Digital setting 1 (adjusted by ▲ and ▼ on the operating panel)
数字设定 2（端子 UP/DN 调节）	Digital setting 2 (adjusted by terminal UP/DN)

数字设定 3（串行口给定）	Digital setting 2 (given by serial port)
AI 模拟给定	AI analog given
端子脉冲给定	Terminal pulse given
扩展卡给定	Expansion card given
端子控制方式下频率通道选择	Frequency channel option in the terminal control mode
串行口控制方式下频率通道选择	Frequency channel option in the serial port control mode
同上	Same as above

The meaning of the above frequency given channels is the same as frequency setting mode P02.03, see the description of function codes in the P02 group.

Different run command channels can be bound to the same frequency given channel.

Online synchronous switching after binding can be realized by the following modes:

Mode 1: modify the function code "run command channel option P02.02";

Mode 2: use LOCAL and DATA/ENTER keys;

Mode 3: use the combination of run command channel option terminals (terminal function should be defined and X1～X8 are set as 28 and 29).

For example,

In order to facilitate remote and local control, requirements are as follows:

①Switching of run command channel: switch by terminal in remote control mode and switch by LOCAL key in local control mode.

②Local control adopts operating panel; press RUN key to run and press STOP key to stop; set frequency is adjusted by ▼ and ▲.

③Remote control adopts external terminal; close FWD key to run forward and close REV key to run reversely; set frequency is adjusted by AI analog given.

④After power on, terminal control mode is available.
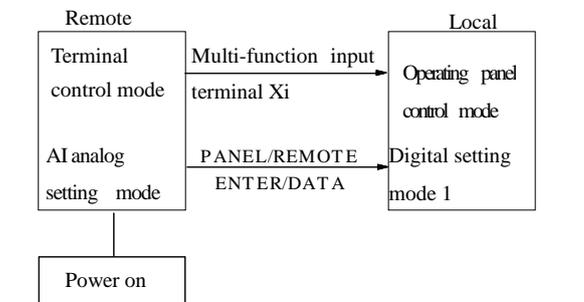
Fig.6-76 Remote and Local Control Requirement

远程	Remote

端子控制方式	Terminal control mode
AI 模拟设定方式	AI analog setting mode
本地	Local
操作面板控制方式	Operating panel control mode
数字设定方式 1	Digital setting mode 1
多功能输入端子 Xi	Multi-function input terminal Xi
上电	Power on

In order to realize the above control, the following setting is required.

P02.02＝1, set as terminal control mode; it is remote control after power on;

P10.00＝28, P10.01＝29, set multi-function input terminals X1 and X2 as run command channel option;

P10.08＝1, set as two-wire control mode 2; when FWD is valid, it runs forward; when REV is valid, it runs reversely;

P00.06＝0020, set LOCAL key to be valid;

P14.22＝041, set terminal control mode is bound to AI analog given and operating panel control mode is bound to digital setting 1.
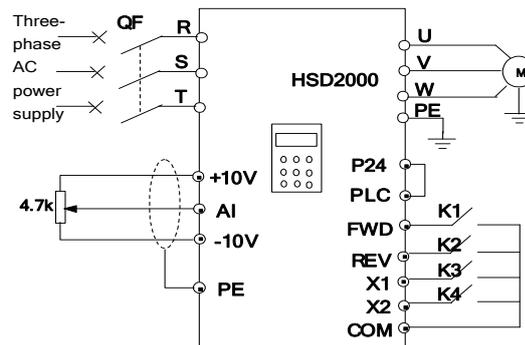
Fig.6-77 Connection Diagram of Remote and Local Control Hardware

三相交流电源	Three-phase AC power supply

📖 **Attention**

Factory setting is 000: no synchronous switching of frequency given channel

P14.23 Jump frequency 1	**0.00～1000.0Hz【0.00Hz】**
P14.24 Range of jump frequency 1	**0.00～30.00Hz【0.00Hz】**
P14.25 Jump frequency 2	**0.00～1000.0Hz【0.00Hz】**
P14.26 Range of jump frequency 2	**0.00～30.00Hz【0.00Hz】**
P14.27 Jump frequency 3	**0.00～1000.0Hz【0.00Hz】**
P14.28 Range of jump frequency 3	**0.00～30.00Hz【0.00Hz】**

P14.23 ～ P14.28 are set for the purpose of making output frequency of servo driver avoid the resonance frequency points of mechanical load.

Set frequency of servo driver can jump nearby some frequency points according to the mode in Fig.6-78 and at most three jump ranges can be defined.
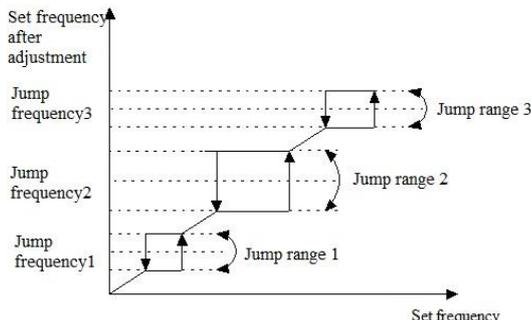
Fig.6-78 Jump Frequency and Range Diagram

调节后的设定频率	Set frequency after adjustment
跳跃频率	Jump frequency
跳跃范围	Jump range
设定频率	Set frequency

After the jump frequency parameter is set, even if set frequency of servo driver is in the mechanical resonance frequency zone of drive system, output frequency of servo driver will also be adjusted out of mechanical resonance zone, to avoid running on the resonance frequency.

P14.29 Reserved	
P14.30 Reserved	50～150【100】

6.1.16 Simple PLC parameters (P15 group)

Simple PLC function is a multi-speed generator. Servo driver can automatically change running frequency and direction according to running time, to meet the process requirement. The function is completed by PLC (programmable controller) before now and it can be realized by the servo driver itself now, as shown in Fig.6-79.
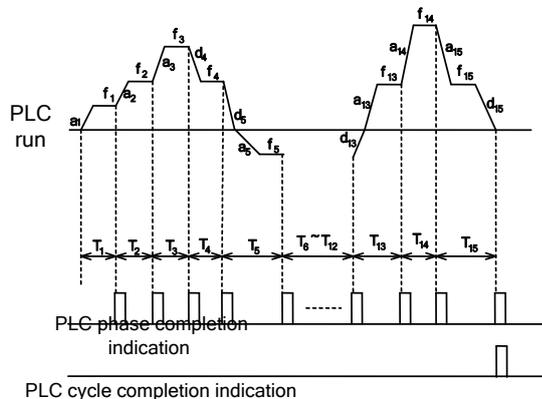
Fig.6-79 Simple PLC Run Diagram

PLC 运行	PLC run
PLC 阶段完成指示	PLC phase completion indication
PLC 循环完成指示	PLC cycle completion indication

In the Fig.6-79, $a_1 \sim a_{15}$ and $d_1 \sim d_{15}$ are acceleration and deceleration time in each phase; $P1 \sim P1_5$ and $T_1 \sim T_{15}$ are set frequency and running time in each phase. The above parameters will be defined respectively in the following function codes.

PLC phase and cycle completion can be indicated by two-way open collector output terminals Y1 and Y2 or relay outputting 500ms pulse indication signals, see the function 11 "PLC phase run completion indication" and function 12 "PLC cycle completion indication" in the P10.18～P10.21.

P15.00 PLC run mode option	0000～1123H【0000】
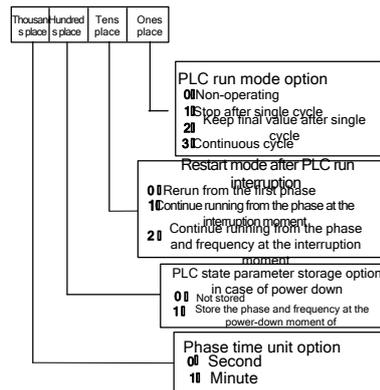
Fig.6-80 Selection of Simple PLC Run Mode

个位	Ones place
十位	Tens place
百位	Hundreds place
千位	Thousands place
PLC 运行方式选择	PLC run mode option
不动作	Non-operating
单循环后停机	Stop after single cycle
单循环后保持最终值	Keep final value after single cycle
连续循环	Continuous cycle
PLC 中断运行再起动方式	Restart mode after PLC run interruption
从第一段开始重新运行	Rerun from the first phase
从中断时刻的阶段继续运行	Continue running from the phase at the interruption moment
从中断时刻阶段、频率继续运行	Continue running from the phase and frequency at the interruption moment
掉电时 PLC 状态参数储存选择	PLC state parameter storage option in case of power down

不储存	Not stored
储存掉电时刻的阶段、频率	Store the phase and frequency at the power-down moment of
阶段时间单位选择	Phase time unit option
秒	Second
分	Minute

Ones place: PLC run mode option

0： non-operating

PLC run mode is invalid.

1： stop after single cycle

As shown in Fig.6-81, servo driver will automatically stop after completing a cycle and it can start only after a run command is given again.
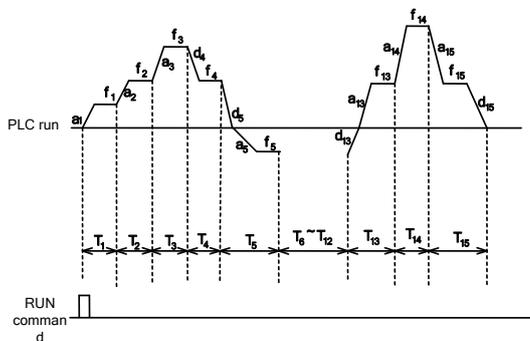
Fig.6-81 Stop Mode after PLC Single Cycle

PLC 运行	PLC run
RUN 命令	RUN command

2： Keep final value after single cycle

As shown in Fig.6-82, servo driver will automatically keep the running frequency and direction in the final phase after completing a cycle.
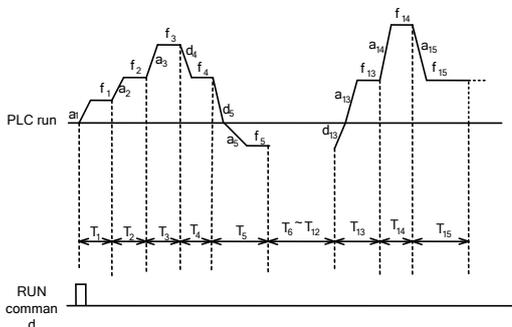
Fig.6-82 Keeping Mode of PLC Single Cycle

PLC 运行	PLC run
RUN 命令	RUN command

3 (continuous cycle)：as shown in Fig.6-83, servo driver will automatically proceed to the next cycle after completing a cycle, till a stop command is given.
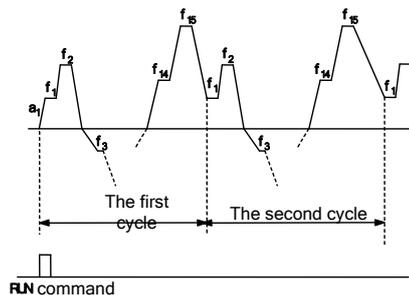
Fig.6-83 PLC Continuous Cycle Mode

第一次循环	The first cycle
第二次循环	The second cycle
RUN 命令	RUN command

Tens place: restart mode option after PLC run interruption

0： rerun from the first phase

If servo driver stops (arising from stop command, fault or power down) when running, it will rerun from the first phase after restart.

1： continue running at the phase frequency at the stop (or fault) moment

If servo driver stops (arising from stop command or fault) when running, it will automatically record the already-running time in current phase and automatically enter the phase after restart, and moreover, continue running of remaining time at the frequency defined in the phase, as shown in the figure below:

a_1 : Acceleration time in the phase 1
a_3 : Acceleration time in the phase 3
f_1 : Frequency in the phase 1
f_3 : Frequency in the phase 3
a_2 : Acceleration time in the phase 2
d_2 : Frequency in the phase 2
f_2 : Frequency in the phase 2
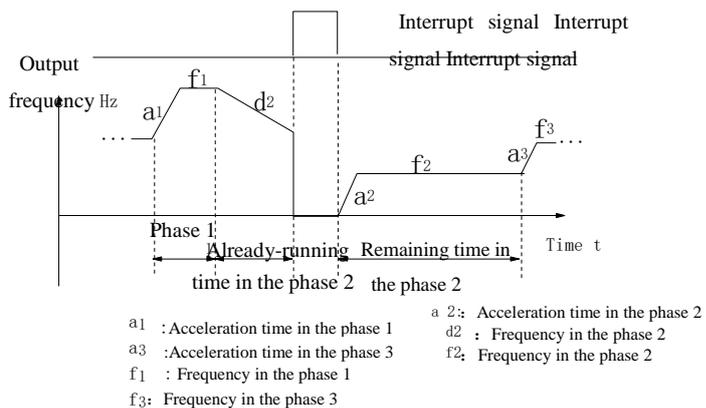
Fig.6-84 PLC Start Mode 1

输出频率	Output frequency
中断信号	Interrupt signal
阶段 1	Phase 1
阶段 2 已运行时间	Already-running time in the phase 2
阶段 2 剩余时间	Remaining time in the phase 2
时间	Time
阶段 1 加速时间	Acceleration time in the phase 1

阶段 2 加速时间	Acceleration time in the phase 2
阶段 3 加速时间	Acceleration time in the phase 3
阶段 2 减速时间	Deceleration time in the phase 2
阶段 1 频率	Frequency in the phase 1
阶段 2 频率	Frequency in the phase 2
阶段 3 频率	Frequency in the phase 3

2：continue running at the running frequency at the stop (or fault) moment

If servo driver stops (arising from stop command or fault) when running, it not only will automatically record the already-running time in current phase but also will record the running frequency at the stop moment; after restart, servo driver will first return to the running frequency at the stop moment and then continue running in remaining phases, as shown in Fig. 6-85.

📖 **Attention**

The difference between mode 1 and mode 2 is that mode 2 memorizes a running frequency at the stop moment more than mode 1 and servo driver continues running at the frequency after restart.

a_1: Acceleration time in the phase 1
a_3: Acceleration time in the phase 3
f_1: Frequency in the phase 1
f_3: Frequency in the phase 3

a_2: Acceleration time in the phase 2
d_2: Deceleration time in the phase 2
f_2: Frequency in the phase 2
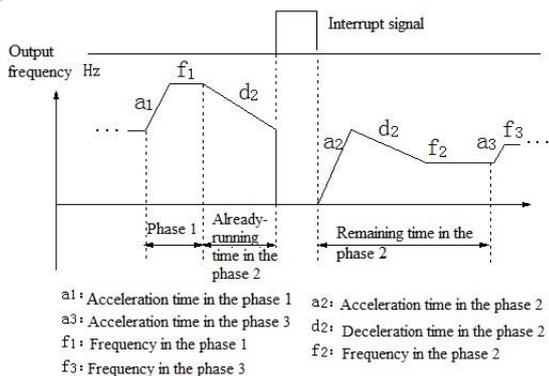
Fig.6-85 PLC Start Mode 2

输出频率	Output frequency
中断信号	Interrupt signal
阶段 1	Phase 1
阶段 2 已运行时间	Already-running time in the phase 2
阶段 2 剩余时间	Remaining time in the phase 2
时间	Time
阶段 1 加速时间	Acceleration time in the phase 1
阶段 2 加速时间	Acceleration time in the phase 2
阶段 3 加速时间	Acceleration time in the phase 3
阶段 2 减速时间	Deceleration time in the phase 2
阶段 1 频率	Frequency in the phase 1
阶段 2 频率	Frequency in the phase 2
阶段 3 频率	Frequency in the phase 3

Hundreds place: PLC state parameter storage option in case of power down

0：not stored

Not memorize PLC running state in case of power down; rerun from the first phase after restart upon power on.

1：store the phase and frequency at the power-down moment

Memorize PLC running state in case of power down, including the phase, running frequency and already-running time at the power-down moment. After power on, it runs according to the restart mode after PLC run interruption defined in the tens place.

Thousands place: phase time unit option

0：s

Running time in each phase is in seconds.

1：min

Running time in each phase is in minutes.

The unit is valid only to the definition of PLC run phase time $T_1 \sim T_{15}$. Selection of acceleration and deceleration time unit during PLC run is determined by P14.09.

📖 **Attention**

1．When PLC running time in a phase is set as zero, the phase is invalid.

2．The pause, fault and memory state clearing of PLC process can be realized by terminals, see the definition of terminal function in the P10 group.

P15.01 Setting in the phase 1	000～323H 【000】
P15.02 Running time in the phase 1	0～6500s (min) 【20.0s】
P15.03 Setting in the phase 2	000～323H 【000】
P15.04 Running time in the phase 2	0～6500s (min) 【20.0s】
P15.05 Setting in the phase 3	000～323H 【000】
P15.06 Running time in the phase 3	0～6500s (min) 【20.0s】
P15.07 Setting in the phase 4	000～323H 【000】
P15.08 Running time in the phase 4	0～6500s (min) 【20.0s】
P15.09 Setting in the phase 5	000～323H 【000】
P15.10 Running time in the phase 5	0～6500s (min) 【20.0s】
P15.11 Setting in the phase 6	000～323H 【000】
P15.12 Running time in the phase 6	0～6500s (min) 【20.0s】
P15.13 Setting in the phase 7	000～323H 【000】
P15.14 Running time in the phase 7	0～6500s (min) 【20.0s】
P15.15 Setting in the phase 8	000～323H 【000】
P15.16 Running time in the phase 8	0～6500s (min) 【20.0s】
P15.17 Setting in the phase 9	000～323H 【000】
P15.18 Running time in the phase 9	0～6500s (min) 【20.0s】
P15.19 Setting in the phase 10	000～323H 【000】
P15.20 Running time in the phase 10	0～6500s (min) 【20.0s】
P15.21 Setting in the phase 11	000～323H 【000】
P15.22 Running time in the phase 11	0～6500s (min) 【20.0s】

P15.23 Setting in the phase 12	000～323H【000】
P15.24 Running time in the phase 12	0～6500s (min)【20.0s】
P15.25 Setting in the phase 13	000～323H【000】
P15.26 Running time in the phase 13	0～6500s (min)【20.0s】
P15.27 Setting in the phase 14	000～323H【000】
P15.28 Running time in the phase 14	0～6500s (min)【20.0s】
P15.29 Setting in the phase 15	000～323H【000】
P15.30 Running time in the phase 15	0～6500s (min)【20.0s】

P15.01, P15.03, P15.05, P15.07, P15.09, P15.11, P15.13, P15.15, P15.17, P15.19, P15.21, P15.23, P15.25, P15.27 and P15.29 are used to set running frequency, direction and acceleration/deceleration time in each PLC phase, selected by places. As shown in Fig. 6-86.
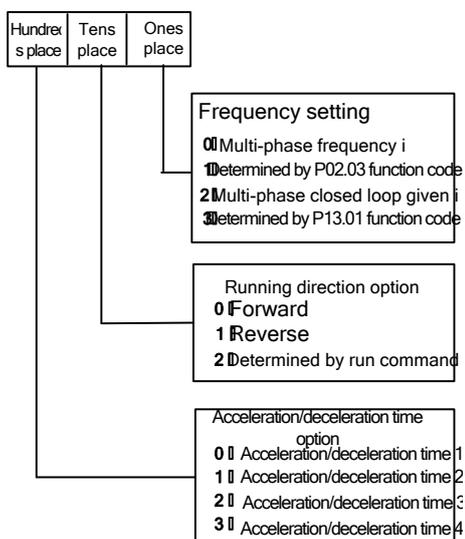
Fig.6-86 Setting in the PLC Phase i (i＝1～15)

个位	Ones place
十位	Tens place
百位	Hundreds place
频率设置	Frequency setting
多段频率 i	Multi-phase frequency i
由 P02.03 功能码决定	Determined by P02.03 function code
多段闭环给定 i	Multi-phase closed loop given i
由 P13.01 功能码决定	Determined by P13.01 function code
运转方向选择	Running direction option
正转	Forward
反转	Reverse
由运行命令确定	Determined by run command
加减速时间选择	Acceleration/deceleration time option
加减速时间 1	Acceleration/deceleration time 1
加减速时间 2	Acceleration/deceleration time 2
加减速时间 3	Acceleration/deceleration time 3
加减速时间 4	Acceleration/deceleration time 4

Setting of LED ones place in the PLC phase i:

0： select multi-phase frequency i

For example, when i is equal to 3, the frequency of phase 3 is multi-phase frequency 3; for definition of multi-phase frequency, see the P16.00～P16.14.

1： the frequency is determined by main set frequency source function code P02.03.

2： I multi-phase closed loop given

For example, when i is equal to 2, the frequency of phase 2 is multi-phase closed loop given 2; for definition of multi-phase closed loop given, see the P13.20～P13.34.

3：determined by closed loop given channel function code P13.01

PLC can realize closed loop running in a phase; closed loop given channel can be multi-phase closed loop given i or determined by P13.01 function code; feedback channel is determined by P13.0. When given channel is determined by P13.01 function code, the closed loop given channel can be switched to multi-phase closed loop given value by the option terminal of multi-phase closed loop given. See the terminal functions 30, 31 and 32 of function codes P10.00～P10.07 and detailed description of P13.20～P13.34.

  Attention

When PLC phase running direction is determined by run command, running direction of motor can be changed in a real-time way by external direction command. For example, realize forward running by FWD－COM and realize reverse running by REV－COM. Running direction is determined by run command; if the direction can not be determined, it follows the running direction in the previous phase.

6.1.17 Multi-speed parameters (P16 group)

P16.00 Multi-phase frequency 1	Lower frequency limit ～Upper frequency limit 【5.00Hz】
P16.01 Multi-phase frequency 2	Lower frequency limit ～Upper frequency limit 【10.00Hz】
P16.02 Multi-phase frequency 3	Lower frequency limit ～Upper frequency limit 【20.00Hz】
P16.03 Multi-phase frequency 4	Lower frequency limit ～Upper frequency limit 【30.00Hz】
P16.04 Multi-phase frequency 5	Lower frequency limit ～Upper frequency limit 【40.00Hz】
P16.05 Multi-phase frequency 6	Lower frequency limit ～Upper frequency limit 【45.00Hz】
P16.06 Multi-phase frequency 7	Lower frequency limit ～Upper frequency limit 【50.00Hz】
P16.07 Multi-phase frequency 8	Lower frequency limit ～Upper frequency limit 【5.00Hz】
P16.08 Multi-phase frequency 9	Lower frequency limit ～Upper frequency limit 【10.00Hz】
P16.09 Multi-phase frequency 10	Lower frequency limit ～Upper frequency limit 【20.00Hz】
P16.10 Multi-phase frequency 11	Lower frequency limit ～Upper frequency

	limit 【30.00Hz】
P16.11 Multi-phase frequency 12	**Lower frequency limit ～Upper frequency limit 【40.00Hz】**
P16.12 Multi-phase frequency 13	**Lower frequency limit ～Upper frequency limit 【45.00Hz】**
P16.13 Multi-phase frequency 14	**Lower frequency limit ～Upper frequency limit 【50.00Hz】**
P16.14 Multi-phase	**Lower frequency limit ～Upper frequency**

6.1.18 LED display parameters (P17 group)

P17.00 LED run display parameter option 1	**000～3F7H【007H】**
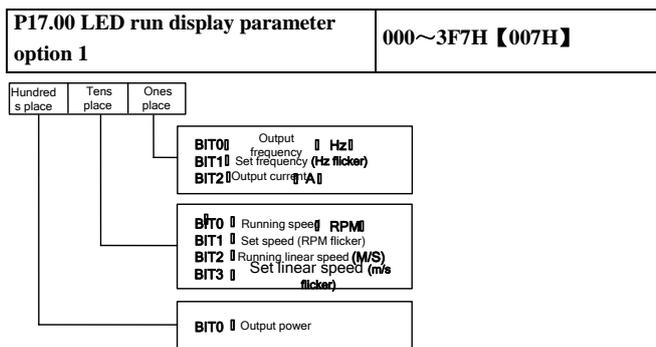
Fig.6-87 Setting of LED Run Display Parameter Option 1

个位	Ones place
十位	Tens place
百位	Hundreds place
输出频率	Output frequency
设定频率（Hz 闪烁）	Set frequency (Hz flicker)
输出电流	Output current
运行转速	Running speed
设定转速（RPM 闪烁）	Set speed (RPM flicker)
运行线速度	Running line speed
设定线速度（m/s 闪烁）	Set line speed (m/s flicker)
输出功率	Output power

P17.00 and P17.01 define the state parameter displayed by LED when servo driver is in running state.

When BIT place is 0, the parameter is not displayed.

When BIT place is 1, the parameter is displayed.

For example, LED ones place-BIT0 is the display switch code of "output frequency"; when BIT0 is equal to 0, the parameter is not displayed; when BIT0 is equal to 1, the parameter is displayed.

P17.01 LED run display parameter option 2	**00～FFH【00H】**
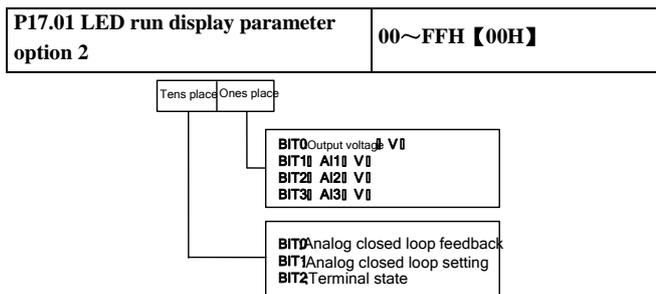
Fig.6-88 Setting of LED Run Display Parameter Option 2

frequency 15	limit 【50.00Hz】

These frequencies will be used in the multi-speed run mode and simple PLC run mode, see the detailed description of multi-speed run terminal functions "1", "2", "3" and "4" in *6.1.11 switching input terminal* P10.00～P10.07 and P15-group function codes in *6.1.16 simple PLC.*

个位	Ones place
十位	Tens place
输出电压	Output voltage
模拟闭环反馈	Analog closed loop feedback
模拟闭环设定	Analog closed loop setting
端子状态	Terminal state

Displayed terminal state includes multi-function terminals X1～X8 and FWD and REV terminals; LED digital tube specified value is used to indicate the state of each function terminal. For example, when X1, X2 and FWD terminals are closed and other terminals are disconnected, displayed terminal state value is 103H. For terminal sequence, see the description of P10.16.

📖 **Attention**

When running speed and line speed are displayed, they can be modified in a real-time way by ▼ and ▲ keys (it is unnecessary to switch to frequency state).

When both P17.00 and P17.01 are 0, default display is output frequency.

In the display state of run parameter, display parameters can be switched successively by shift key .
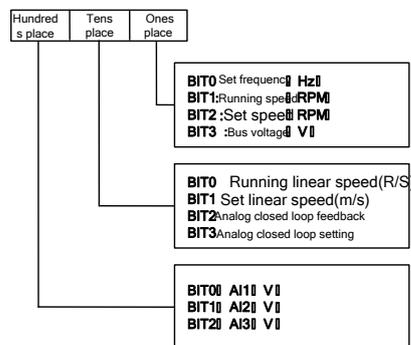
Fig.6-89 Setting of LED Stop Display Parameter Option

P17.02 LED stop display parameter option	**000～FFFH【009H】**
个位	Ones place
十位	Tens place
百位	Hundreds place
设定频率	Set frequency
运行转速	Running speed
设定转速	Set speed
母线电压	Bus voltage
运行线速度	Running line speed

设定线速度	Set line speed
模拟闭环反馈	Analog closed loop feedback
模拟闭环设定	Analog closed loop setting

The parameter defines the state parameter displayed by LED when servo driver is in stop state.

When BIT place is 0, the parameter is not displayed.

When BIT place is 1, the parameter is displayed.

For example, BIT0 is the display switch code of "set frequency"; when BIT0 is equal to 0, the parameter is not displayed; when BIT0 is equal to 1, the parameter is displayed.

📖 **Attention**

When running speed and line speed are displayed, they can be modified directly by ▼ and ▲ keys (it is unnecessary to switch to frequency state).

When P17.02 setting values are all 0, default display is set frequency.

In the display state of stop parameter, display parameters can be switched successively by shift key .

P17.03 Speed display coefficient	0.1%～999.9%【100.0%】

The function code is used to correct the display error of speed scale and it has no influence on actual speed.

P17.04 Line speed coefficient	0.1～999.9%【1.0%】

The function code is used to correct the display error of line speed scale and it has no influence on actual speed.

P17.05 Closed loop analog display coefficient	0.1～999.9%【100.0%】

The function code is used to correct the display error between actual physical quantity (pressure , flow rate, etc.) and given or feedback quantity (voltage and current) under closed loop control and it has no influence on closed loop regulation.

6.1.19 Communication parameters (P18 group)

P18.00 Protocol option	0～1【0】

Communication protocol option

0： Modbus protocol;

1： Reserved

P18.01 Communication configuration	000～155H【001】
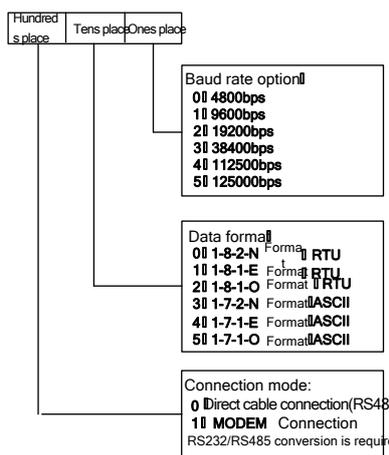
Fig.6-90 Setting of Communication Configuration

个位	Ones place
十位	Tens place
百位	Hundreds place
波特率选择	Baud rate option
数据格式	Data format
格式	Format
接线方式	Connection mode
直接电缆连接	Direct cable connection
MODEM 连接	MODEM Connection
需要 RS232/RS485 转换	RS232/RS485 conversion is required

The function code is set by LED place mode and it is used for parameter selection of serial communication port.

Setting of hundreds place has no influence on processing of communication process, but when the function code is set as MODEM mode, MODEM will be initialized by means of RS485 port on the control panel whenever servo driver is power-on, so that MODEM can automatically answer after receiving the ringing signal of telephone line thrice, to realize the remote control line composed of dialup lines; for connection mode, see *4.2 control circuit wiring and configuration.*

📖 **Attention**

HSD2000 control panel only provides RS485 interface. If communication interface of external device is RS232 (e.g. external communication interface is RS232 modem), an RS232/RS485 conversion device is needed.

P18.02 Local address	0～247【5】

In the serial port communication, the function code is used to identify the address of local servo driver.

Attention: 0 is broadcast address. When set as broadcast address, it can only receive and execute the broadcast command of upper computer and can not respond to the upper computer.

P18.03 Communication time-out detection time	0～1000.0s【0.0s】

When the serial port communication signal disappears, if the duration thereof exceeds the setting value of the function code, it can be concluded that servo driver has a communication fault.

When setting value is 0, servo driver does not detect the serial port communication signal, i.e. the function is invalid.

P18.04 Local response delay	0～1000ms【5ms】

Local response delay refers to the delay time needed from the serial port of servo driver receiving and interpretively executing a command from the upper computer to returning a response frame to the upper computer; the function code is used to set the delay time. For RTU mode, actual response delay is not less than the transmission time of 3.5 characters.

P18.05～P18.09	Reserved

Reserved function

P18.10～P18.19	00.00～99.99【99.99】

Address mapping of input parameter

It is used to map the parameter to be inputted. Integral part corresponds to the group number of the parameter and decimal part corresponds to the index in the group (serial number of the parameter in the group).

For example, set P18.10＝02.01, and it shows the function code P02.01 is mapped to input parameter 1.

P18.20～P18.29	00.00～99.99【99.99】

Address mapping of output parameter

It is used to map the parameter to be outputted. Integral part corresponds to the group number of the parameter and decimal part corresponds to the index in the group (serial number of the parameter in the group).

For example, set P18.20＝01.01, and it shows the function code P01.01 is mapped to output parameter 1.

📖　**Attention**

When rewriting P18.20 ～ P18.29 via communication, a hexadecimal number can be written in directly to facilitate operation; for example, write 0x2034 in the P18.21, and the function code P20.34 is mapped to output parameter 2.

6.1.20 Bus communication parameters (P19 group)

Temporarily Reserved.

6.1.21 Protection parameter and fault record (P20 group)

P20.00 Protection operating option 1	0000～1113【0000】
P20.01 Protection operating option 2	00～23【00】

When servo driver is in some abnormal states, its fault and stop can be masked by setting protection operating option (P20.00 and P20.01), to keep running. Here operating panel will display a fault alarm A0×× (×× represents alarm code; for details, see **Chapter VII Measures relative Fault Alarm, Handling of Abnormality**); the frequency of continuing running in alarm state is described in the setting of function code P20.04.

P20.00 defines the protection operating option when communication, contactor and EEPROM are abnormal and in the case of 24V short circuit.
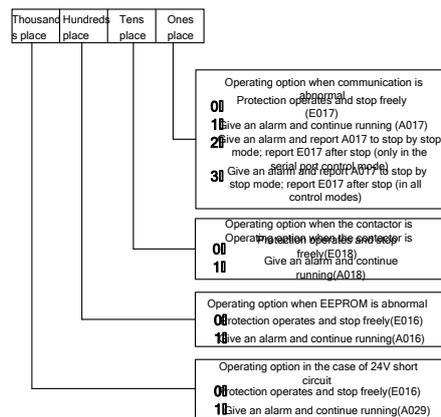
Fig.6-91 Setting of Protection Operating Option 1

个位	Ones place
十位	Tens place
百位	Hundreds place
千位	Thousands place
通讯异常动作选择	Operating option when communication is abnormal
保护动作并自由停车	Protection operates and stop freely
告警且继续运行	Give an alarm and continue running
告警报 A017 按停机方式停机，停机后报 E017（仅串行口控制方式下）	Give an alarm and report A017 to stop by stop mode; report E017 after stop (only in the serial port control mode)
告警报 A017 按停机方式停机，停机后报 E017（所有控制方式下）	Give an alarm and report A017 to stop by stop mode; report E017 after stop (in all control modes)
接触器异常动作选择	Operating option when the contactor is abnormal
EEPROM 异常动作选择	Operating option when EEPROM is abnormal
24V 短路动作选择	Operating option in the case of 24V short circuit
保护动作并自由停车	Protection operates and stop freely
告警且继续运行	Give an alarm and continue running

📖　**Attention**

If the operating option in the case of 24V short circuit is "1", once a 24V short circuit fault arises and the fault does not disappear, servo driver will give an alarm and run for 15min, and then automatically report E029.

P20.01 defines the protection operating option when an input /output phase fails and when an external analog frequency/torque instruction is missing
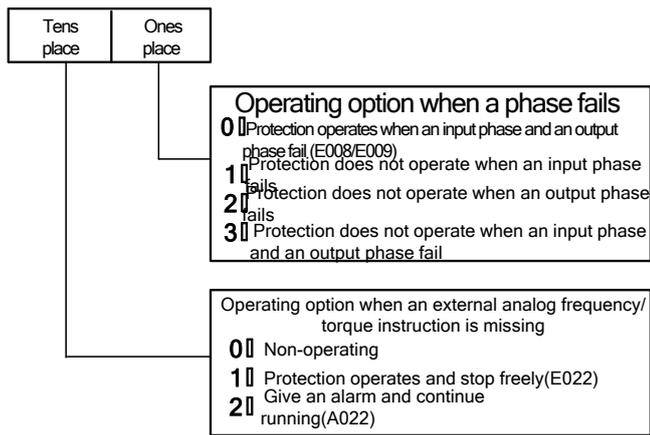
Fig.6-92 Setting of Protection Operating Option 2

个位	Ones place
十位	Tens place
缺相动作选择	Operating option when a phase fails
输入输出缺相将被保护	Protection operates when an input phase and an output phase fail
输入缺相不动作	Protection does not operate when an input phase fails
输出缺相不动作	Protection does not operate when an output phase fails
输入输出均不动作	Protection does not operate when an input phase and an output phase fail
外部模拟频率/转矩指令丧失动作选择	Operating option when an external analog frequency/torque instruction is missing
不动作	Non-operating
保护动作并自由停车	Protection operates and stop freely
告警且继续运行	Give an alarm and continue running

P20.02 Fault indication option 1	000～211【000】

P20.02 defines the protection operating option in the case of undervoltage, automatic reset interval and fault locking.
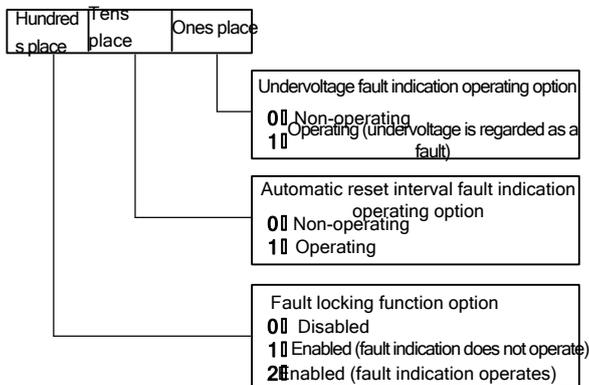
Fig.6-93 Fault Indication Option 1

个位	Ones place
十位	Tens place
百位	Hundreds place
欠压故障指示动作选择	Undervoltage fault indication operating option
不动作	Non-operating
动作（欠压视为故障）	Operating (undervoltage is regarded as a fault)
自动复位间隔故障指示动作选择	Automatic reset interval fault indication operating option
不动作	Non-operating
动作	Operating
故障锁定功能选择	Fault locking function option
禁止	Disabled
开放（故障指示不动作）	Enabled (fault indication does not operate)
开放（故障指示动作）	Enabled (fault indication operates)

⚠ Attention

The protection operating option function should be selected with care and it must be correctly selected after the cause of the fault is determined, or else it may cause an extension of accident scope, personal injury and property damage.

P20.03	Reserved

Reserved function

P20.04 Continuing running frequency option at fault	0～4【0】

0： run at current set frequency

1： run at the set frequency in P02.04 function code

2： run at the upper frequency limit

3： run at the lower frequency limit

4： run at a standby frequency in case of an abnormity

When function 4 is selected, it should be in combination with setting of function code P20.05

P20.05 Setting of standby frequency in case of an abnormity	0.0～100.0%【100.0%】

The setting adopts the running frequency before an abnormity as maximum value 100％.

P20.06 Motor overload protection mode option	0、1、2【1】

0： non-operating

There is no motor overload protection characteristic (it should be selected with care), and here servo driver has no overload protection of load motor;

1： normal motor (with low-speed compensation)

Because the heat dissipation effect of a normal motor is poor at a low speed, the corresponding electronic thermal protection value is also adjusted properly. The low-speed compensation

characteristic said here is to reduce the overload protection threshold value of the motor with running frequency of less than 30Hz.

2： variable frequency motor (without low-speed compensation)

The heat dissipation of a variable frequency motor is not affected by speed, so it is needless to adjust the protection value when running at a low speed.

P20.07 Overvoltage stall option	0, 1 【1】
P20.08 Stall overvoltage point	120～150% 【140.0%】

0： Disable

1： enable

In the process of decelerated running of servo driver, affected by load inertia, actual drop rate of motor speed may be lower than drop rate of output frequency, here the motor will feed back electric energy to servo driver, as a result that DC bus voltage of servo driver rises; if a measure is not taken, overvoltage trip will occur.

For the overvoltage stall protection function, bus voltage is detected in the process of decelerated running of servo driver and it is compared with the stall overvoltage point defined in P20.08 (relative to standard bus voltage); if bus voltage exceeds the stall overvoltage point, output frequency of servo driver will stop dropping; after bus voltage is detected again and it is lower than the stall overvoltage point, decelerated running is implemented, as shown in Fig. 6-94.
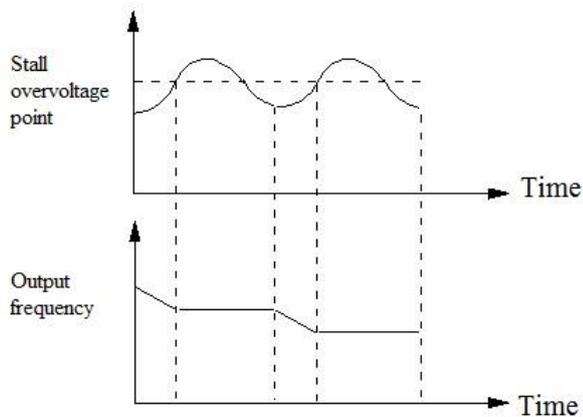
Fig.6-94 Overvoltage Stall Function

失速过压点	Stall overvoltage point
输出频率	Output frequency
时间	Time

📖 **Attention**

When the set stall point is lower, users are proposed to extend the deceleration time properly.

P20.09 Overload pre-alarm detection option	000～111 【000】
P20.10 Overload pre-alarm	20～200% 【130.0%】

detection level	
P20.11 Overload pre-alarm detection time	0.0～60.0s 【5.0s】

HSD2000 has servo driver overload protection and motor overload protection. For servo driver overload protection, see table 2-1; for motor overload protection, see P20.06. P20.09～P20.11 can realize monitoring of overload condition before the overload protection operates.

Overload pre-alarm detection option (P20.09) defines overload pre-alarm detection option, alarm operating option and relative value of detection level.
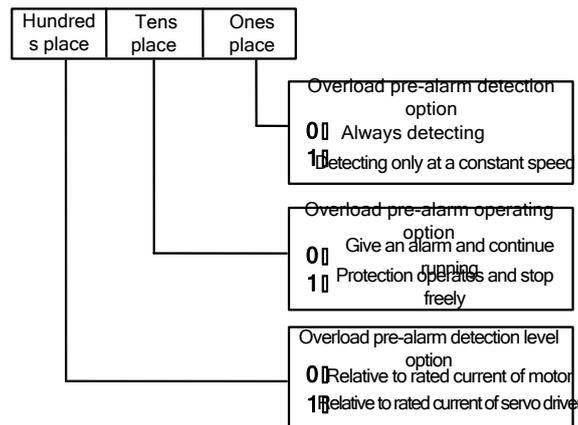
Fig.6-95 Overload Pre-alarm Detection Option

个位	Ones place
十位	Tens place
百位	Hundreds place
过载预报警检测选择	Overload pre-alarm detection option
一直检测	Always detecting
仅恒速检测	Detecting only at a constant speed
过载预报警动作选择	Overload pre-alarm operating option
告警，继续运行	Give an alarm and continue running
保护动作并自由停机	Protection operates and stop freely
过载预报警检出量选择	Overload pre-alarm detection level option
相对电机额定电流	Relative to rated current of motor
相对驱动器额定电流	Relative to rated current of servo driver

Ones place: overload pre-alarm detection option

0： overload detection always works during running of servo driver.

1： overload detection works only when servo driver runs at a constant speed.

Tens place: overload pre-alarm operating option

0： when overload detection is effective, give an alarm and continue running, and operating panel displays A013 or A014 according to setting of hundreds place.

1： when overload detection is effective, protection operates and stop freely, and operating panel displays E013 or E014 according to setting of hundreds place.

Hundreds place: overload pre-alarm detection level option

0： detection level is relative to rated current of motor (fault code E014).

1： detection level is relative to rated current of servo driver (fault code E013).
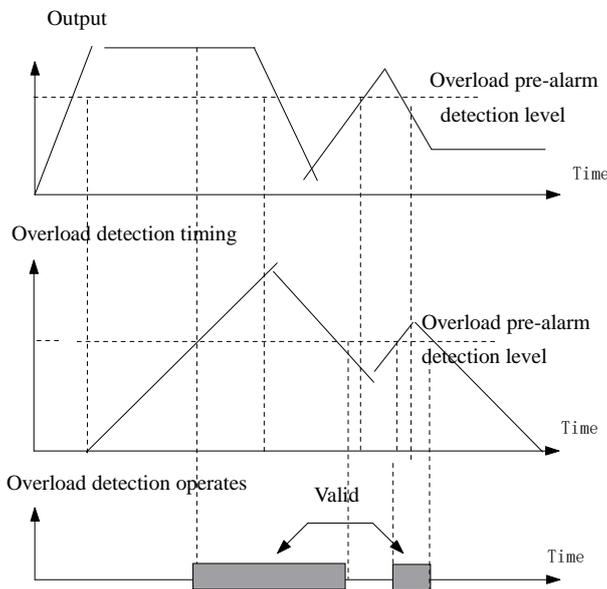
Fig.6-96 Overload Pre-alarm Detection Function Diagram

输出电流	Output
过载预报警检出水平	Overload pre-alarm detection level
过载检出计时	Overload detection timing
过载检出动作	Overload detection operates
过载预报警检出时间	Overload pre-alarm detection time
有效	Valid
时间	Time

Overload pre-alarm detection level (P20.10) defines the current threshold of overload pre-alarm operation and its setting value is the percentage relative to rated current (see P20.09).

Overload pre-alarm detection time (P20.11) defines that an overload pre-alarm signal is outputted after output current of servo driver is greater than overload detection level (P20.10) for more than a certain time.

When output current of servo driver is greater than pre-alarm detection level, pre-alarm detection timing increases by degrees; when output current of servo driver is less than detection level, pre-alarm detection timing decreases by degrees. When overload pre-alarm state is valid, it shows the time kept by pre-alarm detection timer exceeds the overload pre-alarm detection time.

🗡 **Attention**

1． Generally, setting of overload pre-alarm detection level should be less than overload protection level.

2． When output current of servo driver is greater than detection level, pre-alarm detection timing will increase gradually up to built-in amplitude limit. On the contrary, if run current is less than overload pre-alarm detection level, built-in overload pre-alarm detection time will reduce gradually up to zero.

P20.12 Off-load protection option	0～2【0】
P20.13 Off-load detection level	0.0～100％【30.0％】
P20.14 Off-load detection time	0.0～60.0s【1.0s】

Off-load protection option defines the protection operation of servo driver in case of off-load in the torque control mode.

0： off-load protection of servo driver is disabled.

1： off-load protection of servo driver is enabled.

2： Reserved.

Off-load detection level (P20.13) defines the current threshold of off-load operation and its setting value is the percentage relative to rated current of servo driver.

Off-load detection time (P20.14) defines that an off-load signal is outputted after output current of servo driver is continuously less than off-load detection level (P20.13) for more than a certain time.

When off-load state is valid, it shows run current of servo driver is less than off-load detection level and holding time exceeds the off-load detection time.
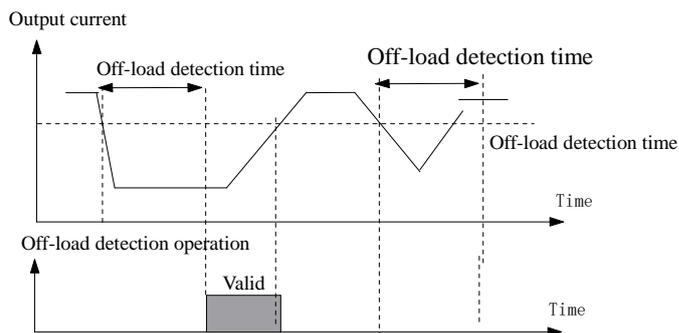
Fig.6-97 Off-Load Protection Detection Function Diagram

输出电流	Output current
掉载检出时间	Off-load detection time
掉载检出水平	Off-load detection level
掉载检出动作	Off-load detection operation
有效	Valid
时间	Time

🗡 **Attention**

After run current is greater than off-load detection level within the off-load detection time, built-in off-load detection time will be reset.

P20.15 Automatic current limiting level	20.0～200.0％【150.0％】
P20.16 Drop rate of frequency during current limiting	0.00～99.99Hz/s【10.00Hz/s】
P20.17 Automatic current	0～1【1】

limiting operation option	

Automatic current limiting function is to automatically restrict current and make it not exceed the set automatic current limiting level (P20.15) through real-time control of load current, so as to prevent the fault tripping arising from current overshoot. The function is especially applicable on the occasions that load inertia is greater or load change is violent.

Automatic current limiting level (P20.15) defines the current threshold of automatic current limiting operation and its setting range is the percentage relative to rated current of servo driver.

Drop rate of frequency during current limiting (P20.16) defines the adjustment rate of output frequency when automatic current limiting operates.

When automatic current limiting operates, if the drop rate of frequency (P20.16) is much lower, it does not get rid of automatic current limiting state easily and an overload fault may be caused finally; if the drop rate (P20.16) is much higher, the degree of frequency adjustment increases and servo driver may be in the power generation state for a long time, causing overvoltage protection.

Automatic current limiting function is always valid in the acceleration/deceleration state. Whether automatic current limiting function is valid when running at a constant speed depends on automatic current limiting operation option (P20.17).

P20.17＝0, it shows automatic current limiting function is invalid when running at a constant speed;

P20.17＝1, it shows automatic current limiting function is valid when running at a constant speed.

When automatic current limiting function operates, output frequency may change, so the function should not be used on the occasions that output frequency must be relatively stable during constant-speed running.

When automatic current limiting function is valid, lower setting of current limiting level may affect the overload capacity of servo driver.

P20.18 Automatic reset number	0～100 【0】
P20.19 Automatic reset interval time	2.0～20.0s 【5.0s】

Automatic fault reset function can automatically reset the running fault according to the set number and interval time. When automatic reset number is set as 0, it shows automatic reset is disabled and fault protection is executed immediately.

  Attention

1．Inversion module protection (E010), external device fault (E015) and analog input overcurrent fault (E041) have no automatic reset function.

2．During reset interval, output is locked out to run at zero frequency; after completion of automatic reset, it starts automatically by speed tracking to run.

3．The automatic fault reset function should be used with care, or else it may cause personal injury and property loss.

P20.20	Reserved

Reserved function

P20.21 Type of the first abnormity	0～50 【0】
P20.22 Bus voltage at the moment of the first fault	0～999V 【0】
P20.23 Actual current at the moment of the first fault	0.0～999.9A 【0】
P20.24 Running frequency at the moment of the first fault	0.00～1000.0Hz 【0.00】
P20.25 Running state of servo driver at the moment of the first fault	0～FFFFH 【0000】
P20.26 Type of the second abnormity	0～50 【0】
P20.27 Bus voltage at the moment of the second fault	0～999V 【0】
P20.28 Actual current at the moment of the second fault	0.0～999.9A 【0】
P20.29 Running frequency at the moment of the second fault	0.00～1000.0Hz 【0.00】
P20.30 Running state of servo driver at the moment of the second fault	0～FFFFH 【0000】
P20.31 Type of the third abnormity	0～50 【0】
P20.32 Bus voltage at the moment of the third fault	0～999V 【0】
P20.33 Actual current at the moment of the third fault	0.0～999.9A 【0】
P20.34 Running frequency at the moment of the third fault	0.00～1000.0Hz 【0.00】
P20.35 Running state of servo driver at the moment of the third fault	0～FFFFH 【0000】

HSD2000 series have 50 kinds of abnormity protection alarms; the type of the latest three abnormal faults (P20.21, P20.26 and P20.31), bus voltage of servo driver at the moment of the latest three faults (P20.22, P20.27 and P20.32), current at the moment of the latest three faults (P20.23, P20.28 and P20.33), frequency at the moment of the latest three faults (P20.24, P20.29 and P20.34) and running state of servo driver at the moment of the latest three faults (P20.25, P20.30 and P20.35) are memorized for users to inquire.

The latest fault record is the record for the third time.

For running state of servo driver, see the function code P01.17. For detailed description of protection alarms and fault handling methods, see *Chapter VII Measures relative Fault Alarm, Handling of Abnormality* .

6.1.22 Traverse operation parameter (P30 group)

Traverse frequency is applicable to textile and chemical fiber industries and on the occasion of needing traversing and winding functions. Typical work of traverse frequency is as shown in Fig. 6-98.

Generally, traverse frequency process is as below: first accelerate to the preset traverse frequency (P30.02) according to acceleration time and wait for a period of time (P30.03), next transit to center frequency according to acceleration/deceleration time, and then run cyclically according to the set traverse frequency amplitude (P30.04), jump frequency (P30.05), traverse frequency period (P30.06) and traverse frequency rise time (P30.07), till a stop command is given to slow down and stop according to deceleration time.
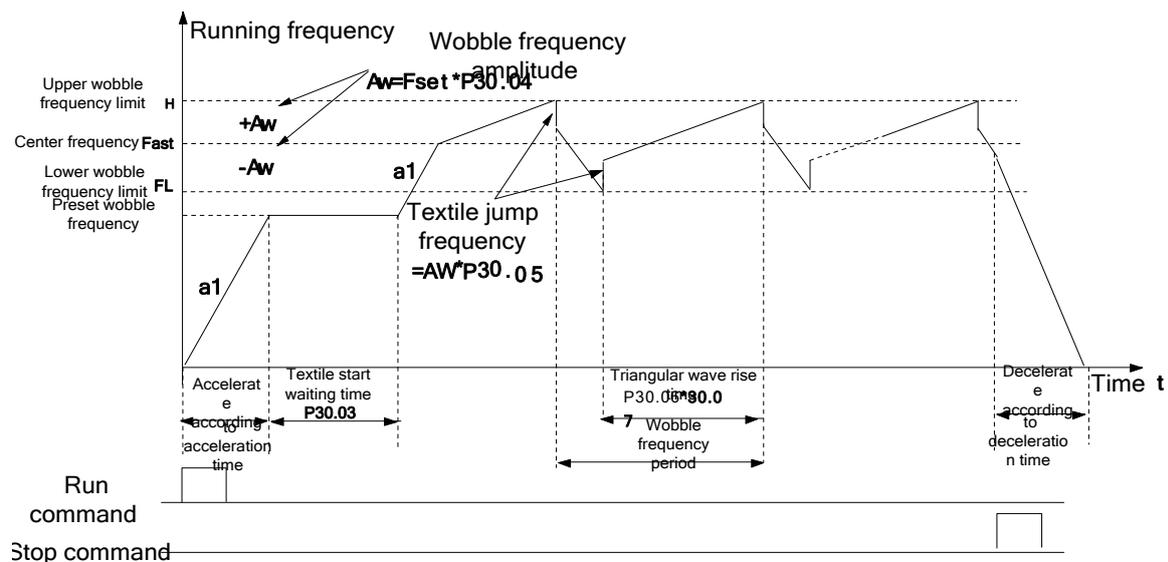
Fig.6-98 Traverse Frequency Diagram

运行频率	Running frequency
摆频上限频率	Upper traverse frequency limit
中心频率	Center frequency
摆频下限频率	Lower traverse frequency limit
摆频预置频率	Preset traverse frequency
运行命令	Run command
停机命令	Stop command
摆频幅度	Traverse frequency amplitude
纺织突跳频率	Textile jump frequency
按加速时间加速	Accelerate according to acceleration time
纺织启动等待时间	Textile start waiting time
三角波上升时间	Triangular wave rise time
摆频周期	Traverse frequency period
按减速时间减速	Decelerate according to deceleration time
时间	Time

Center frequency roots in the set frequency of normal run, multi-speed run or PLC run;

Traverse frequency is automatically cancelled in the jog and closed loop run modes.

PLC and traverse frequency run simultaneously; when switching between PLC phases, traverse frequency becomes invalid; after transition to PLC set frequency according to acceleration/deceleration setting in PLC phase, traverse frequency starts; decelerate according to the deceleration time in PLC phase when stopping.

P30.00 Textile function option	0～1【0】

The function decides whether to use the textile function.

0： textile function is not selected;

1： textile function is selected.

P30.01 Traverse frequency run mode	0000～1111【0000】

The function code is used to the operating mode of traverse frequency function. Users can design programs at will according to own needs. The meaning of each display place of LED is as shown in Fig.6-99.
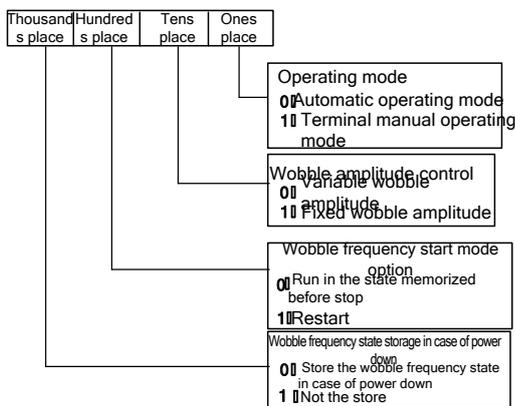
Fig.6-99 Meaning of Traverse Frequency Run Mode Parameter

个位	Ones place
十位	Tens place
百位	Hundreds place
千位	Thousands place
投入方式	Operating mode
自动投入方式	Automatic operating mode
端子手动投入方式	Terminal manual operating mode
摆幅控制	Traverse amplitude control
变摆幅	Variable traverse amplitude
固定摆幅	Fixed traverse amplitude
摆频停机起动方式选择	Traverse frequency start mode option
按停机前记忆的状态运动	Run in the state memorized before stop
重新开始起动	Restart
摆频状态掉电存储	Traverse frequency state storage in case of power down
掉电存储摆频状态	Store the traverse frequency state in case of power down
不存储	Not store the traverse frequency state in case of power down

Ones place: operating mode

0： automatic operating mode

After starting, first run for a period of time (P30.03) at the preset traverse frequency (P30.02) and then run automatically at traverse frequency.

1： terminal manual operating mode

When multi-function terminal (Xi is defined as function 34) is set to be valid, it enters traverse frequency state; when invalid, it goes out of traverse frequency state and running frequency remains at the preset traverse frequency (P30.02).

Tens place: traverse amplitude control

0： variable traverse amplitude

Traverse amplitude AW varies with center frequency and its variation rate is defined in P30.04.

1： fixed traverse amplitude

Traverse amplitude AW depends on maximum frequency and P30.04.

Hundreds place: traverse frequency start mode option

0： start in the state memorized before stop

1： restart

Thousands place: traverse frequency state storage in case of power down

Traverse frequency state parameter is stored in case of power down. The function is valid only the start mode in the state memorized before stop is selected.

0： store the traverse frequency state in case of power down;

1： not store the traverse frequency state in case of power down.

  📖 **Attention**

The terminal (Xi defined as function 34) can be used to reset traverse frequency state.

P30.02 Preset traverse frequency	0.00Hz～P02.06【0.00Hz】
P30.03 Waiting time of preset traverse frequency	0.0～3600.0s【0.0s】

P30.02 is used to define the running frequency of frequency converter before entering traverse frequency running state.

When automatic start mode is selected, P30.03 is used to set the duration of running at the preset traverse frequency before entering traverse frequency state; when manual start mode is selected, P30.03 setting is invalid.

P30.04 Traverse frequency amplitude	0.0%～50.0%【0.0%】

Variable traverse amplitude: AW＝ center frequency ×P30.04

Fixed traverse amplitude: AW＝ maximum running frequency P02.05 ×P30.04

  📖 **Attention**

Running frequency at traverse frequency is restricted by the upper and lower frequency limits; if it is set improperly, traverse frequency will not work properly.

P30.05 Jump frequency	0.0～50.0% （relative traverse amplitude）【0.0%】

As described in Fig.6-98, when set as 0, there will be no jump frequency.

P30.06 Traverse frequency period	0.1～999.9s【10.0s】

It defines the time of a complete period of traverse frequency rise and drop process.

  📖 **Attention**

It is not allowed to select automatic acceleration/deceleration run mode in the traverse frequency run mode, or else the traverse frequency period is abnormal.

P30.07 Triangular wave rise time	0～100.0%【50.0%】

It defines the running time (＝P30.06 ×P30.07 (s)) of traverse frequency at the ascent stage and the running time (＝P30.06 ×9(1-P30.07) (s)) at the descent stage. See the description in Fig.6-98.

  📖 **Attention**

Users select S-curve acceleration/deceleration mode while selecting traverse frequency and traverse frequency running is smoother.

6.1.23 Driver parameters (P97 group)

P97.00 Serial number	0～FFFF【6000】
P97.01 Software version number	0.00～99.99【1.00】
P97.02 Custom version number	0～9999【0】
P97.03 Rated capacity	0～999.9kVA
P97.04 Rated voltage	0～999V
P97.05 Rated current	0～999.9A

The above are the parameters of servo driver and factory defaults are set by the manufacturer.

6.1.24 Custom parameter group (P98 group)

Users can customize parameters by P98 group.

Customization details: first set the first function code parameter that a user wants to display by P98.00, next set the second function code parameter that the user wants to display by P98.01, and so on. At most 32 custom parameters can be set.

After completion of setting, set P00.00 as 3 (user menu mode) and then press DATA/ENTER key.

If not changing P00.00 function code parameter value (set as 3), enter the function code display state; press ▲ or ▼ key, and operating panel will only display P00.00 and custom parameters.

If a user wants to quit from custom parameter display mode, the user can enter P00.00 and change the P00.00 parameter value to a value (not 3), and then press DATA/ENTER key.

For example, a user wants to set three custom parameters: P02.01, P03.02 and P03.00, the user can set them according to the steps as below:

1）Use P98.00 to set the first function code parameter 02.01 and then press DATA/ENTER key;

2）Use P98.01 to set the second function code parameter 03.02 and then press DATA/ENTER key;

3）Use P98.02 to set the third function code parameter 03.00 and then press DATA/ENTER key.

4）Set P00.00 as 3 (user menu mode) and then press DATA/ENTER key.

After completion of setting, if not changing the P00.00 function code parameter value, operating panel will only display the four function code parameters: P00.00, P02.01, P03.02 and P03.00, when entering the function code display state.

📖 **Attention**

1．When a user sets a custom parameter by P98 group, if the set function code parameter is not available in the user manual of HSD2000, setting of parameter customization will not achieve the goal.

For example, a user sets P98.01 parameter value as 02.82 **and then press DATA/ENTER key, here P98.01 parameter value displayed is 99.99.**

Chapter VII Measures relative Fault Alarm, Handling of Abnormality

All potential faults of HSD2000 are summarized in Table 7-1. The range of fault code is E001~E041. Before seeking for service, a user can self-examine as the table, and record phenomenon in detail. For service, please contact the seller.

Table 7-1 Details of and Measures relative Fault Alarm

Fault code	Type	Potential cause	Measure
E001	Overcurrent during acceleration of servo driver	Shorter time of acceleration	Prolong time of acceleration
		Inaccurate motor parameter	Enable self-setting of motor parameter
		Restart of rotating motor after instantaneous stop	Set the start mode P05.00 to "speed tracking for restart".
		Fault of code disc during running of PG	Inspect code disc and its wiring.
		Lower power of servo driver.	Replace the original servo driver with one with higher power level.
		Improper V/F curve	Adjust V/F curve setting and manual torque boosting capacity.
E002	Overcurrent during deceleration of servo driver	Shorter time of deceleration	Prolong time of deceleration.
		Potential energy or high inert torque of load	Add proper dynamic braking assembly.
		Fault of encoder during running of PG	Inspect encoder and its wiring
		Lower power of servo driver.	Replace the original servo driver with one with higher power level
E003	Overcurrent during constant speed running of servo driver	Shorter set time of acceleration/deceleration	Properly prolong time of acceleration/deceleration
		Sudden change or abnormality of load	Inspect load
		Low grid voltage	Inspect input power.
		Fault of encoder during running of PG.	Inspect encoder and its wiring
		Lower power of servo driver	Replace the original servo driver with one with higher power level.
E004	Overvoltage during acceleration of servo driver	Abnormal input voltage.	Inspect input power
		Shorter set time of acceleration	Properly prolong time of acceleration
		Restart of rotating motor after instantaneous stop	Set the start mode P05.00 to "speed tracking for restart"
E005	Overvoltage during deceleration of servo driver	Shorter time of deceleration (relative to regenerated energy)	Prolong time of deceleration
		Potential energy or high inert torque of load	Select proper dynamic braking assembly
E006	Overvoltage during constant speed running of servo driver	Improper ASR parameter setting during vector control running	See ASR parameter setting in P07 group
		Shorter set time of acceleration/deceleration	Properly prolong time of acceleration/deceleration
		Abnormal input voltage	Inspect input power
		Abnormal fluctuation in input voltage	Install input reactor
		High load inertia	Consider addition of dynamic braking assembly
E007	Overvoltage of control power of servo driver	Abnormal input voltage	Inspect input power or seek for service
E008	Phase fault at input side	Phase fault on input R.S.T	Inspect installation wiring and input voltage
E009	Phase fault at output side	Phase fault on output U.V.W	Inspect output wiring, motor and cable
E010	Power module protection	Inter-phase short circuit or grounded short circuit among 3 output phases	Re-wiring; confirm good state of motor insulation
		Instantaneous overcurrent of servo driver	See the measures relative overcurrent

Fault code	Type	Potential cause	Measure
		Blocking of air duct, damage of fan	Unblock air duct or replace fan
		Higher ambient temperature	Lower ambient temperature
		Looseness of wiring or plug-in of control panel	Inspect whether re-wiring is needed
		Abnormal current waveform due to output phase fault	Inspect wiring
		Damage of auxiliary power and undervoltage of driver	Seek for service
		Shoot-through of bridge arm of inverter module	Seek for service
		Abnormality of control panel	Seek for service
E011	Overheat of heat radiator of inverter module	Higher ambient temperature	Lower ambient temperature
		Blocking of air duct	Clean air duct
		Damage of fan	Replace fan
		Abnormality of inverter module	Seek for service
E012	Overheat of heat radiator of rectifier module	Higher ambient temperature	Lower ambient temperature
		Blocking of air duct	Clean air duct
		Damage of fan	Replace fan
E013	Overload of servo driver	Inaccurate motor parameter	Enable self-setting of motor parameter
		Higher load	Replace the original servo driver with one with higher power
		DC over-braking	Reduce DC brake current and prolong time of braking
		Restart of rotating motor after instantaneous stop	Set the start mode P05.00 to "speed tracking for restart"
		Shorter time of acceleration	Prolong time of acceleration
		Lower grid voltage	Inspect grid voltage
		Improper V/F curve	Adjust V/F curve and torque boosting capacity
E014	Overload of motor	Incorrect setting of motor overload protection factor	Correctly set motor overload protection factor
		Blocking of motor or excess of sudden change in load	Inspect load.
		Long-time low-speed running of universal motor under heavy load	Select special motor for long-time low-speed running
		Lower grid voltage	Inspect grid voltage
		Improper V/F curve	Correctly set V/F curve and torque boosting capacity
E015	Emergency stop or fault of external equipment	The key "STOP" pressed;	See the functional definition of the key "STOP" in P00.06.
		Effectiveness of external emergency stop terminal	After cancellation of external fault, release external emergency stop terminal
E016	Read-write fault of EEPROM	Error in read-write of control parameter	Press STOP/RESET for reset or seek for service
E017	Abnormal communication at serial port	Improper setting of Baud rate	Set Baud rate as appropriate
		Communication error at serial port	Press STOP/RESET for reset or seek for service
		Improper setting of fault alarm parameter	Modify settings in P18.03 and P20.00
		Inactiveness of upper computer	Inspect whether upper computer is active and its wiring is correct
E018	Abnormality of contactor	Lower grid voltage	Inspect grid voltage
		Damage of contactor	Replace contactor of main circuit or seek for service
		Damage of power-on buffer resistor	Replace buffer resistor or seek for service
		Damage of control circuit	Seek for service
		Phase fault of input	Inspect input R.S.T wiring

Fault code	Type	Potential cause	Measure
E019	Abnormality of current detection circuit	Looseness of wiring or plug-in of control panel	Inspect whether re-wiring is needed
		Damage of auxiliary power	Seek for service
		Damage of Hall device	Seek for service
		Abnormality of amplifying circuit	Seek for service
		Higher AI analog input voltage	Reduce AI analog input voltage to a level below 12V
E020	System interference	Severe interference	Press STOP/RESET for reset or add power filter at power input side
		Wrong read-write of DSP on main control panel	Press STOP/RESET for reset or seek for service
E021	Loss of closed-loop feedback	Parameter loss during feedback or improper setting of feedback	Modify setting in P13.37.
		Disconnection of feedback	Re-wiring
		Lower closed-loop feedback setting	Increase feedback setting in reference to setting in P13.02
E022	Loss of external setting command	Disconnection of analog demand signal under main frequency setting or analog current setting selected by torque command, or lower analog demand signal (<2mA)	Inspect wiring or adjust input type of setting signal.
E023	Error of parameter copying on operation panel	Incomplete parameters of operation panel, dismatch between versions of operation panel and main control panel	Refresh data and version of operation panel; upload parameter by setting P00.05 as 1, and then download parameter by setting P00.05 as 2 or 3
		Damage of EEPROM on operation panel	Seek for service
E024	Bad self-setting	Wrong setting of parameters specified on nameplate of motor	Set parameters in accordance with nameplate of motor
		Reverse rotation (for self-setting) during prohibition of reverse rotation	Cancel prohibition of reverse rotation
		Overtime of self-setting	Inspect motor wiring
			Inspect whether setting of P02.06 (upper limit of frequency) is lower than the rated value
E025	Fault of PG	Control with PG vector or PG V/F, disconnection of encoder signal	Re-wire encoder when necessary
E026	Load fault of servo driver	Loss or reduction of load	Inspect load
		Improper setting of load fault protection	Set parameters of load fault protection as appropriate
E027	Fault of brake unit	Damage of brake pipe	Seek for service
E028	Error of parameter setting	Running of servo control under open-loop vector mode	Cancel servo control or modify servo control to closed-loop vector mode;, confirm correctness of encoder parameter
		Wrong setting of closed-loop process call	For vector control, prevent torque limit (P08.08, P08.09) and frequency setting (stage frequency setting of P02.08, P13.00 or PLC) from being simultaneously established in closed-loop process
E029	Short circuit of 24V power of control panel	Short circuit between P24 and terminal COM	Confirm correct connection between P24 and COM
		Damage of interface board circuit	Replace interface board or seek for service
E030~ E033	Reserved		
E034	Over-deviation (DEV)	Improper ASR parameter	Modify function code in P07 group
		Lower DEV detection value	Modify setting of DEV detection value
		Sharp fluctuation of load	Eliminate load shake
E035	Overspeed (OS)	Disconnection of encoder	Inspect encoder wiring
		Incorrect encoder parameter setting	Reset encoder parameters

Fault code	Type	Potential cause	Measure
		Lower overspeed detection value	Modify setting of overspeed detection value
E036～ E040	Reserved		
E041	Input overcurrent of CCI	Abnormality of control circuit	Seek for servicfe
		Higher input current	Inspect analog current input
E042～ E045	Reserved		

📖   **Attention**

Short circuit of brake resistor on the servo driver can cause damage to brake unit of the servo driver.

All potential alarms of HSD2000 are shown in Table 7-2 (for detail, see the settings of function codes in P20 group). If fault automatically disappears during running, the servo driver will automatically recover to the pre-alarm state, except A017 (for detail, see the note on function codes in P20 group).

Table 7-2 Details of and Measures relative Alarm

Alarm code	Type	Potential cause	Measure
A013	Overload of servo driver	Inaccurate motor parameter	Enable self-setting of motor parameter
		Higher load	Replace the original servo driver with one with higher power
		DC over-braking	Reduce DC brake current and prolong time of braking
		Restart of rotating motor after instantaneous stop	Set the start mode P05.00 to "speed tracking for restart"
		Shorter time of acceleration	Prolong time of acceleration
		Lower grid voltage	Inspect grid voltage
		Improper V/F curve	Adjust V/F curve and torque boosting capacity
A014	Overload of motor	Incorrect setting of motor overload protection factor	Correctly set motor overload protection factor
		Blocking of motor or excess of sudden change in load	Inspect load
		Long-time low-speed running of universal motor under heavy load	Select special motor for long-time low-speed running
		Lower grid voltage	Inspect grid voltage
		Improper V/F curve	Correctly set V/F curve and torque boosting capacity
A016	Read-write fault of EEPROM	Error in read-write of control parameter	Press STOP/RESET for reset or seek for service
A017	Abnormal communication at serial port	Improper setting of Baud rate	Set Baud rate as appropriate
		Communication error at serial port	Press STOP/RESET for reset or seek for service
		Improper setting of fault alarm parameter	Modify settings in P18.03 and P20.00
		Inactiveness of upper computer	Inspect whether upper computer is active and its wiring is correct
A018	Abnormality of contactor	Lower grid voltage	Inspect grid voltage
		Damage of contactor	Replace contactor of main circuit or seek for service
		Damage of power-on buffer resistor	Replace buffer resistor or seek for service
		Damage of control circuit	Seek for service
		Phase fault of input	Inspect input R.S.T wiring
A021	Loss of closed-loop feedback	Parameter loss during feedback or improper setting of feedback	Modify setting in P13.37.
		Disconnection of feedback	Re-wiring
		Lower closed-loop feedback setting	Increase feedback setting in reference to setting in P13.02

Alarm code	Type	Potential cause	Measure
A022	Loss of external setting command	Disconnection of analog demand signal under main frequency setting or analog current setting selected by torque command, or lower analog demand signal (<2mA)	Inspect wiring or adjust input type of setting signal
A029	Short circuit of 24V power of control panel	Short circuit between P24 and terminal COM	Confirm correct connection between P24 and COM.
		Damage of interface board circuit	Replace interface board or seek for service

⚠ Attention

The function of fault alarm shall be enabled with caution, otherwise accident can spread and cause personal injury and property damage.

Table 7-3 Abnormality in Operation and Measure

Phenomenon	Detail	Potential cause	Measure
No response on operation panel	Individual or all keys fail to respond.	The function of operation panel locking is enabled.	In out-of-service state or state of running parameter, keep down the key "DATA/ENTER", and then press the key "▼" for 3 continuous times for unlocking
			Re-connect power supply of servo driver after full power-down
		Poor contact of connecting wire of operation panel	Inspect connecting wire by re-hot-plug
		Damage of key of operation panel	Replace operation panel or seek for service
Function code modification fault	Modification fault in running state	The function code is non-modifiable in running state.	Modify the function code in out-of-service state
	Part of function codes are non-modifiable.	The function code P00.03 is set as "1" or "2".	Modify P00.03 to 0
		The function code is measured value.	User is not allowed to modify measured value of function code.
	No response is given by pressing MENU/ESC.	The function of operation panel locking is enabled; other cause	See the solution for "no response on operation panel"
	Modification can't be entered by pressing MENU/ESC, and function code is displayed as "0000".	User password required	Input correct user password
			Seek for service
Accidental stop of servo driver during running	Without stop command, servo driver automatically stops and running indicator lamp goes out.	Fault alarm	Find cause of and clear fault
		Simple PLC single cycle completed	Inspect parameter setting of PLC
		Interruption of power supply	Inspect power supply
		Switching of running command channel	Inspect setting of function code related to operation and running command channel
		Speed over-deviation (DEV)	Modify setting of DEV detection value
		OS	Modify setting of OS detection value
		Change in positive and negative logic of control terminal	Inspect conformity of setting in P10.16
	Without stop command, motor automatically stops and servo driver runs at zero frequency with brightness of running indicator.	Automatic fault recovery	Inspect setting of automatic fault recovery and cause of fault
		Simple PLC pause	Inspect PLC pause terminal
		External interruption	Inspect setting of external interruption and fault source
		Frequency setting of 0	Inspect frequency setting

Phenomenon	Detail	Potential cause	Measure
		Start frequency is higher than frequency setting	Inspect start frequency
		Improper setting of hopping frequency	Inspect setting of hopping frequency
		Negative closed-loop output during prohibition of reverse rotation	Inspect settings in P13.35 and P05.12
		Enablement of the terminal "no forward rotation" during forward rotation	Inspect setting of terminal function
		Enablement of the terminal "no reverse rotation" during reverse rotation	Inspect setting of terminal function
		"Frequency adjustment"= 0	Inspect settings in P02.12 and P02.13
		Instantaneous LV compensation at restart after power outage, lower power voltage	Inspect setting of the function "restart after power outage" and input voltage
Running fault of servo driver	Servo driver doesn't run, and running indicator lamp is inactive after running key is pressed.	Effectiveness of free stop terminal	Inspect free stop terminal
		Effectiveness of running prohibition terminal	Inspect running prohibition terminal
		Effectiveness of external stop terminal	Inspect external stop terminal
		Opening of three-wire running control terminal under three-wire control mode	Set and close three-wire running control terminal
		Fault alarm	Remove the fault
		Improper setting of upper computer analog terminal	Cancel the function of upper computer analog terminal, or offer proper setting with upper computer, or modify setting in P10.17.
		Improper setting of positive and negative logic of input terminal	Inspect setting in P10.16
The alarm "P.oFF" immediate after connection of power supply of servo driver	Contactor is opened, and load on servo driver is high.	Since contactor is unclosed, DC bus voltage of main circuit will fall when servo driver runs under high load. Servo driver first doesn't display the fault E018 but displays "P.oFF".	Put servo driver into running after full closing of contactor

Chapter VIII Servicing and Maintenance

Potential fault of the servo driver can occur due to any of ambient temperature, humidity, dust, vibration and ageing or wear of internal components of servo driver. Given this, it is necessary to maintain the servo driver daily and regularly.

  📖 **Attention**

1. Before inspection or maintenance, the items below shall be confirmed, otherwise electric shock can occur.

2. Power supply of the servo driver has been disconnected.

3. The charge indicator lamp will go out when cover plate is opened.

4. The voltage measured with DC HV voltmeter between (+) and (-) is lower than 36V.

8.1 Daily servicing and maintenance

The servo driver must run in the service environment specified in 2.1. Accidents can occur during running. Daily maintenance shall be carried out as the table below. Keeping good running environment, recording data about daily running and finding cause of abnormality as soon as possible are favorable to prolonging service life of the servo driver.

Table 8-1 Prompt on Daily Inspection

Object	Essentials			Standard
	Content	Interval	Method	
Service environment	Temperature and humidity	Anytime	Thermometer and hydrometer	Derating under the temperature range -10℃ ~+40℃ or 40℃~50℃,
	Dust, water and leak		Visual inspection	No sign of water leak
	Gas		Olfactory inspection	No odor
Servo driver	Shake and heat	Anytime	Touch on shell	Stable vibration and reasonable air temperature
	Noise		Audible inspection	No abnormal sound
Motor	Heat	Anytime	Touch	No abnormal heat
	Noise		Audible inspection	Even noise
Running state parameter	Output current	Anytime	Ammeter	Current within the range of rated value
	Output voltage		Voltmeter	Voltage within the range of rated value
	Internal temperature		Thermometer	Temperature lower than 35℃

8.2 Regular maintenance

With a view to service environment, the servo driver can be inspected once 3 or 6 months.

  📖 **Attention**

1．Only one that has passed professional training can undertake removal of component, maintenance and replacement of device.

2．Metals such as screw and washer shall not be left in the servo driver, otherwise damage can be caused to the servo driver.

Common contents of inspection

1. Whether screw of the control terminal is loose (if the screw is loose, tighten it with screwdriver)

2. Whether there's poor contact on terminal of the main circuit or sign of overheat at connection of the copper bar.

3. Whether there's damage of power cable or control cable especially sign of cut on sheath in contact with metal surface

4. Whether insulating binding tape of power cable nose has fallen off.

5. Fully clear dust on circuit board and air duct with dust collector

6. A servo driver stored for long term must be energized once within 2 years, for 5h at least. In this process, voltage shall be slowly increased to the rated value with voltage regulator. During the increase, the servo driver can be unloaded.

7. For insulation test of the servo driver, all input and output terminals (R, S, T, U, V, W, PE, P1, +, -) of the main circuit must be short-circuited and grounded for test. A terminal mustn't be individually grounded for test, otherwise damage can be caused to the servo driver. For the test, 500V megameter shall be used.

8. For insulation test of the motor, input terminals (U, V, W) of the motor must be removed from the servo driver, and the motor shall be independently tested, otherwise damage can be caused to the servo driver.

📖　**Attention**

1. Before delivery, withstand voltage test has been carried out. It is unnecessary for user to newly carry out withstand voltage test. Improper test can damage the device.

2. The element for replacing an original element must be the same model with the same electrical parameters, otherwise damage can be caused to the servo driver.

8.3 Replacement of quick-wear parts of servo driver

Quick-wear parts of the servo driver are cooling fan and filter electrolytic capacitor. Their lives are tightly associated with service environment and situation of maintenance. Their common lives are shown in the table below.

Table 8-2 Life of Component

Name of device	Life
Fan	30000~40000h
Electrolytic capacitor	40000~50000h
Relay	100000 times

A user can establish replacement interval according to running time.

1. Cooling fan

　Potential cause of damage: wear of bearing, ageing of blade

　Standard: whether there's crack on blade or sound of abnormal vibration at start

2. Filter electrolytic capacitor

　Potential cause of damage: high ambient temperature, increase in pulsating current due to frequent load hopping, ageing of electrolyte

　Standard: whether there's leakage of liquid or protrusion of safety valve, measurement of electrostatic capacity, measurement of insulation resistance

3. Relay

　Potential cause of damage: corrosion, frequent action

　Standard: opening/closing fault

8.4 Storage of servo driver

For temporary or long-term storage of the servo driver, attention must be paid to those below.

1. The servo driver shall not be stored where there's high temperature, humidity, dust or metal dust. The place for storing the servo driver shall be well ventilated.

2. Long-term storage can worsen electrolytic capacitor. Given this, for long-term storage, the servo driver must be energized once within 2 years, for 5h at least. In this process, voltage must be slowly increased to the rated value with voltage regulator.

8.5 Maintenance of servo driver

In any of the circumstances below, we will undertake repair.

1. The scope of warranty only refers to body of the servo driver.

2. For fault or damage occurring during normal service of the servo driver, the manufacturer will undertake repair within 18 months as of the date of delivery. Anytime out of the 18 months, proper maintenance cost will be collected.

3. In any of the circumstances below, proper maintenance cost will be collected even within the 18 months.

　1）Damage due to operation in violation of the user manual

　2）Damage due to fire disaster, flood or abnormal voltage

　3）Damage due to application of the servo driver for abnormal purpose.

4. Related service fee will be collected as actually incurred. If there's an agreement concerned, the agreement shall prevail.

Chapter IX Functional Code List

Parameters of HSD2000 series servo driver is grouped by function including 25 units as P00-P19, P20,P30 and P97-P99, each group contain some functional codes which adopt "functional group number +function code" for grouping, samples as P XX.YZ given in the manual mean: the YZ functional code in the XX group, for example, P10.26 means that 26th functional code in the 10th group.

Introduction to the structure of functional code list:

Table 9-1 Introduction to the structure of functional code list

Line	Name	Description
1	Functional code	Number of functional parameter group and parameters
2	Name	Full name of functional parameters
3	LCD display	Functional parameter name is simply shown through LCD on the panel
4	Setting scope	Valid setting scope for functional parameters, shown through LCD on the panel
5	Min unit	Min unit for setting functional parameters
6	Factory default	Original value of functional parameters set in factory
7	Change	Change of functional parameters (allow to change or not and conditions for any change) "○": means the parameter can be changed when the servo drive is kept in stop and running; "×": means the parameter cannot be changed when the servo drive is kept in running; "*": means the parameter cannot be changed when it is the actual test value; "--": means the parameter is "factory default" to be set by the factory only, and the user is forbidden to change. (The servo drive has make automatic check limit to the change of parameters so as to prevent from improper change by the user)

Note:
1. Parameter systems adopt decimal system (DEC) and hexadecimal system (HEX), if the HEX is used, each data in editing shall be kept independent and some values can adopt HEX (0-F).
2. LCD display in the table is available for LCD Chinese/English operation panel only.
3. "Factory default" means when the user selects the factory default, the functional code parameters will brush the value, but actually tested parameters or record values will not be brushed.

Table 9-2 Functional Code List

Group P00: System Management						
Functional Code	Name	LCD Display	Setting Scope	Min Unit	Default	Change
P00.00	Menu mode option	Menu mode option	0: Shortcut menu: display only parameters related to the shortcut operation of servo driver; 1: Basic menu: display only basic functional parameters 2: Advanced menu: display all parameters; 3: User menu: display only 32 parameters that the user set in P98; 4: Proof menu: display only parameter groups differing from the default.	1	2	○
P00.01	LCD language option	Language option	0: Chinese 1: English 2~4: Reserved	1	0	○
P00.02	Password	Password	0: No password Other: Password needed	1	0	○
P00.03	Parameter protection setting	Parameter protection setting	0: Able to change all data; 1: Not allow to change except this functional code and main frequency setting P02.04. 2: Not allow to change except this functional code	1	0	○

Group P00: System Management							
Functional Code	Name	LCD Display	Setting Scope	Min Unit	Default	Change	
P00.04	Parameter initialization	Parameter initialization	0: Parameter changed 1: Remove fault memory 2: Restore to the default 3: Restore only the quick start functional group 4: Restore only the user-set parameter group	1	0	×	
P00.05	Parameter copy	Parameter copy	0: No action 1: Parameter upload to the keyboard 2: Parameter download to the drive 3: Parameter download (excluding motor parameters) Note: No upload/download to the servo driver parameters.	1	0	×	
P00.06	Key function option	Key function option	LED ones place: STOP key function option 0: Invalid for non-panel control 1: Press the "stop machine" to stop for non-panel operation 2: Free to stop for non-panel operation Report E015 LED tens place: LOCAL key function option 0: Invalid 1: Valid for machine stop status 2: Valid for machine running or stop LED Hundreds place: Operation panel lock 0: No lock 1: All locked 2: All locked except STOP key 3: All locked except SHIFT key 4: All locked except RUN, STOP keys LED thousands place: double-click STOP key for emergent stop 0: double-click STOP key for free stop 1: No function	1	0000	×	

Group P01: Status Display Parameters							
Functional Code	Name	LCD Display	Setting Scope	Min Unit	Default	Change	
P01.00	Main setting frequency channel	Main setting frequency channel	0: Invalid 1: Digit given 1: Operation panel ▲, ▼ Given 2: Digit given2: Terminal UP/DOWN given 3: Digit given 3: Serial port given 4: AI mode given 5: Terminal PULSE given 6: Reserved	1	0	*	
P01.01	Main given setting frequency	Main given setting frequency	−1000.0~1000.0Hz	0.01Hz	0.00	*	
P01.02	Auxiliary given setting frequency	Auxiliary given setting frequency	−1000.0~1000.0Hz	0.01Hz	0.00	*	
P01.03	Setting frequency	Setting frequency	−1000.0~1000.0Hz	0.01Hz	0.00	*	
P01.04	Frequency	Frequency	−1000.0~1000.0Hz	0.01Hz	0.00	*	

Group P01: Status Display Parameters						
Functio nal Code	Name	LCD Display	Setting Scope	Min Unit	Default	Chang e
	instruction(after Acc or Dec)	instruction				
P01.05	Output frequency	Output frequency	−1000.0~1000.0Hz	0.01Hz	0.00	*
P01.06	Output voltage	Output voltage	0~480V	1V	0	*
P01.07	Output current	Output current	0.0~3Ie	0.1A	0.0	*
P01.08	Torque current	Torque current	−300.0%~+300.0%	0.1%	0.0%	*
P01.09	Flux current	Flux current	0.0%~+100.0%	0.1%	0.0%	*
P01.10	Output torque	Output torque	−300.0%~+300.0%	0.1%	0.0%	*
P01.11	Motor power	Motor power	0.0%~200.0%(relative rated power of the motor)	0.1%	0.0%	*
P01.12	Motor estimate frequency	Estimated motor frequency	−600.00~600.00Hz	0.01	0.00	*
P01.13	Motor measured frequency	Motor measured frequency	−600.00~600.00Hz	0.01	0.00	*
P01.14	Energy consumption high bit(kWh)	Energy consumption high bit (kWh)	0~65535*10000kWh	10000kW h	0	*
P01.15	Energy consumption low bit (kWh)	Energy consumption low bit (kWh)	0~9999kWh	1kWh	0	*
P01.16	Bus voltage	Bus voltage	0~800V	1V	0	*
P01.17	Servo driver running status	Servo driver running status	0~7FFFH BIT0: Run/Stop BIT1: Reverse/Forward BIT2: Zero speed run BIT3: Accelerate BIT4: Decelerate BIT5: Constant speed run BIT6: Pre-excitation BIT7: Setting BIT8: Over current limit BIT9: DC over voltage limit BIT10: Torque limit BIT11: Speed limit BIT12: Servo driver fails BIT13: Speed control BIT14: Torque control BIT15: Place control	1	0	*
P01.18	Digital input terminal status	DI terminal status	0~3FFH, 0: off; 1: on	1	000	*
P01.19	Digital output terminal status	DO terminal status	0~FH, 0: off; 1: on	1	0	*
P01.20	AI1 input voltage	AI1 input voltage	−10.00~10.00V	0.01V	0.00	*
P01.21	AI2 input voltage	AI2 input voltage	−10.00~10.00V	0.01V	0.00	*
P01.22	AI3 input voltage	AI3 input voltage	−10.00~10.00V	0.01V	0.00	*
H01.23	Adjusted AI1 input	Adjusted AI1 input	−10.00~10.00V	0.01V	0.00	*
P01.24	Adjusted AI2 input	Adjusted AI2 input	−10.00~10.0V	0.01V	0.00	*

Group P01: Status Display Parameters
Functional Code	Name	LCD Display	Setting Scope	Min Unit	Default	Change
P01.25	Adjusted AI3 input	Adjusted AI3 input	－10.00~10.00V	0.01V	0.00	*
P01.26	AO1 output	AO1 output	0.0~100.0%(percent relative full range)	0.1%	0.0%	*
P01.27	AO2 output	AO2 output	0.0~100.0%(percent relative full range)	0.1%	0.0%	*
P01.28	Process close-loop given	Process close-loop given	－100.0~100.0%(percent relative full range)	0.1%	0.0%	*
P01.29	Process close-loop feedback	Process close-loop feedback	－100.0~100.0%(percent relative full range)	0.1%	0.0%	*
P01.30	Process close-loop error	Process close-loop error	－100.0~100.0%(percent relative full range)	0.1%	0.0%	*
P01.31	Process close-loop output	Process close-loop output	－100.0~100.0%(percent relative full range)	0.1%	0.0%	*
P01.32	Radiator1 temperature	Radiator1 temperature	0.0~150.0℃	0.1℃	0.0	*
P01.33	Radiator2 temperature	Radiator2 temperature	0.0~150.0℃	0.1℃	0.0	*
P01.34	Reserved	Reserved				*
P01.35	Reserved	Reserved				*
P01.36	Power on hours accumulated	Power on hours accumulated	0~max65535 hours	1 hour	0	*
P01.37	Run hour accumulated	Run house accumulated	0~max65535 hours	1 hour	0	*
P01.38	Fan run hour accumulated	Fan run hour accumulated	0~max65535 hours	1 hour	0	*
P01.39	Reserved	Reserved				*
P01.40	ASR controller output	ASR controller output	－300.0~300.0%(Rated torque relative motor)	0.1%	0.0%	*
P01.41	Torque given	Torque given	－300.0~300.0%(Rated torque relative motor)	0.1%	0.0%	*
P01.42	Reserved	Reserved				*
P01.43	Position loop given high bit	Given high bit	0~FFFFH	1	0	*
P01.44	Position loop given low bit	Given low bit	0~FFFFH	1	0	*
P01.45	Position loop feedback high position	Feedback high position	0~FFFFH	1	0	*
P01.46	Position loop feedback low position	Feedback low position	0~FFFFH	1	0	*
P01.47	Position error pulse	Position error	－9999~9999	1	0	*
P01.48	Reserved	Reserved	Reserved	-	-	*
P01.49 ~P01.57	Reserved	Reserved	Reserved	-	-	*

\	Group P02: Basic Operation Parameters					
Functional Code	Name	LCD Display	Setting Scope	Min Unit	Default	Change
P02.00	Motor and mode option	Motor and mode option	Ones place: Motor 1 control mode option 0: Vector control without PG 1: Vector control with PG 2: V/F control without PG 3: V/F control with PG Tens place: Motor 1 type option 0: Asynchronous motor 1: Synchronous motor Hundreds place: Motor 2 control mode option 0: Vector control without PG 1: Vector control with PG 2: V/F control without PG 3: V/F control with PG Thousands place: Motor 2 type option 0: Asynchronous motor 1: Synchronous motor	1	0002	×
P02.01	Motor option	Motor option	0: Motor 1 1: Motor 2	1	0	×
P02.02	Operation command channel option	Command channel option	0: Operation panel control 1: Terminal control 2: Comm. control 3: Reserved	1	0	○
P02.03	Main setting frequency source option	Main given source option	0: Digit given1: operation panel▲,▼ given 1: Digit given2: Terminal UP/DOWN given 2: Digit given3: Serial port comm. given 3: AI analog given 4: Terminal PULSE given 5: Reserved	1	0	○
P02.04	Main setting frequency digital setting	Main setting frequency set	P02.07~P02.06	0.01Hz	50.00	○
P02.05	Max output frequency	Max output frequency	MAX{50.00, Upper frequency limitP02.06}~1000.0Hz	0.01Hz	50.00	×
P02.06	Upper limit frequency	Upper limit frequency	P02.07~P02.05	0.01Hz	50.00	○
P02.07	Lower limit frequency	Lower limit frequency	0.00~P02.06	0.01Hz	0.00	○
P02.08	Auxiliary setting frequency source option	Auxiliary frequency source option	0: no assistance given 1: Digit given1: operation panel▲,▼ given 2: Digit given2: Terminal UP/DOWN given 3: Digit given3: Serial port comm. given 4: AI analog given 5: Terminal PULSE given 6: Reserved 7: Process closed-loop output	1	0	○
P02.09	Auxiliary given	Auxiliary given	0.00~9.99	0.01	1.00	○

Group P02: Basic Operation Parameters						
Functional Code	Name	LCD Display	Setting Scope	Min Unit	Default	Change
	coefficient	coefficient	For P02.08＝4~7 only			
P02.10	Auxiliary given digital setting	Auxiliary given digital setting	0.00~1000.0Hz	0.01Hz	0.00	○
P02.11	Main and Auxiliary given caculation	Main and Auxiliary given caculation	0: ＋ 1: － 2: * 3: MAX(main given, Auxiliary given) 4: MIN(main given, Auxiliary given) 5: sqrt(main given)+sqrt(Auxiliary given) 6: sqrt(main given+Auxiliary given)	1	0	○
P02.12	Setting frequency proportion adjustment option	frequency proportion adjustment	0: No action 1: Relative maximum output frequency P02.05 adjustment 2: Relative current frequency adjustment	1	0	○
P02.13	Setting frequency adjustment coefficient	coefficient for proportion adjustment	0.0%~200.0%	0.1%	100.0%	○
P02.14	acceleration time1	acceleration time1	0.0~3600.0	0.1(Unit takes P14.09)	1.5~22: 6.0S 30~45: 20.0S Other: 30S	○
P02.15	deceleration time 1	deceleration time 1	0.0~3600.0	0.1(Unit takes P14.09)	1.5~22: 6.0S 30~45: 20.0S Other: 30S	○
P02.16	Jog frequency	Jog frequency	0.10~50.00Hz	0.01Hz	5.00	○
P02.17	Jog acceleration time	Jog acceleration time	0.1~60.0S	0.1s	6.0	○
P02.18	Jog deceleration time	Jog Deceleration time	0.1~60.0S	0.1s	6.0	○
P02.19	Jog time interval	Jog time interval	0.0~100.0s	0.1s	0.0	○
P02.20	Run direction setting	Run direction setting	0: Forward 1: Reverse	1	0	○

P03: Motor 1 Parameters						
Functional Code	Name	LCD Display	Setting Scope	Min Unit	Default	Change
P03.00	Asynchronous motor rated power	rated power	0.4~999.9kW	0.1	Decided by Machine Type	×
P03.01	Asynchronous motor rated voltage	rated voltage	0~Servo driver's rated voltage(P97.04) 2 series: 220V; 4 series: 380V	1	Decided by Machine Type	×
P03.02	Asynchronous motor rated current	rated current	0.1~999.9A	0.1A	Decided by Machine Type	×

Functional Code	Name	LCD Display	Setting Scope	Min Unit	Default	Change
			P03: Motor 1 Parameters			
P03.03	Asynchronous motor's rated frequency	rated frequency	1.00~1000.0Hz	0.01Hz	Decided by Machine Type	×
P03.04	Asynchronous motor rated rotation speed	rated rotation speed	0~60000RPM	1RPM	1440RPM	×
P03.05	Asynchronous motor power factor	power factor	0.001~1.000 Used when calculation motor parameters as per nameplates	0.001	Decided by Machine Type	×
P03.06	Asynchronous motor stator resistance%R1	stator resistance%R1	0.00%~50.00%	0.01%	Decided by Machine Type	×
P03.07	Asynchronous motor leakage inductance resistance %X	leakage inductance resistance %X	0.00%~50.00%	0.01%	Decided by Machine Type	×
P03.08	Asynchronous motor rotor resistance%R2	rotor resistance%R2	0.00%~50.00%	0.01%	Decided by Machine Type	×
P03.09	Asynchronous motor mutual inductance %Xm	mutual inductance resistance %Xm	0.0%~2000.0%	0.1%	Decided by Machine Type	×
P03.10	Asynchronous motor no-load current I0	No-load current I0	0.1~999.9A	0.1A	Decided by Machine Type	×
P03.11	Asynchronous motor parameter self tunning	Parameter self tunning	0: No action 1: Action(Motor static) 2: Action(Motor rotating) 3: Reserved	1	0	×
P03.12	Asynchronous motor overload protection parameter setting	Protection coefficient	20.0%~110.0% Set work level(%)＝Motor rated current/Servo driver's rated current×100 Low-speed compensation & actual work level ＝ set work level×(Output frequency/30HZ ×45＋55) Overload protection actual current＝ sampled current/overload protection work level	0.1%	100.0%	×
P03.13	Synchronous motor rated power	rated power	0.4~999.9kW	0.1kW	Decided by Machine Type	×

P03: Motor 1 Parameters						
Functional Code	Name	LCD Display	Setting Scope	Min Unit	Default	Change
P03.14	Synchronous motor rated voltage	rated voltage	0~Servo driver's rated voltage(P97.04)	1V	Decided by Machine Type	×
P03.15	Synchronous motor rated current	rated current	0.1~999.9A	0.1A	Decided by Machine Type	×
P03.16	Synchronous motor's rated frequency	Motor rated frequency	1.00~1000.0Hz	0.01Hz	Decided by Machine Type	×
P03.17	Synchronous motor pole pairs	Motor pole pairs	1~40	1	2	×
P03.18	Synchronous motor rated speed	rated rotation speed	0~60000RPM	1RPM	1500RPM	×
P03.19	Synchronous motor stator resistance	stator resistance%R1	0.00%~50.00%	0.01%	Decided by Machine Type	×
P03.20	Synchronous motor d-axis inductance	d-axis inductance	0.0~999.9mH	0.1mH	Decided by Machine Type	×
P03.21	Synchronous motor q-axis inductance	q-axis inductance	0.0~999.9mH	0.1mH	Decided by Machine Type	×
P03.22	Synchronous motor back-EMF constant	Back-EMF constant	1000V/1000rpm	1	150	×
P03.23	Synchronous motor position identification	position identification	Identify from 0→1, and change to 0 after ending	1	0	×
P03.24	Synchronous motor identify current	Identify current	0~30%Motor rated current	1	10	×
P03.25	Synchronous motor initial angle	initial angle	0~FFFFH	1	0	×
P03.26	Z pulse initial angle	Z pulse angle	0~FFFFH	1	0	×
P03.27	synchronous motor overload protection coefficient setting	protective coefficient	20.0%~110.0% Setting work level(%)＝Motor rated current/Servo driver's rated current×100 Low-speed compensation & actual work level ＝Setting work level×(Output frequency/30HZ×45＋55) Overload protection and actual current＝ sampled current/overload protection work level	0.1%	100.0%	×

P04: Motor 2 Parameters						
Functional Code	Name	LCD Display	Setting Scope	Min Unit	Default	Change

Functional Code	Name	LCD Display	Setting Scope	Min Unit	Default	Change
			P04: Motor 2 Parameters			
P04.00	Asynchronous motor rated power	rated power	0.4~999.9kW	0.1kW	Decided by Machine Type	×
P04.01	Asynchronous motor rated voltage	rated voltage	0~Servo driver's rated voltage(P97.04) 2 series: 220V 4 series: 380V	1V	Decided by Machine Type	×
P04.02	Asynchronous motor rated current	rated current	0.1~999.9A	0.1A	Decided by Machine Type	×
P04.03	Asynchronous motor's rated frequency	rated frequency	1.00~1000.0Hz	0.01Hz	Decided by Machine Type	×
P04.04	Asynchronous motor rated speed	rated rotation speed	0~60000RPM	1RPM	1440RPM	×
P04.05	Asynchronous motor power factor	power factor	0.001~1.000 Used when calculating motor parameters as per nameplates	0.001	Decided by Machine Type	×
P04.06	Asynchronous motor stator resistance%R1	Stator resistance%R1	0.00%~50.00%	0.01%	Decided by Machine Type	×
P04.07	Asynchronous motor leakage inductance resistance %X	Leakage inductance resistance %X	0.00%~50.00%	0.01%	Decided by Machine Type	×
P04.08	Asynchronous motor rotor resistance%R2	Rotor resistance%R2	0.00%~50.00%	0.01%	Decided by Machine Type	×
P04.09	Asynchronous motor mutual inductance resistance %Xm	mutual inductance resistance %Xm	0.0%~2000.0%	0.1%	Decided by Machine Type	×
P04.10	Asynchronous motor no-load current I0	no-load current I0	0.1~999.9A	0.1A	Decided by Machine Type	×
P04.11	Asynchronous motor parameters self tunning	Parameters self tunning	0: No action 1: Action(Motor static) 2: Action(Motor rotation) 3: Reserved	1	0	×

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Functional Code	Name	LCD Display	Setting Scope	Min Unit	Default	Change
P04: Motor 2　Parameters						
P04.12	Asynchronous motor overload protection coefficient setting	Protective coefficient	20.0~110.0% Setting work level(%)＝Motor　rated current/Servo driver's rated current×100 Low-speed compensation & actual work level＝Setting work level×(Output frequency/30HZ×45＋55)	0.1%	100.0%	×
P04.12	Asynchronous motor overload protection coefficient setting	Protective coefficient	Overload protection and actual current＝Sampled current/overload protection work level	0.1%	100.0%	×
P04.13	Synchronous motor rated power	Rated power	0.4~999.9kW	0.1kW	Decided by Machine Type	×
P04.14	Synchronous motor rated voltage	rated voltage	0~Servo driver's rated voltage(P97.04)	1V	Decided by Machine Type	×
P04.15	Synchronous motor rated current	rated current	0.1~999.9A	0.1A	Decided by Machine Type	×
P04.16	Synchronous motor's rated frequency	Motor rated frequency	1.00~1000.0Hz	0.01Hz	Decided by Machine Type	×
P04.17	Synchronous motor pole pairs	Motor pole pairs	1~40	1	2	×
P04.18	Synchronous motor rated speed	rated rotation speed	0~60000RPM	1RPM	1500RPM	×
P04.19	Synchronous motor stator resistance	stator resistance%R1	0.00%~50.00%	0.01%	Decided by Machine Type	×
P04.20	Synchronous motor d-axis inductance	d-axis inductance	0.0~999.9mH	0.1mH	Decided by Machine Type	×
P04.21	Synchronous motor q-axis inductance	q-axis inductance	0.0~999.9mH	0.1mH	Decided by Machine Type	×
P04.22	Synchronous back-EMF constant	Synchronous back-EMF constant	1000V/1000rpm	1	150	×
P04.23	Synchronous motor position identification	position identified	Identify from 0→1, and change to 0 after ending	1	0	×
P04.24	Synchronous motor identify current	current identified	0%~30%Motor　rated current	1	10	×
P04.25	Synchronous motor	initial angle	0~FFFFH	1	0	×

P04: Motor 2　Parameters							
Functio nal Code	Name	LCD Display	Setting Scope	Min Unit	Default	Chang e	
	initial angle						
P04.26	Synchronous motor Z pulse initial angle	Z pulse angle	0~FFFFH	1	0	×	
P04.27	Synchronous motor overload protection coefficient setting	protective coefficient	20.0%~110.0% Setting work level(%)＝Motor　rated current/Servo driver's rated current×100 Low-speed compensation & actual work level ＝Setting work level×(Output frequency/30HZ×45＋55) Overload protection and actual current＝ Sampled current/overload protection work level	0.1%	100.0%	×	
P04.28	Motor 2 PI Parameters option	PI Parameters option	0: The same as motor 1 PI Parameters 1: Taken from P04.29~P04.32	1	0	×	
P04.29	Motor 2 ASR-P	ASR1-P	0.1~200.0	0.1	20.0	○	
P04.30	Motor 2 ASR-I	ASR1-I	0.010~1.000S	0.001s	0.200s	○	
P04.31	Motor 2 ACR-P	ACR-P	1~5000	1	1000	○	
P04.32	Motor 2 ACR-I	ACR-I	0.5~100.0ms	0.1	8.0	○	
P04.33	Motor 2 encoder option	Motor 2 encoder option	0: Local encoder 1: Expansion encoder	1	1	×	

P05: Start/close Control Parameters							
Functio nal Code	Name	LCD Display	Setting Scope	Min Unit	Defaul t	Chang e	
P05.00	Start mode	Start mode	0 Starting from starting frequency 1 First brake, then start from starting frequency 2 Rotation speed track, including direction judgment before start	1	0	×	
P05.01	Start frequency	Start frequency	0.00~60.00Hz	0.01Hz	0.00H z	○	
P05.02	Start frequency holding time	Start frequency holding time	0.00~10.00s	0.01s	0.00s	○	
P05.03	Start DC brake current	Start DC brake current	0.0%~100.0%Servo driver's rated current	0.1%	0.0%	○	
P05.04	Start DC brake time	Start DC brake time	0.00(No action) 0.01~30.00s	0.01s	0.00s	○	
P05.05	Stop Mode	Stop Mode	0: deceleration stop 1: Free to stop 2: deceleration stop＋DC brake	1	0	×	
P05.06	Stop DC brake initial frequency	Stop brake initial frequency	0.00~60.00Hz	0.01Hz	0.00H z	○	
P05.07	Stop DC brake waiting time	Stop brake waiting time	0.00~10.00s	0.01s	0.00s	○	
P05.08	Stop DC brake current	Stop DC brake current	0.0%~100.0%Servo driver's rated current	0.1%	0.0%	○	
P05.09	Stop DC brake time	Stop DC brake time	0.0(No action) 0.01~30.00s	0.01s	0.00s	○	
P05.10	Restart after power	Restart after	0: No action	1	0	×	

			P05: Start/close Control Parameters				
Functional Code	Name	LCD Display	Setting Scope	Min Unit	Default	Change	
	fault	power fault	1: Action				
P05.11	Waiting time for restart after power fault	Waiting time for restart after power fault	0.0~10.0s	0.1s	0.0s	○	
P05.12	Anti-reverse option	Anti-reverse option	0: Allow reverse 1: Forbid reverse(apply reverse run command for 0-frequency run)	1	0	×	
P05.13	Forward-Reverse dead zone time	Forward-Reverse dead zone time	0.00~360.00s	0.01s	0.00s	○	
P05.14	Forward -Reverse switch mode	Forward -Reverse switch mode	0: 0 frequency switch 1: Over starting frequency switch	1	0	×	
P05.15	Stop speed	Stop speed	0.00~150.00Hz	0.01Hz	0.10Hz	×	
P05.16	Stop speed test	Stop speed test	0: Speed value set(only the method for V/F mode) 1: Speed measure value	1	0	×	
P05.17	Stop speed delay time	Stop speed delay time	0.00~10.00S	0.01s	0.05s	×	
P05.18	Energy consumption brake option	Energy consumption brake option	0: No action 1: Action	1	0	×	
P05.19	Energy consumption brake service rating	Brake service rating	0.0~100.0%	0.1%	80.0%	○	

			P06: V/F control Parameters				
Functional Code	Name	LCD Display	Setting Scope	Min Unit	Default	Change	
P06.00	Motor 1V/F curve setting	Motor 1V/F curve setting	0: User defines V/F curve 1: Square curve 2: One point seven power curve 3: One point two power curve	1	0	×	
P06.01	Motor 1V/F frequency 3	Motor 1V/F frequency 3	P06.03~P02.05	0.01Hz	0.00Hz	×	
P06.02	Motor 1V/F voltage 3	Motor 1V/F voltage 3	P06.04~100.0%	0.1%	0.0%	×	
P06.03	Motor 1V/F frequency 2	Motor 1V/F frequency 2	P06.05 ~P06.01	0.01Hz	0.00Hz	×	
P06.04	Motor 1V/F voltage 2	Motor 1V/F voltage 2	P06.06~P06.02	0.1%	0.0%	×	
P06.05	Motor 1V/F frequency 1	Motor 1V/F frequency 1	0.00~P06.03	0.01Hz	0.00Hz	×	
P06.06	Motor 1V/F voltage 1	Motor 1V/F voltage 1	0~P06.04	0.1%	0.0%	×	
P06.07	Motor 1 torque lift	Motor 1 torque lift	0.0%~30.0%	0.1%	0.0%	○	
P06.08	Motor 1 torque lift cut-off point	Torque lift cut-off point	0.0%~50.0%(relative to P06.09)	0.1%	10.0%	○	
P06.09	Motor 1 base frequency	Base frequency	1.00~1000.0Hz	0.01Hz	50.00	×	
P06.10	Motor 1Max Output voltage	Max Output voltage	0~480V	1V	Rated value of servo driver	×	

Functional Code	Name	LCD Display	Setting Scope	Min Unit	Default	Change
			P06: V/F control Parameters			
P06.11	Motor 1 stable factor	Motor 1 stable factor	0~255	1	10	○
P06.12	Motor 2V/F curve setting	Motor 2V/F curve setting	0: User defines V/F curve 1: Square curve 2: One point seven power curve 3: 1.2 power curve	1	0	×
P06.13	Motor 2V/F frequency 3	Motor 2V/F frequency 3	P06.15~P02.05	0.01Hz	0.00Hz	×
P06.14	Motor 2V/F voltage 3	Motor 2V/F voltage 3	P06.16~100.0%	0.1%	0.0%	×
P06.15	Motor 2V/F frequency 2	Motor 2V/F frequency 2	P06.17 ~P06.13	0.01Hz	0.00Hz	×
P06.16	Motor 2V/F voltage 2	Motor 2V/F voltage 2	P06.18~P06.14	0.1%	0.0%	×
P06.17	Motor 2V/F frequency 1	Motor 2V/F frequency 1	0.00~P06.15	0.01Hz	0.00Hz	×
P06.18	Motor 2V/F voltage 1	Motor 2V/F voltage 1	0~P06.16	0.1%	0.0%	×
P06.19	Motor 2 torque lift	Motor 2 torque lift	0.0%~30.0%	0.1%	0.0%	○
P06.20	Motor 2 torque lift cut-off point	Torque lift cut-off point	0.0%~50.0%(relative to P06.21)	0.1%	10.0%	○
P06.21	Motor 2 base frequency	Base frequency	1.00~1000.0Hz	0.01Hz	50.00	×
P06.22	Motor 2Max Output voltage	Max Output voltage	0~480V	1V	Rated value of servo driver	×
P06.23	Motor 2 stable factor	Motor 2 stable factor	0~255	1	10	○
P06.24	AVR function	AVR function	0: No action 1: Always action 2: No action in deceleration only	1	1	×

Functional Code	Name	LCD Display	Setting Scope	Min Unit	Default	Change
			P07: Speed Control Parameters			
P07.00	Speed feedback option	Speed feedback option	0: Local encoder 1: Expansion encoder	1	0	×
P07.01	ASR1-P	ASR1-P	0.1~200.0	0.1	20.0	○
P07.02	ASR1-I	ASR1-I	0.000~10.000S	0.001s	0.200s	○
P07.03	ASR1 output filter	ASR1 output filter	0~8(relative 0~2^8/10ms)	1	0	○
P07.04	ASR2-P	ASR2-P	0.1~200.0	0.1	20.0	○
P07.05	ASR2-I	ASR2-I	0.000~10.000S	0.001s	0.200s	○
P07.06	ASR2 output filter	ASR2 output filter	0~8(relative0~2^8/10ms)	1	0	○
P07.07	ASR1/2 switch frequency	ASR1/2 switch frequency	0.0%~100.0%	0.1	10.0%	○
P07.08	Speed limit mode	Speed limit mode	0: forward limit value from channel 1, Reverse limit value from channel 2 1: Use channel 1 for normal/reverse limit 2: Reserved	1	0	×
P07.09	Speed limit channel 1	Speed limit channel 1	0: Speed limit value 1 1: AI given	1	0	×
P07.10	Speed limit channel 2	Speed limit channel 2	0: Speed limit value 2 1: AI given	1	0	×

Functional Code	Name	LCD Display	Setting Scope	Min Unit	Default	Change
			P07: Speed Control Parameters			
P07.11	Speed limit value 1	Speed limit value 1	0.0%~100.0%	0.1%	100.0%	○
P07.12	Speed limit value 2	Speed limit value 2	0.0%~100.0%	0.1%	100.0%	○
P07.13	Speed deviation (DEV) action select	DEV action select	0: Deceleration stop 1: Free to stop, report E034 2: Continue to action	1	2	×
P07.14	DEV test value	DEV test value	0%~50.0%	0.1%	20.0%	×
P07.15	DEV test time	DEV test time	0.0~10.0S	0.1S	10.0	×
P07.16	Overspeed action select	Overspeed action select	0: Deceleration stop 1: Free to stop, report E035　　2: Continue to run	1	1	×
P07.17	Over speed(OS) test value	Over speed test value	0.0%~130.0%	0.1%	120.0%	×
P07.18	Over speed(OS) test time	Over speed test time	0.0~2.00	0.01s	0.10	×
P07.19	Pre-excitation time	Pre-excitation time	0.0~10.0s	0.1	0.0	×
P07.20	Reserved	Reserved	10~400	1	100	×
P07.21	Reserved	Reserved	0~2	1	0	×
P07.22	Reserved	Reserved	10~100	1	10	×
P07.23	Field weaken control coefficient	Low magnetic control coefficient	500~1200	1	1024	○
P07.24	Min flux given value	Min flux given value	10%~80%	1%	10%	×
P07.25	Reserved	Reserved	10~100	1	50	×

Functional Code	Name	LCD Display	Setting Scope	Min Unit	Default	Change
			P08: Torque Control			
P08.00	Speed/torque control mode	Speed/torque option	0: Speed control mode 1: Torque control mode	1	0	×
P08.01	Torque instruction option	Torque instruction option	0: Torque given 1: Torque current given	1	0	×
P08.02	Torque given option	Torque given option	0: AI given 1: Terminal PULSE given 2: Serial port comm. given 3: Process close-loop output 4: Reserved	1	0	×
P08.03	Given torque filter time	Given torque filter time	0~65535ms	1	0	×
P08.04	Speed→torque switch point	Speed/torque switch point	0~300.0% initial torque	0.1%	100.0%	×
P08.05	Speed torque switch delay	Speed torque switch delay	0~1000ms	1	0	×
P08.06	Torque limit mode	Torque limit mode	0: Limit invalid: current limit only, limit to the max overload current allowed of drive; 1: Torque limit: Torque limit for constant torque area, current limit for constant power area; 2: Power limit: Current limit for constant torque area, output capacity limit for constant power area;	1	3	×

Functional Code	Name	LCD Display	Setting Scope	Min Unit	Default	Change
			3: Torque current limit: Torque limit for constant torque area, output capacity limit for constant power area;			
P08.07	Torque limit channel option	Torque limit channel option	0: Limit channel 1, same limit for 4 quadrants 1: Motor mode use channel 1,regen mode use channel 2 2: Upper limit use limit channel 1, lower limit use channel 2 3: Same limit for 4 quadrants, torque limit channels 1 and2 are switched by terminal	1	1	×
P08.08	Torque limit channel 1	Torque limit channel 1	0: Torque limit value 1 1: AI given 2: Terminal PULSE given 3: Process close-loop output	1	0	×
P08.09	Torque limit channel 2	Torque limit channel 2	0: Torque limit value 2 1: AI given 2: Terminal PULSE given 3: Process close-loop output	1	0	×
P08.10	Torque limit value 1	Torque limit value 1	0.0%～＋300.0%	0.1%	180.0%	○
P08.11	Torque limit value 2	Torque limit value 2	0.0%～＋300.0%	0.1%	180.0%	○
P08.12	Mechanical loss compensation value	Mechanical loss compensation	－20.0%～＋20.0%	0.1%	0.0%	×
P08.13	Torque bias T1	Torque bias T1	－300.0%～＋300.0%	0.1%	0.0%	×
P08.14	Torque bias T2	Torque bias T2	－300.0%～＋300.0%	0.1%	0.0%	×
P08.15	Torque bias T3	Torque bias T3	－300.0%～＋300.0%	0.1%	0.0%	×
P08.16	Torque bias start time delay	Torque bias start time delay	0.00～1.00S	0.01S	0.00	×
P08.17	Over torque/less torque detection action option1	Torque detection action 1	0: Over torque/less torque: invalid test 1: With consistent speed, after over torque detection, continue to action; 2: During the run after torque detection, continue to run; 3: With consistent speed, after over torque detection, cut off the output; 4: During the run, after over torque detection, cut off the output; 5: With consistent speed, after over torque detection, continue to run; 6: During the run, after less torque detection, continue to run; 7: With consistent speed, after less torque detection, cut off the output; 8: During the run, after less torque detection, continue to run;	1	0	×
P08.18	Over torque/Less torque test value1	Torque test value1	0.0%～300.0% 0.0%～300.0% SVC: Relative to motor rated torque V/F: Relative driver rated current	0.1	0	×
P08: Torque control						
Functional Code	Name	LCD Display	Setting Scope	Min Unit	Default	Change

P08.19	Over torque/Less torque test time 1	Torque test time1	0.0~10.0s	0.1	0.0s	×
P08.20	Over torque/Less torque detection option 2	Torque detection option 2	0: Over torque/Less torque detection: invalid 1: With consistent speed, after over torque detection, continue to work; 2: During the work, after less torque detection, continue to work; 3: With consistent speed, after less torque detection, cut off the output; 4: During the work, after less torque detection, continue to work; 5: With consistent speed, after less torque detection, cut off the output; 6: During the run, after less torque detection, continue to run; 7: With consistent speed, after less torque detection, cut off the output; 8: During the run, after less torque detection, continue to run;	1	0	×
P08.21	Over torque/Less torque test value2	Torque test value2	0.0~300.0% SVC: Relative motor rated torque V/F: Relative driver rated current	0.1%	0.0%	×
P08.22	Over torque/Less torque test time2	Torque test time2	0.0~10.0s	0.1	0.0s	×

P09: Servo Control						
Functional Code	Name	LCD Display	Setting Scope	Min Unit	Default	Change
P09.00	Servo control switch option	Servo control option	0: Non-Servo control 1: Speed/Torque←→Servo control 2: Servo←→Speed/Torque control 3: Servo control	1	0	×
P09.01	Servo run mode option	Servo run mode option	0: Normal run 1: Reserved 2: Spindle run	1	0	×
P09.02	Orientation mode of spindle	Orientation mode of spindle	Ones place: Position zero point option 0: Z pulse position 1: Photoswitch position Tens place: Accelerating/Deceleration time option 0~3: Accelerating /Deceleration time 1~4 Hundreds place: Run after position completion 0: Keep at the position point 1: Keep within the position scope Thousands place: position calculation mode 0: Position loop 1: Position loop+ feedforward	1	0010H	×
P09.03	Position given source	Position given source	0: Terminal pulse given 1: Reserved 2: Expansion PG given 3: Position digital given	1	0	×

			4: Reserved			
P09.04	Pulse given input mode option	Pulse given input mode option	0: A/B phase pulse 1: PLUS+SIGN pulse	1	0	×
P09.05	Position digital given high position	High position given	0~150	1	0	○
P09.06	Position digital given low position	Low position given	0~65535	1	0	○
P09.07	Reserved	Reserved	Reserved	1	0	○
P09.08	Position given filtering time constant	Position command filtering time	0.0~3000.0ms	0.1ms	10.0ms	○
P09.09	Reserved	Reserved	Reserved			○
P09.10	Numerator of position instruction ratio	Numerator of position	1~65535	1	1024	×
P09.11	Denominator of position instruction ratio	Denominator of position	1~65535	1	1024	×
P09.12	Position completed range	Position completed range	0~10000	Command unit	10	○
P09.13	Width of position approach	Width of position approach	1~32767	Command unit	100	○
P09.14	Position out-of-tolerance detection range	Position out-of-tolerance detection range	0~32767	Command unit	1000	○
P09.15	Position out-of-tolerance alarm option	Position out-of-tolerance alarm option	0: Valid; 1: Invalid	1	0	○
P09.16	Spindle transmission ratio	Spindle transmission ratio	0.000~30.000	0.001	1.000	×
P09.17	Reserved	Reserved	Reserved	0.01	5.00	○
P09.18	Reserved	Reserved	Reserved	1	0	*
P09.19	Orientation speed	Orientation speed	0.00~200.00Hz	0.01	5.00	×
P09.20	Starting position of spindle orientation	Starting position of spindle orientation	0~30000	1	0	*
P09.21	Orientation Deceleration time	Orientation Deceleration time	0~3000.0	0.1s	10.0	×
P09.22	Orientation positioning 1	Orientation positioning 1	0~30000	1	0	×
P09.23	Orientation positioning 2	Orientation positioning 2	0~30000	1	0	×
P09.24	Orientation positioning 3	Orientation positioning 3	0~30000	1	0	×
P09.25	Orientation positioning 4	Orientation positioning 4	0~30000	1	0	×
P09.26	Position loop gain 1	Position loop gain 1	1~8000	1Hz	50	○
P09.27	Position loop gain 2	Position loop gain 2	1~8000	1Hz	200	○
P09.28	Position gain 1 and gain 2 switch mode	Gain 1/2 switch mode	0: No switch ; 1~2: Reserved 3: Position DEV 4: External terminal switch	1	0	○
P09.29	Reserved	Reserved	Reserved			○
P09.30	Reserved	Reserved	Reserved			○

P09.31	Position gain switch Position DEV level	Gain switch Position DEV	0~10000	1 command unit	100	○
P09.32	Gain switch smoothing time	Gain switch smoothing time	0~100ms	1ms	1	○
P09.33	Speed feedforward gain	Speed feedforward gain	0.00~120.00%	1.00%	100.00%	○
P09.34	Position controller output limit	Position loop limit	0~100.0%Max frequency	0.1%	0.0%	○
P09.35	Servo stop mode	Servo stop mode	0: Emergency stop by torque limit 1: Stop by switching to speed control	1	0	○

P10: Switch Input /Output Terminal						
Functional Code	Name	LCD Display	Setting Scope	Min Unit	Default	Change
P10.00 ~P10.07	Input Terminal X1~X8 function option	X1 Terminal function X2 Terminal function X3 Terminal function X4 Terminal function X5 Terminal function X6 Terminal function X7 Terminal function X8 Terminal function	0: No function 1: Multiplex frequency Terminal 1 2: Multiplex frequency Terminal 2 3: Multiplex frequency Terminal 3 4: Multiplex frequency Terminal 4 5: Accelerating/Deceleration time Terminal 1 6: Accelerating /Deceleration time Terminal 2 7: External fault normally open Input 8: External fault normally closed Input 9: External reset(RESET) Input 10: External Jog Forward Run control Input 11: External Jog Reverse Run control Input 12: Free stop Input (FRS) 13: Frequency increase instruction(UP) 14: Frequency decrease instruction (DOWN) 15: Simple PLC pause instruction 16: Accelerating/Deceleration disable instruction 17: Three-line operation control 18: External break normally open contact input 19: External break normally closed contact input 20: Stop DC break Input instruction 21: Process close-loop disable 22: PLC disable 23: Main setting frequency source option1 24: Main setting frequency source			

			option2 25: Main setting frequency source option3 26: Main setting frequency switch to AI 27: Command switch to terminal 28: Command source option1 29: Command source option2 30: Multiplex Process close-loop given Terminal 1 31: Multiplex Process close-loop given Terminal 2 32: Multiplex Process close-loop given Terminal 3 33: Multiplex Process close-loop given Terminal 4 34: Traverse frequency input 35: Traverse frequency reset 36: External Stop command(valid for all control modes, stop under current stop mode) 37: Servo driver run disable 38: Forward disable 39: Reverse disable 40: Auxiliary setting frequency clear 41: PLC stop memory remove 42~44: Reserved 45: Main setting frequency pulse input (for X8 setting only) 46: Auxiliary setting frequency pulse input)(for X8 setting only) 47: PG speed measuring input (for X8 setting only) 48: Reserved 49: Reserved 50: Reserved 51: Pre-excitation command terminal 52: Reserved 53: Reserved 54: Speed control and torque control switch terminal 55: Reserved 56: Torque limit channel1, 2 option 57: Reserved 58: Torque bias option Terminal 1 59: Torque bias option Terminal 2 Combination of status switch's three torque bias values 60: AI torque bias hold Hold torque bias AI input value 61: Torque limit 1 pulse input Terminal (for X8 setting only) 62: Torque limit 2 pulse input Terminal (for X8 setting only) 63: Torque given pulse input Terminal (for X8 setting only)	1	00	×

P10: Switch Input/Output Terminal						
Functional Code	Name	LCD Display	Setting Scope	Min Unit	Default	Change
P10.00 ~P10.07	Input Terminal X1~X8 function option	X1 Terminal function X2 Terminal function X3 Terminal function X4 Terminal function X5 Terminal function X6 Terminal function X7 Terminal function X8 Terminal function	64~70: Reserved 71: Position pulse direction(for X7 only) 72: Position pulse Input (for X8 only) 73: Position DEV counter clear 74: Given pulse disable 75: Reserved 76: Reserved 77: Spindle orientation start 78: Position option Terminal 1 79: Position option Terminal 2 80: Reserved 81: Servo control switch Terminal 82: Reserved 83: Position reference point input terminal (for X6,X7 X8 only) 84: Spindle orientation return to zero 85~87: Reserved 88: Motor 1 and 2 switch terminal Display only under shortcut menu function numbers: 0,7,8,9,10,11,12,13,14,17,18,19,20,26,27,35,37,45,46,47,48	1	00	×
P10.08	FWD/REV operation mode setting	Run control mode	0: Two-line control mode 1 1: Two-line control mode 2 2: Three-line operation control 1－self holding function(Add any terminal from X1~X8) 3: Three-line operation control 2－self holding function(Add any terminal from X1~X8)	1	0	×
P10.09	Terminal UP accelerated speed	Terminal UP accelerated speed	0.01~99.99Hz/s	0.01	1.00	○
P10.10	Terminal DOWN Deceleration speed	Terminal DOWN Deceleration speed	0.01~99.99Hz/s	0.01	1.00	○
P10.11	X8 pulses per revolution	X8 pulses per revolution	1~9999	1	1024	×
P10.12	Terminal filtering time	Terminal filtering time	0~500ms	1	10	○
P10.13	Max Input pulse frequency	Max Input pulse	0.1~100.0(Max 100k) Valid only for X8 option high-speed pulse input	0.1kHz	10.0	○
P10.14	Pulse given center option	Pulse given center	0: No center 1: With center, center: (P10.13)/2, frequency if less than center, shall be positive 2: With center, center: (P10.13)/2, frequency, if more than center, shall be positive.	1	0	○
P10.15	Pulse given filtering time	Pulse given filtering time	0.00~10.00s	0.01s	0.05	○

Functional Code	Name	LCD Display	Setting Scope	Min Unit	Default	Change
P10.16	Input terminal valid state setting	Input terminal valid state setting	Binary system setting 0: Normal logic, valid onstate 1: Adverse logic, valid break LED Ones place: BIT0~BIT3: X1~X4 LED Tens place: BIT0~BIT3: X5~X8 LED Hundreds place: BIT0~BIT1: FWD,REV	1	000	○

P10: Switch Input/Output Terminal						
Functional Code	Name	LCD Display	Setting Scope	Min Unit	Default	Change
P10.17	Virtual Input Terminal setting	Virtual Input Terminal setting	Binary system setting 0: Invalid 1: Valid LED Ones place: BIT0~BIT3: X1~X4 LED Tens place: BIT0~BIT3: X5~X8 LED Hundreds place: BIT0~BIT1: FWD,REV	1	000	○
P10.18	Output terminal Y1 of open collector	Output terminal Y1 of open collector	0: Servo driver run signal (RUN) 1: Frequency arrival signal (FAR) 2: Non-zero speed signal 3: Frequency level test signal (FDT1) 4: Frequency level test signal (FDT2) 5: Overload detection signal (OL) 6: Stop due to under voltage (LU) 7: External fault stop(EXT)	1	00	×
P10.19	Output terminal Y2 of open collector	Output terminal Y2 of open collector	8: Frequency upper limit (FHL) 9: Frequency lower limit (FLL) 10: Servo driver run at zero speed 11: Simple PLC stage running completion indices 12: PLC recycle completion indication 13: Traverse frequency upper/lower limit 14: Encoder direction output	1	01	×
P10.20	Output function option of relay BR	BR function option	15: Servo driver run prepared (RDY) 16: Servo driver fault 17: Upper computer switch signal 18: Reserved 19: Torque limit Torque command value limited by torque limit value 1 or 2 limit 20: Flux test signal Flux test value over P10.37 shall be valid 21: Reserved	1	15	×

P10.21	Output function option of relay T	T function option	22: Valid analog torque bias 23: Over torque/Less torque output1 24: Over torque/Less torque output2 25: Position completed 26: Position accessed 27: Reserved 28: Position out of tolerance warning 29: Reserved 30: Reserved 31: Reserved	1	16	×
			32: Reserved 33: Reserved 34: Servo driver normal/reverse indication terminal 35: Motors 1 and 2 indication terminal Display only under shortcut menu function numbers: 0,1,4,5,6,7,8,9,15,16	1	16	×
P10.22	Output terminal valid state setting	Output terminal valid state setting	Binary system setting 0: Valid onstate 1: Valid break LED Ones place: BIT0~BIT3: Y1,Y2,BR,T	1	0	○
P10.23	Relay BR output time delay	BR output time delay	0.1~10.0s	0.1s	0.1	○
P10.24	Relay T output time delay	T output time delay	0.1~10.0s	0.1s	0.1	○
P10.25	Frequency arrive(FAR)detection width	Frequency arrive detection width	0.00~1000.0Hz	0.01Hz	2.50Hz	○
P10.26	FDT1 detection mode	FDT1 detection mode	0: Speed setting value(accelerated/decelerated frequency command) 1: Speed test value	1	0	○
P10.27	FDT1 level	FDT1 level	0.00~1000.0Hz	0.01Hz	50.00Hz	○
P10.28	FDT1 lag	FDT1 lag	0.00~1000.0Hz	0.01Hz	1.00Hz	○
P10.29	FDT2 detection mode	FDT2 detection mode	0: Speed setting value(Accelerated/decelerated frequency command) 1: Speed test value	1	1	○
P10.30	FDT2 level	FDT2 level	0.00~1000.0Hz	0.01Hz	25.00Hz	○
P10.31	FDT2 lag	FDT2 lag	0.00~1000.0Hz	0.01Hz	1.00Hz	○

P10.32	DO Terminal output	Digit output	0: No function 1: Output frequency 2: Setting frequency(0~Max Output frequency) 3: Output current(0~2*Iei) 4: Output current(0~3*Iem) 5: Output torque(0~3*Tem) 6: Output Torque current(0~3*Tem) 7: Motor rotation speed(0~Max Output frequency) 8: Output voltage(0~1.5*Ve) 9: Adjusted AI1(−10~10V/4~20mA) 10: Adjusted AI2(−10~10V/4~20mA) 11: Adjusted AI3(−10~10V) 12: Output power(0~3*Pe) 13: Torque limit value 1(0~3Tem) 14: Torque limit value 2(0~3Tem) 15: Torque bias (0~3Tem) 16: Torque given(0~3Tem) 17: Host machine expanded function(0~65535) 18: Encoder frequency division output 19: Expansion percent output Display only under shortcut menu function numbers: 0~8	1	00	○
P10.33	Max output pulse frequency	Max output pulse	0.1~100.0(Max 100.0k)	0.1kHz	10.0	○
P10.34	Pulse output center option	Pulse output center option	0: No center 1: With center, center: (P10.33)/2, frequency if less than center, shall be positive 2: With center, center: (P10.33)/2, frequency if more than center, shall be positive	1	0	○
P10.35	Pulse output filtering time	Pulse output filtering time	0.00~10.00s	0.01s	0.05	○
P10.36	Flux test value	Flux test value	10.0%~100.0%	0.1%	100.0%	○
P10.37	Zero speed threshold	Zero speed threshold	0.0%~100.0%Max frequency	0.1%	1.0%	○
P10.38	Reserved	Reserved	-	-	-	*

P11: analog Input /output Terminal						
Functional Code	Name	LCD DISPLAY	Setting Scope	Min Unit	Default	Change
P11.00	Analog input type option	Analog input type option	Ones place: AI1 0: voltage Input 1: Current Input Tens place: AI2 0: voltage Input 1: Current Input AI3: differential voltage Input	1	00	×
P11.01	AI1 function option	AI1 function option	0: No function 1: Main setting frequency given 2: Auxiliary setting frequency setting	1	00	×

			P11: analog Input /output Terminal			
Functional Code	Name	LCD DISPLAY	Setting Scope	Min Unit	Default	Change
			3: Torque bias 4: Speed limit value 1 5: Speed limit value 2 6: Torque limit value 1 7: Torque limit value 2 8: Torque command(given) 9~11: Reserved 12: Output voltage bias (V/F mode) 13: Output voltage(V/F mode) Display only under shortcut menu function numbers: 0,1,9			
P11.02	AI1 zero bias	AI1 zero bias	－100.0%~100.0%	0.1%	0.0%	○
P11.03	AI1 gain	AI1 gain	－10.00~10.00	0.01	1.00	○
P11.04	AI1 filtering	AI1 filtering	0.01~10.00s	0.01s	0.05	○
P11.05	AI1 zero bias correction mode	AI1 zero bias correction mode	0: Center at bias 1: Lower than bias, equal to bias 2: Higher than bias, equal to bias 3: Take absolute value centered at bias	1	0	×
P11.06	AI2 function option	AI2 function option	As given in P11.01	1	00	×
P11.07	AI2 zero bias	AI2 zero bias	－100.0%~100.0%	0.1%	0.0%	○
P11.08	AI2 gain	AI2 gain	－10.00~10.00	0.01	1.00	○
P11.09	AI2 filtering	AI2 filtering	0.01~10.00s	0.01s	0.05	○
P11.10	AI2 zero bias correction mode	AI2 zero bias correction mode	As given in P11.05	1	0	×
P11.11	AI3 function option	AI3 function option	As given in P11.01	1	00	×
P11.12	AI3 zero bias	AI3 zero bias	－100.0%~100.0%	0.1%	0.0%	○
P11.13	AI3 gain	AI3 gain	－10.00~10.00	0.01	1.00	○
P11.14	AI3 filtering	AI3 filtering	0.01~10.00s	0.01s	0.05	○
P11.15	AI3 zero bias correction mode	AI3 zero bias correction mode	As given in P11.05	1	0	×
P11.16	Analog output type	Analog output type	LED Ones place: AO1 option 0: 0~10V 1: 0~20mA 2: 2~10V 3: 4~20mA LED Tens place: AO2 option 0: 0~10V 1: 0~20mA 2: 2~10V 3: 4~20mA	1	00	○

			P11: analog Input /output Terminal			
Functio nal Code	Name	LCD DISPLAY	Setting Scope	Min Unit	Default	Change
P11.17	Analog output terminal AO1 function	AO1 function	0: Output frequency(0~Max frequency) 1: Setting frequency(0~Max frequency) 2: Setting frequency(after Accelerating/Deceleration)(0~Max frequency) 3: Motor rotation speed(0~Max rotation speed) 4: Output current(0~2*Iei) 5: Output current(0~2*Iem) 6: Output torque(0~3*Tem) 7: Output Torque current(0~3*Tem) 8: Output voltage(0~1.2*Ve) 9: Bus voltage (0~800V) 10: Adjusted AI1 11: Adjusted AI2 12: Adjusted AI3 13: Output power(0~2*Pe) 14: Host machine expansion function(0~4095) 15: Torque limit value 1（＋10V/＋ 300%） 16: Torque limit value 2（＋10V/＋ 300%） 17: Torque bias （＋10V/＋300%） 18: Torque command（＋10V/＋300%） 19: Flux command（＋10V/＋100%） 20: Position DEV（＋10V/2048 command pulse) 21: Output torque（－300.0~＋300.0%） 22: Output Torque current（－300.0~＋ 300.0%） 23: Torque bias （－300~＋300%） 24: Motor rotation speed(Double polarity, at V/F output frequency－slip compensation) 25: Reserved Display only under shortcut menu function numbers: 0~9	1	00	○
P11.18	AO1 filtering	AO1 filtering	0.0~20.0s	0.1	0.1	○
P11.19	AO1 gain	AO1 gain	0.0%~200.0%	0.1%	100.0%	○
P11.20	AO1 zero bias correction	AO1 zero bias correction	－100.0%~100.0%	0.1%	0.0%	○

			P11: analog Input /output Terminal			
Functional Code	Name	LCD DISPLAY	Setting Scope	Min Unit	Default	Change
P11.21	Analog output Terminal AO2 function	AO2 function	As given in P11.17	1	0	○
P11.22	AO2 filtering	AO2 filtering	0.0~20.0s	0.1	0.1	○
P11.23	AO2 gain	AO2 gain	0.0%~200.0%	0.1%	100.0%	○
P11.24	AO2 zero bias correction	AO2 zero bias correction	－100.0%~100.0%	0.1%	0.0	○
P11.25	Analog curve option	curve option	LED Ones place: AI1 curve option 0: curve1 1: curve2 LED Tens place: AI2 curve option 0: curve1 1: curve2	1	0000	○
P11.25	Analog curve option	curve option	LED Hundreds place: AI3 curve option 0: curve 1 1: curve 2 LED Thousands place: pulse input curve option 0: curve 1 1: curve 2	1	0000	○
P11.26	Curve1 max given	Max given 1	P11.28~100.0%	0.1%	100.0%	○
P11.27	Curve1 max given relative actual value	Max given 1 actual value	Frequency given: 0.0~100%Fmax Torque: 0.0~300%Te Flux: 0.0~100%Φe	0.1%	100.0%	○
P11.28	Curve1 inflection point 2 given	Curve1 inflection point 2 given	P11.30~P11.26	0.1%	100.0%	○
P11.29	Curve1 inflection point 2 given relative actual value	Curve1 inflection point 2 actual value	As given in P11.27	0.1%	100.0%	○
P11.30	Curve1 inflection point 1 given	Curve1 inflection point 1 given	P11.32~P11.28	0.1%	0.0%	○
P11.31	Curve1 inflection point 1 given relative actual value	Curve1 inflection point 1 actual value	As given in P11.27	0.1%	0.0%	○
P11.32	Curve1 min given	Min given 1	0.0%~P11.30	0.1%	0.0%	○
P11.33	Curve1 min given relative actual value	Min given1 actual value	As given in P11.27	0.1%	0.0%	○
P11.34	Curve 2 Max given	Max given2	P11.36~100.0%	0.1%	100.0%	○
P11.35	Curve 2 Max given relative actual value	Max given2 actual value	As given in P11.27	0.1%	100.0%	○
P11.36	Curve2 inflection point 2 given	Curve2 inflection point 2 given	P11.38~P11.34	0.1%	100.0%	○
P11.37	Curve2 inflection point 2 given relative actual value	Curve2 inflection point 2 actual value	As given in P11.27	0.1%	100.0%	○
P11.38	Curve2 inflection point 1 given	Curve2 inflection point 1 given	P11.40~P11.36	0.1%	0.0%	○

Functional Code	Name	LCD DISPLAY	Setting Scope	Min Unit	Default	Change
P11: analog Input /output Terminal						
P11.39	Curve2 inflection point 1 given relative actual value	Curve2 inflection point 1 actual value	As given in P11.27	0.1%	0.0%	○
P11.40	Curve2 min given	Min given2	0.0%~P11.38	0.1%	0.0%	○
P11.41	Curve2 min given relative actual value	Min given2 actual value	As given in P11.27	0.1%	0.0%	○

Functional Code	Name	LCD DISPLAY	Setting Scope	Min Unit	Default	Change
P12: Encoder Parameters						
P12.00	Pulses per revolution of local PG	Pulses per revolution of local PG	1~10000	1	1024	○
P12.01	Rotation direction of local PG	Rotation direction of local PG	0: A is in advance of B. 1: B is in advance of A.	1	0	×
P12.02	Reserved	Reserved	1~128	1	1	×
P12.03	Local encoder signal filtering time	Local encoder filtering time	0~99	1	30	○
P12.04	Disconnection detection time of local PG	Disconnection detection time of local PG	0.0: No action 0.1~10.0	0.1s	0.0	○
P12.05	Disconnection action of local PG	Disconnection action of local PG	0: Free stop(E025) 1: Reserved	1	0	○
P12.06	Expansion PG interface card type(R)	Expansion PG interface card type(R)	0: Incremental interface card 1~3: Reserved	1	0	*
P12.07	Pulses per revolution of expansion PG1	Pulses per revolution of expansion PG1	1~10000	1	2048	○
P12.08	Rotation direction of expansion PG1	Rotation direction of expansion PG1	0: A is in advance of B. 1: B is in advance of A.	1	0	×
P12.09	Frequency division coefficient	Frequency division coefficient	0~4096	1	1	×
P12.10	Disconnection detection time of expansion PG1	Disconnection detection time of expansion PG1	0.0: No action 0.1~10.0 s	0.1	0.0	×
P12.11	Disconnection action of local PG1	Disconnection action of local PG1	0: Free stop(E025) 1: Switch to SVC Run(Reserved)	1	0	○
P12.12	Pulses per revolution of expansion PG2	Pulses per revolution of expansion PG2	1~10000	1	2048	○
P12.13	Rotation direction of expansion PG2	Rotation direction of expansion PG1	0: A beyond B 1: B beyond A	1	0	○
P12.14	Expansion PG signal filtering	Expansion PG signal filtering	Ones place: PG1 filtering: 0~9 Tens place: PG2 filtering: 0~9	1	30	○
P12.15	Expansion PG signal-enable	Expansion PG signal-enable	BIT0: Z pulse enabled BIT1: UVW signal enabled	1	10	×
P12.16	Expansion PG1 UVW Input status	UVW Input status	0~7	1	0	*
P12.17	Expansion PG1Speed	Expansion PG1Speed	0.00~600.00Hz	0.01	0.00	*
P12.18	Expansion PG2Speed	Expansion PG2Speed	0.00~600.00Hz	0.01	0.00	*

			P12: Encoder Parameters			
Functional Code	Name	LCD DISPLAY	Setting Scope	Min Unit	Default	Change
P12.19	Expansion PG1 counter value	Expansion PG1 counter value	0~65535	1	0	*
P12.20	Expansion PG1 U pulse relative Position	Expansion PG1 U pulse position	0~65535	1	0	*
P12.21	Expansion PG1 Z pulse relative Position	Expansion PG1 Z pulse position	0~65535	1	0	*
P12.22	Expansion PG2 counter value	Expansion PG2 counter value	0~65535	1	0	*
P12.23	Expansion PG2 Z pulse relative Position	Expansion PG2 Z pulse position	0~65535	1	0	*

			P13: Process close-loop control			
Functional Code	Name	LCD DISPLAY	Setting Scope	Min Unit	Default	Change
P13.00	Process close-loop function option	Process close-loop function option	0: No action 1: Action	1	0	×
P13.01	Given channel option	Given channel option	0: Digit given; 1: AI1; 2: AI2; 3: AI3; Note: for speed close loop, analog given 10V relative max frequency P02.05 is synchronous rotation speed, -10v relative neg-max	1	1	○
P13.02	Feedback channel option	Feedback channel option	0: AI1; 1: AI2; 2: AI1+AI2; 3: AI1-AI2; 4: MIN(AI1, AI2); 5: MAX(AI1, AI2)	1	1	○
P13.03	Given channel filtering	Given filtering constant	0.01~50.00s	0.01s	0.50s	○
P13.04	Feedback channel filtering	Feedback filtering constant	0.01~50.00s	0.01s	0.50s	○
P13.05	Digital given setting	Digital given setting	-10.00V~10.00V	0.01	0.00	○
P13.06	Min given	Min given	0.0%~(P13.08)(Min given and reference value 10V; 20mA's percent)	0.1%	0.0%	○
P13.07	Min given relative feedback	Min feedback	0.0~100.0%(Min given relative feedback and reference value 10V; 20mA's percent)	0.1%	0.0%	○
P13.08	Max given	Max given	(P13.06)~100.0%(Max given and reference value 10V;20mA's percent)	0.1%	100.0%	○
P13.09	Max given relative feedback	Max feedback	0.0~100%(Max given relative feedback and reference value 10V;20mA's percent)	0.1%	100.0%	○
P13.10	Proportional gain KP	Proportional gain KP	0.000~10.000	0.001	2.000	○
P13.11	Integral gain Ki	Integral gain	0.000~10.000	0.001	0.100	○

P13: Process close-loop control

Functional Code	Name	LCD DISPLAY	Setting Scope	Min Unit	Default	Change
P13.12	Reserved	Reserved				○
P13.13	Sampling period	Sampling period	0.01~50.00s	0.01s	0.50s	○
P13.14	Output filtering time	Output filtering time	0.01~10.00s	0.01s	0.05	○
P13.15	Deviation limit	Deviation limit	0.0~20.0% (Relative process close-loop given value)	0.1%	2.0%	○
P13.16	Process close-loop adjustment	Process close-loop adjustment	0: Positive effect 1: Negative effect Note: Relation between the given and rotation speed	1	0	×
P13.17	Integral adjustment option	Integral adjustment option	0: Frequency upper/lower limit, stop integral adjustment 1: Frequency upper/lower limit, continue integral adjustment	1	0	×
P13.18	Process close-loop preset frequency	Process close-loop preset frequency	0.00~1000.0Hz	0.01Hz	0.00Hz	○
P13.19	Preset holding time	Preset holding time	0.0~3600.0S	0.1S	0.0S	×
P13.20	Multiplex Process close-loop given1	Multiplex Process close-loop given1	−10.00V~10.00V	0.01V	0.00V	○
P13.21	Multiplex Process close-loop given2	Multiplex Process close-loop given2	−10.00V~10.00V	0.01V	0.00V	○
P13.22	Multiplex Process close-loop given3	Multiplex Process close-loop given3	−10.00V~10.00V	0.01V	0.00V	○
P13.23	Multiplex Process close-loop given4	Multiplex Process close-loop given4	−10.00V~10.00V	0.01V	0.00V	○
P13.24	Multiplex Process close-loop given5	Multiplex Process close-loop given5	−10.00V~10.00V	0.01V	0.00V	○
P13.25	Multiplex Process close-loop given6	Multiplex Process close-loop given6	−10.00V~10.00V	0.01V	0.00V	○
P13.26	Multiplex Process close-loop given7	Multiplex Process close-loop given7	−10.00V~10.00V	0.01V	0.00V	○
P13.27	Multiplex Process close-loop given8	Multiplex Process close-loop given8	−10.00V~10.00V	0.01V	0.00V	○
P13.28	Multiplex Process close-loop given9	Multiplex Process close-loop given9	−10.00V~10.00V	0.01V	0.00V	○
P13.29	Multiplex Process close-loop given10	Multiplex Process close-loop given10	−10.00V~10.00V	0.01V	0.00V	○
P13.30	Multiplex Process close-loop given11	Multiplex Process close-loop given11	−10.00V~10.00V	0.01V	0.00V	○
P13.31	Multiplex Process close-loop given12	Multiplex Process close-loop given12	−10.00V~10.00V	0.01V	0.00V	○
P13.32	Multiplex Process close-loop given13	Multiplex Process close-loop given13	−10.00V~10.00V	0.01V	0.00V	○
P13.33	Multiplex Process close-loop given14	Multiplex Process close-loop given14	−10.00V~10.00V	0.01V	0.00V	○
P13.34	Multiplex Process close-loop given15	Multiplex Process close-loop given15	−10.00V~10.00V	0.01V	0.00V	○
P13.35	Process close-loop output reverse option	Process close-loop output reverse	0: Process close-loop output is negative, 0 frequency actions	1	0	○

			P13: Process close-loop control				
Functional Code	Name	LCD DISPLAY	Setting Scope	Min Unit	Default	Change	
		option	1: Process close-loop output is negative, reverse, if P05.12 setting forbid reverse, 0 frequency actions				
P13.36	Process close-loop feedback missing action option	Feedback missing option	0: Process close-loop missing, no action 1: Run as per P20.04 setting, no fault signal output, display A021 2: Run freely to stop, without fault signal output	1	0	○	
P13.37	Process close-loop feedback missing test value	Feedback missing test value	0.0~100.0%　Max Output frequency: 100%	0.1%	50.0%	○	
P13.38	Process close-loop feedback missing test time	Feedback missing test time	0.0s~20.0s	0.1s	1.0s	○	

			P14: Expansion　function Parameters				
Functional Code	Name	LCD DISPLAY	Setting Scope	Min Unit	Default	Change	
P14.00	Carrier frequency	Carrier frequency	2.0~15.0kHz	0.1	Decided by Machine Type	○	
P14.01	PWM mode optimized	PWM mode optimized	Ones place: Over-modulation enabled 0: Invalid　　1: Valid Tens place: Carrier frequency automatic adjustment option 0: Non-automatic adjustment 　1: Automatic adjustment Hundreds place: Modulation mode 0: 2phase/3phase switch 1: 3 phase modulation	1	001	×	
P14.02	Cooling fan control	Fan control	0: Automatic run 1: Always run Note: Last 3 minutes after stop	1	1	×	
P14.03	ACR-P	ACR-P	1~5000	1	1000	○	
P14.04	ACR-I	ACR-I	0.5~100.0ms	0.1	8.0	○	
P14.05	Reserved	Reserved				○	
P14.06	Main digital setting frequency control	Main digital given frequency control	LED Ones place: 0:　Frequency　power down saved 1:　frequency　power down not saved LED Tens place: 0: Stop frequency held 1: Stop frequency store P02.04 Note: Only for P02.03＝0, 1, 2	1	00	○	
P14.07	Auxiliary digital setting frequency control	Auxiliary digital setting frequency	LED Ones place: Memory control 0:　power down saved 1:　power down not saved	1	00	○	

			P14: Expansion function Parameters			
Functional Code	Name	LCD DISPLAY	Setting Scope	Min Unit	Default	Change
		control	LED Tens place: 0: Stop held 1: Stop clear			
P14.08	Accelerating/deceleration mode option	Accelerating/deceleration mode option	0: Straight-line accelerating/deceleration; 1: S curve accelerating/	1	0	×
P14.09	Accelerating/deceleration time unit	Accelerating/deceleration time unit	0: 0.1s; 1: s; 2: min	1	1	○
P14.10	Acceleration time2	Acceleration time2	0.0~3600.0	Unit takes P14.09	6.0	○
P14.11	Deceleration time 2	Deceleration time 2	0.0~3600.0	Unit takes P14.09	6.0	○
P14.12	Acceleration time3	Acceleration time3	0.0~3600.0	Unit takes P14.09	6.0	○
P14.13	Deceleration time 3	Deceleration time 3	0.0~3600.0	Unit takes P14.09	6.0	○
P14.14	Acceleration time4	Acceleration time4	0.0~3600.0	Unit takes P14.09	6.0	○
P14.15	Deceleration time 4	Deceleration time 4	0.0~3600.0	Unit takes P14.09	6.0	○
P14.16	S curve accumulation starting time	Accumulation starting time	10.0%~50.0%(acceleration time) P14.16+ P14.17≤90%	0.1%	20.0%	○
P14.17	S curve acceleration end time	Accumulation ending time	10.0%~80.0%(acceleration time) P14.16+ P14.17≤90%	0.1%	20.0%	○
P14.18	S curve deceleration start time	Deceleration starting time	10.0%~50.0%(Deceleration time) P14.18+ P14.19≤90%	0.1%	20.0%	○
P14.19	S curve deceleration end time	Deceleration ending time	10.0%~80.0%(Deceleration time) P14.18+ P14.19≤90%	0.1%	20.0%	○
P14.20	Acc and Dec time 1 and 2 switching frequency	Acc and Dec time 1 and 2 switching frequency	0.00~1000.0Hz	0.01Hz	0.00	○
P14.21	Hysteresis frequency between Acc/Dec time 1 and 2 switch	Hysteresis frequency between Acc/Dec time 1 and 2 switch	0.00~655.35Hz	0.01Hz	1.00	○
P14.22	Run command channel given bound frequency channel	Bound command frequency	LED Ones place: operation panel start/stop control, frequency channel option 0: No binding 1: operation panel▲,▼ given 2: Terminal UP/DOWN given 3: Serial port comm. given 4: AI analog given 5: Terminal pulse given LED Tens place: Terminal start/stop control, frequency channel option	1	0000	○
P14.22	Binding of run command channels	Command binding	0: No binding 1: operation panel▲,▼ given	1	0000	○

Functional Code	Name	LCD DISPLAY	Setting Scope	Min Unit	Default	Change
	and frequency given channels	frequency	2: Terminal UP/DOWN given 3: Serial port comm. given 4: AI analog given 5: Terminal pulse given LED Hundreds place: Comm. Start/stop control, frequency channel option 0: No binding 1: operation panel ▲, ▼ given 2: Terminal UP/DOWN given 3: Serial port comm. given 4: AI analog given 5: Terminal pulse given			
P14.23	Jump frequency 1	Jump frequency 1	0.00~1000.0Hz	0.01Hz	0.00	×
P14.24.	Range of jump frequency 1	Range of jump frequency 1	0.00~30.00Hz	0.01Hz	0.00	×
P14.25	Jump frequency 2	Jump frequency 2	0.00~1000.0Hz	0.01Hz	0.00	×
P14.26	Range of jump frequency 2	Range of jump frequency 2	0.00~30.00Hz	0.01Hz	0.00	×
P14.27	Jump frequency 3	Jump frequency 3	0.00~1000.0Hz	0.01Hz	0.00	×
P14.28	Range of jump frequency 3	Range of jump frequency 3	0.00~30.00Hz	0.01Hz	0.00	×
P14.29	Reserved	Reserved				×
P14.30	Reserved	Reserved				○
P14.31	LCD contrast	LCD contrast	0~10	1	5	○

P15: Simple PLC						
Functional Code	Name	LCD DISPLAY	Setting Scope	Min Unit	Default	Change
P15.00	PLC run mode option	PLC Run mode	LED Ones place: PLC run mode 0: No work 1: Stop after single cycle 2: Final value held after single cycle 3: Continued cycle LED Tens place: start mode 0: Re-work from paragraph 1 1: Run from stop (or fault) 2: Frequency Continue to run from stop (or fault) LED Hundreds place: power down saved 0: No memory 1: Memory of power down, frequency LED Thousands place: stage time unit option 0: s 1: min	1	0000	×

Functional Code	Name	LCD DISPLAY	Setting Scope	Min Unit	Default	Change
			P15: Simple PLC			
P15.01	Stage 1 setting	Stage 1 setting	LED Ones place: 0: Multiplex frequency 1(P16.00) 1: Decided by P02.03 functional code 2: Multiplex Process close-loop given1 3: Decided by P13.01 Functional Code LED Tens place: 0: Forward 1: Reverse 2: Decided by Run Command LED Hundreds place: 0: Accelerating/Deceleration time 1 1: Accelerating/Deceleration time 2 2: Accelerating/Deceleration time 3 3: Accelerating/Deceleration time 4	1	000	○
P15.02	Run time in stage 1	Time in stage 1	0.0~6500.0	0.1	20.0	○
P15.03	Stage 2 setting	Stage 2 setting	LED Ones place: 0: Multiplex frequency 2(P16.01) 1: Decided by P02.03Functional Code 2: Multiplex Process close-loop given2 3: Decided by P13.01Functional Code LED Tens place: 0: Forward 1: Reverse 2: Decided by Run Command LED Hundreds place: 0: Accelerating/Deceleration time 1 1: Accelerating/Deceleration time 2 2: Accelerating/Deceleration time 3 3: Accelerating/Deceleration time 4	1	000	○
P15.04	Run time in stage 2	Time in stage 2	0.0~6500.0	0.1	20.0	○
P15.05	Stage 3 setting	Stage 3 setting	LED Ones place: 0: Multiplex frequency 3(P16.02) 1: Decided by P02.03Functional Code 2: Multiplex Process close-loop given3 3: Decided by P13.01Functional Code LED Tens place: 0: Forward 1: Reverse 2: Decided by Run Command LED Hundreds place: 0: Accelerating/Deceleration time 1 1: Accelerating/Deceleration time 2 2: Accelerating/Deceleration time 3 3: Accelerating/Deceleration time 4	1	000	○
P15.06	Run time in stage 3	Time in stage 3	0.0~6500.0	0.1	20.0	○

P15: Simple PLC						
Functional Code	Name	LCD DISPLAY	Setting Scope	Min Unit	Default	Change
P15.07	Stage 4 setting	Stage 4 setting	LED Ones place: 0: Multiplex frequency 4(P16.03) 1: Decided by P02.03Functional Code 2: Multiplex Process close-loop given4 3: Decided by P13.01Functional Code LED Tens place: 0: Forward 1: Reverse 2: Decided by Run Command LED Hundreds place: 0: Accelerating/Deceleration time 1 1: Accelerating/Deceleration time 2 2: Accelerating/Deceleration time 3 3: Accelerating/Deceleration time 4	1	000	○
P15.08	Run time in stage 4	Time in stage 4	0.0~6500.0	0.1	20.0	○
P15.09	Stage 5 setting	Stage 5 setting	LED Ones place: 0: Multiplex frequency 5(P16.04) 1: Decided by P02.03Functional Code 2: Multiplex Process close-loop given5 3: Decided by P13.01Functional Code LED Tens place: 0: Forward 1: Reverse 2: Decided by Run Command LED Hundreds place: 0: Accelerating/Deceleration time 1 1: Accelerating/Deceleration time 2 2: Accelerating/Deceleration time 3 3: Accelerating/Deceleration time 4	1	000	○
P15.10	Run time in stage 5	Time in stage 5	0.0~6500.0	0.1	20.0	○
P15.11	Stage 6 setting	Stage 6 setting	LED Ones place: 0: Multiplex frequency 6(P16.05) 1: Decided by P02.03Functional Code 2: Multiplex Process close-loop given6 3: Decided by P13.01Functional Code LED Tens place: 0: Forward 1: Reverse 2: Decided by Run Command LED Hundreds place: 0: Accelerating/Deceleration time 1 1: Accelerating/Deceleration time 2 2: Accelerating/Deceleration time 3 3: Accelerating/Deceleration time 4	1	000	○
P15.12	Run time in stage 6	Time in stage 6	0.0~6500.0	0.1	20.0	○
P15.13	Stage 7 setting	Stage 7 setting	LED Ones place: 0: Multiplex frequency 7(P16.06) 1: Decided by P02.03Functional Code 2: Multiplex Process close-loop given7 3: Decided by P13.01Functional Code	1	000	○

			P15: Simple PLC				
Functional Code	Name	LCD DISPLAY	Setting Scope	Min Unit	Default	Change
			LED Tens place: 0: Forward 1: Reverse 2: Decided by Run Command LED Hundreds place: 0: Accelerating/Deceleration time 1 1: Accelerating/Deceleration time 2 2: Accelerating/Deceleration time 3 3: Accelerating/Deceleration time 4			
P15.14	Run time in stage 7	Time in stage 7	0.0~6500.0	0.1	20.0	○
P15.15	Stage 8 setting	Stage 8 setting	LED Ones place: 0: Multiplex　frequency 8(P16.07) 1: Decided by P02.03Functional Code 2: Multiplex Process close-loop given8 3: Decided by P13.01Functional Code LED Tens place: 0: Forward 1: Reverse 2: Decided by Run Command LED Hundreds place: 0: Accelerating/deceleration time 1 1: Accelerating/ deceleration time 2 2: Accelerating/ deceleration time 3 3: Accelerating/ deceleration time 4	1	000	○
P15.16	Run time in stage 8	Time in stage 8	0.0~6500.0	0.1	20.0	○
P15.17	Stage 9 setting	Stage 9 setting	LED Ones place: 0: Multiplex　frequency 9(P16.08) 1: Decided by P02.03Functional Code 2: Multiplex Process close-loop given9 3: Decided by P13.01Functional Code LED Tens place: 0: Forward 1: Reverse 2: Decided by Run Command LED Hundreds place: 0: Accelerating/Deceleration time 1 1: Accelerating/Deceleration time 2 2: Accelerating/Deceleration time 3 3: Accelerating/Deceleration time 4	1	000	○
P15.18	Run time in stage 9	Time in stage 9	0.0~6500.0	0.1	20.0	○
P15.19	Stage 10 setting	Stage 10 setting	LED Ones place: 0: Multiplex　frequency 10(P16.09) 1: Decided by P02.03Functional Code 2: Multiplex Process close-loop given10 3: Decided by P13.01Functional Code LED Tens place: 0: Forward 1: Reverse 2: Decided by Run Command LED Hundreds place: 0: Accelerating/Deceleration time 1	1	000	○

Functional Code	Name	LCD DISPLAY	Setting Scope	Min Unit	Default	Change
			P15: Simple PLC			
			1: Accelerating/Deceleration time 2 2: Accelerating/Deceleration time 3 3: Accelerating/Deceleration time 4			
P15.20	Run time in stage 10	Time in stage 10	0.0~6500.0	0.1	20.0	○
P15.21	Stage 11 setting	Stage 11 setting	LED Ones place: 0: Multiplex frequency 11(P16.10) 1: Decided by P02.03Functional Code 2: Multiplex Process close-loop given11 3: Decided by P13.01Functional Code LED Tens place: 0: Forward 1: Reverse 2: Decided by Run Command LED Hundreds place: 0: Accelerating/Deceleration time 1 1: Accelerating/Deceleration time 2 2: Accelerating/Deceleration time 3 3: Accelerating/Deceleration time 4	1	000	○
P15.22	Run time in stage 11	Time in stage 11	0.0~6500.0	0.1	20.0	○
P15.23	Stage 12 setting	Stage 12 setting	LED Ones place: 0: Multiplex frequency 12(P16.11) 1: Decided by P02.03Functional Code 2: Multiplex Process close-loop given12 3: Decided by P13.01Functional Code LED Tens place: 0: Forward 1: Reverse 2: Decided by Run Command LED Hundreds place: 0: Accelerating/Deceleration time 1 1: Accelerating/Deceleration time 2 2: Accelerating/Deceleration time 3 3: Accelerating/Deceleration time 4	1	000	○
P15.24	Run time in stage 12	Time in stage 12	0.0~6500.0	0.1	20.0	○
P15.25	Stage 13 setting	Stage 13 setting	LED Ones place: 0: Multiplex frequency 13(P16.12) 1: Decided by P02.03Functional Code 2: Multiplex Process close-loop given13 3: Decided by P13.01Functional Code LED Tens place: 0: Forward 1: Reverse 2: Decided by Run Command LED Hundreds place: 0: Accelerating/Deceleration time 1 1: Accelerating/Deceleration time 2 2: Accelerating/Deceleration time 3 3: Accelerating/Deceleration time 4	1	000	○

			P15: Simple PLC				
Functional Code	Name	LCD DISPLAY	Setting Scope	Min Unit	Default	Change
P15.26	Run time in stage 13	Time in stage 13	0.0~6500.0	0.1	20.0	○
P15.27	Stage 14 setting	Stage 14 setting	LED Ones place: 0: Multiplex frequency 14(P16.13) 1: Decided by P02.03Functional Code 2: Multiplex Process close-loop given14 3: Decided by P13.01Functional Code LED Tens place: 0: Forward 1: Reverse 2: Decided by Run Command LED Hundreds place: 0: Accelerating/Deceleration time 1 1: Accelerating/Deceleration time 2 2: Accelerating/Deceleration time 3 3: Accelerating/Deceleration time 4	1	000	○
P15.28	Run time in stage 14	Time in stage 14	0.0~6500.0	0.1	20.0	○
P15.29	Stage 15 setting	Stage 15 setting	LED Ones place: 0: Multiplex frequency 15(P16.14) 1: Decided by P02.03Functional Code 2: Multiplex Process close-loop given15 3: Decided by P13.01Functional Code LED Tens place: 0: Forward 1: Reverse 2: Decided by Run Command LED Hundreds place: 0: Accelerating/Deceleration time 1 1: Accelerating/Deceleration time 2 2: Accelerating/Deceleration time 3 3: Accelerating/Deceleration time 4	1	000	○
P15.30	Run time in stage 15	Time in stage 15	0.0~6500.0	0.1	20.0	○

		P16: Multiplex Speed and Traverse Frequency Parameters				
Functional Code	Name	LCD DISPLAY	Setting Scope	Min Unit	Default	Change
P16.00	Multiplex frequency 1	Multiplex frequency 1	P02.07(Lower frequency limit)~P02.06(Upper frequency limit)	0.01Hz	5.00Hz	○
P16.01	Multiplex frequency 2	Multiplex frequency 2		0.01Hz	10.00Hz	○
P16.02	Multiplex frequency 3	Multiplex frequency 3		0.01Hz	20.00Hz	○
P16.03	Multiplex frequency 4	Multiplex frequency 4		0.01Hz	30.00Hz	○
P16.04	Multiplex frequency 5	Multiplex frequency 5		0.01Hz	40.00Hz	○

P16.05	Multiplex frequency 6	Multiplex frequency 6		0.01Hz	45.00Hz	○
P16.06	Multiplex frequency 7	Multiplex frequency 7		0.01Hz	50.00Hz	○
P16.07	Multiplex frequency 8	Multiplex frequency 8		0.01Hz	5.00Hz	○
P16.08	Multiplex frequency 9	Multiplex frequency 9		0.01Hz	10.00Hz	○
P16.09	Multiplex frequency 10	Multiplex frequency 10		0.01Hz	20.00Hz	○
P16.10	Multiplex frequency 11	Multiplex frequency 11		0.01Hz	30.00Hz	○
P16.11	Multiplex frequency 12	Multiplex frequency 12		0.01Hz	40.00Hz	○
P16.12	Multiplex frequency 13	Multiplex frequency 13		0.01Hz	45.00Hz	○
P16.13	Multiplex frequency 14	Multiplex frequency 14		0.01Hz	50.00Hz	○
P16.14	Multiplex frequency 15	Multiplex frequency 15		0.01Hz	50.00Hz	○

P17: LED Parameters Display						
Functional Code	Name	LCD DISPLAY	Setting Scope	Min Unit	Default	Change
P17.00	LED Run parameters display option1	Run display 1	Binary system setting: 0: No display; 1: Display LED Ones place: BIT0: Output frequency(Hz)) BIT1: Setting frequency(Hz flash) BIT2: Output current(A) LED Tens place: BIT0: Run rotation speed(RPM) BIT1: Setting rotation speed(RPM flash) BIT2: Run line speed(m/s) BIT3: Setting line speed(m/s flash) LED Hundreds place: BIT0: Output power BIT1: Output torque(%) Note: All are zeros, display default: Output frequency	1	007H	○
P17.01	LED Run parameters display option2	Run display 2	Binary system setting: 0: No display; 1: Display LEDOnes place: BIT0: Output voltage(V) BIT1: AI1(V) BIT2: AI2(V) BIT3: AI3(V) LED Tens place: BIT0: Analog Process close-loop feedback BIT1: Analog Process close-loop setting	1	00	○

			P17: LED Parameters Display			
Functional Code	Name	LCD DISPLAY	Setting Scope	Min Unit	Default	Change
			BIT2: Terminal status BIT3: Bus voltage (V)			
P17.02	LED Stop parameters display option	Stop display	Binary system setting: 0: No display; 1: Display LEDOnes place: BIT0: Setting frequency(Hz) BIT1: Run rotation speed(RPM) BIT2: Setting rotation speed(RPM) BIT3: Bus voltage LED Tens place: BIT0: Run line speed(m/s) BIT1: Setting line speed(m/s) BIT2: Analog process close-loop feedback BIT3: Analog process close-loop setting LED Hundreds place: BIT0: AI1(V) BIT1: AI2(V) BIT2: AI3(V) BIT3:　terminal status Note: All are zeros, display default: Setting frequency	1	009H	○
P17.03	Rotation speed display coefficient	Rotation speed display coefficient	0.1%~999.9% V/F control mode with PG : Run rotation speed＝Mechanical rotation speed* P17.03 Setting rotation speed＝ setting rotation speed* P17.03 V/F control mode without PG : Run rotation speed＝ run frequency*Motor rated rotation speed/Motor　rated frequency* P17.03 Setting rotation speed＝Setting frequency*Motor rated rotation speed/Motor　rated frequency* P17.03 Non V/F mode: Run rotation speed＝Actual /estimated rotation speed* P17.03 Setting rotation speed＝Setting frequency*Motor rated rotation speed/Motor　rated frequency* P17.03	0.1%	100.0%	○
P17.04	Line speed coefficient	Line speed coefficient	0.1%~999.9% V/F control mode with PG: Line speed＝Mechanical rotation speed* P17.04 Setting line speed＝ setting rotation speed* P17.04	0.1%	1.0%	○

P17: LED Parameters Display						
Functional Code	Name	LCD DISPLAY	Setting Scope	Min Unit	Default	Change
			V/F control mode without PG :			
P17.04	Line speed coefficient	Line speed coefficient	Line speed＝ run frequency* P17.04 Setting line speed＝Setting frequency* P17.04 Non V/F mode: Line speed＝Actual/estimated rotation speed* P17.04 Setting line speed＝Setting frequency* P17.04	0.1%	1.0%	○
P17.05	Process close-loop analog display coefficient	Process close-loop display coefficient	0.1%~999.9% Note: Process close-loop analog given/feedback display 0~9999.9	0.1%	100.0%	○

P18: Communication Parameters						
Functional Code	Name	LCD DISPLAY	Setting Scope	Min Unit	Default	Change
P18.00	Protocol option	Protocol option	0: MODBUS 1: Reserved	1	0	×
P18.01	Communication configuration	Communication configuration	LED Ones place: Baud rate option 0: 4800BPS 1: 9600BPS 2: 19200BPS 3: 38400BPS 4: 115200BPS 5: 125000BPS LED Tens place: Data format 0: 1-8-2-N format, RTU 1: 1-8-1-E format, RTU 2: 1-8-1-O format, RTU 3: 1-7-2-N format, ASCII 4: 1-7-1-E format, ASCII 5: 1-7-1-O format, ASCII LED Hundreds place: Connection mode 0: Director cable connection(232/485) 1: MODEM(232)	1	001	×
P18.02	Local address	Local address	0~247, 0: broadcast address	1	5	×
P18.03	Communication time-out detection time	Communication time-out detection time	0.0~1000.0s	0.1	0.0s	×
P18.04	Local response delay	Local response delay	0~1000ms	1	5ms	×
P18.05~P18.29	Reserved	Reserved		1	0	○

P19 Bus Communication Parameters						
Functional Code	Name	LCD DISPLAY	Setting Scope	Min Unit	Default	Change
P19.00-	Reserved	Reserved	Reserved	1	0	*

P20: Protective Parameters and Fault Record						
Functional Code	Name	LCD DISPLAY	Setting Scope	Min Unit	Default	Change
P20.00	Protection operating option 1	Protection operating option 1	LED Ones place: Abnormal comm. action option 0: Protective action and free stop 1: Warn and continue to run 2: Warn and stop by stop mode (Only for comm. Control mode) 3: Warn and stop by stop mode (for all control modes) LED Tens place: abnormal contactor action option 0: Protective action and free stop 1: Warn and continue to run LED Hundreds place: abnormal EEPROM action option 0: Protective action and free stop 1: Warn and continue to run LED Thousands place: 24V short circuit action option 0: Protective action and free stop 1: Warn and continue to run	1	0000	×
P20.01	Protective action option 2	Protective action option2	LED Ones place: Phase loss action option 0: Input/output phase loss protection 1: No action for input phase loss 2: No action for output phase loss 3: No action for Input/output loss LED Tens place: Action for external analog frequency /torque instruction loss option 0: No action 1: Protective action and free stop 2: Warn and continue to run	1	00	×
P20.02	Fault indication option1	Fault indication option1	LED Ones place: Under voltage fault indication action option 0: No action 1: Action (under voltage is regarded as fault) LED Tens place: Automatic reset interval fault indication action option 0: No action 1: Action LED Hundreds place: fault lock function option	1	000	×

Functional Code	Name	LCD DISPLAY	Setting Scope	Min Unit	Default	Change
			P20: Protective Parameters and Fault Record			
			0: Disable 1: Enable (fault indication don't operate) 2: Enable (Fault indication operates)			
P20.03 ~P20.05	Reserved	Reserved				×
P20.06	Motor overload protection mode option	Overload protection	0: No action 1: Common motor (with low-speed compensation) 2: variable frequency motor (without low-speed compensation)	1	1	×
P20.07	Overvoltage stall option	Overvoltage stall option	0: Disable (when installing brake resistance) 1: Enable	1	1	×
P20.08	Overvoltage stall point	Overvoltage stall point	120.0%~150.0%Udce	0.1%	140.0%	×
P20.09	Overload pre-alarm detection option	Overload pre-alarm detection option	LED Ones place: Detection option 0: Always detect 1: Only detect at constant speed LED Tens place: Alarm option 0: Alarm, continue to run 1: Protective action and free stop LED Hundreds place: Detection level option 0: Relative to motor rated current(E014) 1: Relative to Servo driver's rated current(E013)	1	000	×
P20.10	Overload pre-alarm detection level	Overload detection level	20.0%~200.0%	0.1%	130.0%	○
P20.11	Overload pre-alarm detection time	Overload pre-alarm detection time	0.0~60.0s	0.1S	5.0S	○
P20.12	Off load protection option	Off load protection option	0: Servo driver Off load protection forbidden 1: Servo driver off load protective action 2: Reserved	1	0	○
P20.13	Off load detection level	Off load detection level	0.0~100.0%Ie	0.1%	30.0%	○
P20.14	Off load detection time	Off load detection time	0.0~60.0s	0.1s	1.0s	○
P20.15	Automatic current limit level	Current limit level	20.0%~200.0%Ie	0.1%	150.0%	×
P20.16	Drop rate of frequency during current limiting	Drop rate of frequency during current limiting	0.00~99.99Hz/s	0.01 Hz/s	10.00 Hz/s	○
P20.17	Automatic current limit action option	Automatic current limit action	0: Invalid for constant speed 1: Valid for constant speed Note: in accelerating/deceleration always valid	1	1	×

P20: Protective Parameters and Fault Record						
Functional Code	Name	LCD DISPLAY	Setting Scope	Min Unit	Default	Change
P20.18	Automatic reset time	Automatic reset time	0: No action 1~100: Automatic reset time Note: Module protection, External equipment fault, AI overcurrent fault without automatic reset function	1	0	×
P20.19	Automatic reset time interval	Reset time interval	2.0~20.0s/ time	0.1s	5.0s	×
P20.20	Reserved	Reserved				○
P20.21	First abnormality type	First abnormality	0: No records of abnormality 1: Overcurrent when accelerate(E001) 2: Overcurrent when decelerates (E002) 3: Overcurrent when constant speed(E003) 4: Overvoltage when accelerates(E004) 5: Overvoltage when decelerates(E005) 6: Overvoltage when constant speed (E006) 7: Control voltage overvoltage (E007) 8: Input side phase loss (E008) 9: Output side phase loss (E009) 10: Power module protection (E010) 11: Radiator 1 overheat(E011) 12: Radiator 2 overheat(E012) 13: Servo driver overload (E013) 14: Motor overload (E014) 15: External fault(E015) 16: EEPROM read/write error (E016) 17: Serial port abnormal comm. (E017) 18: Contactor abnormal (E018) 19: Current measure circuit abnormal (E019) 20: System disturbance(E020) 21: Process close-loop feedback missing(E021) 22: External given command missing(E022) 23: Operation panel parameters copy error(E023) 24: Motor parameter identification error (E024) 25: PG fault(E025) 26: Servo driver Off load (E026) 27: Braking unit fault (E027) 28: Parameters setting error (E028) 29: Control board 24V short circuit(E029) 30~33: Reserved 34: DEV error (E034) 35: Overspeed (OS) fault(E035) 36~40: Reserved 41: CCI Input overcurrent fault 42: Reserved 43: Reserved 44~50: Reserved Note: 1．E007 at 18.5G/22G or below will not be detected, others will be tested after stop;	1	0	*

			P20: Protective Parameters and Fault Record				
Functional Code	Name	LCD DISPLAY	Setting Scope	Min Unit	Default	Change	
			2．E010 can be reset after 10s of fault; 3．In case of overcurrent fault, reset with time delay of 6s; 4．With fault alarming, operation panel shows fault: A×××(as: contactor fails, if protective action operation panel shows E018, if alarms, continue to work and the operation panel shows A018)				
P20.22	Bus voltage at the 1st fault	Fault voltage	0~999V	1V	0V	*	
P20.23	Actual current at the 1st fault	Fault current	0.0~999.9A	0.1A	0.0A	*	
P20.24	Output frequency at the 1st fault	Fault frequency	0.00Hz~1000.0Hz	0.01Hz	0.00Hz	*	
P20.25	Servo drive running status at the 1st fault	Servo driver status in fault	0~FFFFH	1	0000	*	
P20.26	Second abnormality type	Second abnormality	As given in P20.21	1	0	*	
P20.27	Bus voltage at the 2nd fault	Fault voltage	0~999V	1V	0V	*	
P20.28	Actual current at the 2nd fault	Fault current	0.0~999.9A	0.1A	0.0A	*	
P20.29	Output frequency at the 2nd fault	Fault frequency	0.00Hz~1000.0Hz	0.01Hz	0.00Hz	*	
P20.30	Servo driver running status at the 2nd fault	Servo driver status in fault	0~FFFFH	1	0000	*	
P20.31	Third abnormality type	Third abnormality	As given in P20.21	1	0	*	
P20.32	Bus voltage at the 3rd fault	Fault voltage	0~999V	1V	0V	*	
P20.33	Actual current at the 3rd fault	Fault current	0.0~999.9A	0.1A	0.0A	*	
P20.34	Output frequency at the 3rd fault	Fault frequency	0.00Hz~1000.0Hz	0.01Hz	0.00Hz	*	
P20.35	Servo driver running status at the 3rd fault	Servo driver status in fault	0~FFFFH	1	0000	*	

			P30: Traverse operation Parameters			
Functional Code	Name	LCD DISPLAY	Setting Scope	Min Unit	Default	Change
P30.00	Traverse function option	Traverse function option	0: No action 1: Action	1	0	×

Functional Code	Name	LCD DISPLAY	Setting Scope	Min Unit	Default	Change
P30.01	Traverse operation running mode	Traverse operation running mode	LED Ones place: Start mode 0: Automatic 1: Terminal manual LED Tens place: amplitude control 0: Relative center frequency 1: Relative max frequency LED Hundreds place: traverse frequency status memory 0: Stop memory 1: Not stop memory LED Thousands place: traverse frequency status power off saved 0: Memory 1: No memory	1	0000	×
P30.02	Traverse frequency preset frequency	Traverse frequency preset frequency	0.00Hz~Upper frequency limit	0.01Hz	0.00Hz	○
P30.03	Traverse frequency preset frequency waiting time	Traverse frequency waiting time	0.0~3600.0s	0.1s	0.0s	○
P30.04	Traverse frequency amplitude value	Traverse frequency amplitude value	0.0%~50.0%	0.1%	0.0%	○
P30.05	Hot frequency	Hot frequency	0.0%~50.0%	0.1%	0.0%	○
P30.06	Traverse frequency period	Traverse frequency period	0.1~999.9s	0.1s	10.0s	○
P30.07	Triangular wave rising time	Rising time	0.0%~100.0%(means: Traverse frequency period)	0.1%	50.0%	○

P97: Servo driver Parameters						
Functional Code	Name	LCD DISPLAY	Setting Scope	Min Unit	Default	Change
P97.00	Series No	Series No	0~FFFF	1	6000	*
P97.01	Software version No.	Software version No.	0.00~99.99	1	1.00	*
P97.02	Customized version No.	Customized version No.	0~9999	1	0	*
P97.03	Rated capacity	Rated capacity	Output power, 0~999.9kVA(Automatic setting by machine type)	0.1kVA	Setting by manufacturer	*
P97.04	Rated voltage	rated voltage	0~999V(Automatic setting by machine type)	1V	Setting by manufacturer	*
P97.05	Rated current	rated current	0~999.9A(Automatic setting by machine type)	0.1A	Setting by Manufacturer	*

P98: Customized Parameters Group						
Functional Code	Name	LCD DISPLAY	Setting Scope	Min Unit	Default	Change
P98.00~P98.31	Customized Parameters1~32	Customized Parameters1~32	P00.00~P99.99	1	9999 No customized Parameters	○

P99: Manufacturer Parameters						
Functional Code	Name	LCD DISPLAY	Setting Scope	Min Unit	Default	Change
P99.00	Password Input by manufacturer	Manufacturer's password	**** Note: After correct password input, the parameters left in the group will be shown.	1	Setting by manufacturer	―

Note:

○: Change in working; ×: No change in working; *: Actual parameters, unable to change; ―Manufacturer setting, unable to change by users.

Appendix I: Communication Protocol

1. Networking mode

     As given in Fig 1, the networking mode of servo drive has two kinds: single host machine/several slave machine, single machine/single slave machine.
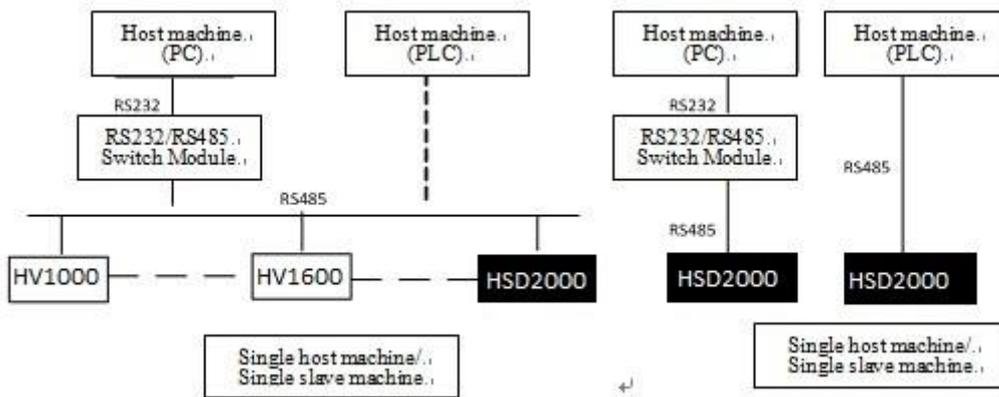
Fig. 1 Servo Driver Networking Diagram

2. Interface

RS485 interface: asynchronous, half-duplex. Default: 1-8-N-2, 9600bps, RTU. Parameters setting refers to group P18 Functional Code Indication.

3. Communication

1．Based on the Modbus protocol, servo driver not only support common reading/writing of register but also extend some commands and manage the servo driver functional codes.

2．Servo driver is a slave machine, master-slave point-point communication. When the host machine use broadcast address to send commands, the slave machine will make no replies.

3．In case of several machine communications or long distance, connect at positive and negative terminals of main station communication signal lines in parallel resistance of 100~120ohm to improve the communication immunity.

4．HSD2000 offers only RS485 interface, if the external comm.. interface is RS232, it will need additional RS232/RS485 switch devices.

4. Protocol format

Modbus protocol supports RTU and ASCII, corresponding frame formats are given in Fig. 2.

Fig. 2 Modbus Protocol Format

RTU
Modbus data frame

Initial (at least 3.5 character free)	Slave machine address	Command code	Data	Check code	End (at 3.5 characters free)

ASCI
Modbus data frame

Initial (0x3A)	Slave machine address	Command code	Data	Check code	End (0x0D, postamble byte)

Modbus in coding, followed adopts "Big Endian" firstly sending high bit, by low one.
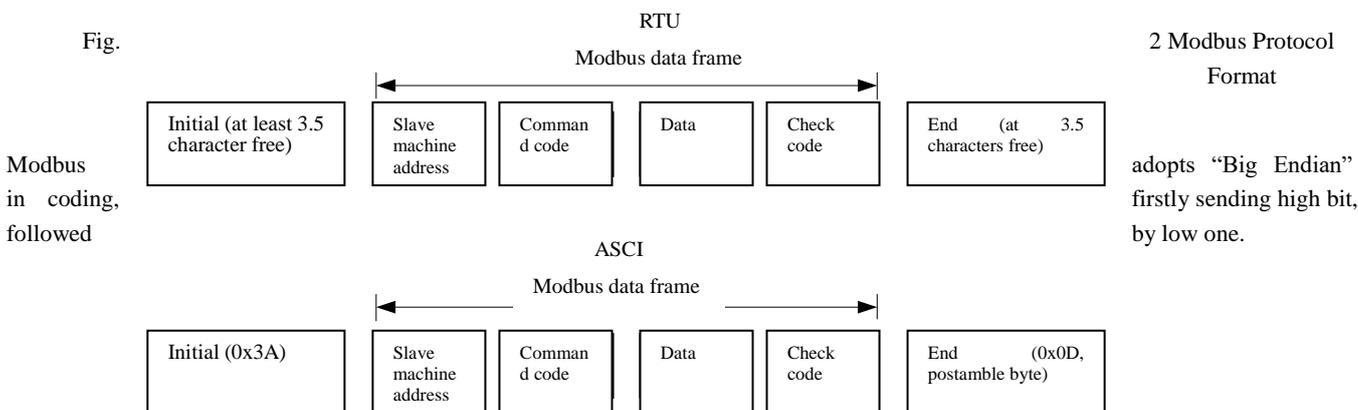
1．RTU

Under RTU, free time between frames shall take the bigger value between function code setting and Modbus value agreed internally. The min frame agreed in Modbus shall be: the bus-through time from frame head to frame end shall have at least 3.5 characters to define frames. Data check adopts CRC-16, all information will be checked, check and high/low bit shall be exchanged for sending. Specific CRC check refers to samples attached hereto. Note: there shall be 3.5 characters at least for bus free between frames, and the bus free between frames shall not need to accumulate initial and final idle.

The following is applicable for: under RTU, read the register 0101(P01.01) parameters from No. 5 slave machine.

Request frame:

Slave machine address	Command code	Data				Check code	
		Register address		Read characters			
0x05	0x03	0x01	0x01	0x00	0x01	0xD5	0xB2

Response frame:

Slave machine address	Command code	Data			Check code	
		Response bit	Register content			
0x05	0x03	0x02	0x13	0x88	0x44	0xD2

Where, check code is CRC check value, CRC check calculations refer to the following instruction.

2．ASCII

Under ASCII, the frame head is "0x3A", the frame end default: "0x0D,0x0A", which can be also set by users, under the mode, except the frame head and the frame end, other data bytes all adopt ASCII codes for sending, first sending high 4 byte, followed by low one. Under ASCII, the data have 7 digits, for "A"~"F", adopt uppercase ASCII codes. At the time, the data adopt LRC for check, which cover from slave machine address to data information. Total check equals to all characters for check and complement codes (no carry available).

The following is applicable for: under ASCII, write the register 0201(P02.01) parameters from No. 5 slave machine.

Request frame:

	Frame Head	Slave machine address		Command Code		Data								Check code		Frame End	
						Register address				Written Content							
Character	:	0	5	0	6	0	2	0	1	0	F	A	0	4	3	CR	LF
ASCII	3A	30	31	30	36	30	32	30	31	30	46	41	30	34	33	0D	0A

Where, Check code is total LRC check, equal to complement codes of (05+06+02+01+0x0F+0xA0).

Response frame:

	Frame Head	Slave machine address		Command Code		Data								Check code		Frame End	
						Register address				Written Content							
Character	:	0	5	0	6	0	2	0	1	0	F	A	0	4	3	CR	LF
ASCII	3A	30	31	30	36	30	32	30	31	30	46	41	30	34	33	0D	0A

Through functional code, servo driver can set different response time delay to meet different main stations, for RTU mode, the response time delay shall keep at least 3.5 characters interval; for ASCII mode, the response time delay shall be not less than 1ms.

5.　Protocol function

Modbus' most function is to read/write parameters, different command codes decide different operation requests. HSD2000 servo driver Modbus protocol support the operation in the table.

Command code	Description
0x03	Read servo driver parameters, including functional code parameters, control parameters and status parameters
0x06	Modify single 16-bit servo driver functional code parameter or control parameters, after power off, servo driver keeps no parameters.
0x08	Line diagnosis
0x10	Modify several servo driver functional code or control parameters, after power off, servo driver keeps no parameters.
0x41	Modify single 16-bit servo driver functional code parameter or control parameters, after power off, servo driver keeps parameters.
0x42	Servo driver functional code management
0x43	Modify several servo driver functional code or control parameters, after power off, servo driver keeps parameters.

Servo driver's functional code parameters, control parameters and status parameters all image to be Modbus's read/write register. Reading/writing characteristics and scope of functional code parameters follow servo driver user manual. Group number of servo driver functional code images to be high bit of register address, index in groups (namely parameters' number in the group) images to be low bit of register address. Servo driver's control parameters and status parameters are taken as servo driver functional code group. Functional code group number and its imaged high bit of register address have coincidence relations as follows:

Servo driver Group Parameters	High Bit of Image Address	Servo driver Group Parameters	High Bit of Image Address
Group P00	0x00	Group P19	0x13
Group P01	0x01	Group P20	0x14
Group P02	0x02	Group P30	0x1E
Group P03	0x03	Group P31	0x1F
Group P04	0x04	Group P32	0x20
Group P05	0x05	Group P33	0x21
Group P06	0x06	Group P34	0x22
Group P07	0x07	Group P35	0x23
Group P08	0x08	Group P36	0x24
Group P09	0x09	Group P40	0x28

Servo driver Group Parameters	High Bit of Image Address	Servo driver Group Parameters	High Bit of Image Address
Group P10	0x0A	Reserved	Reserved
Group P11	0x0B	Reserved	Reserved
Group P12	0x0C	Reserved	Reserved
Group P13	0x0D	Reserved	Reserved
Group P14	0x0E	Group P97	0x61
Group P15	0x0F	Group P98	0x62
Group P16	0x10	Group P99	0x63
Group P17	0x11	Control Parameters Group	0x32
Group P18	0x12	Status Parameters Group	0x33

For example, servo driver functional code parameters P03.02's register address is 0x0302, the first control parameters(control command 1)'s register address is 0x3200。

Whole data frame format have been given as above, the following will specify Modbus protocol "Command Code" and "Data" formats and meaning. The two parts form Modbus's application layer protocol data unit as given below. The following frame format is based on RTU mode, ASCII mode application layer protocol data unit will be doubled in length.

1．Read servo driver parameters

Application layer protocol data unit given as follows:

Request format:

Application layer protocol data unit	Data Length(Bit)	Value or Scope
Command code	1	0x03
Initial register address	2	0x0000~0xFFFF
Register quantity	2	0x0001~0x000A

Response format for successful operation:

Application layer protocol data unit	Data Length(Bit)	Value or Scope
Command code	1	0x03
Read bit	1	2×register quantity
Read content	2×register quantity	Parameter value

If the operation fails, it will return abnormal response frame, including error code and abnormal code, where error code = (Command code＋0x80), and abnormal code will show reasons for errors.

Abnormal response format:

Application layer protocol data unit	Data Length(Bit)	Value or Scope
Error code	1	(Command code ＋0x80)

	Abnormality code	1	

Abnormality code and meaning given as follows:

Abnormality code	Description
0x01	Illegal command code。
0x02	Illegal register address。
0x03	Data error (data are out of upper/lower limit scope)
0x04	Operation on slave machine fails, including data within upper/lower limit scope, but the invalid data cause errors.
0x05	Valid command in process, main applications are in memory data to non-volatile memory.
0x06	The slave machine is occupied, please wait, main applications are in memory data to non-volatile memory.
0x16	Operation not supported (mainly for control parameters and status parameter, as ort attribute, reading of upper/low limit of default.
0x17	Register quantity error in request frame(as Bit is odd number for 32btye operation)
0x18	Info frame error: Including info length error and check error
0x20	Parameters unable to change
0x21	Servo driver works, parameters unable to change
0x22	Parameters under password protection

2．Modify single 16-bit servo driver functional code parameter and status parameters, after power off, servo driver keeps no parameters.

During the command operation, after power off of servo driver, with power supply the parameters will keep unchanged.

Application layer protocol data unit given as follows

Request format:

Application layer protocol data unit	Data Length(Bit)	Value or Scope
Command code	1	0x06
Register address	2	0x0000~0xFFFF
Register content	2	0x0000~0xFFFF

Response format for successful operation:

Application layer protocol data unit	Data Length(Bit)	Value or Scope
Command code	1	0x06
Register address	2	0x0000~0xFFFF
Register content	2	0x0000~0xFFFF

If the operation fails, it will return abnormal response frame given as above.

3．Line diagnosis

Application layer protocol data unit given as follows

Request format:

Application layer	Data Length(Bit)	Value or Scope

protocol data unit		
Command code	1	0x08
Sub-command code	2	0x0000~0x0030
Data	2	0x0000~0xFFFF

Response format for successful operation:

Application layer protocol data unit	Data Length(Bit)	Value or Scope
Command code	1	0x08
Sub-command code	2	0x0000~0x0030
Data	2	0x0000~0xFFFF

If the operation fails, it will return abnormal response frame given as above.

Command code supported by line diagnosis and meaning are given as follows:

Sub-Command code	Data(Request)	Data(Response)	Meaning
0x0001	0x0000	0x0000	Re-initializing communication: make "No response mode" invalid
	0xFF00	0xFF00	Re-initializing communication: make "No response mode" invalid
0x0003	High bit is "new frame end", low bit is "00"	High bit is "new frame end", low bit is "00"	Set the frame end of ASCII mode to replace the original line break symbol, in case of power off, the new frame end will keep no change. (Note: the new frame end shall not exceed 0x7F and not equal to 0x3A).

Sub-Command code	Data(Request)	Data(Response)	Meaning
0x0004	0x0000	No response	Set "No response mode", under which, the slave machine only responds "Re-initializing communication request" (request of sub-function code 0x0001) and nothing to other requests. The function is mainly used for slave machines failing and separated.
0x0030	0x0000	0x0000	Set "Slave machine makes no responses" invalid command and error command。
	0x0001	0x0001	Set "Slave machine response invalid" command and error command。

4．During the command operation, after power off of servo driver, with power supply the parameters will keep unchanged.

Application layer protocol data unit given as follows:

Request format:

Application layer protocol data unit	Data Length(Bit)	Value or Scope
Command code	1	0x10
Initial register address	2	0x0000~0xFFFF
Operating register quantity	2	0x0001~0x000A
Register content Byte	1	2×Operating register quantity
Register content	2×Operating register quantity	

Response format for successful operation:

Application layer protocol data unit	Data Length(Bit)	Value or Scope
Command code	1	0x10
Initial register address	2	0x0000~0xFFFF
Operating register quantity	2	0x0001~0x000A

The command is used to modify contents of continuous data unit starting from the register address.

If the operation fails, it will return abnormal response frame given as above.

5．Modify single 16-bit servo driver functional code parameter and status parameters, after power off, servo driver keeps parameters.

Command code 0x41 is used to modify single 16-bit servo driver functional code parameters or control parameters, and save in non-volatile memory unit.

The command format is the same as that of 0x06, and the sole difference is: 0x06 Command operation parameters, after power off, keeps no parameters, and 0x41 operation parameters, after power off, keeps parameters.

6．Servo driver functional code management

Servo driver functional code management include reading upper/lower limit of parameters, parameters characteristics, functional code menu max index in group, read the next functional code group number and previous functional code group number, read current parameter display index, display the next status parameters, read the default of functional code parameters. Parameters characteristics include parameters' readability and writability, parameter unit and calibration relation. The commands are used for remote modification. Servo driver Functional Code Parameters。

Application layer protocol data unit given as follows

Request format:

Application layer protocol data unit	Data Length(Bit)	Value or Scope
Command code	1	0x42
Sub-Command code	2	0x0000~0x0008
Data	2	Decided by servo driver type

Response format for successful operation:

Application layer protocol data unit	Data Length(Bit)	Value or Scope
Command code	1	0x42
Sub-Command code	2	0x0000~0x0008
Data	2 or 4	0x00000000~ 0xFFFFFFFF

If the operation request fails, the response shall be error code and abnormality code, and the abnormality response codes can refer to the description mentioned above.

Functional code manages and supports sub-command code as follows:

Sub-command code	Data(Request)	Data(Response)	Meaning
0x0000	Parameter group number and group index occupy high and low bits respectively	Parameters' upper limit(4-bit length)	Read parameters' upper limit (Not supported by status parameters)
0x0001	Parameter group number and group index occupy high and low bits respectively	Parameters' lower limit(4-bit length)	Read parameters' lower limit (Not supported by status parameters)
0x0002	Parameter group number and group index occupy high and low bits respectively	Parameter characteristics (refer to character table for details)	Read functional code parameters' characteristics (Not supported by control parameters and status parameters)
0x0003	Parameter group number occupies high bit, the low bit is "00"	Quantity of parameters in the group	Read the quantity of parameters in the group
0x0004	Parameter group number occupies high bit, the low bit is "00"	High bit is the next group number of parameters, low bit is "00"	Read the number of next parameter group
0x0005	Parameter group number occupies high bit, the low bit is "00"	High bit is the next group number of parameters, low bit is "00"	Read the number of previous parameter group
0x0006	0x3300	Current display of status parameters index	Read current display of status parameter index (Status parameters' meaning is defined in the status parameter group)
0x0007	0x3300	Next status parameters index	Display the next status parameters (Status parameters' meaning is defined in the status parameter

Sub-command code	Data(Request)	Data(Response)	Meaning
			group)
0x0008	Parameter group number and group index occupy high and low bits respectively	Parameters' Default	Read the default of functional code parameters(Not supported by control parameters and status parameters)

In the table, when read the upper/low limit of parameters, the data length returned shall be 32-bit length, namely four bytes. The operation is not supported by status parameters. The upper/low limit read in the operation shall be that to be reached by the functional code parameters, if the parameters' scope is limited by other functional code parameters (namely related to the functional code parameters), it shall consider the related functional code parameters for decision.

Except otherwise stated, the data length of response frame shall have 2 bits.

Functional code parameters' characteristics have two-bit length, which is defined as follows:

Bit	Characteristic	Value	Meaning
BIT0	Upper limit restriction	0	Decimal system restriction
		1	Hex restriction
BIT3~BIT1	Decimal Position	000B	Part without decimals
		001B	1 decimal
		010B	2 decimals
		011B	3 decimals
		100B	Step size: 2
		101B	Step size: other
		Other	Reserved
BIT5~BIT4	Modify attributes	00B	Real parameters, unable to change
		01B	Change in working
		10B	No change/factory setting in working, unable to change by users
		11B	Reserved
BIT8~BIT6	Display unit	000B	No unit
		001B	Unit: Hz
		010B	Unit: A
		011B	Unit: V
		100B	Unit: r/min
		101B	Unit: line speed(m/s)
		110B	Unit: percent(%)
		Other	Reserved
BIT9	Reserved		

Bit	Characteristic	Value	Meaning
BIT10	Restore to Default	1	Restore
		0	Not restore
BIT11	Quick menu	1	Valid
		0	Invalid
BIT12	Basic menu	1	Valid
		0	Invalid
BIT13	16/32-bit Parameters	1	32 位
		0	16 位
BIT15~BIT14	Reserved		

7．Modify several servo driver functional code parameters and status parameters, after power off, servo driver keeps parameters.

Command code 0x43 is used to modify several servo driver functional code parameters or control parameters, and save in non-volatile memory unit.

The command format is the same as that of 0x10, and the sole difference is: 0x10 Command operation parameters, after power off, keeps no parameters, and 0x43 operation parameters, after power off, keeps parameters.

6. Servo driver's control parameters and status parameters

Servo driver's control parameters can servo driver startup, stop, setting work frequency and so on. Searching the servo driver's status parameters to obtain servo driver's work frequency, output current, output torque and other parameters.

1．Control parameters

Servo driver's control parameters given as follows:

Register address	Parameters Name	Save in Power Off	Remark
0x3200	Control command1	No	Refer to the definition table
0x3201	Main given	No	Main given frequency; valid for main given channel as serial comm.; whether or not to save shall relate to P14.06 setting
0x3202	work frequency given	No	As above
0x3203	Digit Process close-loop given	Yes	Process close-loop enabled
0x3204	Pulse Process close-loop given		HSD2000: not supported
0x3205	analog outputAO1 setting	No	P11.17＝14: Valid
0x3206	analog outputAO2 setting	No	P11.21＝14: Valid
0x320	Digit output DO	No	P10.32＝17: Valid

Register address	Parameters Name	Save in Power Off	Remark
7	setting		
0x3208	frequency ratio setting		HSD2000: not supported
0x3209	Virtual Terminal control setting	No	BIT0~BIT9: X1~X8/FWD/REV, valid for bits in P10.17; BIT10~BIT13: Y1/Y2/RO1/RO2, P10.18~P10.21＝17 Terminal: Valid
0x320A	Setting acceleration time1	Yes	
0x320B	Setting Deceleration time 1	Yes	
0x320C	Auxiliary frequency given	No	Auxiliary given channel: serial comm, Auxiliary given bits(Control 2's BIT2): valid
0x320D	Torque given	No	Torque control mode, torque given channel: serial and under torque control mode: valid
0x320E	Torque current given	No	Torque control mode: Torque given channel: serial and under torque current control mode: valid
0x3212	Control command 2	No	Refer to the definition table

 📖 **Attentions**

1．When reading control parameters, the return value will be the one written in previous communication;

2．Within control parameters, max length of "Main setting"," work frequency setting" and "Auxiliary frequency setting" shall be 32 bits, and others shall be 16 bits in length;

3．Within control parameters, all units given, input/output setting scope, decimal calibration and so on can be seen in related functional code parameters。

Control command 1 is defined as follows:

Bit	Value	Function	Remark
BIT2~BIT0	111B	Work Command	Start servo driver (Valid when JOG is invalid)
	110B	Mode 0: stop	Stop as per the set deceleration time(Valid when JOG is invalid)

Bit	Value	Function	Remark
	101B	Mode 1: stop	Free to stop
	100B	Stop due to external fault	Free to stop, servo driver displays external fault
	011B	Mode 2: stop	HSD2000: not support
	Other	No command	
BIT3	1	Reverse	Set work direction with work command valid
	0	Forward	
BIT4	1	Jog Forward	Jog does not act with normal and reverse valid, and stops with normal and reverse invalid
	0	Jog Forward invalid	
BIT5	1	Jog Reverse	
	0	Jog Reverse invalid	
BIT6	1	Allow accelerating/Deceleration	When the bit is valid, the control 1's BIT5~BIT0 will be valid
	0	Disable accelerating/Deceleration	
BIT7	1	Upper computer control 1 valid	Valid option bit of control 1 of upper computer
	0	Upper computer control 1 invalid	
BIT8	1	Reserved	Reserved
	0	Reserved	
BIT9	1	Fault reset valid	Valid option bit for upper computer fault reset
	0	Fault reset invalid	
BIT15~BIT10	000000B	Reserved	

 📖 **Attentions**

1．Upper computer's control command(control command 1 and control command 2) shall be valid with "Work command channel option" value equal to "Communication Command" ; When the control 1's BIT7 bit is valid, the whole control 1 will be valid; When control 1's BIT6 bit is valid, BIT5~BIT0 will be valid.

2．Upper computer's treatment on fault and alarm: When servo driver fails, as for control 1 and 2 command, except the fault reset command, the upper computer will be invalid if sending other commands. Namely the upper computer shall firstly reset the fault before sending command. When alarms exist, the control will be valid.

Control Command 2 is defined as follows:

Bit	Value	Function	Remark
BIT0	1	Servo driver work disable	Servo driver allow/disable work option bit
	0	Servo driver work allowed	

Bit	Value	Function	Remark
BIT1	1	Work(direction taken from functional code)	Work direction
	0	Other work status(refer to control 1)	
BIT2	1	Auxiliary given valid	Valid option bit for Auxiliary given frequency of upper computer
	0	Auxiliary given invalid	
BIT3	1	Upper computer control 2 valid	Valid option bit for control 2 of upper computer
	0	Upper computer control 2 invalid	
BIT15~BIT4		Reserved	

Note: When control command's BIT3 bit is valid, the whole control 2 will be valid.

2．Status parameters

Register address	Parameters Name	Remark
0x3300	Servo driver operating status 1	
0x3301	Current main given actual work value	Current work frequency
0x3302	Slave machine type	
0x3303	Servo driver type	
0x3304	Software version	
0x3305	Current work frequency	
0x3306	Output current	
0x3307	Output voltage	
0x3308	Output power	
0x3309	Work rotation speed	
0x330A	Work line speed	
0x330B	Analog Process close-loop feedback	
0x330C	Bus voltage	
0x330D	External counter	HSD2000: not support
0x330E	Output torque	
0x330F	Switch Input output terminal status	BIT0~BIT9: X1~X8/FWD/REV; BIT10~BIT13: Y1/Y2/RO1/RO2
0x3310	Actual length	HSD2000: not support
0x3311	Work frequency after compensation	HSD2000: not support
0x3312	The 1st work fault	
0x3313	The 2nd work fault	

Register address	Parameters Name	Remark
0x3314	The 3rd (latest) work fault	
0x3315	work frequency setting	
0x3316	Setting rotation speed	
0x3317	Analog Process close-loop setting	
0x3318	setting 线 Speed	
0x3319	AI1	
0x331A	AI2	
0x331B	Setting length	HSD2000: not support
0x331C	Setting acceleration time1	
0x331D	Setting Deceleration time 1	
0x331E	Command given channel: 0: Panel control; 1: Terminal control; 2: Serial port control	
0x331F	Servo driver operating status 2	
0x3320	frequency given channel: 0: Digit given1(operation panel ▲▼ given); 1: Digit given2(Terminal UP/DOWN given); 2: Digit given3(Serial port); 3: AI analog given; 4: Terminal PULSE given;	
0x3321	Accumulated length	HSD2000: not support
0x3322	Motor and mode option: Ones place: Motor 1 control mode option 0: Vector control without PG 1: Vector control with PG 2: V/F control without PG 3: V/F control with PG Tens place: Motor 1 type option 0: Asynchronous motor 1: Synchronous motor Hundreds place: Motor 2 control mode option 0: Vector control without PG 1: Vector control with PG 2: V/F control without PG 3: V/F control with PG Thousands place: Motor 2 type option	

Register address	Parameters Name	Remark
	0: Asynchronous motor 1: Synchronous motor	
0x3323	Bus voltage at the 3rd fault	
0x3324	Actual current at the 3rd fault	
0x3325	Work frequency at the 3rd fault	
0x3326	Servo driver operating status at the 3rd fault	Bit is defined as work status 1
0x3327	AI3	
0x3328	Servo driver operating status 3	

📖 **Attentions**

1．Status parameters do not support writing operation.

2．Within status parameters, max length of "Actual work value of main setting"," work frequency setting" and "work frequency at the 3rd fault" shall be 32 bits, and others shall be 16 bits in length.

Servo driver operating status 1 is defined as follows:

Bit	Value	Function	Remark
BIT0	1	Servo driver Work	
	0	Servo driver Stop	
BIT1	1	Servo driver Reverse	
	0	Servo driver Forward	
BIT2	1	Reach main setting	
	0	Fail to reach main setting	
BIT3	1	Allow serial port control	
	0	Disable serial port control	
BIT4	1	Allow serial port given	
	0	Disable serial port given	
BIT5~BIT6		Reserved	
BIT7	1	Alarm	When the bit is 0, it shall consider control 1's BIT15~8 to judge whether it is normal or fault. BIT15~8 equal to 0 means normal, otherwise, it will be fault.
	0	Fault or normal	

Bit	Value	Function	Remark
BIT15~BIT8	0x00~0xFF	Fault/alarm code	0: Servo driver is normal; Non 0: fault/alarm, specific fault/alarm codes can be seen in user manual. Fault/alarm can be seen in status 1 defined in BIT7.

Servo driver operating status 2 is defined as follows:

Bit	Value	Function	Remark
BIT0	1	Jog Work	
	0	Non-Jog Work	
BIT1	1	Process close-loop Work	
	0	Non Process close-loop Work	
BIT2	1	PLCWork	
	0	Non-PLC Work	
BIT3	1	Multiplex frequency Work	
	0	Non-Multiplex frequency Work	
BIT4	1	Common Work	
	0	Uncommon Work	
BIT5	1	Traverse frequency	
	0	Non-Traverse frequency	
BIT6	1	Under voltage	
	0	Normal voltage	
BIT7		Reserved	
BIT8		Servo Work	
BIT9		Customized Work	
BIT10		Synchronous speed work	
Other		Reserved	

Servo driver operating status 3 is defined as follows:

Bit	Value	Function	Remark
BIT0~BIT1		Reserved	
BIT2		Zero-speed Work	
BIT3		Accelerating	
BIT4		Decelerating	
BIT5		Constant-speed Work	
BIT6		Pre-excitation	
BIT7		Setting	
BIT8		Over current limit	
BIT9		DC over voltage limit	

Bit	Value	Function	Remark
BIT10		Torque limit	
BIT11		Speed limit	
BIT12		Servo driver fails	
BIT13		Speed control	
BIT14		Torque control	
BIT15		Position control	

7.   Expansion access

Standard Modbus protocol support 16-bit register, the description mentioned above are based on 16-bit registers. HSD2000 serial servo driver's parameters include 16-bit (single character) and 32-bit length, so the parameter reading/writing operation shall consider the data of two length.

The access to servo driver parameters has 16 bit and 32 bit, namely take 16 bits and 32 bits as unit for read/write parameters respectively. Use "initial register address" in request frame to differentiate the access of 16 bits and 32 bits, if the max bit of the address is "0", just read/write as per 16 bits, otherwise, do as per 32 bits as follows.

Initial register address		Access Type	Remark
BIT15	BIT14~BIT0		
0	Actual address of initial parameters	16 bits	
1	Actual address of initial parameters	32 bits	

When accessing to parameters as per 32 bits, for the register in the request frame takes 16 bits as unit, each 32 bit parameter needs to use two 16-bit registers, so it needs to set correct "register quantity". The "register quantity" in the request frame is two times of parameters to be accessed, otherwise, it will return abnormal response frame.

1．Read operation

16-bit access is the same as what given above, as for the 32 bit access, the returned data take 32 bits as unit, as given below, read four continuous Functional Code(Slave machine address:) with P01.01 as initial address.

Request frame:

Bit	Value		Description
	16 bits	32 bits	
0	0x05	0x05	Slave machine address
1	0x03	0x03	Command code
2~3	0x0101	0x8101	Initial address (for 32 bits, the highest level of initial address is1)
4~5	0x0004	0x0008	Register quantity(for 32 bits, register quantity is twice of parameter quantity)
6~7	Check code	Check code	CRC check

Response frame after successful operation:

Bit	Value	Description

	16 bits	32 bits	
0	0x05	0x05	Slave machine address
1	0x03	0x03	Command code
2	0x08	0x10	Read bit
3~4	P01.01 value	P01.01 value	Read content: 16-bit: 8 bits 32-bit mode: total 16 bytes
5~6	P01.02 value		
7~8	P01.03 value	P01.02 value	
9~10	P01.04 value		
11~12	Check code	P01.03 value	
13~14	—		
15~16	—	P01.04 value	
17~18	—		
19~20	—	Check code	

If the operation fails, it will return abnormal response frame as given above.

Servo driver parameters have two kinds: the first kind takes decimal system restriction to indicate parameters of real variables; the second kind takes hex restriction. The first one is used for real variable such as current, voltage , frequency , power, torque, percent and so on, negative or positive, the data type is int or long; the second one is used for mode option or status indication such as parameters option, work status, no negative or positive, and the data type is unsigned int and unsigned long. Parameters' type and value scope are given in the following:

Type	Bit Qty	Value Scope	Remark
int	16	－32768~32767	Category I Parameters
long	32	－2147483648~2147483647	
unsigned int	16	0~65535	Category II Parameters
unsigned long	32	0~4294967296	

If a 16-bit access is used to read parameters of 32-bit in length, it will return with the low 16 bits of 32-bit parameters taken, the value take may be not equal to the real value, which will be explained in the context.

If 32-bit operation is used to read 16-bit parameter in length, it will return an extended 32-bit data, namely the 16-bit parameter value is extended. Principle for length extending: if the highest bit of the 16-bit parameter is 0, 0 will be added to the highest 16th bit; if the highest bit of the 16-bit parameter is 1, it will need to judge the parameter category, if it belongs to category I, 1 will be added to the highest 16 bit; if it belongs to category II, 0 will be added to the highest 16 bit.

With the same data length, namely read 16-bit parameters under 16 bit mode, read 32-bit parameters under 32 bit mode, it needs no

length extension or take, and return original data directly. For example:

P01.01 value：4500(16bits category I Parameters, 0x1194);

P01.02 value：65036(32bits category I Parameters, 0x0000FE0C);

P01.03 value：-500(16bits category I Parameters, 0xFE0C);

P01.04 value：5000(32bits category I Parameters, 0x00001388);

P01.05 value ： 100000(32bits category I Parameters, 0x000186A0);

P01.06 value ： -100000(32bits category I Parameters, 0x FFFE7960);

P01.07 value：0x FFFF(16bit category II Parameters).

After read operation, the data return is given as follows:

Register address	Access Mode	Returned Value	Description
P01.01	16 bits	0x1194	Return real value
	32 bits	0x00001194	0 added to highest 16th bit, Return real value
P01.02	16 bits	0xFE0C	Take the lower 16th bit, return value: -500, incompatible with real value
	32 bits	0x0000FE0C	Return real value
P01.03	16 bits	0xFE0C	Return real value
	32 bits	0xFFFFFE0C	1 added to highest 16th bit,, Return real value
P01.04	16 bits	0x1388	Take the lower 16th bit, Return real value
	32 bits	0x00001388	Return real value
P01.05	16 bits	0x86A0	Take the lower 16th bit, return value: -31072, incompatible with real value
	32 bits	0x000186A0	Return real value
P01.06	16 bits	0x 7960	Take the lower 16th bit, return value: -31072, incompatible with real value
	32 bits	0x FFFE7960	Return real value
P01.07	16 bits	0x FFFF	
	32 bits	0x0000FFFF	Category II parameters, 0 added to the highest 16th bit

In the above table, when 16-bit access is used to read 32-bit parameters in length, it cannot assure that the return value will be real parameters.

So, more attention shall be paid to: under 16-bit mode, read operation is applicable for parameters of -32768~32767 only, and 32 bits shall be needed for read operation of other parameters.

2．Write operation

(1) Command code 0x06 and 0x41

The two command codes only support to change single 16-bit long parameters but not support 32-bit access. If the highest bit of

initial register address in the request frame is 1, it will return abnormal info frame and show address error.

Attentions:

(1) 16-bit write operation is applicable for category I parameter in the scope of -32768~32767 and category II parameters of 0~0xFFFF.

(2) For category I parameters, when using the two commands to write 16-bit long value to 32-bit long parameters, the real value will be extended one. Principle for length extension: extend as per the highest bit of 16-bit parameters, if the highest bit is 1, add 0xFFFF to the high 16 bit, otherwise, add 0x0000. If the extended data are within upper/lower limit of parameters, the value is valid and parameters are allowed to modify, it can be written. Category II parameters will need no extension.

For example: suppose Functional Code P01.01 and P01.02 are 32-bit data and 16-bit data, both belong to category I parameters, if the write operation succeeds, the written data are given as follows:

Register address	Value to be Written	Real Value Written	Description
P01.01	0x1194	0x00001194	Add 0x0000 to high 16 bits
	0xFE0C	0xFFFFFE0C	Add 0xFFFF to high 16 bits
P01.02	0x1194	0x1194	
	0xFE0C	0xFE0C	

(2)Command code 0x10 and 0x43

The two command codes are used to modify servo driver functional code parameters or control parameters, supporting 16-bit and 32-bit access.

The 16-bit access is given as above.

As for the 32-bit access, the data to be written shall be 32-bit long.

As given below, modify four continuous functional code (Slave machine address: 5) with P02.00 as initial address.

Request frame:

Byte	Value 16bits	Value 32 bits	Description
0	0x05	0x05	Slave machine address
1	0x10/0x43	0x10/0x43	Command code
2~3	0x0200	0x8200	Initial address (for 32 bits, the highest initial address is 1)
4~5	0x0004	0x0008	Register quantity(for 32 bits, register quantity is twice of parameter quantity)
6	0x08	0x10	Register content Byte
7~8	P02.00 value	P02.00 value	Content to be written: 16-bit operation, total 8

Byte	Value		Description
	16bits	32 bits	
9~10	P02.01 value		bytes
11~12	P02.02 value	P02.01 value	
13~14	P02.08 value		
15~16	Check code	P02.02 value	
17~18	—		32-bit operation: total 16 bytes
19~20	—	P02.08 value	
21~22	—		
23~24	—	Check code	

Response frame after successful operation:

Byte	Value		Description
	16-bit	32-bit	
0	0x05	0x05	Slave machine address
1	0x10/0x43	0x10/0x43	Command code
2~3	0x0200	0x8200	Initial address (for 32 bits, the highest initial address is 1)
4~5	0x0004	0x0008	Register quantity(for 32 bits, register quantity is twice of parameter quantity)
6~7	Check code	Check code	CRC check

If the operation fails, it will return abnormal response frame as given above.

Attention:

(1) The 16-bit write operation is applicable for category I parameters in the scope of -32768~32767 only, and category II parameters of 0~0xFFFF, and 32 bits shall be needed for write operation of other parameters.

(2) (2) For category I parameters, when using 16-bit access to write 16-bit long value to 32-bit long parameters, the real value written will be the extended one. Principle for length extension: extend as per the highest bit of 16-bit parameters, if the highest bit is 1, add 0xFFFF to the high 16 bit, otherwise, add 0x0000. If the extended data are within upper/lower limit of parameters, the value is valid and parameters are allowed to modify, it can be written. Category II parameters will need no extension and have nothing to do with high 16 bits.

(3) As for 32-bit access, whether the length of real parameters are 16 bits or 32bits, as long as the 32- bit value is within the upper/lower limit, the value is valid and the parameter is allowed to modify, it can be written successfully.

(4) If 16-bit access is used to modify 16-bit long parameters, just refer to the contents concerned above.

8.   Precautions

1．For command code 0x10 and 0x43, when write servo driver functional code parameters continuously, if the write operation of any functional code is invalid (as invalid parameter, unable to modify parameters), it will return error and all parameters will not be modified; when write control parameters continuously, if the write operation of any parameter is invalid (as invalid parameter, unable to modify parameters), the operation will return from the first fault memory address, the parameter and followed ones cannot be modified, but the previous ones can be written normally, and return error information.

2. For some special functional codes, 0x06 and 0x41, 0x10 and 0x43 own the same function, during the write operation, keep power supply after power off to save parameters. Functional codes are given in the following:

Functional Code	Description
P00.03	Parameters protection setting
P02.01	Motor option
P10.00~P10.07	Input Terminal X1~X8 function option
P14.06	Main setting frequency control
P14.07	Auxiliary frequency control
P15.00	PLCWork mode
P30.01	Traverse frequency Work
P03.00	Asynchronous motor1 rated power
P04.00	Asynchronous motor2 rated power
P03.13	Synchronous motor1 rated power
P04.13	Synchronous motor2 rated power
P03.17	Synchronous motor1 pole number
P04.17	Synchronous motor2 pole number
P03.18	Synchronous motor1rated rotation speed
P04.18	Synchronous motor2rated rotation speed
P99.01	Machine type setting(factory Parameters)
P99.09	Servo driver series option(factory parameters)

3. Some control parameters cannot be saved in nonvolatile memory units, so as for such parameters, command code 0x41 and 0x06, 0x43 and 0x10 own the same operation effect, namely during the write operation, keep power supply after power off and save no parameters. Refer to control parameters for details.

4. 6000Servo driver has some parameter reversed inside, which cannot be modified through communication setting, such parameters are given as follows:

Functional Code	Function Description
P00.00	Menu mode option
P00.05	Parameters copy
P03.11	Asynchronous motor1 Parameters self setting
P04.11	Asynchronous motor2 Parameters self setting
P03.23	Synchronous motor1 position identified

P04.23	Synchronous motor2 position identified

5．Upper computer's operation on user password and factory password

(1) User password

1) Reading/writing of functional code parameters protected by user password, functional code management ("read and display data address", except data switch display).

2) If user password is set (P00.02!＝0), only after passport removal, can the upper computer access to functional code parameters, yet the access to control parameters and status parameters will not be limited by password.

3) Upper computer cannot set, modify or cancel user password, which can be done only through operation panel. As for P00.02 write operation, it is valid under two conditions only: I, remove password if any; II, write 0 if there is no password, and invalid operation return for other conditions.

4)Upper computer and operation panel have independent operation on password, even the password is removed through the operation panel, but the upper computer must have password removed so as to access to functional code parameters through the upper computer, vice versa.

5)After the upper computer obtains the right to access to parameters, it will read the user password and return "0000" but not the real user password.

6) After removal password, the upper computer will obtain the right to access to functional code, if there is no communication within 5 minutes, the access will be invalid. If it needs to access to the functional code, just input password again.

7) After the upper computer obtains the right to access (no user password or password removal), through the operation panel, set the user password or new password, and the upper computer still has the right to current access, needing no password removal again. If failing to access, just remove the password (write new password) to obtain the right to access.

(2) Factory password

1) Reading/writing of group P99 parameter for factory password protection, functional code management of parameters in group P99.

2) Only after password removal (write correct factory password to P99.00), can the upper computer access to functional code of the group P99; if there is no communication within 5 minutes with the right to access, the right will be invalid automatically, and correct password shall be input again to access to the group 99.

3)With the right to access to group P99, the upper computer will read P99.00 and return "0000" but not real factory password.

4)Upper computer and operation panel have independent password operation, namely correct password shall be input respectively to access;

5)Upper computer has no right to modify the factory password, when the upper computer write P99.00, the password must be correct, otherwise, it will return invalid operation with prompt "unable to modify".

9. CRC Check

In order to increase the speed, CRC-16 is expressed generally by form, the following are language C source code to realize CRC-16, attention: the final result has exchanged high and low bytes and the result is the CRC total of CRC.

```
unsigned short CRC16 (unsigned char *msg, unsigned char length)        /* The function returns the CRC as a unsigned
                                                                          short type */

{
        unsigned char uchCRCHi = 0xFF ;                                /* high byte of CRC initialized */
        unsigned char uchCRCLo = 0xFF ;                                /* low byte of CRC initialized */
        unsigned uIndex ;                                              /* index into CRC lookup table */
        while (length--)                                               /* pass through message buffer */
        {
                uIndex = uchCRCLo ^ *msg++ ;                           /* calculate the CRC */
                uchCRCLo = uchCRCHi ^ (crcvalue[uIndex] >>8);
                uchCRCHi =crcvalue[uIndex]&0xff;
        }
        return (uchCRCHi | uchCRCLo<<8) ;
}
/* Table of CRC values */
const unsigned int   crcvalue[ ] = {
0x0000,0xC1C0,0x81C1,0x4001,0x01C3,0xC003,0x8002,0x41C2,0x01C6,0xC006,0x8007,0x41C7,
0x0005,0xC1C5,0x81C4,0x4004,0x01CC,0xC00C,0x800D,0x41CD,0x000F,0xC1CF,0x81CE,0x400E,
0x000A,0xC1CA,0x81CB,0x400B,0x01C9,0xC009,0x8008,0x41C8,0x01D8,0xC018,0x8019,0x41D9,
0x001B,0xC1DB,0x81DA,0x401A,0x001E,0xC1DE,0x81DF,0x401F,0x01DD,0xC01D,0x801C,0x41DC,
0x0014,0xC1D4,0x81D5,0x4015,0x01D7,0xC017,0x8016,0x41D6,0x01D2,0xC012,0x8013,0x41D3,
0x0011,0xC1D1,0x81D0,0x4010,0x01P0,0xC030,0x8031,0x41P1,0x0033,0xC1P3,0x81P2,0x4032,
0x0036,0xC1P6,0x81F7,0x4037,0x01F5,0xC035,0x8034,0x41P4,0x003C,0xC1FC,0x81FD,0x403D,
0x01FF,0xC03F,0x803E,0x41FE,0x01FA,0xC03A,0x803B,0x41FB,0x0039,0xC1P9,0x81P8,0x4038,
0x0028,0xC1E8,0x81E9,0x4029,0x01EB,0xC02B,0x802A,0x41EA,0x01EE,0xC02E,0x802F,0x41EF,
0x002D,0xC1ED,0x81EC,0x402C,0x01E4,0xC024,0x8025,0x41E5,0x0027,0xC1E7,0x81E6,0x4026,
0x0022,0xC1E2,0x81E3,0x4023,0x01E1,0xC021,0x8020,0x41E0,0x01A0,0xC060,0x8061,0x41A1,
0x0063,0xC1A3,0x81A2,0x4062,0x0066,0xC1A6,0x81A7,0x4067,0x01A5,0xC065,0x8064,0x41A4,
0x006C,0xC1AC,0x81AD,0x406D,0x01AF,0xC06F,0x806E,0x41AE,0x01AA,0xC06A,0x806B,0x41AB,
0x0069,0xC1A9,0x81A8,0x4068,0x0078,0xC1B8,0x81B9,0x4079,0x01BB,0xC07B,0x807A,0x41BA,
0x01BE,0xC07E,0x807F,0x41BF,0x007D,0xC1BD,0x81BC,0x407C,0x01B4,0xC074,0x8075,0x41B5,
0x0077,0xC1B7,0x81B6,0x4076,0x0072,0xC1B2,0x81B3,0x4073,0x01B1,0xC071,0x8070,0x41B0,
0x0050,0xC190,0x8191,0x4051,0x0193,0xC053,0x8052,0x4192,0x0196,0xC056,0x8057,0x4197,
0x0055,0xC195,0x8194,0x4054,0x019C,0xC05C,0x805D,0x419D,0x005F,0xC19F,0x819E,0x405E,
0x005A,0xC19A,0x819B,0x405B,0x0199,0xC059,0x8058,0x4198,0x0188,0xC048,0x8049,0x4189,
0x004B,0xC18B,0x818A,0x404A,0x004E,0xC18E,0x818F,0x404F,0x018D,0xC04D,0x804C,0x418C,
0x0044,0xC184,0x8185,0x4045,0x0187,0xC047,0x8046,0x4186,0x0182,0xC042,0x8043,0x4183,
0x0041,0xC181,0x8180,0x4040}
```

To calculate the total CRC check of online sending will take a long time, yet it will save the program space occupied by forms. CRC codes for online calculation are given as follows:

```
unsigned int crc_check(unsigned char *data,unsigned char length)
{
        int i;
        unsigned crc_result=0xffff;
```

```
    while(length--)
    {
    crc_result^=*data++;
            for(i=0;i<8;i++)
            {
            if(crc_result&0x01)
                    crc_result=(crc_result>>1)^0xa001;
            else
                    crc_result=crc_result>>1;
            }
            }
            return (crc_result=((crc_result&0xff)<<8)|(crc_result>>8));
    }
```

    10.   Application Samples

Command to start 5#Servo driver forward, rotation speed setting to be 50.00HZ (internal expression: 5000):

Data Frame	Address	Command code	Register address	register quantity	Register contentByte	Register content	Check code
Request	0x05	0x10	0x3200	0x0002	0x04	0x01C7, 0x1388	0x16A9
Response	0x05	0x10	0x3200	0x0002	No	No	0x4EF4

5#Servo driver free to stop:

Data Frame	Date Frame	Address	Command code	Register address	Register content	Check code
Request	Request	0x05	0x06	0x3200	0x00C5	0x46A5
Response	Response	0x05	0x06	0x3200	0x00C5	0x46A5

5#Servo driver Jog Forward:

Data Frame	Date Frame	Address	Command code	Register address	Register content	Check code
Request	Request	0x05	0x06	0x3200	0x00D0	0x876A
Response	Response	0x05	0x06	0x3200	0x00D0	0x876A

5#Servo driver Jog stop:

Data Frame	Date Frame	Address	Command code	Register address	Register content	Check code
Request	Request	0x05	0x06	0x3200	0x00C0	0x86A6
Response	Response	0x05	0x06	0x3200	0x00C0	0x86A6

5#Servo driver fault reset:

Data Frame	Date Frame	Address	Command code	Register address	Register content	Check code
Request	Request	0x05	0x06	0x3200	0x0280	0x8636
Response	Response	0x05	0x06	0x3200	0x0280	0x8636

Read 5#Servo driver's work frequency, servo driver response work frequency will be 50.00HZ (16 bits)

Data Frame	Date Frame	Address	Command code	Register address	Register quantity or Read byte	Register content	Check code
Request	Request	0x05	0x03	0x3301	0x0001	No	0xDB0A
Response	Response	0x05	0x03	No	0x02	0x1388	0x44D2

Read 5#Servo driver's work frequency, servo driver response work frequency will be 50.00HZ (32 bits):

Data Frame	Date Frame	Address	Command code	Register address	register quantity or Read byte	Register content	Check code
Request	Request	0x05	0x03	0xB301	0x0002	No	0xB2CB
Response	Response	0x05	0x03	No	0x04	0x00001388	0xB2A5

Modify 5#Servo driver's acceleration time1(namely functional code P02.14) to be 10.0s, no protection of power off (16 bits)

Data Frame	Date Frame	Address	Command code	Register address	Register content	Check code
Request	Request	0x05	0x06	0x020E	0x0064	0xE9DE
Response	Response	0x05	0x06	0x020E	0x0064	0xE9DE

Modify 5#Servo driver's acceleration time1(namely functional code P02.14) to be 10.0s, no protection of power off (32 bits)

Data Frame	Date Frame	Address	Command code	Register address	register quantity	Register content Byte	Register content	Check code
Request	Request	0x05	0x10	0x820E	0x0002	0x04	0x00000064	0x1E5E
Response	Response	0x05	0x10	0x820E	0x0002	No	No	0x09F7

Modify 5#Servo driver's Output current, Servo driver Response output current to be 30.0A. (16 bits)

Data Frame	Date Frame	Address	Command code	Register address	register quantity or Read byte	Register content	Check code
Request	Request	0x05	0x03	0x3306	0x0001	No	0x6ACB
Response	Response	0x05	0x03	No	0x02	0x012C	0x49C9

Modify 5#Servo driver's Output current, Servo driver Response output current to be 30.0A. (32 bits)

Data Frame	Date Frame	Address	Command code	Register address	Register quantity or Read byte	Register content	Check code
Request	Request	0x05	0x03	0xB306	0x0002	No	0x030A
Response	Response	0x05	0x03	No	0x04	0x0000012C	0xBFBE

Read 5#Servo driver's deceleration time 1 (namely P02.15), Servo driver Response Deceleration time to be 6.0s (16 bits)

Data Frame	Date Frame	Address	Command code	Register address	Register quantity or Read byte	Register content	Check code
Request	Request	0x05	0x03	0x020F	0x0001	No	0xB435
Response	Response	0x05	0x03	No	0x02	0x003C	0x4995

Read 5#Servo driver's deceleration time 1 (namely P02.15), Servo driver Response Deceleration time to be 6.0s (32 bits)

Data Frame	Date Frame	Address	Command code	Register address	register quantity or Read byte	Register content	Check code
Request	Request	0x05	0x03	0x820F	0x0002	No	0xDDF4
Response	Response	0x05	0x03	No	0x04	0x0000003C	0xBFE2

11.   Servo driver's calibration relation

1．Frequency's calibration is 1: 100

If servo drive is required to run as per 50HZ, the main setting shall be 0x1388(5000).

2．Time's calibration is 1: 10

If servo driver acceleration time is 30s, the functional code setting shall be 0x012C(300).

3．Current's calibration is 1: 10

If servo driver feedback current is 0x012C(300), the present current of the servo driver shall be 30A.

4．Output power shall be its absolute value.

5．Other (as terminal input , output, etc), refer to Servo Driver Manual.

Version: 1.2

Thanks for choosing HNC product.

Any technique support, PLS feel free to contact our support team

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