B Series AC Servo Drive Brief Manual(Edition--V2.00)

General Precautions

Thank you very much for purchasing this product.This manual provides some relevant information of B Series AC Servo Drive and Servo Drive.Please read it thoroughly to make sure correct usage before putting to use.In addition,please keep it properly to refer to some time when needed. Please make sure to do comply with the following regulation before finishing reading the manual.

- The installation surrounds must have no steam,corrosive and combustible gases.
- It forbids wiring the three phase power to the U,V,W joints of the motor. Or, it will damage the servo drive.
- It must connect to the ground properly and act in accordance to regulation of your country.
- Please don't disassemble the drive and motor or changing the wiring layout when there is power on.
- Please ensure the emergency stop device is workable before operation.
- Please don't touch the cooling fin of the drive in case of burn when there is power on.

If you still have problem to use it,please consult your local distributor and our customer service center.The products will update if needed, should there is correction of the standard,please consult your local agent .

Safety Precautions

B Series is an open type servo drive, it is advised to install it in the control cabinet with shielding.It applies precise feedback control combining with Digital Signal Processor(DSP)with high-speed computation capability to control IGBT to generate precise current output.It can drive three phase permanent magnetic ac servo motor (PMSM) to reach accurate position.

B Series can be apply to industrial occasion. And it is advised to install the corresponding wiring and cabinet layout same as that mentioned in the manual(drive,wiring and motor should install in the environment in accordance with the lowest standard of UL50 Type 1 or NEMA 250 Type 1).
Please note the safety precautions at any moment when doing Receiving Inspection,Installation,Wiring,Operation,Maintain and Inspection

Receiving Inspection

- Please match the servo motor with the specified servo drive, or, it will cause fire or equipment failure.
- It forbids to expose it with the environment of steam,corrosive gas and combustible gas, or it will cause electric shock or fire.

Wiring Precautions

- Please wire the ground terminal to PE(below 100Ω) ground connection. Improper ground wiring will cause electric or fire.
- Please don't wire the three phase power to U,V,W output terminals. Or it will lead to personnel be injured or fire.
- Please fasten the set screws of the power and output terminals, or it will lead to fire.

- Please do wiring according to the information on the cable in case of dangerous incident.

Operation Precautions

- Before the operation of the mechanical equipment,it needs to adjust the setting value according to the user's parameter. It may make the mechanical equipment revolve out of control or cause malfunction if the parameter is not set properly.
- Please make sure the emergency stop switch workable before operation.
- Please touch any rotating parts when the motor is working, or it will cause personnel injured.
- In avoid of an accident,please do the first test run with no connection to the connection shaft or belt of the equipment.
- Should there is an operation mistake when operating with the servo motor connected to the equipment, it will damage not only the equipment but cause the human injury some time.
- Highly Recommend: please test whether the servo motor works normal or not with no other load to avoid unnecessary danger.
- Please don't touch the radiator of the servo drive when it is operating. Or you will get a burn because of high temperature.

Maintain and Inspection

- It forbids to touch the inner side of the servo motor and servo drive, or it will lead to electric shock.
- Please don't disassemble the panel of the drive when it is power on, or it will lead to electric shock.
- Please don't touch the wiring terminals in 10 minutes of power off, it will lead to electric shock because of residual voltage.
- Please don't disassemble the servo motor, or it will cause electric shock or human injury.
- Please don't change the wiring when the power is on, or it will cause electric shock or human injury.
- It is required the qualified motor specified person to install,wire,repair and maintain the servo drive and servo motor.
- Please make sure the indicator light of POWER off and do the maintain,inspection and repairing.

Main Circuit Wiring

- Please don't pass through the same pipeline with encoder cable and power cable or strap them together.When wiring power and encoder cables,please make them have a distance over 30cm(or 11.8inch).
- Please apply stranded wire and multi-fiber twisted shielding wire to do signal,encoder(PG) feedback cables and the maximum length for signal input is 3m(9.84feet),PG feedback 15m(49.22feet).
- Please don't touch the terminals of the power when power off in 10 minutes, because it still has high power retention in the servo drive. Please make sure the indicator light POWER is off and do the inspection.
- Please don't switch on and off frequently. Please it needs to switch on and off

continuously,please control it below one time in a minute.

Wiring of Main Circuit Terminal Blocks

Please insert only one cable in the slot of the terminal blocks.

- Please don’t make the core wire have a short circuit with the nearby wires when insert the cable.
- The end of the core wire should be fasten with Y-connected terminal.
- Please make sure the wiring is correct before power on.

Contents

Chapter One Specification and Installation

1.1 Specification of Servo Drive

Model No.		**15B**	**20B**	**30B**	**50B**	**75B**
Output Power（KW）		0.1-0.75	0.4-1.5	1.7-2.3	2.3-3.8	3.0-5.5
Rated Torque（N.m）		0.01-3.5	4-10	6-15	15-35	35-55
Input Power		Single PhaseL1,L2;Three PhasesL1,L2,L3 AC220V-15%~+10%				
Temperature		Working:0~40℃ Storing:-40~50℃				
Humidity		Working:40%~80%(No Dew) Storing:below 93%(No Dew)				
IP Grade		IP20				
Control Method		PWM sine wave vector control				
Regenerative Braking		With built-in braking resistance for the motor power below 1KW items;Should the inertia is higher,it is advised to have external resistance with terminal end B1 and B2.				
Feedback Mode		2500PPR incremental encoder				
Control Mode		Position				
Digital Input		Servo On/Alarm Clear/CCWL/CWL/TCCW/TCW/EMG STOP/Electronic Gear 1/Electronic Gear 2/Position Deviation Clear/Pulse Input Prohibited				
Digital Output		Servo Ready/Alarm/Location Completed/Speed Arrival/Electromagnetic Brake				
Signal of Encoder Output		Signal Type	Differential A,B,Z Output,Signal Z Output			
Position	Input Frequency	Differential A,B,Z Input:≤500kHz （ kpps ） ,Single Ended Input ≤200kHz（kpps）				
	Command Mode	Pulse+Direction;CCW/CW Pulse;Orthogonal AB Pulse				
	Electronic Gear Ratio	1~32767/1~32767				
Monitor Function		Speed/Present Location/Location Deviation/Motor Torque/Motor Current/Frequency of Command Pulse.etc				
Protection Function		Over-speed/Over Voltage/Over Current/Over Load/Brake Abnormal/Encoder Abnormal/Location out-of-tolerance				
Characteristics	Speed Frequency Response	>400Hz				
	Speed Fluctuation Ratio	<±0.03% (Electrical Load:0~100%);<±0.02%(Power:-15~+10%)				
	Speed Regulation Ratio	1:5000				

1.2 Servo Motors and Corresponding Drives (B Series)

Series	Motor No.	Corresponding Drive	Specification
60 Flange	60ST-M00630	WD15B020A	Rated 200W 3000RPM 0.637NM
	*60ST-M01330	WD15B040A	Rated 400W 3000RPM 1.27NM
	60ST-M01930	WD15B060A	Rated 600W 3000RPM 1.91NM
80 Flange	*80ST-M02430	WD15B075A	Rated 750W 3000RPM 2.4NM
	*80ST-M03520	WD15B075A	Rated 750W 2000RPM 3.5NM
	80ST-M04025	WD15B100A	Rated 1.0KW 2500RPM 4.0NM
90 Flange	90ST-M02430	WD15B075A	Rated 750W 3000RPM 2.4NM
	90ST-M03520	WD15B075A	Rated 750W 2000RPM 3.5NM
	90ST-M04025	WD20B100A	Rated 1.0KW 2500RPM 4.0NM
110 Flange	*110ST-M04030	WD20B120A	Rated 1.2KW 3000RPM 4.0NM
	110ST-M06020	WD20B120A	Rated 1.2KW 2000RPM 6.0NM
	*110ST-M06030	WD30B180A	Rated 1.8KW 3000RPM 6.0NM
	*110ST-M05030	WD30B150A	Rated 1.8KW 3000RPM 5.0NM
130 Flange	*130ST-M04025	WD20B100A	Rated 1.0KW 2500RPM 4.0NM
	130ST-M10010	WD20B130A	Rated 1.3KW 2500RPM 5.0NM
	130ST-M06030	WD20B100A	Rated 1.0KW 1000RPM 10.0NM
	*130ST-M06025	WD30B157A	Rated 1.57KW 2500RPM 6.0NM
	130ST-M07720	WD30B160A	Rated 1.6KW 2000RPM 7.7NM
	*130ST-M07725	WD30B200A	Rated 2.0KW 2500RPM 7.7NM
	130ST-M10015	WD30B150A	Rated 1.5KW 1500RPM 10.0NM
	*130ST-M10025	WD30B260A	Rated 2.6KW 2500RPM 10.0NM
	*130ST-M15015	WD30B230A	Rated 2.3KW 1500RPM 15NM
	130ST-M15025	WD30B380A	Rated 3.8KW 2500RPM 15NM
180 Flange	180ST-M18015	WD50B290A	Rated 2.9KW 1500RPM 18NM
	*180ST-M19015	WD50B300A	Rated 3.0KW 1500RPM 19NM
	180ST-M21520	WD75B450A	Rated 4.5KW 2000RPM 21NM
	*180ST-M27010	WD50B290A	Rated 2.9KW 1000RPM 27NM
	180ST-M27015	WD75B430A	Rated 4.3KW 1500RPM 27NM
	*180ST-M35010	WD75B350A	Rated 3.5KW 1000RPM 35NM
	*180ST-M48010	WD50B500A	Rated 5.0KW 1000RPM 48NM
	*180ST-M35015	WD75B550A	Rated 5.5KW 1500RPM 35NM

Note: The items marked with‘*’ is the normal ones. They are in stock with certain amount generally.

1.3 Installation and Size

【Servo Motor】

The servo drive can install either in horizontal or in vertical direction.However, it will shorten the life the motor or cause unexpected incidents if install it wrong or in a improper position.

Installation Precautions of Servo Motor:

1）Storage Temperature

Please keep the servo motor with the scope of temperature from -20℃ to +60℃ when it is not power on.

2）Installation Site

The servo motor should install indoor to meet the environment conditions listed before.

No corrosive or combustible,explosive gases;

Good ventilation,less dust and dry;

Environment temperature 0~40°C;

Relative humidity:26%~80%RH,no dew.

It is good for inspection and cleaning.

3）Installation Concentricity

Please use coupling to connect the motor with the equipment, and keep the axis of the motor and the axis of the equipment in a straight line.If the deviation of concentric is large, it will cause vibration or over load, may damage the bearings.

When installing the motor, please not impact the motor shaft, or it will damage the encoder of the motor easily.

4）Installation Direction

The servo motor can be installed in either horizontal or vertical direction.

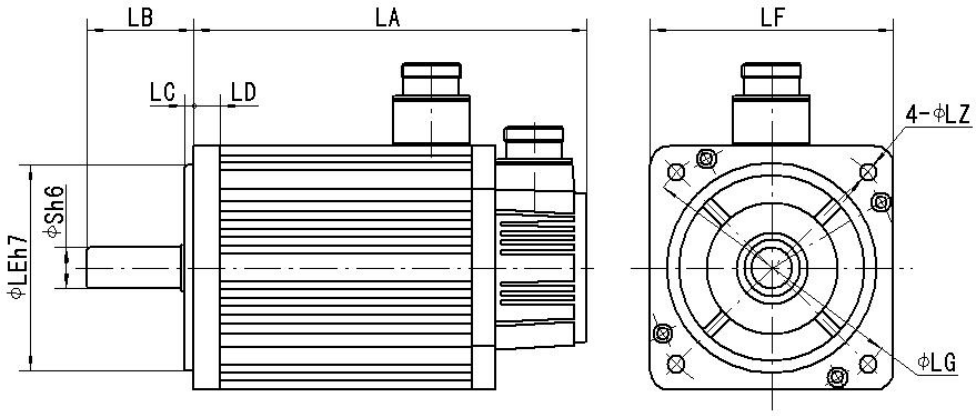
5）Drip Prevention

Please use the motor with seal for the place with water drops and oil drops.

6）Tensity of the Wire

Please don’t bend or strain the wire too much. It is because the core wire of signal is pretty thin with 0.2,0.3mm. Please don’t strength and draw it so tight when wiring.

1.4 Installation Size of Servo Motor



Motor No.		Power	LA	LB	LC	LD	LE	LF	LG	LZ	S
Low Inertia	60ST-M00630*	200W	112	30	3	7	50	60	70	5.5	14
	60ST-M01330	400W	137	30	3	7	50	60	70	5.5	14
	80ST-M02430	750W	150	35	3	8	70	80	90	4.5	19
	110ST-M04030	1.2KW	187	55	5	12	95	110	130	9	19
	110ST-M06020	1.2KW	217	55	5	12	95	110	130	9	19
Middle Inertia	90ST-M03520	750W	171	35	3	12	80	90	100	6.5	16
	130ST-M05025	1.3KW	173	57	5	14	110	130	145	9	22
	130ST-M06025	1.57KW	182	57	5	14	110	130	145	9	22
	130ST-M07725	2.0KW	196	57	5	14	110	130	145	9	22
	130ST-M10025	2.6KW	217	57	5	14	110	130	145	9	22
Big Inertia	130ST-M10010	1.0KW	217	57	5	14	110	130	145	9	22
	130ST-M10015	1.5KW	217	57	5	14	110	130	145	9	22
	130ST-M15015	2.3KW	260	57	5	14	110	130	145	9	22
	180ST-M19015	3.0KW	232	65	3.2	18	114.3	180	233	13.5	35
	180ST-M27010	2.9KW	262	65	3.2	18	114.3	180	233	13.5	35
	180ST-M27015	4.3KW	262	65	3.2	18	114.3	180	233	13.5	35
	180ST-M35010	3.5KW	292	65	3.2	18	114.3	180	233	13.5	35
	180ST-M48010	4.8KW	346	65	3.2	18	114.3	180	233	13.5	35
	180ST-M35015	5.5KW	292	65	3.2	18	114.3	180	233	13.5	35
	180ST-M48015	7.5KW	346	65	3.2	18	114.3	180	233	13.5	35

Note: The length will extend for the motor with brake.60 flange ,LA extends 48MM;80 f l a n g e ,54MM;110 flange,74MM;130 flange ,57MM;180,82MM.

1.5 Installation of Servo Drive

Installation Precautions

B Series servo drive is the servo drive based on the foot mounting. If installed improperly, it may cause fault.

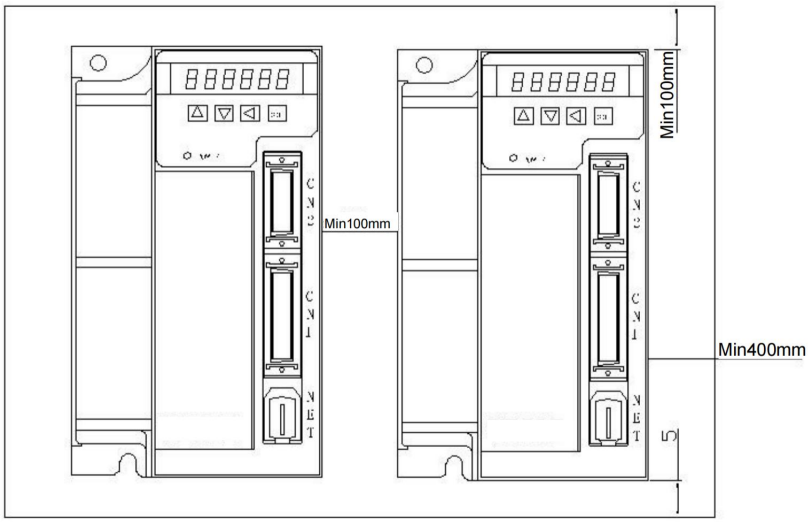
1）Storage Condition

Please keep the servo drive in the range of temperature from -20℃ to +85℃ when it is not operating.

2）Installation Site

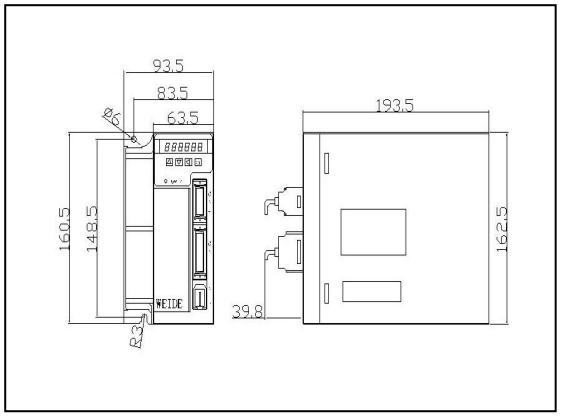
- Please make sure the surrounding temperature is below 55℃ with good ventilation when installed it in the electric cabinet.
- In order to prevent the vibration passed to the drive, please install anti-vibration tool under the drive.
- Please prevent the corrosive article(gas) flowing into the cabinet to damage the drive.
- Please avoid installing the drive in the place with high temperature,humidity,dust and iron power.

3）Installation Interval

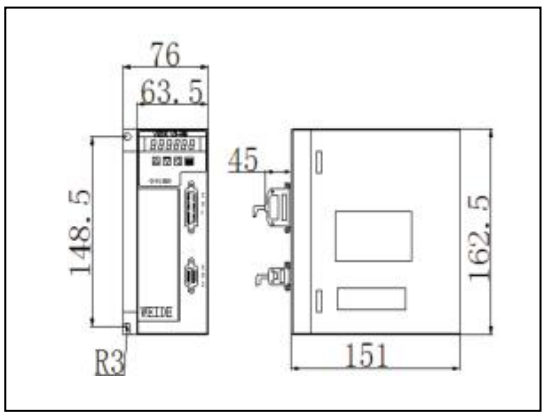


4） Installation Size of Servo Drive

20B、30B

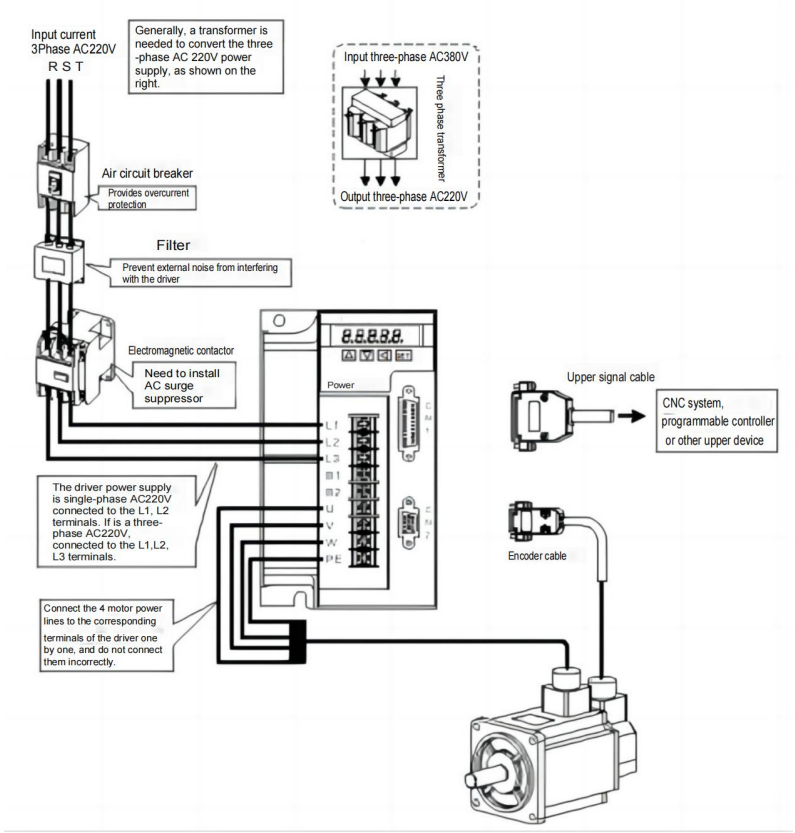


15B



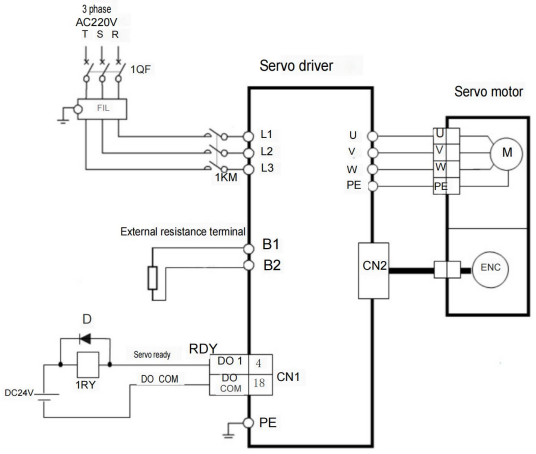
Chapter Two Wiring

2.1 Wiring Diagram of Servo Drive



2.2 Wiring Diagram of Motor and Power

The power of servo drive is three phase ac 220v. It generally is from three phase ac 380v with the transformer. Under some specific condition, the motor with power lower to 750w can connect with single phase 220v(single phase connected to L1,L2,leave L3 in vacant)



2.2.1 Wiring of Servo Motor

60、80、90 Serial Motor

Terminal Symbol	Terminal No.	Terminal Explanation
U	1	Motor U Phase Power Input
V	2	Motor V Phase Power Input
W	3	Motor W Phase Power Input
⊥	4	Ground Terminal of Motor Housing

Note: Power cable 0.5~1.0 square mm

110、130 Serial Motor

Terminal Symbol	Terminal No.	Terminal Explanation
U	2	Motor U Phase Power Input
V	3	Motor V Phase Power Input
W	4	Motor W Phase Power Input
⊥	1	Ground Terminal of Motor Housing

Note: Power cable 1.5~2.5 square mm

Brake

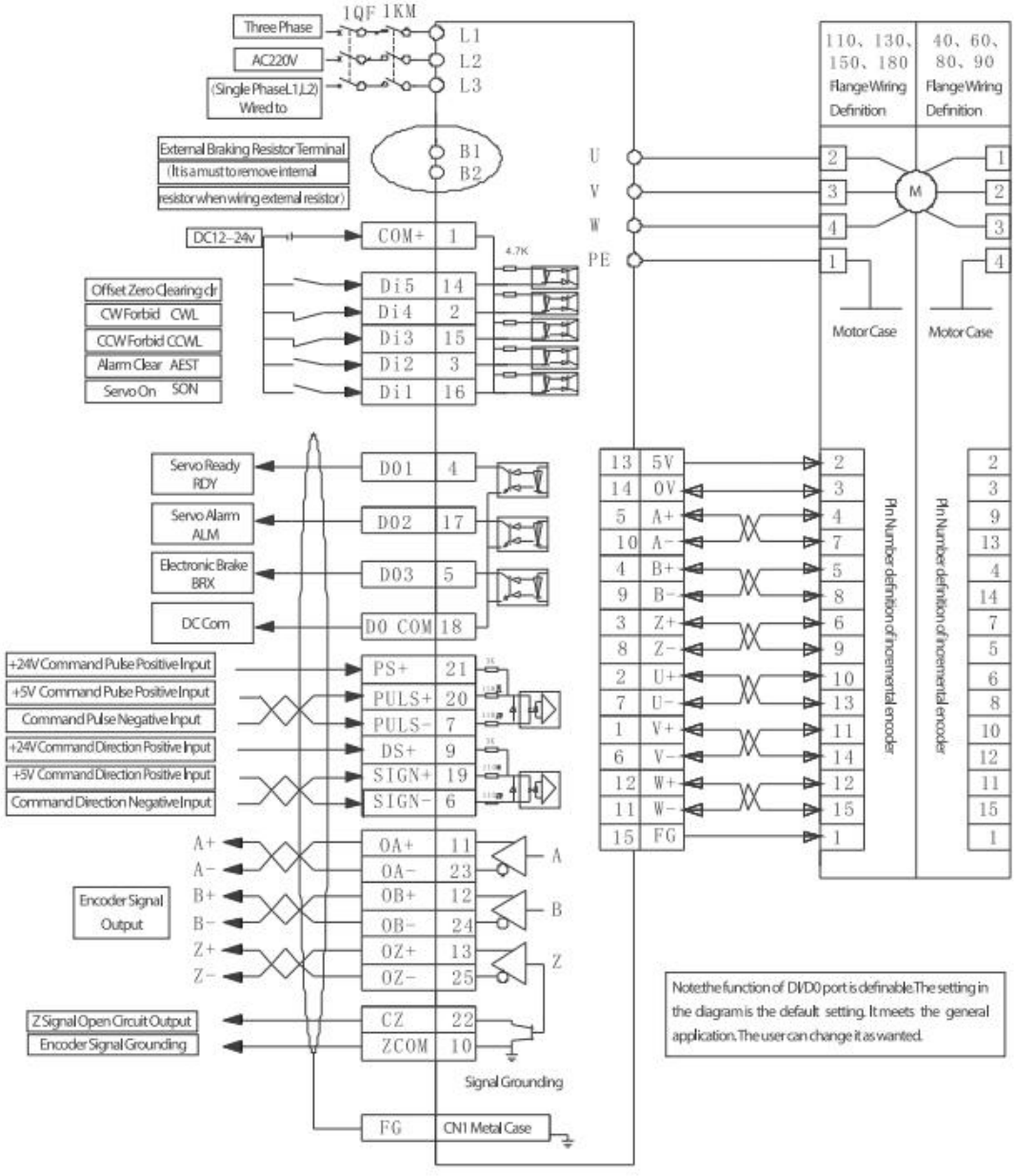
Terminal Symbol	Terminal No.	Terminal Explanation
DC+	1	Power of Braking
DC-	2	
⊥	3	Ground Terminal of Motor Housing

2.2.2 Terminal Explanation

Name	Terminal	Detailed Description
Power of Main Circuit	L1、L2、L3	Wiring External ac power three phase 220VAC -15%～+10% 50/60Hz
Terminals of External Resistor	B1、B2	Wiring External Resistor
Wiring Terminals of Motor	U	Output to U phase power of Motor
	V	Output to V phase power of Motor
	W	Output to W phase power of Motor
Ground Terminal	PE	Ground Terminal of Motor Housing

2.3 Typical Usage Wiring Diagram of Servo Drive

2.3.1 Wiring Diagram of Position Control



Note:The function of D1/Do port for CN1 is definable. It is default setting in the diagram. The user could revise it if needed

2.4 CN1 Terminal of Control Signal

The CN1 Signal terminal provides the signals needed to connect to upper controller. It is DB25 socket. The signals included the following items:

●5*programmable inputs;

●3*programmable outputs;

●Analog Command Input;

●Command Pulse Input;

●Encoder Signal Output.

2.2.1 CN1 Terminal Socket

2.2.2 CN1 Terminal Signal Explanation

Signal Name		Pin No.	Function	Port
Digital Input	Di1 Di2 Di3 Di4 Di5	16 3 15 2 14	Opto-electronic isolated input,the function is programmable,defined by Parameter P100~P104.	C1
	COM+	1	DI Power (DC12V～24V)	
Digital Output	DO1 DO2 DO3	4 17 5	Opto-electronic isolated output,the maximum output capacity is 50mA/25V, the function is programmable,defined by Parameter P130～P132.	C2
	DOCOM	18	DO Common Port	
Position Pulse Command	PS+ PULS+ PULS- DS+ SIGN+ SIGN-	21 20 7 9 19 6	High-speed Opto-electronic isolated input,set the working manner by Parameter P035: Pulse+Direction; CCW/CW Pulse; Orthogonal AB Pulse.	C3
Analog Command Input	AS+ AS-	21 8	Analog input of Speed/torque,range -10V～10V。 Please don’t connect it,because it cannot work.	C4
	AGND	9	Analog Signal Ground	
Encoder Signal Output	OA+ OA- OB+ OB- OZ+ OZ-	11 23 12 24 13 25	Fractional frequency of the encoder signal and output by differential drive(line driver)	C5

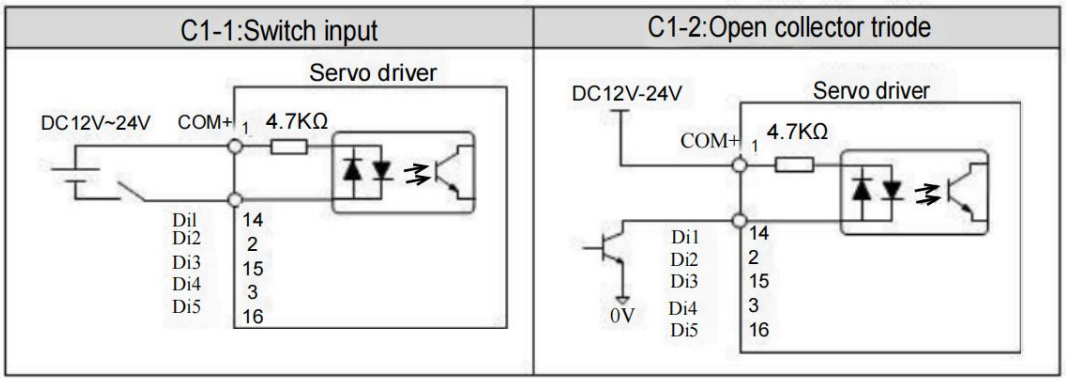
	CZ	22	Open-circuit Output of Z signal Collector electrode	C6
	GND	10	Encoder Signal Ground	
Ground Shielding Wire	Plug metal case		Shielding Wire connecting to Shielding cable	

2.5 Type of CN1 Terminal Interface

The interface circuits of CN1 and the wiring mode with the upper controller are introduced below.

2.5.1 Digital Input Interface(C1)

The circuit of digital input interface can be controlled by the switch,relay,collector electrode transistor, photoelectric coupler. And the relay should choose low-current relay,in avoiding of poor contact.The external voltage range is DC12V~24V.



2.5.2 Digital Output Interface(C2)

Output circuit utilized Darlington photoelectric coupler, it can connect with relay and photoelectric coupler.Precautions:

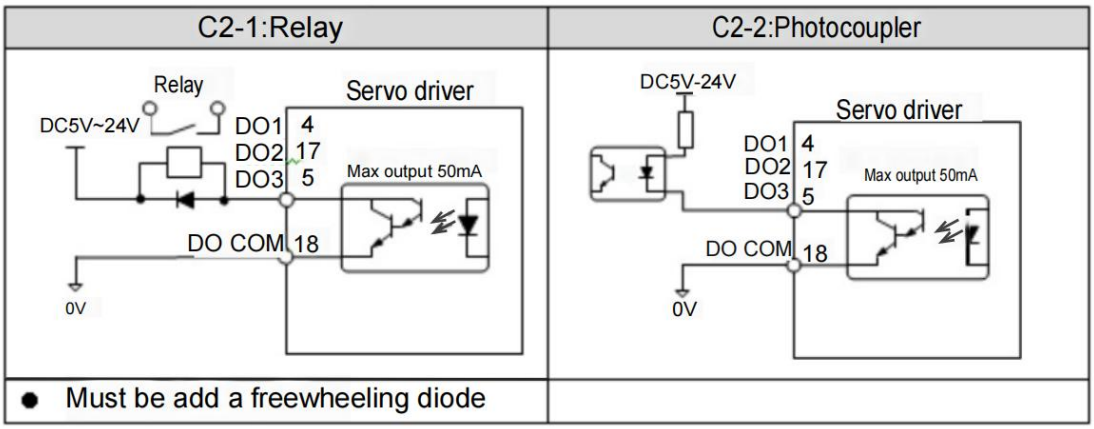
● The power is supplied by the user. If wiring it wrong, it will cause the damage of the drive.

● The maximum external power is 25V,output maximum current is 50mA, the total current of the three path is not over 100mA.

● When using relay and other inductive loads, please do parallel connection of the inductive load and an added diode. If wiring the diode wrong, it will cause damage of the drive.

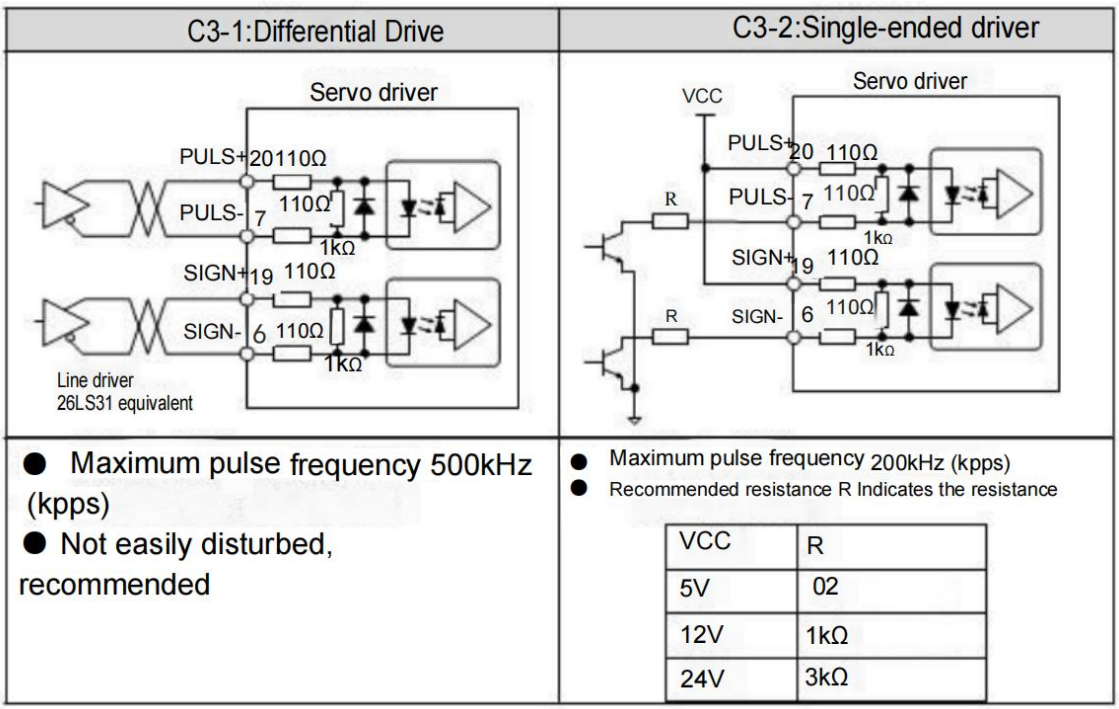
● There will be around 1 voltage loss when powering on, which it cannot

meet the requirement of TTL low electric level. Therefore it cannot wire direct with TTL circuit.



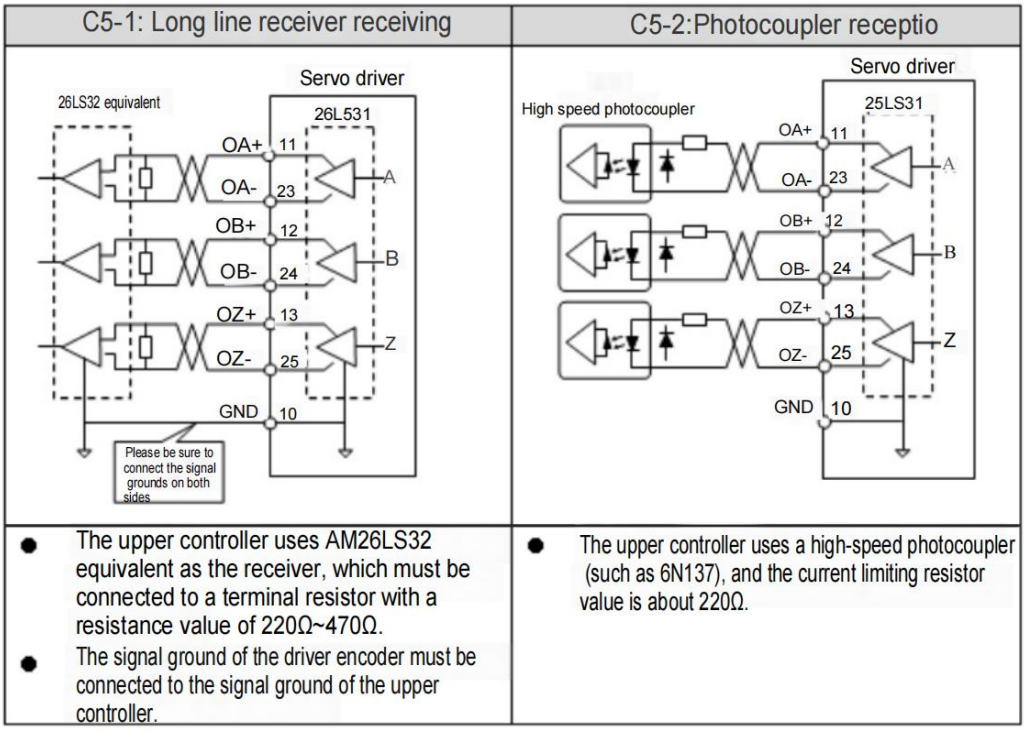
2.5.3 Position Pulse Command Interface (C3)

There are differential and single-ended drives wiring modes. It is advised to have differential one. The twisted-pair wires is advised to utilize. Drive current 8~15mA,The working mode set by parameter P035:pulse+direction,CCW/CW pulse, and orthogonal AB pulse.



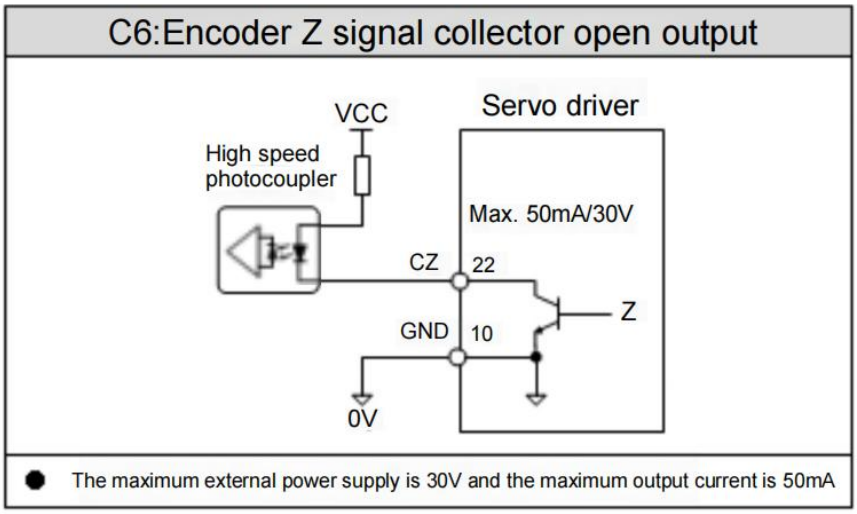
2.5.4 Encoder Signal Wire Drive Output(C5)

Fractional frequency of the encoder signal and output to the upper controller by Wire Driver



2.5.5 Encoder Z Signal Collecting Electrode Open Circuit Output(C6)

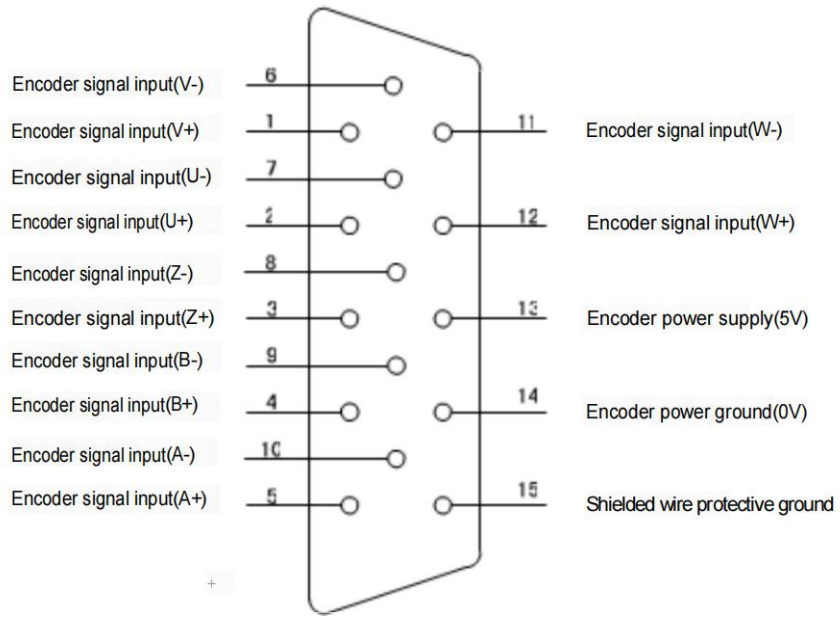
Z signal of encoder output to the upper controller by collector electrode open circuit. Please receive it with high-speed photoelectric coupler because the pulse width of Z signal is narrow.

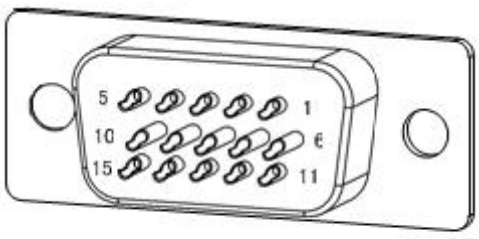


2.6 CN2 Encoder Signal Terminals

2.6.1 CN2 Terminal Plug

The signal terminal of CN2 encoder connects with the motor encoder with 3 row of DB15 sockets(VGA sockets). The outlook and the layout of pins is in the following:





CN2 plug solder pin distribution

2.6.2 CN2 Terminal Signal Explanation

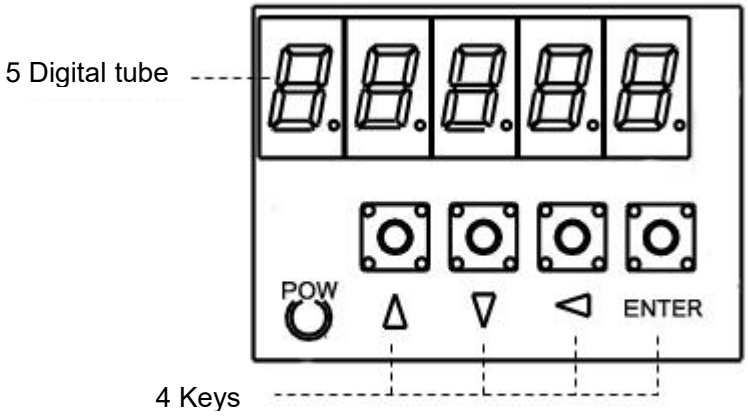
Signal name		Pin no.	Color of Signal wire Standard (16pins) [not 1]	Function
Power of Encoder	5V	13	Red	The encoder utilizes 5V power(supplied by the drive).In order to avoid to lower the voltage of the encoder when the cable is over 15m,the power and the ground cables can utilize multi-wire cables or thick cables.
	0V	14	Black	
Input of Encoder A phase	A+	5	Green	Wiring with A Phase output of the Encoder.
	A-	10	Yellow	
Input of Encoder B phase	B+	4	Pink	Wiring with B Phase output of the Encoder.
	B-	9	Light Blue	
Input of Encoder Z phase	Z+	3	Orange	Wiring with Z Phase output of the Encoder.
	Z-	8	Purple	
Input of Encoder U phase	U+	2	Blue	Wiring with U Phase output of the Encoder,Please don’t wire for wire-saving encoder.
	U-	7	Gray	
Input of Encoder V phase	V+	1	White	Wiring with V Phase output of the Encoder,Please don’t wire for wire-saving encoder.
	V-	6	Brown	
Input of Encoder W phase	W+	12	Yellow-black	Wiring with W Phase output of the Encoder,Please don’t wire for wire-saving encoder.
	W-	11	Red-black	
Ground Shielding Wire	FG	15	Shielding Ground	Wiring with shielding wire of signal cable.

Chapter Three Operation and Display

3.1 Explanation of Drive Panel

3.1.1 Consists of Panel

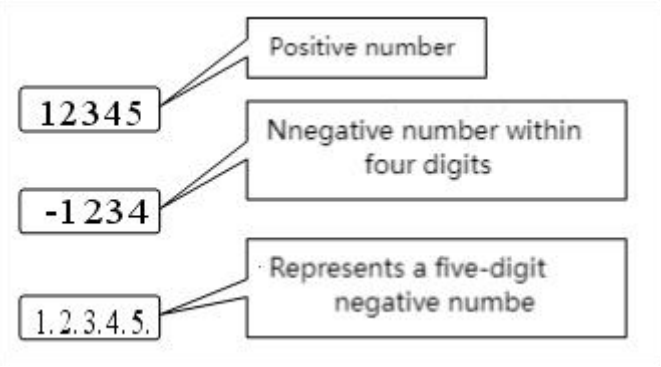
The panel is consist of 5 led nixie tube display and 4 keys. It can display all kinds of status of the system and set the parameter. The operation is divided with different layers from the main menu to the inner operation.



3.1.2 Panel Explanation

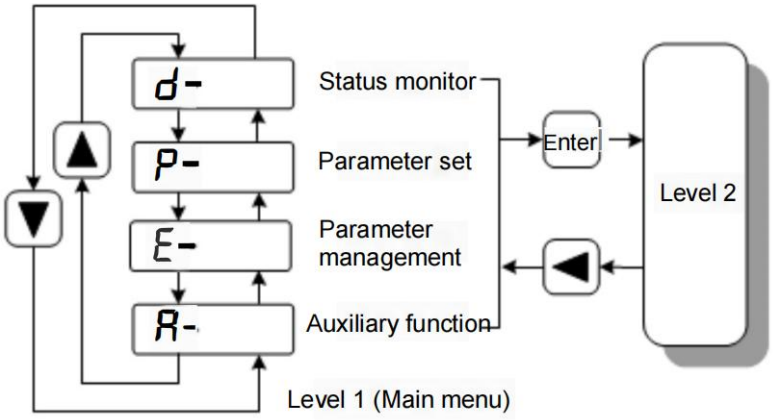
Symbol	Name	Function
POW	Main Power light	Light-up: Power on; Extinguish:Power off.
Δ	Increase	Increase the serial no. or value of number; long press will repeat.
∇	Decrease	Decrease the serial no. or value of number; long press will repeat.
◁	ESC	Exit the menu;cancel the operation.
Set	Confirm	Enter the menu;confirm the operation.

3.1.3 Numeric Display



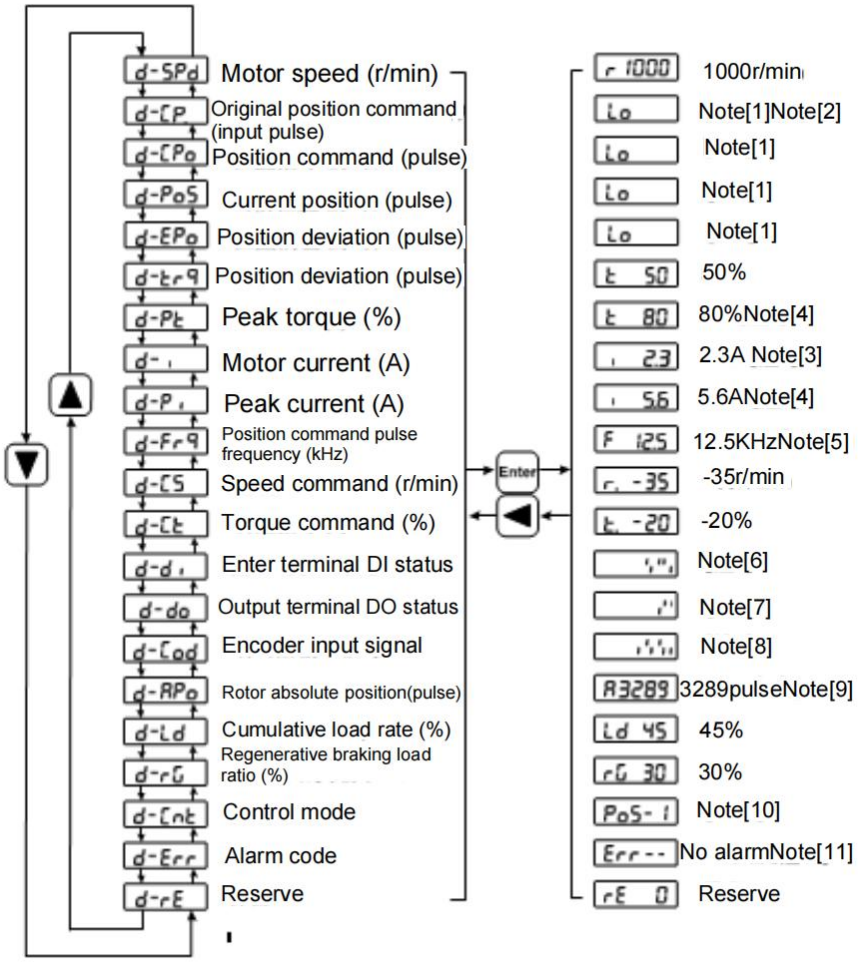
3.2 The First Layer

The first layer is the main menu. It has four operation. To change the item by pressing Δ and ∇ , to press SET into the second layer to do the operation. Press ◁ ,to exit the main menu from the second layer.



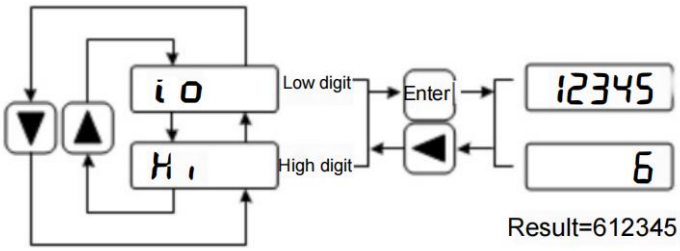
3.3 Status Monitor

Select “d-” in the main menu,Press SET enter into d- menu. There is a list of “d-” items. The user can select the one needed by pressing Δ and ∇ , and press SET, enter into the display status of the needed “d-” item.



1. Display of 32bit binary system numerical value[Note 1]

The 32bit binary number range is -2147483648～2147483647. It shows by combining high numbers and low numbers. Select the low number and high number from the menu and composed them with the formula of the following to have a complete number.



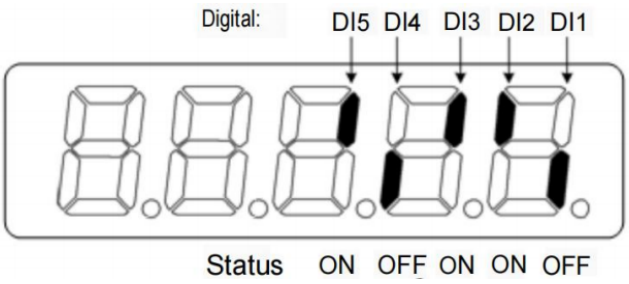
32 bits high digit = high digit value × 100000 + low digit value

2. Pulse Unit[Note 2]

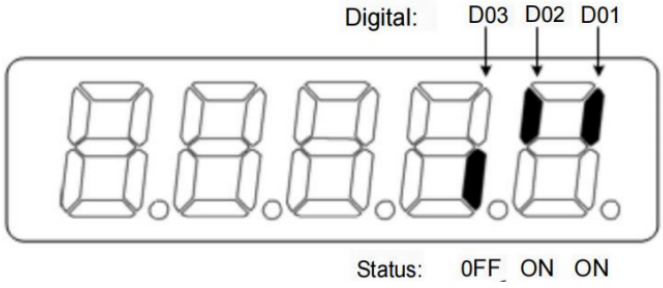
The pulse of original position command is the number of input pulses, which is not changed by the electronic gear.The pulse unit of other items is the pulse unit of encoder. Take 2500 wire encoder for an example.

Pulse unit of encoder= resolution ratio of encoder
= 4 x wire numbers of encoder
= 4 x 2500(pulse / rev)
=10000(pulse / rev)

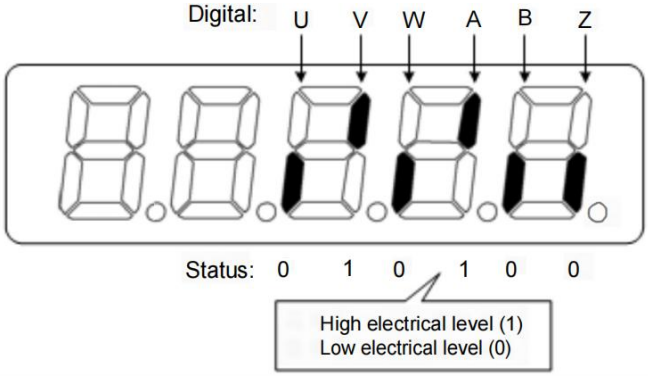
3. Input Terminal DI[Note 6]



4. Output Terminal DO[Note 7]



5. Encoder Input Signal[Note 8]



6. Alarm Code[Note 11]

Err-- No alarm

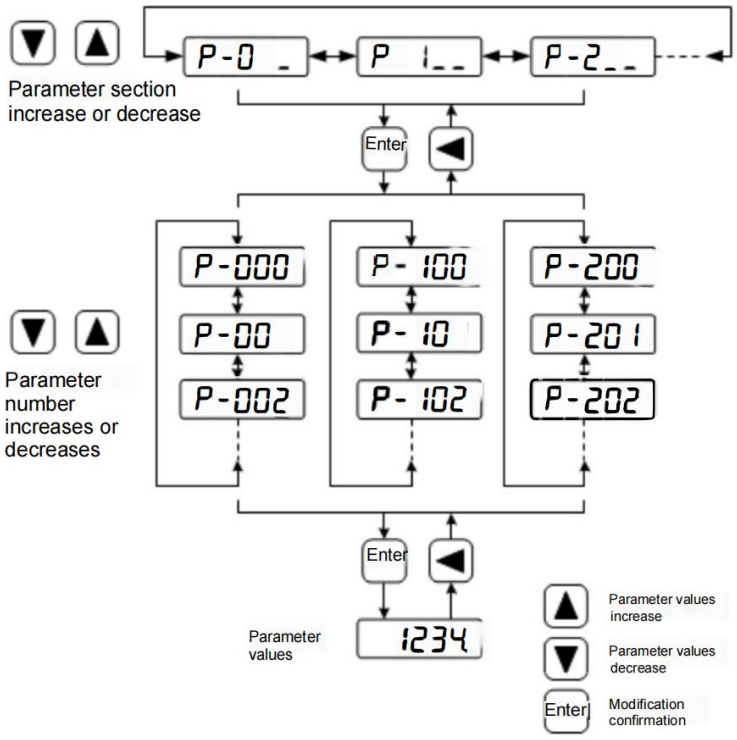
Err 9 Flicker No.9 alarm

3.4 Parameter Setting

The parameter is showed by parameter segment+parameter number.The hundreds' digit is segment, and tens digit and units digit is parameter number. For example, parameter P102, the segment is"1", the number "02".It will display as "P-102".

Select "P-"in the main menu and press SET enter into parameter setting. First, select the parameter segment by pressing Δ and ∇ , and press SET enter the selected segment. And then by pressing Δ and ∇ ,press SET to display the parameter value.

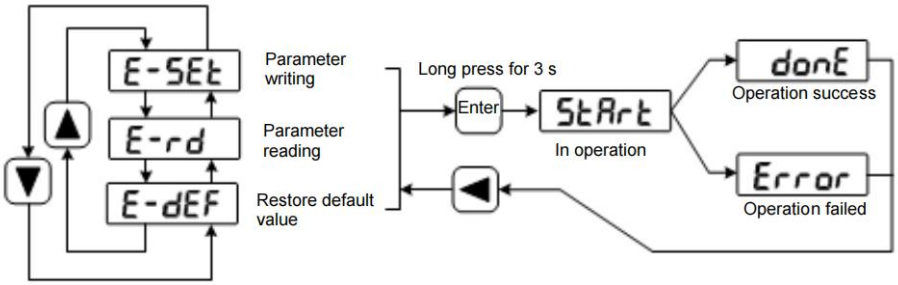
The modified parameter is not stored to EEPROM. If you want store it permanently,please apply with the E-SEt operation in the parameter management.



3.5 Parameter Management

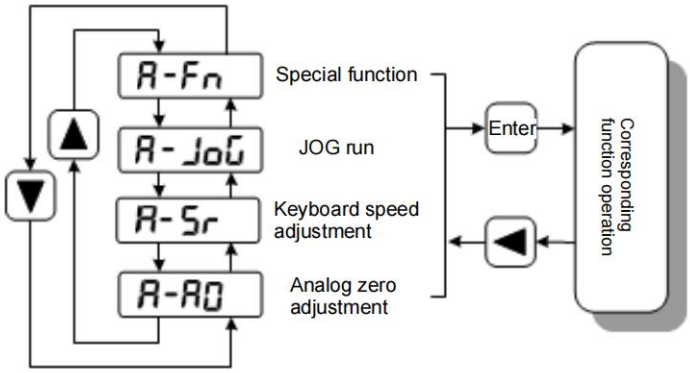
Parameter management deals with the operation of parameter table and EEPROM. Select “E-” in the menu and press SET enter into parameter management mode.

There are three operation modes.They can be selected by pressing Δ and ∇. After select the item wanted,press SET and keep pressing over 3seconds to activate the operation. After that, press ◁ to exit to operation mode selection menu.



3.6 Auxiliary Function

Select “A-” in the main menu,press SET enter into auxiliary function. Select operation mode by pressing Δ and ∇ and press SET enter into the specific item. And press ◁ to exit to the operation mode selection.



Chapter Four Parameter

4.1 Test Run with No Load

The purpose of test run is to check whether the following requirements are right or wrong.

1.Wiring of the Drive power

2.Wiring of Servo Motor

3.Wiring of Encoder

4.Rotating direction and speed of Servo Motor

4.1.1 Please make sure the following things before power on

1.Please make no load on the shaft of the motor. Disconnect the motor installed on the machine from the connector.

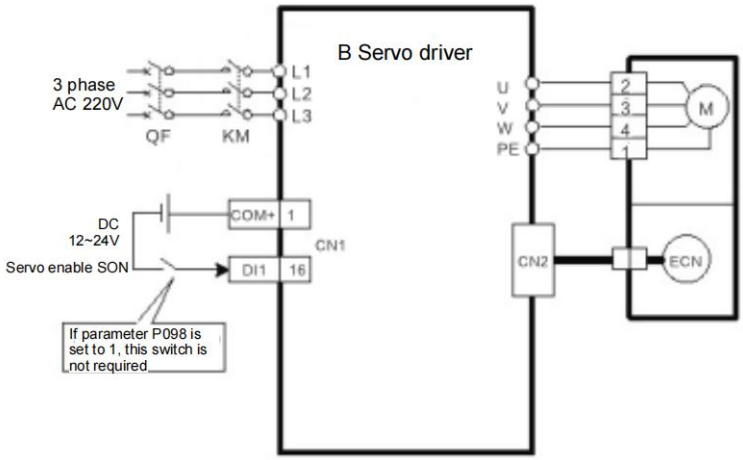
2.Please fixed the motor because there is impact when it do acceleration or deceleration.

Wiring the motor as the diagram below, and check the following items before powering on:

1.Are the wiring with the terminals correct or not? Especially are the wiring of L1,L2,L3 and the wiring of U,V,W with the correspondent terminals of the motor or not?

2.Is the input voltage right or wrong?

3.Is the wiring of encoder cable right or not?



4.1.2 JOG TEST RUN

1. Power on

When switch on, the digital display tube and the POWER indicator light light up. If there is an alarm, please check the wiring.

2. Parameter Setting

Set the Parameter according to the following table

Parameter	Name	Setting Value	Default Value	Parameter Explanation
P004	Control Mode	1	0	Set as test run Control
P025	Source of Speed Command	3	3	Set as JOG source
P060	Accelerating of Speed Command	appropriate	0	Reduce the impact of accelerating
P061	Decelerating of speed command	appropriate	0	Reduce the impact of accelerating
P076	JOG operating	100	100	JOG speed

	speed			
P097	Neglect the forbid of the drive	3	3	Neglect the CCWL and the CWL drive forbid
P098	Forcing enabled	1 or 0	0	Forcing enable. If needs external enable, the set value is 0. If not, the value is 1.
P100	Digital input DI1 function	1	1	DI1 set as Servo is on (SON)

3.Operation

After making sure there is no alarm or any abnormal conditions, the servo is ON(SON).The motor is excited. The shaft of the motor is locked and can not rotate in a zero speed status.

Select “A-JOG” in Auxiliary Function and press SET enter into JOG operation mode. The unit is r/min. The speed command is provided by the keys. Press ▲ and keeping for a moment, the motor will do CCW operation with JOG speed, loosen the key, the motor stops rotation and keep at zero speed.Press ▼ and keeping for a moment, the motor will do CW operation with JOG speed, loosen the key, the motor stops rotation and keep at zero speed.The JOG speed is set by P076.

4.1.3Test run of keyboard speed adjusting

1. Power On

When switch on, the digital display tube and the POWER indicator light light up. If there is an alarm, please check the wiring.

2.Parameter Setting

Set the parameter according to the following table:

Parameter	Name	Set Value	Default Value	Parameter Description
P004	Control Mode	1	0	Set as test run control
P025	Source of Speed command	4	3	Set as keyboard
P097	Neglect the forbid of the drive	3	3	Neglect the CCWL and the CWL drive forbid
P098	Forcing enabled	1 or 0	0	Forcing enable. If needs external enable, the set value is 0. If not, the value is 1.

P100	Digital input DI1 function	1	1	DI1 set as Servo is on (SON)

3.Operation

After making sure there is no alarm or any abnormal conditions, the servo is ON(SON).The motor is excited. The shaft of the motor is locked and can not rotate in a zero speed status.

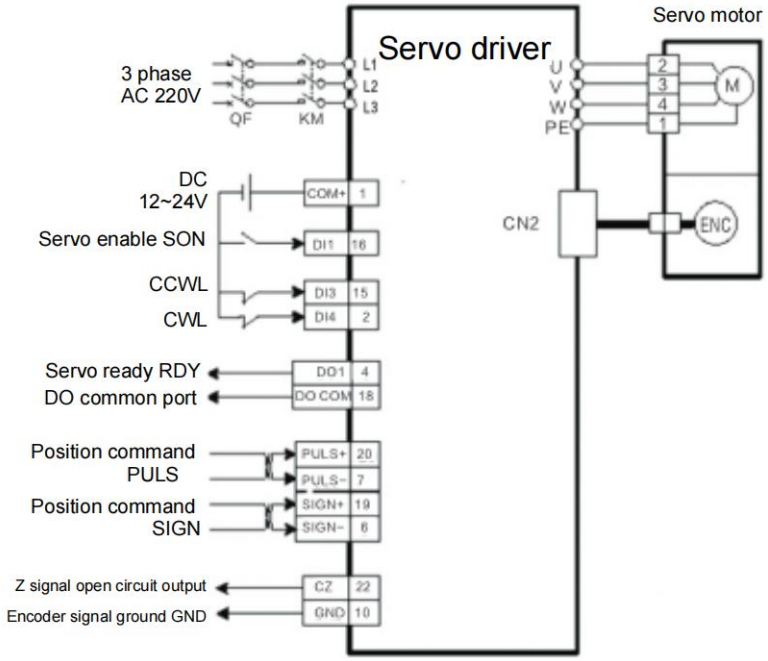
Select “A-Sr”in Auxiliary Function and press SET enter into keyboard speed adjusting mode. The unit is r/min. The command of speed is provided by the keyboard. Press ▲▼ to change the speed command, the motor will rotate with the given speed. The positive number means CCW direction rotation, negative number CW rotation. The minimum given speed is 0.1r/min.

4.2 Position Control

The position control is applied to the system needing precision positioning,such as numerical control machine tool,textile machinery. The source of position command is pulse command. The pulse is input by input terminals of PULS+,PULS-, and SIGN+,SIGN-.

4.2.1 A simple example of position control

It is a simple example of position control. The following the wiring diagram.



Parameter setting of the example:

Parameter	Name	Setting Value	Default Value	Parameter Description
P004	Control Mode	0	0	Set as position control
P097	Neglect the forbid of the drive	0	3	Utilize the drive forbid of CCWL and CWL. If the setting is neglect,no need to wiring CCWL and CWL.
P100	Digital input DI1 function	1	1	DI1 set as Servo is on (SON)
P130	Digital input DI1 function	2	2	DO1 Set as the servo is Ready (RDY)

4.2.2 Position Command

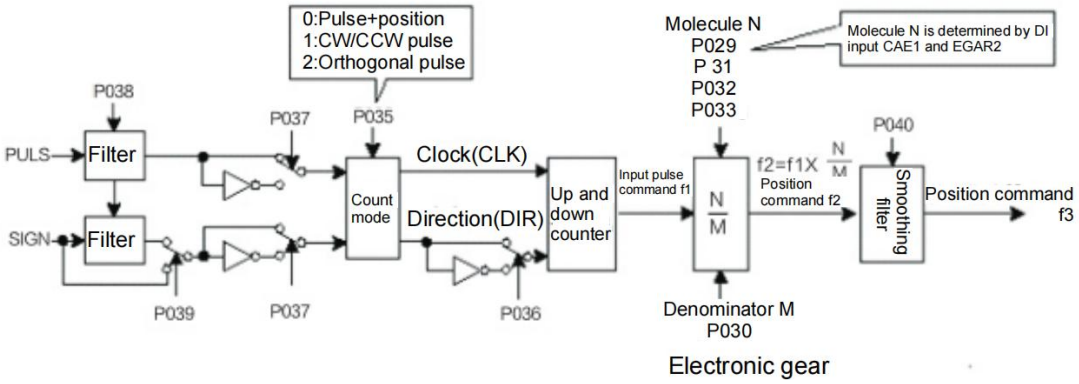
1.Parameter relevant to position command

Parameter	Name	Parameter Range	Default value	Unit	Applicable
P029	The first numerator of the electronic gear of the command pulse	1~32767	1		P
P030	The denominator of the electronic gear of the command pulse	1~32767	1		P
P031	The second numerator of the electronic gear of the command pulse	1~32767	1		P
P032	The third numerator of the electronic gear of the command	1~32767	1		P

	pulse				
P033	The fourth numerator of the electronic gear of the command pulse	1~32767	1		P
P035	Input mode of command pulse	0~2	0		P
P036	Input direction of command pulse	0~1	0		P
P037	Input Signal Logic of Command Pulse	0~3	0		P
P038	Input Signal Filtering of Command Pulse	0~21	7		P
P039	Input Filtering mode of Command Pulse	0~2	0		P
P040	Smoothing Filtering Time of	0~1000	0	ms	P

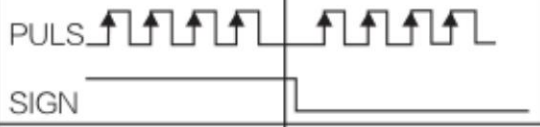
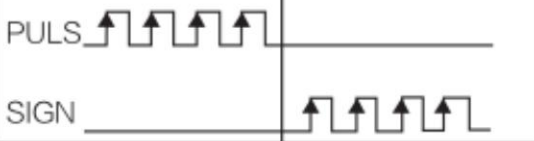
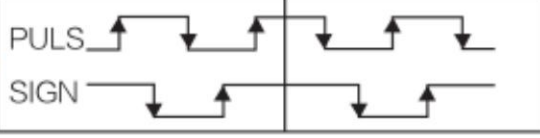
	position command index				

2.Transmission Path of Command Pulse



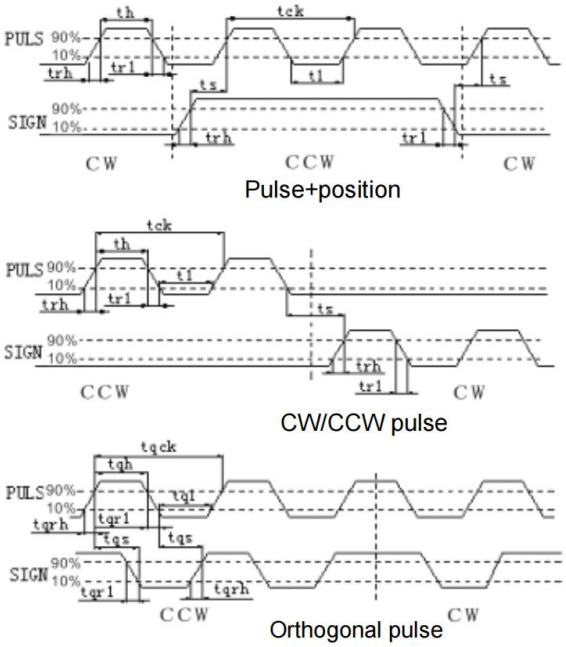
3.Input Mode of Command Pulse

Input mode decided by P035. The count edge can be adjust by parameter P037 set the phase of input signal of PULS and SIGN.Parameter applied to change the count direction.

Pulse command form	Forward rotation(CCW)	Reverse rotation(CW)	Parameter P035
Pulse+position			0
CW/CCW pulse			1
Orthogonal pulse			2

Note:the arrow stands for the count edge when P036=0 and P037=0.

4.Time sequence standard of pulse command

Position command pulse form	Position command pulse form	
	Difference	Single-ended
	t_{ck}>2us t_h>1us t_l>1us t_{rh}<0.2us t_{rl}<0.2us t_s>1us t_{qck}>8us t_{qh}>4us t_{ql}>4us t_{qrh}>0.2us t_{qrl}>0.2us t_{qs}>1us	t_{ck}>5us t_h>>2.5us t_l>>2.5us t_{rh}<0.3us t_{rl}<0.3us t_s>2.5us t_{qck}>10us t_{qh}>5us t_{ql}>5us t_{qrh}<0.3us t_{qrl}<0.3us t_{qs}>2.5us

5.Signal Filtering

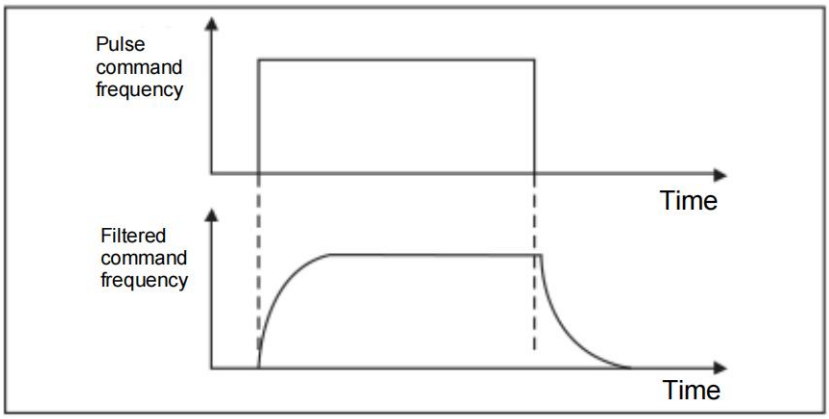
Parameter P038 set the digital filtering of input signal PULS and SIGN. The bigger the value is, the bigger the filtering time constant.The maximum pulse input frequency is 500kHz(kpps)with default value. The bigger the value is, the maximum pulse input frequency will lower accordingly

It is used to filter the noise of the signal wire in avoid of the error count.If there is inaccurate because of mistake count, the user can increase the value. Parameter P039 can close SIGN signal filtering.

6.Smoothing Filtering

See the following fig.. Parameter P040 is the smoothing filtering to the command pulse. It has deceleration and acceleration of index form. It

will not lose the input pulse in the filter but there is a delay of the command.The set value is 0, the filter has no function. The parameter value shows the time from 0 to 63.2% of position command frequency.



The filter makes the input pulse frequency smoothly. This filter applied to the condition when the upper controller has no accelerating and decelerating function ,higher electronic gear ratio and lower command frequency.

4.2.3 Input electronic gear

Through electronic gear can define the distance the transmission device moved with the unit of pulse command, pulse command generated by upper controller with no considering the gear ratio,reduction ratio and wire numbers of motor encoder.The variate description of electronic gear is in the following table.

Variate	Variate Description	Value in the drive
C	Wire numbers of encoder	2500
Pt	Resolution Ratio of Encoder	=4xC

	（pulse/rev）	=4x2500 10000（pulse/rev）
R	reduction ratio	R=B/A,in which A:Rotating circles of the Motor; B:Rotating circles of load shaft.
△P	Amount of Movement with a command pulse	
Pc	Command Pulse Numbers with One circle of load shaft	
Pitch	Pitch of Ball screw（mm）	
D	Diameter of Roller（mm）	

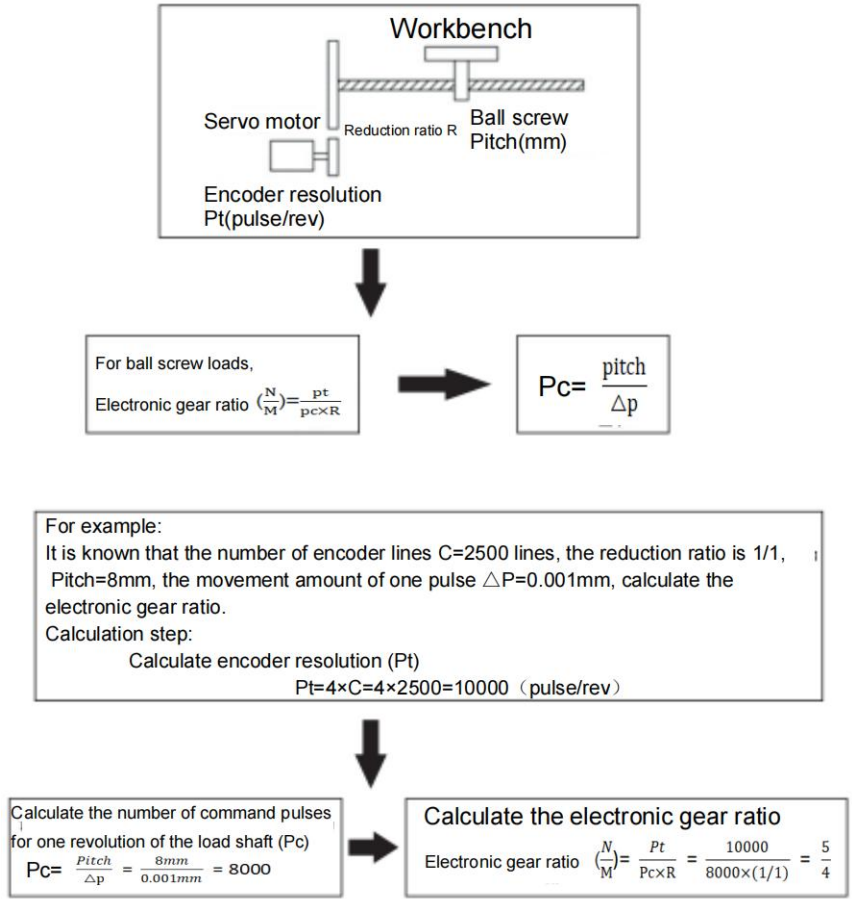
Calculation formula:

$$\text{Electronic gear ratio}\left(\frac{N}{M}\right)=\frac{\text{Encoder one revolution resolution（Pt）}}{\text{Number of command pulses for one revolution of the load shaft（Pc）}\times\text{Reduction ratio（R）}}$$

$$\text{Number of command pulses for one revolution of the load shaft}=\frac{\text{The vaule of movement of the load shaft one revolution}}{\text{One command pulse movement amount（}\triangle\text{P）}}$$

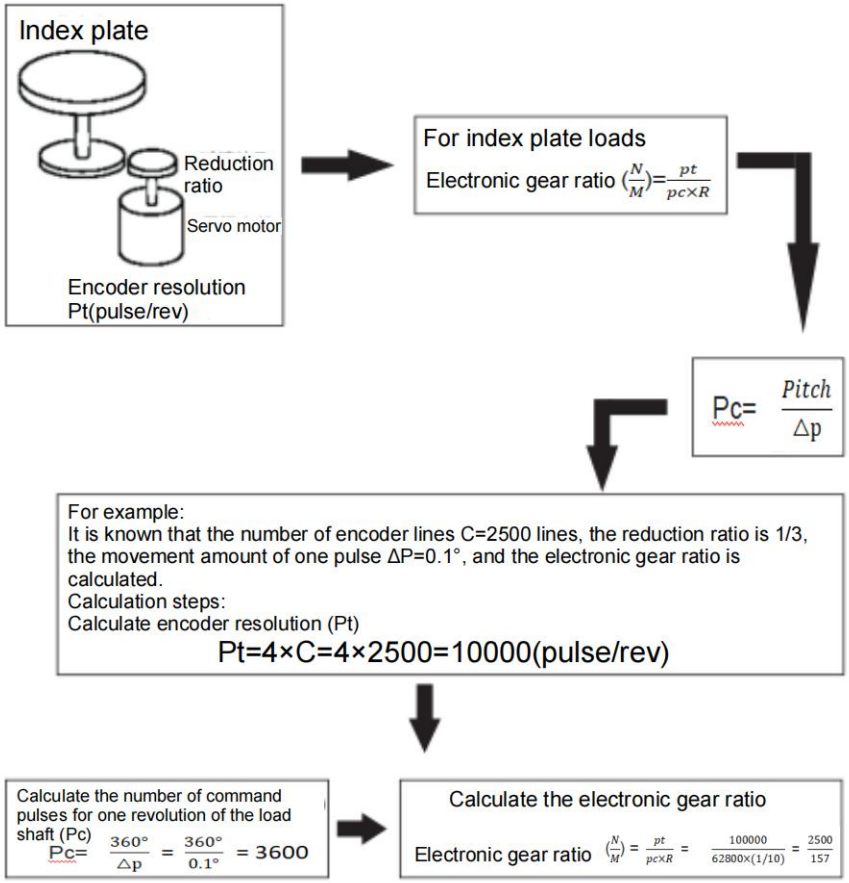
Reduce fraction of the above result and make the value of the numerator and the denominator to less than or equal to the integral value of 32767. And make sure the ratio is in the range of 1/50<N/M<200 and write into the parameter.

1.Application of electronic gear in ball screw system



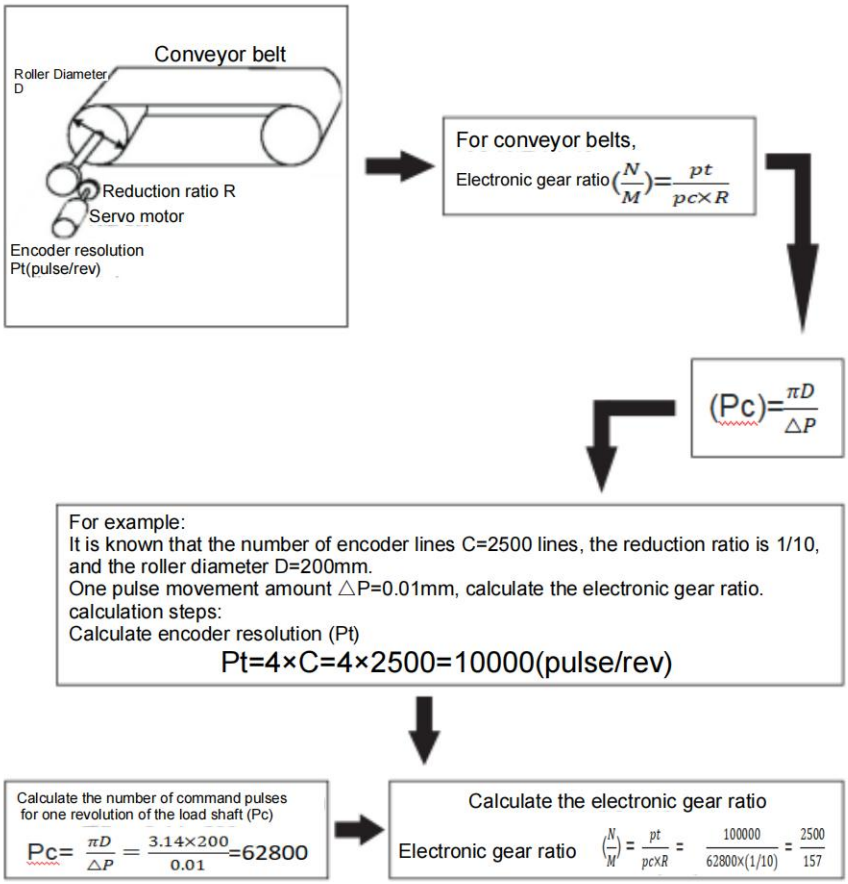
Set parameter(take the first numerator as an example) Numerator N=5, Denominator M=4, then Set P029=5 and P030=4.

2.Application of Electronic Gear in Dividing Plate



Set parameter(take the first numerator as an example) Numerator N=25, Denominator M=3, then Set P029=25 and P030=3.

3.Application of Electronic Gear in Conveyor Belt



Set parameter(take the first numerator as an example) Numerator N=2500, Denominator M=157, then Set P029=2500 and P030=157.

4.The relation of Rotating cycles of the motor and Electronic Gear Ratio

The relation of Rotating cycles of the motor and Electronic Gear Ratio:

Rotating cycles of the motor=pulsexN/(ptxM)

In which,pulse is the number of input pulse.For example,the wire of encoder C=2500 wires,N=20,M=3,pulse=1000,then the result is

Rotating cycles of the motor=1000x20/(10000x3)=2/3 cycles

5.The relation of Rotating Speed of the motor and Electronic Gear Ratio

The relation of Rotating Speed of the motor and Electronic Gear Ratio:

Speed of the motor（r/min）=f(Hz)x60xN/(PtxM)

In which,f is input pulse frequency.The unit is Hz（pps）.

For example,the wire of encoder C=2500 wires,N=3,M=1,f=100kHz（kpps）,then the result is

Speed of the motor（r/min）=100 x 10^3 x 60 x 3/(10000 x 1)=1800(r/min)

6.Switch of Electronic Gear Ratio

The drive provides 4 sets of numerator of the electronic gear (N), which can be changed online. It is definable by the GEAR1 and GEAR2 input of DI. The denominator(M)is the same.

DI Signal[Note]		The input numerator of electronic gear (N)	The input denominator of electronic gear (M)
GEAR2	GEAR1		
0	0	The first numerator(Parameter P029)	Denominator (parameter P030)
0	1	The second numerator(Parameter P031)	
1	0	The third numerator(Parameter P032)	
1	1	The fourth numerator(Parameter P033)	

Note:0 means OFF,1 means ON.

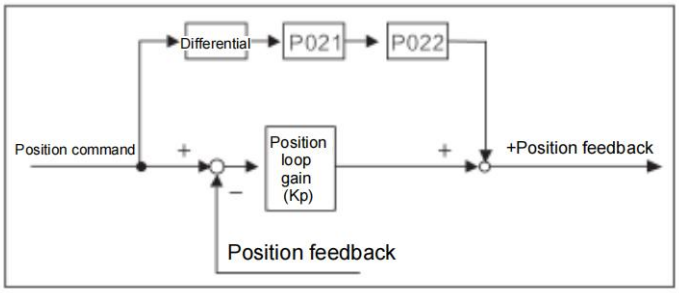
4.2.4 Relevant Gains of Position Control

Parameter	Name	Range of Parameter	Default value	Unit	Applicable
P009	Gain of position loop	1~1000	40	1/s	P
P021	Feed-forward Gain of Position loop	0~100	0	%	P
P022	Feed-forward Filtering Time Constant of Position Loop	0.20~50.00	1.00	ms	P

The position loop includes position loop. First set rotational inertia ratio with load and then adjust speed loop gain,speed loop integral time constant,and adjust gain of position loop at last according to the sequence of inner loop first and outer loop next.

The following is the position controller of the system. The bandwidth of position loop can increase with the advance of the gain of position loop(Kp).However, it is limited by the bandwidth of speed loop.

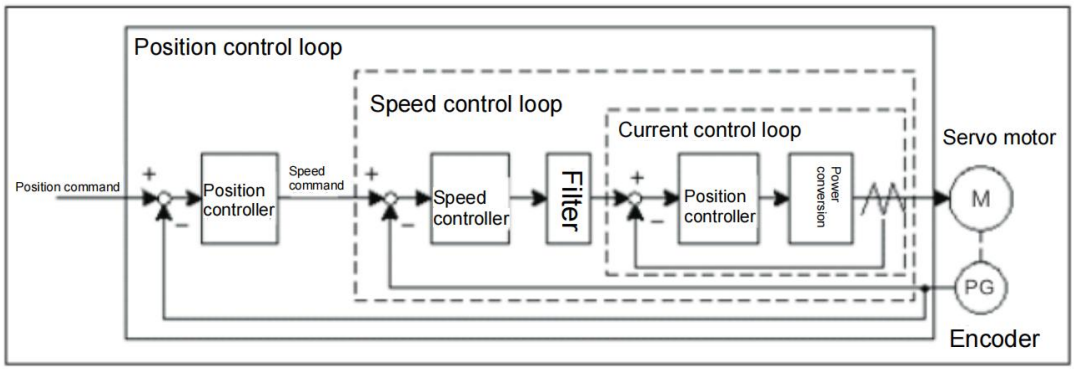
It is a must to increase the bandwidth of speed loop and then advance the gain of the position loop.



Feed-forward can reduce the phase delay of the position loop control ,lessen the position tracking error under position control and shorten the positioning time.With the increase of the feed-forward value, the error of the position control tracking is decreased. However, if the feed-forward value is too large, the system will be unstable and overshooting. If the electronic gear ratio is over 10, it can have noise easily.With general application, the P021 can set as 0%, the value can increase properly when needing the system to be high response and low tracking error, however the value is inadvisable to be over 80%.When increasing the value, it may be needed to adjust feed-forward filtering time constant of position loop(Parameter P022).

4.3 Gain Adjustment

The drive includes current,speed,and potion control loops.The control block diagram is in the following.



Theoretically, the bandwidth of the inner control loop should higher than the outer one, or the whole control system will be unstable to cause vibration or poor response. Then the relation the three loops is in the following：

Bandwidth of Current loop>Bandwidth of Speed loop>Bandwidth of Position loop

The user only need to adjust the parameter of speed control loop and position control loop, because the current control loop has already adjusted by the drive to the best status.

4.3.1 Gain Parameter

The parameter relevant to the Gain

Parameter	Name	Parameter Range	Default Value	Unit	Applicable
P005	Gain of Speed Loop	1~3000	40	Hz	P,S
P006	Integral Time	1.0~1000.0	20.0	Ms	P,S

	Constant of Speed Loop				
P009	Gain of Position Loop	1~1000	40	1/s	P
P017	Rotational Inertia Ratio with Load	0.0~200.0	1.5	times	P,S

The definition of the symbols is in the following.

Kv:Gain of Speed Loop;

Ti:Integral Time Constant of Speed Loop;

Kp:Gain of Position Loop;

G:Rotational inertia ratio with load（P017）

JL:Rotational inertia with load converted to the shaft of the motor;

JM:Rotational inertia of motor rotor

1.Gain of Speed Loop (Kv)

Gain of Speed Loop(Kv) defines directly the response bandwidth of the speed loop. When there is no vibration or noise in the system, the bigger the value of the gain of speed, the faster the speed response and the better the tracking to speed command.However, it will cause mechanical resonance if the value is too big.The calculation method of the bandwidth of speed loop is

Bandwidth of Speed Loop（Hz）=[(1+G)/(1+JI/JM)]xKv

If the setting of rotational inertia ratio with load (G)(G=JL/JM) is correct,then the bandwidth of speed loop is equal to the gain of speed loop(Kv).

2.Integral Time Constant of Speed Loop (Ti)

Integral of Speed Loop can eliminate steady-state error of speed effectively, fast reacting the wispy change of the speed.When there is no vibration or noise in the system, to reduce the integral time constant of the speed loop(Ti) can increase the stiffness of the system and reduce the steady-state error.If the inertia ratio with load is big or there is resonance in the system, it is a must to make sure the integral time constant of speed loop is big. Or the system can have resonance easily.If the setting of rotational inertia with load (G)(G=JL/JM) is right, the integral time constant can get with the following formula:

$$Ti(ms) \geqq 4000/[2\pi \times kv(Hz)]$$

3.Gain of Position Loop (Kp)

Gain of position loop defines directly the response speed of position loop.When there is no vibration or noise, to increase the value of position loop is to fasten the response speed, to decrease the error of position tracking ,and to shorten the positioning time.However, if the setting is big, there will be a vibration of the system or position overshooting.The bandwidth of position loop should not be higher than bandwidth of position loop. Generally,

Bandwidth of Position Loop（Hz）≤ Bandwidth of Speed Loop（Hz）/4

If the setting of rotational inertia with load (G)(G=JL/JM) is right, the Gain of Position Loop(Kp) can get with the following formula:

Kp（1/s）≤ 2π x [kv(Hz)/4]

4.3.2 Adjusting Steps of Gain

The bandwidth of position and speed decided by the stiffness of the machine and the application occasion.The stiffness of the convey machine connected by belt is low, then the bandwidth can set in a low value; The stiffness of the ball screw rotated by gearbox is medium, the bandwidth in a medium value;The stiffness of direct drive ball screw or linear motor is high, the bandwidth in a high value. If the characteristics of the machine is unknown, it can increase the gain to increase the bandwidth till resonance, and then adjust low the gain.

In the gain of servo, if one parameter has changed, the other parameters needed to readjust also.Please don’t make big changes of one parameter only.General principle to change the parameter is in the following.

Increase response	Reduce response, eliminate vibration and overshooting
1.Increase Gain of Speed Loop (Kv)	1.Reduce Gain of Position Loop (Kp)
2.Reduce Integral Time Constant of	2.Increase Integral Time Constant

Speed Loop (Ti)	of Speed Loop (Ti)
3.Increase Gain of Position Loop (Kp)	3.Reduce Gain of Speed Loop (Kv)

Adjust Steps of the Gain of Speed Control

1.Set Rotational Inertia Ratio with Load.

2. Set a larger value of Integral Time Constant of Speed Loop.

3. Adjust larger of the gain of Speed Loop when there is no vibration or noise;Adjust a little lower if there is vibration.

4.Adjust lower of Integral Time Constant when there is no vibration;adjust a little larger if there is vibration.

5. If it cannot adjust larger of the gain because of resonance of the machine system and cannot have the desirable response, it can adjust Torque Filtering Time Constant(P007), and then repeat the above steps to increase the response.

Adjust Steps of the Gain of Position Control

1.Set Rotational Inertia Ratio with Load.

2. Set a larger value of Integral Time Constant of Speed Loop.

3. Adjust larger of the gain of Speed Loop when there is no vibration or noise;Adjust a little lower if there is vibration.

4.Adjust lower of Integral Time Constant when there is no vibration;adjust a little larger if there is vibration.

5.Increase the Gain of Position Loop, adjust a little lower if there is

vibration.

6. If it cannot adjust larger of the gain because of resonance of the machine system and cannot have the desirable response, it can adjust Torque Filtering Time Constant(P007), and then repeat the above steps to increase the response.

7.If want to have shorter positioning time and less error of position tracking, it can adjust the position feed-forward properly, please refer to chapter 4.2.4.

4.4 Restraining of Resonance

When there is resonance in the system,the proper reason is the higher stiffness of the servo system and fast response speed.The situation can improve by lower the gain. The drive provides low pass filter to restrain resonance with no change of the gain.The parameters relevant to restraining of resonance is in the following.

Parameter	Name	Parameter Range	Default Value	Unit	Applicable
P007	Torque Filtering Time Constant	0.10~50.00	2.50	ms	ALL

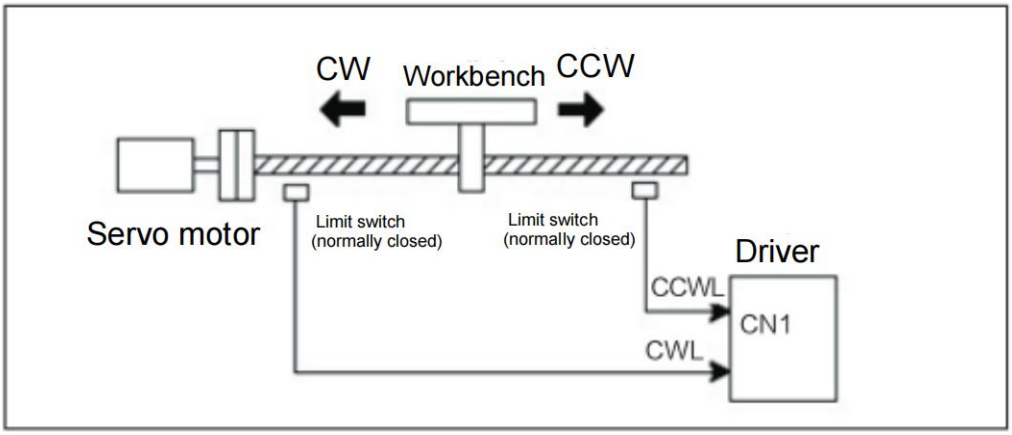
It sets by parameter P007. The low pass filter is default to be valid. Low pass filter has good attenuation to high frequency. It can restrain high frequency resonance and noise well. For example, for the machine with ball screw, when increasing the gain of the drive, it will have high frequency resonance. Then the low pass filter will restrain the resonance well.However,the response bandwidth and the phase margin will lower also. The system will be probably unstable.

When there is high frequency resonance because of the servo drive, the resonance can eliminate by adjusting Torque Filtering Time Constant (Tf).The lower the value, the better the control to response, but it restricted by the machine condition; the bigger the value, the better the restraining of high frequency resonance. If it is too large, it will cause the reducing of the phase margin and resonance. If the setting of the rotational inertia ratio G (G=JL/JM) is right, it needs to meet the following formula.

Tf（ms）≤2π x 2 x Kv（Hz）

4.5 Over-travel Protection

Over-travel Protection is the safety function of the forcing stop of the motor when the movement part of the machine is over the design safe movement range, the limit switch off. The diagram of over-travel protection is in the following.



It is advised to have a normally closed connect of the limit switch. When it is in the safety range, it is closed;it is over-travel,the switch disconnected. Wiring it to Drive Forbid of CCWL and CWL directions. It can set as in use or neglect by parameter P097.If set as in use, it is a must to wire a limit signal;if in neglect, no need to wire the signal. The default setting of the parameter is the neglect both CCWL and CWL. If it needs to be used,please modify parameter P097. Even in over-travel condition, it permits to input reverse command to exit over-travel condition.

P097	Drive Forbid of CWL Direction	Drive Forbid of CCWL Direction
0	In use	In use
1	In use	In neglect
2	In neglect	In use
3	In neglect	In neglect

4.6 Torque Restriction

With the aim to protect the machine, it is advised to restrict the output torque.

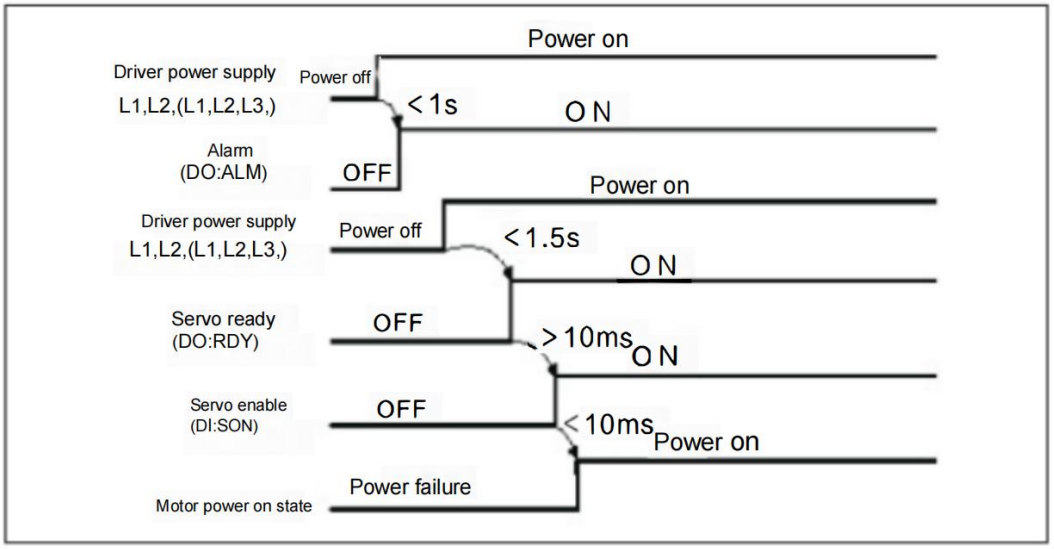
4.6.1 Parameter of Torque Restriction

Parameter relevant to Torque Restriction

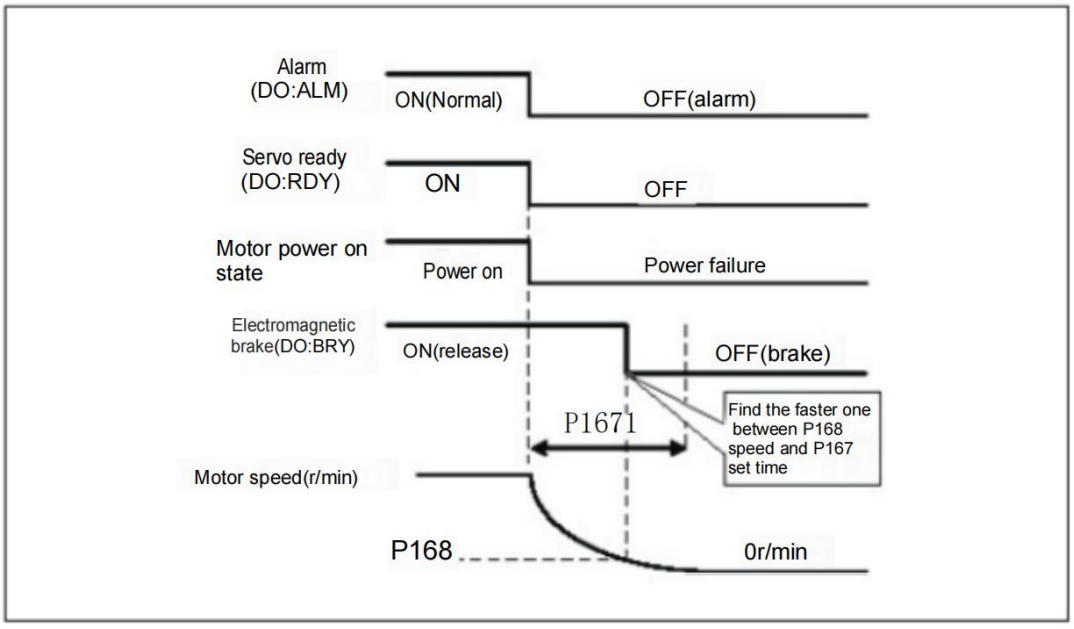
Parameter	Name	Parameter Range	Default Value	Unit	Applicable
P065	Internal CCW Torque Restriction	0~300	300	%	ALL
P066	Internal CW Torque Restriction	-300~0	-300	%	ALL
P067	External CCW Torque Restriction	0~300	300	%	ALL
P068	External CW Torque Restriction	-300~0	-300	%	ALL
P069	Torque Restriction of Test Run	0~300	300	%	ALL

4.7.1 Switch-On Sequence of Power

After wiring L1,L2 and L3 of the power well, the servo is ready the signal （RDY ON） in 1.5 second.Then it can receive the servo enabled signal(SON).If detecting the SON is valid,the power circuit starts and the motor is excited to be operation.If detecting the SON is invalid or there is an alarm, the power circuit will shut off, the motor is under free state.



4.7.2 Alarm Sequence when Servo is On



4.8 Electromagnetic Brake

Electromagnetic Brake (Maintaining Brake and Power-off Brake) is used to lock the table connected to the motor in vertical or tilting to avoid the fall of the table when the servo drive powers off. If the user wants to have this function, it is a must to buy the motor with brake.Brake is used to hold the table,but not used to slow down the speed or stop the movement of the machine.

4.8.1 Parameters of Electromagnetic Brake

Parameters relevant to electromagnetic brake

Para meter	Name	Range of Parameter	Default Value	Unit	Applicable
P165	Speed detection point of the motor in stillness	0~1000	5	r/min	ALL
P166	The Braking delay time of Electromagnetic Brake when the motor in stillness	0~2000	0	Ms	ALL
P167	The Braking waiting time of	0~2000	500	ms	ALL

	Electromagnetic Brake when the motor in operation				
P168	The Movement speed of Electromagnetic Brake when the motor in operation	0~3000	400	r/min	ALL

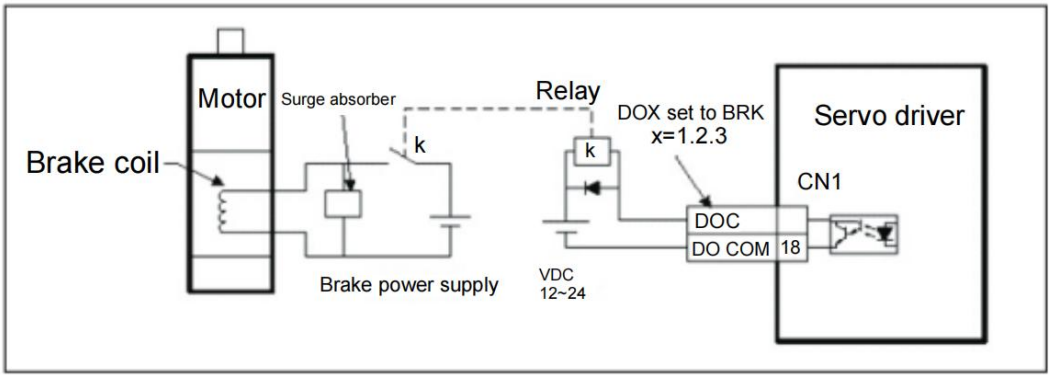
4.8.2 The Usage of Electromagnetic Brake

The following is the wiring diagram of the brake. The brake signal (BRK) of the drive wires to the coil of the relay, while the contact of the relay wires to the power of the brake. The power of the brake is supplied the user, and it should have sufficient capacity.It is advised to install surge absorber to restrain surge voltage caused the switching on/off of the relay. The diode can be surge absorber also, please there will be a little time of braking delay.

The servo is OFF when the motor stops in stillness(speed is less than P165). Then the motor is still have power to maintain the position. From the releasing to braking of the Brake,and after it keeps for a certain(time can set by P166) and the power of motor is off.

The servo is OFF when the motor is in operation(speed is over P165), then the power of the motor is off and the Brake is still in releasing state

and after a certain time of delay, the brake is braking. It is a way to avoid the damage to the brake by making the motor from high speed rotating state to low speed rotating state and then the brake working. The delay time is the lower one between Parameter P167 and the time of the motor speed slowing down to the speed of parameter P168.



4.9 Parameter List

Applicable Control Mode: Position Control

4.9.1 0 Segment Parameter

Parameter	Name	Parameter Description	Parameter Range [Default value]	Unit
P000	Password	● Administrate the parameter in different levels.It can ensure the parameter not be modified by accident. ● Set as 315,then can check and modify the 0,1,2 segment parameters. Set as not 315, then can only check but not modify the parameter. ● Some special operation needs to set the suitable password.	0～9999 【315】	

P004	Control Mode	● Meaning of the parameter: 0:position control 1:speed control	0～1 【0】	
P005	Gain of speed loop	● Proportional Gain of Speed Adjuster,increase the value, the response speed will be faster;If it is too larger, it will caused vibration and noise. ● If the setting of P017(Rotational Inertia Ratio)is correct,then the parameter value is same as bandwidth of Speed Response.	1～3000 【40】	Hz
P006	Integral Time Constant of Speed Loop	● Integral Time Constant of Speed Adjuster,if reduce the value of the parameter,the error of speed control will be lessened and the stiffness will be increased. If it is too low, it can cause vibration and noise. ● Set it as the maximum value(1000.0)to cancel the integral.The Speed Adjuster is P controller.	1.0～1000.0 【20.0】	ms
P007	Torque Filtering Time Constant	● Torque is the low pass filtering, it can eliminate the vibration caused by the machine. ● The bigger the value is, the better the vibration elimination effects,if the value is too big, the response speed will be slow and caused vibration;The smaller the value is, the faster the response speed and it limited by the condition of the machine. ●When the load inertia is small, it can set as a small value; if the load inertia is big, set a big value.	0.10～50.0 【2.50】	ms
P009	Gain of Position Loop	● Proportional Gain of Position Adjuster;Increase the value of the parameter, it can lessen the error of position tracking and increase the response. If the value is too big, it can caused overshooting or vibration.	1～1000 【40】	1/s

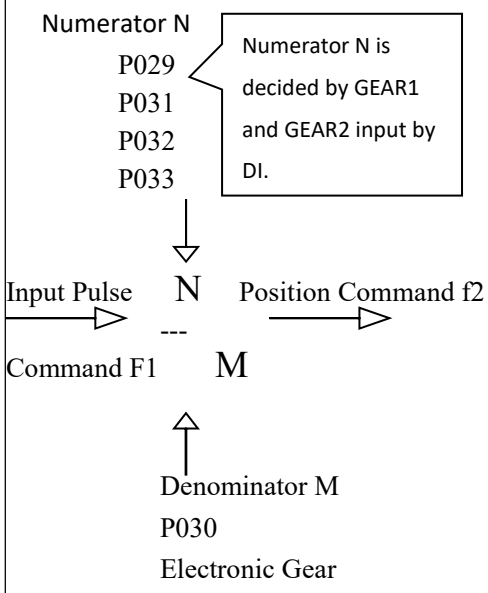
P017	Rotational Inertia Ratio with Load	● Ratio of Rotational Inertia of the machine load(converting to the shaft of the motor) and Rotational Inertia of the motor rotor	0.0～200.0 【1.0】	times
P019	Speed Detection Filtering Time Constant	● The bigger the value is, the more smooth the detecting is;The smaller the value is, the faster the detecting response;Too small will cause noise, too big will cause vibration.	0.50～50.00 【2.50】	ms
P021	Feed-forward Gain of Position Loop	● Feed-forward can reduce the error of position tracking under position control,if set as 100, under any frequency of command pulse,the error of position tracking is always 0. ● The bigger the value is, the faster the response speed of position control;if it is too big, it can make the system unstable and cause vibration easily.	0～100 【0】	%
P022	Feed-forward Filtering Time Constant of Position Loop	●It is the filtering of feed-forward quantity of the position loop, the function is to increase the stability of feed-forward control.	0.20～50.00 【1.00】	ms
P025	Source of Speed Command	3:JOG speed command, it needs to set when doing JOG operation. 4:Keyboard speed command,it needs to set when doing keyboard speed adjuster(Sr)operation. 5:demonstrative speed command, it needs to set when demonstrating the speed adjusting.The speed command will change automatically.	3～5 【3】	

<table>
<tr>
<td>P029</td>
<td>The first Numerator of Electronic Gear of the Command Pulse</td>
<td>

It is applied to do fraction or doubling of the input frequency, making them match with all kinds of pulse source convenient to meet the resolution ratio of the pulse needed by the user.
The Numerator of Electronic Gear of the command pulse (N) is decided by GEAR1 and GEAR2 input by DI. The denominator(M) is set by Parameter P030.

<table>
<tr><td colspan="2">DI Signal「Note」</td><td rowspan="2">Numerator of Electronic Gear of the Command Pulse N</td></tr>
<tr><td>GEAR2</td><td>GEAR1</td></tr>
<tr><td>0</td><td>0</td><td>The first Numerator(Parameter P029)</td></tr>
<tr><td>0</td><td>1</td><td>The second Numerator(Parameter P031)</td></tr>
<tr><td>1</td><td>0</td><td>The third Numerator(Parameter P032)</td></tr>
<tr><td>1</td><td>1</td><td>The fourth Numerator(Parameter P033)</td></tr>
</table>
Note:0=OFF,1=NO.

The input pulse command changed by N/M to have the position command, the range of ratio:1/50 < N/M < 200



</td>
<td>1～32767

【1】</td>
<td></td>
</tr>
</table>

P030	The denominator of Electronic Gear of Command Pulse	●The denominator of Electronic Gear of Command Pulse(M),the application refers to Parameter P029	1～32767 【1】	
P031	The second Numerator of Electronic Gear of the Command Pulse	● Refers to Parameter P029.	1～32767 【1】	
P032	The third Numerator of Electronic Gear of the Command Pulse	● Refers to Parameter P029.	1～32767 【1】	
P033	The fourth Numerator of Electronic Gear of the Command Pulse	● Refers to Parameter P029.	1～32767	
P035	Input Mode of Command Pulse	● Set the Input Mode of Command Pulse, the meaning of the parameter value is: 0：Pulse+Direction 1：CCW/CW Pulse 2：Orthogonal AB Pulse	0～2 【0】	
P036	Input Direction of Command Pulse	● The meaning of the parameter value is: 0：Normal Direction 1：Reverse Direction	0～1 【0】	

<table>
<tr>
<td>P037</td>
<td>Input Signal Logic of Command Pulse</td>
<td>● Set signal phase of pulse input signal PULS and SIGN, it is used to adjust count edge and count direction.
<table>
<tr><th>P037</th><th>PULS
Signal Phase</th><th>SIGN
Signal Phase</th></tr>
<tr><td>0</td><td>Same Phase</td><td>Same Phase</td></tr>
<tr><td>1</td><td>Reverse Phase</td><td>Same Phase</td></tr>
<tr><td>2</td><td>Same Phase</td><td>Reverse Phase</td></tr>
<tr><td>3</td><td>Reverse Phase</td><td>Reverse Phase</td></tr>
</table>
</td>
<td>0～3

【0】</td>
<td></td>
</tr>
<tr>
<td>P038</td>
<td>Input Signal Filtering of Command Pulse</td>
<td>● The digital filtering to Pulse input signal PULS and SIGN signal.The bigger the value is, the bigger the filtering time constant is;Every one increase of the value,will be 0.53 increase of the time constant.
● Set as 0, the maximum pulse input frequency is 500KHZ(kpps),the bigger of the value, the lower the maximum pulse input frequency.
● It is used to filer the noise of the signal wire to avoid counting error. If there is any inaccuracy of the operation because of error counting,please increase the value properly.</td>
<td>0～21
【7】</td>
<td></td>
</tr>
<tr>
<td>P039</td>
<td>Input Filtering Mode of Command Pulse</td>
<td>● The meaning of the value:
0:The digital filtering to PULS and SIGN signal
1:The digital filtering only to PULS but not SIGN</td>
<td>0～1

【0】</td>
<td></td>
</tr>
</table>

P040	Smoothing Filtering Time of Position Command Index	● To do smoothing filtering to the command pulse, it have the accelerating and decelerating with index format.The filter will loss no the input pulse, but there is a delay of the command.When set as 0, the filter has no function. ● The filter applied to: 1. The upper controller have no function of acceleration and deceleration; 2. Relative Larger Electronic Gear Ratio(N/M > 10); 3. Lower command frequency;there will be jump like step-motor and other unstable moves when the motor is operating	0～1000 【0】	ms
P060	Accelerating Time of Speed Command	● Set the accelerating time of the motor from zero speed to rated speed; ● If the command speed is lower than rated speed, then the accelerating time needed will be shorter; ● Apply only to speed control,invalid to position control; ● If the position control is formed by the drive and the up controller,then set the parameter value as 0, or it will affect the performance of position control.	0～30000 【0】	ms
P061	Decelerating Time of Speed Command	● Set the decelerating time of the motor from rated speed to zero speed; ● If the command speed is lower than rated speed, then the decelerating time needed will be shorter; ● Apply only to speed control,invalid to position control; ● If the drive is worked with the external position loop, then the parameter should set as 0,or it will affect the performance of position control.	0～30000 【0】	ms

P065	Torque Restriction of Internal CCW	● Set the internal torque restriction value of CCW direction of the motor. ● The restriction is valid under any condition. ●If the set value surpasses the maximum overload capability allowed by the system,then the real restriction value is the maximum overload capability allowed by the system.	0～300 【300】	%
P066	Torque Restriction of Internal CW	● Set the internal torque restriction value of CW direction of the motor. ● The restriction is valid under any condition. ●If the set value surpasses the maximum overload capability allowed by the system,then the real restriction value is the maximum overload capability allowed by the system.	-300～0 【-300】	%
P067	Torque Restriction of External CCW	● Set the external torque restriction of the CCW direction of the servo motor. ● The restriction is valid only when the input of TCCW(Torque Restriction of CCW direction) by DI is ON. ● When the restriction is valid, the real torque restriction is the lowest among the maximum overload capability allowed by the system,internal torque restriction in CCW direction, and external torque restriction in CCW direction.	0～300 【100】	%
P068	Torque Restriction of External CW	● Set the external torque restriction of the CW direction of the servo motor. ● The restriction is valid only when the input of TCW(Torque Restriction of CW direction) by DI is ON . ● When the restriction is valid, the real torque restriction is the lowest absolute value among the maximum overload capability allowed by the system,internal torque restriction in CW direction, and external torque restriction in CW direction.	-300～0 【-100】	%

P069	Torque Restriction of Test Run	● Set the Torque Restriction value under test run modes(Speed JOG operation,Keyboard Speed Adjuster, Demonstrative Mode). ● It has no relation to rotational direction.There is restriction to both CW and CCW directions. ● The external and internal torque restriction is still valid.	0～300 【100】	%
P070	Torque Overload Alarm of CCW Direction	● Set the CCW Torque Overload Value, it is the percentage of the rated torque. ● When the CCW torque of the motor surpasses P070 and lasting time overpasses P072, the drive has an alarm, the alarm no. Is Err29 and the motor stopped.	0～300 【300】	%
P071	Torque Overload Alarm of CW Direction	● Set the CW Torque Overload Value, it is the percentage of the rated torque. ● When the CW torque of the motor surpasses P071 and lasting time overpasses P072, the drive has an alarm, the alarm no. Is Err29 and the motor stopped.	-300～0 【-300】	%
P072	Detecting Time of Torque Overload Alarm	● Refers to parameters P070 and P071 ● When it sets as 0, there is an alarm of shielding Torque Overload.	0～10000 【0】	10ms
P075	The Restriction of the maximum speed	● Set the maximum restriction speed allowed of the servo motor ● It has no connection to rotational direction ● If the set value overpasses the maximum speed allowed by the system,the real speed speed will restrict in the maximum speed.	0～5000 【3500】	r/min
P076	Speed of JOG	● Set the operation speed of JOG operation	0～5000 【100】	r/min

P080	Position Out of Tolerance Detection	● Set detecting Range of the Alarm of Position Out of Tolerance ●Under position control,when the value of position out of tolerance counter overpasses the pulse corresponding to this parameter,The drive will have an Alarm Err4 of over position. ● The unit is cycle. The pulse quantity is the cycle times the resolution ratio every cycle of the encoder. If the encoder is 2,500wires,the resolution ratio every cycle of the encoder will be 10,000, when the parameter value is 4.00, the corresponding encoder pulse is 40,000.	0.00～ 327.67 【4.00】	Cycl e

<table>
<tr>
<td>P096</td>
<td>Initial Display Items</td>
<td>● Display status of the display after the drive powers on. The meaning of the parameter:
<table>
<tr><th>P096</th><th>Display Item</th><th>P096</th><th>Display Item</th></tr>
<tr><td>0</td><td>The Speed of the Motor</td><td>12</td><td>Analog Voltage of Speed Command</td></tr>
<tr><td>1</td><td>Original Position Command</td><td>13</td><td>Analog Voltage of Torque Command</td></tr>
<tr><td>2</td><td>Position Command</td><td>14</td><td>Digital Input (DI)</td></tr>
<tr><td>3</td><td>Position of the motor</td><td>15</td><td>Digital Input (DO)</td></tr>
<tr><td>4</td><td>Position Deviation</td><td>16</td><td>Signal of Encoder</td></tr>
<tr><td>5</td><td>Torque</td><td>17</td><td>Absolute Position in a cycle</td></tr>
<tr><td>6</td><td>Peak Torque</td><td>18</td><td>Accumulative Overload Ratio</td></tr>
<tr><td>7</td><td>Current</td><td>19</td><td>Overload Ratio of Braking</td></tr>
<tr><td>8</td><td>Peak current</td><td>20</td><td>Control Mode</td></tr>
<tr><td>9</td><td>Frequency of Input Pulse</td><td>21</td><td>Alarm No.</td></tr>
<tr><td>10</td><td>Speed Command</td><td>22</td><td>Reserve</td></tr>
<tr><td>11</td><td>Torque Command</td><td></td><td></td></tr>
</table>
</td>
<td>0～22

【0】</td>
<td></td>
</tr>
</table>

<table>
<tr>
<td>P097</td>
<td>Neglect of Drive Forbid</td>
<td>●The drive forbid of CCW direction(CCWL) and CW direction(CWL) input by DI is used to limiting travel protection, it has normally-closed switch, when the input is ON, the motor moves at the direction;OFF, the motor don’t move at the direction.If there is no limiting travel protection, can set neglect by the parameter,it can operate without drive forbid signal.
●The default value is neglect the drive forbid. If needs the function,please modify this parameter first.
● The meaning of the parameter:
<table>
<tr><th>P097</th><th>Drive Forbid of CW Direction(CWL)</th><th>Drive Forbid of CCW Direction(CCWL)</th></tr>
<tr><td>0</td><td>In use</td><td>In use</td></tr>
<tr><td>1</td><td>In use</td><td>In neglect</td></tr>
<tr><td>2</td><td>In neglect</td><td>In use</td></tr>
<tr><td>3</td><td>In neglect</td><td>In neglect</td></tr>
</table>
</td>
<td>0～3

【3】</td>
<td></td>
</tr>
<tr>
<td>P098</td>
<td>Forcing Enabled</td>
<td>● The meaning of the parameter:
0:The usage is controlled by the SON input by DI;
1:The software forced enabling ON</td>
<td>0~1

【0】</td>
<td></td>
</tr>
</table>

4.9.2 1 Segment Parameter

<table>
<tr><th>Parameter</th><th>Name</th><th>Parameter Description</th><th>Parameter Range [Default Value]</th><th>Unit</th></tr>
<tr><td>P100</td><td>Digital Input Di1 Function</td><td>● Function plan of Digital Input Di1,the absolute value of the parameter means the function;the symbol means the logic.The function please refer to 4.9.3.
● Symbol means the input logic; positive number means positive logic,negative number negative logic.ON means valid,OFF invalid.
<table>
<tr><th>Parameter Value</th><th>Di input signal</th><th>Di result</th></tr>
<tr><td rowspan="2">Positive number</td><td>Open circuit</td><td>OFF</td></tr>
<tr><td>Breakover</td><td>ON</td></tr>
<tr><td rowspan="2">Negative number</td><td>Open circuit</td><td>ON</td></tr>
<tr><td>Breakover</td><td>OFF</td></tr>
</table>
● When the function of several input channel is the same,the function result is logic or relation. Eg. When set P100 and P101 as 1(SON function),then any one of Di1 or Di2 is on, the SON is valid.
● The input function was not selected by parameter P100~P104,namely,the unplanned functions, the result is invalid.But there is exception,Set parameter P120~P124 can force the input function ON(valid),no matter it is planned or not.</td><td>-21～21
【1】</td><td></td></tr>
<tr><td>P101</td><td>Digital Input DI2 Function</td><td>●Please refer to P100 for the function plan of digital input Di2</td><td>-21～21
【2】</td><td></td></tr>
<tr><td>P102</td><td>Digital Input DI3 Function</td><td>● Please refer to P100 for the function plan of digital input Di3</td><td>-21～21
【3】</td><td></td></tr>
</table>

<table>
<tr><td>P103</td><td>Digital Input DI4 Function</td><td>●Please refer to P100 for the function plan of digital input Di4</td><td>-21～21
【4】</td><td></td></tr>
<tr><td>P104</td><td>Digital Input DI5 Function</td><td>●Please refer to P100 for the function plan of digital input Di5</td><td>-21～21
【20】</td><td></td></tr>
<tr><td>P110</td><td>Digital Input DI1 Function</td><td>● The digital filtering time constant input by DI1
● The smaller the parameter value is, the faster the signal response speed is;the bigger the parameter value is, the slower the signal response speed is, but the stronger the capability of noise filtering is.</td><td>0.1～100.0
【2.0】</td><td>ms</td></tr>
<tr><td>P111</td><td>Digital Input DI2 Function</td><td>●Please refer to P110 for the digital filtering time constant input by Di2.</td><td>0.1～100.0
【2.0】</td><td>ms</td></tr>
<tr><td>P112</td><td>Digital Input DI3 Function</td><td>●Please refer to P110 for the digital filtering time constant input by Di3.</td><td>0.1～100.0
【2.0】</td><td>ms</td></tr>
<tr><td>P113</td><td>Digital Input DI4</td><td>●Please refer to P110 for the digital filtering time constant input by Di4.</td><td>0.1～100.0
【2.0】</td><td>ms</td></tr>
<tr><td>P114</td><td>Digital Input DI5 Function</td><td>●Please refer to P110 for the digital filtering time constant input by Di5.</td><td>0.1～100.0
【2.0】</td><td>ms</td></tr>
<tr><td>P130</td><td>Digital Input DO1 Function</td><td>●Function plan of digital input DO1, the absolute value of the parameter means function,the symbol means logic. Please refer to 4.9.4 for the function.
● 0 is forcing OFF,1 is ON.
●Symbol means input logic,positive number means positive logic,negative number negative logic.
<table>
<tr><th>Parameter value</th><th>Corresponding Function</th><th>DO output signal</th></tr>
<tr><td rowspan="2">Positive number</td><td>ON</td><td>Breakover</td></tr>
<tr><td>OFF</td><td>cut-off</td></tr>
<tr><td rowspan="2">Negative Number</td><td>ON</td><td>cut-off</td></tr>
<tr><td>OFF</td><td>Breakover</td></tr>
</table></td><td>-12～12
【2】</td><td></td></tr>
</table>

<table>
<tr><td>P131</td><td>Digital Input DO2 Function</td><td>● Please refer to parameter P130 for function plan of digital input DO2</td><td>-12～12
【3】</td><td></td></tr>
<tr><td>P132</td><td>Digital Input DO3 Function</td><td>● Please refer to parameter P130 for function plan of digital input DO3</td><td>-12～12
【8】</td><td></td></tr>
<tr><td>P150</td><td>Range of Positioning Completed</td><td>● Set pulse range of positioning completed under position control.
●The residue pulse number in the counter of position deviation is less than or equal to the setting the value,the COIN(positioning completed) of digital output DO is ON ,or it will be OFF.
● The comparator can return difference. It sets by Parameter P151.</td><td>0～32767
【10】</td><td>pulse</td></tr>
<tr><td>P151</td><td>Backlash of Positioning Completed</td><td>● Refers to Parameter P150</td><td>0～32767
【5】</td><td>pulse</td></tr>
<tr><td>P154</td><td>Arrival Speed</td><td>● When the speed of the motor surpasses the parameter, the ASP(Arrival Speed) of digital output DO is ON, or it is OFF.
● The comparator can return difference. It sets by Parameter P155.
● It can set the polarity.
<table>
<tr><th>P156</th><th>P154</th><th>Comparator</th></tr>
<tr><td>0</td><td>＞0</td><td>No direction of the speed</td></tr>
<tr><td rowspan="2">1</td><td>＞0</td><td>Detecting the speed of CCW ONLY</td></tr>
<tr><td>＜0</td><td>Detecting the speed of CW ONLY</td></tr>
</table></td><td>-5000～5000
【500】</td><td>r/min</td></tr>
<tr><td>P155</td><td>Backlash of Arrival Speed</td><td>● Refers to Parameter P154</td><td>0～5000
【30】</td><td>r/min</td></tr>
</table>

P156	Polarity of Arrival Speed	● Refers to Parameter P154	0～1 【0】	
P163	Clear methods of Position out of tolerance	● Under position control, to clear the counter of position deviation by using CLR（Clear of Position Deviation） of DI. ● The meaning of the value, the clear of position deviation occurred when 0:CLR ON electrical level 1:CLR top edge（the moment from OFF to ON）	0～1 【0】	
P165	Speed detecting point of the motor in Stillness	●Detecting of the motor in stillness, it will consider the motor in stillness when the speed of the motor lower than the parameter value. ● Apply only to judge the time sequence of electromagnetic brake.	0～1000 【5】	r/min
P166	Delay Time of Electromagnetic Brake when the motor in stillness	● When the system changes from SON status to no SON or with alarm,it defines the delay time from the motor in stillness to the braking of electromagnetic brake (DO output terminal is BRK OFF) ●The parameter is making the reliable braking of the electromagnetic and cutoff the current to avoid the tiny displacement of the motor and the fall of the work-piece.The parameter should not be less than the delay time of mechanical braking. ●Please refer to 4.12.3 for the corresponding sequence	0～2000 【0】	ms

P167	Waiting Time of Electromagnetic Brake when the motor in operation	● When the system changes from SON status to no SON or with alarm,it defines the delay time from the cut-off of current of the motor to the braking of electromagnetic brake sending BRK OFF by DO output terminal during the motor is in rotation. ● The parameter is to make the motor reduce to low speed from a high speed in rotation and then do braking with the brake to avoid the damage to the brake. ● The real action time is the smaller value between P167 and the time for the motor reducing to the value of P168. ● Please refer to 4.12.3 for the corresponding sequence	0～2000 【500】	ms
P168	Operation Speed of Electromagnetic Brake when the motor in operation	●Refers to parameter P167	0～3000 【100】	r/min

4.9.3 Di Function List

No.	Symbol	Di Function
0	NULL	No Function
1	SON	The servo is on
2	ARST	Alarm Clear
3	CCWL	Forbid of CCW Direction Drive
4	CWL	Forbid of CW Direction Drive
5	TCCW	Torque Restriction of CCW Direction
6	TCW	Torque Restriction of CW Direction
15	EMG	Emergency Stop
18	GEAR1	Electronic Gear Selection 1
19	GEAR2	Electronic Gear Selection2
20	CLR	Clear Position Offset
21	INH	Forbid Pulse Input

4.9.4 D0 Function List

No.	Symbol	DO Function
0	OFF	Always invalid
1	ON	Always valid
2	RDY	The servo is on
3	ALM	Alarm
5	COIN	Position Accomplished
6	ASP	Speed Arrival
8	BRK	Electromagnetic Brake
11	TRQL	Under Torque Restriction

Chapter Five Alarm

5.1 Alarm List

Alarm Code	Alarm Name	Alarm Content	Alarm Clear
Err--	No Alarm	Work Normal	
Err 1	Over-speed	The speed of motor overpass the maximum limited value	no
Err 2	Over Voltage of Main Circuit	The voltage of main circuit overpasses the rated value	no
Err 4	Position Offset	The value of position offset counter overpasses the setting value	yes
Err 7	Error of Drive Forbid	Invalid Input of CCWL,CWL Drive Forbid	yes
Err 8	Overflow of Position Offset Counter	The absolute value of position offset counter over passes 2^{30}	yes
Err 9	Failure of Encoder Signal	Lack of Encoder Signal	no
Err11	Error of Power Module	Error of Power Module	no
Err12	Over Current	Over current of Motor	no
Err13	Over Load	Over load of Motor	no
Err14	Overload of Braking Peak Power	Instant Overload of Braking	no
Err15	Count Error of Encoder	Count Error of Encoder	no
Err16	Motor Overheat	Heat value of motor overpasses the setting value(I^2t Test)	no
Err17	Overload of Braking Average Power	Long time Overload of Braking Average Power	no
Err18	Overload of Power Module	Overload of Power Module Output Average	no
Err20	EEPROM Error	EEPROM reading and writing Error	no
Err21	Logical Circuit Error	Error of Processor Outside Logical Circuit	no
Err23	Error of AD Switch	Error of Circuit or Current Sensor	no
Err24	Low Voltage of Control Power	LDO Error of Control Loop	no
Err29	Alarm of Torque Overload	Load of the motor overpasses the setting value and time	yes
Err30	Lost of Encoder Z signal	No Z Signal of Encoder	no
Err31	Error of Encoder U,V,W Signal	Error of Encoder U,V,W Signal or mismatching of poles	no
Err32	Illegal Coding of Encoder U,V,W Signals	U,V,W signals existed All High Electric Level or All Low Electric Level	no
Err33	Error of Wiring-saving Encoder Signal	No high-impedance state in POWER on Time Sequence	no