Single-channel all-digital AC servo drives
ATTENTION QS1 Series
User Manual

This manual is only for drivers with 20XX (or higher) version.
Do not use this manual for drivers with 10XX version.

Adtech (Shenzhen) CNC Technology Co., LTD
Address: 5th floor，27-29th Bulding,Tianxia IC Industrial Park, MaJiaLong, Yiyuan Road, Nanshan District, Shenzhen City, China
Tel.: (+86-755) 2609 9116 Fax: (+86-755) 2672 2718
PC：518052 Website: www.adtechen.com

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Basic Information of Manual

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Precautions and Explanations

※Transport and storage:

☞ Do not stack product package more than six layers;

- ☞ Do not climb, stand on or place heavy stuff on the product package;
- ☞ Do not pull the cable still connecting with machine to move product.
- ☞ Forbid impact and scratch on the panel and display;
- ☞ Prevent the product package from humidity, sun exposure, and rain.

※Open-box inspection:

- ☞ Open the package to confirm the product to be purchased by you.
- ☞ Check damages situation after transportation;
- ☞ Confirm the integrity of parts comparing with the parts list or damages situation;
- ☞ Contact our company promptly for discrepant models, shortage accessories, or transport damages.

※Wiring

- ☞ Ensure the persons involved into wiring and inspecting are specialized staff;
- ☞ Guarantee the product is grounded with less than 4Ω grounding resistance. Do not use neutral line (N) to substitute earth wire.
- ☞ Ensure grounding to be correct and solid, in order to avoid product failures or unexpected consequences;
- ☞ Connect the surge absorption diodes to the product in the required direction, otherwise, the product will be damaged;
- ☞ Ensure the power switch is OFF before inserting or removing plug, or disassembling chassis.

※Overhauling

- ☞ Ensure the power is OFF before overhauling or components replacement;
- ☞ Make sure to check failures after short circuit or overloading, and then restart the machine after troubleshooting
- ☞ Do not allow to frequently connect and disconnect the power, and at least one minute interval between power-on and power-off.

※Miscellaneous

- ☞ Do not open housing without permit;

Keep power OFF if not in use for a long time;

- ☞ Pay close attention to keep dust and ferrous powder away from control;
- ☞ Fix freewheel diode on relay coil in parallel if non-solid state relay is used as output relay. Check whether power supply meets the requirement to ensure not burning the control.
- ☞ Install cooling fan if processing field is in high temperature, due to close relationship between service life of the control and environmental temperature. Keep proper operative temperature range for the control: 0℃ ～ 60℃.
- ☞ Avoid to use the product in the overheating, humid, dusty, or corrosive environments;
- ☞ Add rubber rails as cushion on the place with strong vibration.

※Maintenance:

Please implement routine inspection and regular check upon the following items, under the general usage conditions (i.e. environmental condition: daily average 30℃, load rate: 80%, and operating rate: 12 hours/ day)

Routine Inspection	Routine	● Confirm environmental temperature, humidity, dust, or foreign objects. ● Confirm abnormal vibration and noise; ● Check whether vents are blocked by yarn etc..
Regular Check	One year	● Check whether solid components are loose ● Confirm whether terminal block is damaged

contents

Chapter I Overview

1.1 Introduction

Modern industrial automation technology is the key technology in the information society, in which AC servo technology is the core technology, which has developed since the early eighties, to be increasingly sophisticated in technology and improved in performance. Now this technology has been widely used in automation field, such as CNC machine tools, printing packaging machinery, textile machinery, and automated production lines.

Modern servo technology will significantly improve production efficiency, product quality, and economic benefits, with the increasing development of AC servo technology in full-digital, open-style, and intelligence.

This AC servo drive is a self-developed new generation fully digital AC servo drive, mainly using the latest digital signal processor DSP technology and large-scale programmable FPGA technology as the core computing units and intelligent IPM power module, with many advantages, such as fast response, perfect protection, and high reliability. It is applicable to high-precision CNC machine tools, automatic production lines, machinery manufacturing and other industrial control automations.

This drive is a new generation full-digital AC servo drives, characterized by high integration and small volume for installation, which has been a desired product for energy conservation and economic benefits enhancement in the industrial automation.

This servo drive has the following advantages in comparison with the previous servo drives:

- Motor power supports 220V power input 100W ~ 3.7KW and 380V power input 3.7W ~ 11KW
- Torque, speed, location, point to point positioning and hybrid switching features are available.
- Multiply control modes can be used, such as position control, speed control, torque control, electric tool control and JOG control.
- Built-in braking system is capable to meet large load applications.
- Built-in 4-position positioning control instruction freely plans point to point positioning control.
- Own encoder can feed back position signal to the servo drive, and constitute the semi-closed-loop control system with the open-loop position control.
- Speed regulation ratio is 1:5000, with stable torque feature from low speed to high speed.
- The maximum speed of servo motors can reach to 6000 RPM.
- Control positioning accuracy can achieve ± 0.01%.
- Improved space vector control algorithm generates bigger torque and less noise than the average SPWM.
- 300% overload capacity guarantees the load capability is strong.
- Wide supply applicative range:： AC220V-15%～+10% or AC380V-15%～+10%
- Perfect protection functions are made for over-current, overvoltage, overheating, and encoder faults.
- A variety of display functions: including motor speed, motor current, motor position, position deviation, pulse number, pulse frequency, straight-line speed, input and output diagnostic interface, and historic alarm records etc.

1.2 Technical Specifications of Servo Drive

Input Power	AC220V -15%～+10%					
Drive current	20A	30A	50A	75A	100A	150A
Adaptive motor	≤0.75 KW	≤1.5KW	≤2.6KW	≤3.5KW	≤5.5KW	≤7.5KW
Input Power	AC380V -15%～+10%					
Drive current		50A	75A			
Adaptive motor		≤3.8KW	≤5.5KW			
Usage temperature	Working：45℃ Storage：-40℃～55℃					
Relative Humidity	40% ~ 80% with non-condensing					
ATM	86-106 kpa					
Control Mode	①Position Control ②JOG Control ③Speed Control ④Torque Control ⑤Position and speed control ⑥Internal impulse control ⑦Electric tool control ⑧Position and torque control					
Pulse command	①Pulse + direction ②CW+CCW pulse ③AB Two-phase orthogonal pulse					
Control precision	0.01%					
Response frequency	≤200Hz					
Pulse frequency	≥500kHz					
Speed regulation ratio	1：5000					
Regenerative brake	Built-in					
Electronic Gear	1/30000～30000/1					
Overload capability	≥300%					
Feedback pulse	2500p/r					
Displays	Motor speed, motor current, motor torque, motor position, position deviation, command pulse, pulse frequency, straight-line speed, input and output diagnostics					
Protection	Overspeed,overcurrent,overvoltage,undervoltage,overload,out-of-tolerance,Ecode fault, over temperature, internal IC fault, and module fault					

Chapter II Installation

- Satisfy the requirement and conditions of environment for product storage and installation;
- Ensure to use fire-proof material for installation; in order to avoid fire, forbid to install on or near the flammable substances;
- Install servo drive in the electric control cabinet to prevent the intrusion of dust, corrosive gases, conductive objects, liquids, and combustibles;
- Avoid vibration and impact on the servo drive and servo motor;
- Consider to install lighting protection device under the usage environment of the servo drive;
- Prohibit pulling the cables of servo motor, motor shaft, and encoder.

2.1 Installation Environment

2.1.1 Installation of electric control cabinet

The ambient temperature directly affect lift span of the drive. However, heating of electric equipment in the electric control cabinet and cooling condition of control cabinet will impact on the temperature around the servo drives. Therefore, when the chassis design is considered, the cooling system of drive an control cabinet configuration should be taken into account, to ensure the ambient temperature of servo drive to be below 55 ℃, relative humidity to be below 95%. Besides, long-term security working temperature should be below 45 ℃.

2.1.2 Heating devices around servo drive

Servo drive working under high temperature conditions will significantly reduce its service life, and easily generate failures. Thereby, the ambient temperature should be guaranteed to be below 55 ℃under the conditions of thermal convection and heat radiation.

2.1.3 Vibration devices around servo drive

All kinds of anti-vibration measures should be adopted to prevent the servo drive from vibrations, which should be guaranteed to be 0.5G (4.9m/s^2) below.

2.1.4 Use under harsh environments

When used in harsh environments, servo drive will contact with corrosive gases, moisture, metal dust, water and processing liquids, which shall bring the malfunctions. Therefore, noise filter and other anti-interference measures should be taken to ensure the drive to work normally. Please note that leakage current will be increased after installed noise filter. In order to avoid the above situation, you can select isolation transformer, in particular, control signal lines of drive are easy to be interfered and reasonable wiring and shielding measures should be considered.

2.1.5 Jamming equipment around the servo drive

Jamming equipment around the servo drive will produce interference, resulted in false operation. Noise filter and other anti-jamming measures can be used to guarantee drive to operate normally. Please note that leakage current will increase after noise filter added. To avoid the above situation, isolation transformer can be adopted. Please pay special attention that reasonable wring and shielding measures can prevent drive control signal from interference.

2.2 Driver Installation

Attention

- Install servo drive in the electric control cabinet with good lighting protection.
- Install servo drive upon the required direction and interval; good cooling condition is must.
- Do not install servo drive on or near the combustibles, in order to prevent fires.

2.2.1 Installation environment

1) Protection

Servo drive structure has no protection, and therefore it must be installed in the electric control cabinet with excellent protection, to prevent contact with corrosive and flammable gases, and avoid the intrusion of the conductive objects, metal dust, oil mist and liquids.

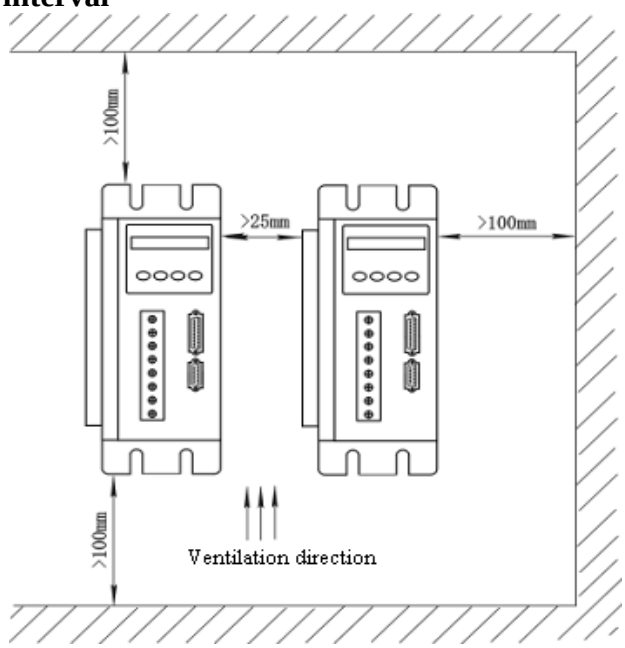
2) Temperature

Ambient Temperature is 0 ~ 55 ℃, and long-term security working temperature is below 45 ℃. Excellent cooling conditions should be guaranteed, and relative humidity is 95%.

3) Vibration and impact

Installation should avoid vibration and vibration release measures should be taken to control it to be 0.5 (4.9m/S2) below. Besides, when installing the drive, heavy pressure and impact are not allowed.

2.2.2 Ventilation interval



2.2.3 Installation method

1) Installation direction: the direction of the normal installation is vertical upright orientation.
2) Fixing: 4 pieces M5 screw on servo drive should be fixed.
3) Ventilation and cooling: natural cooling mode is adopted. Cooling fan should be installed in the electric control cabinet.

Attention

- Do not hit motor or motor shaft while disassembling pulley, in order to prevent encoder from damage; use spiral drawing tools for disassembly;
- Prohibit large axial and radial load on motor; suggest to select flexible coupling to connect the load;
- Fix motor with washer fastening to prevent the motor from loosing.

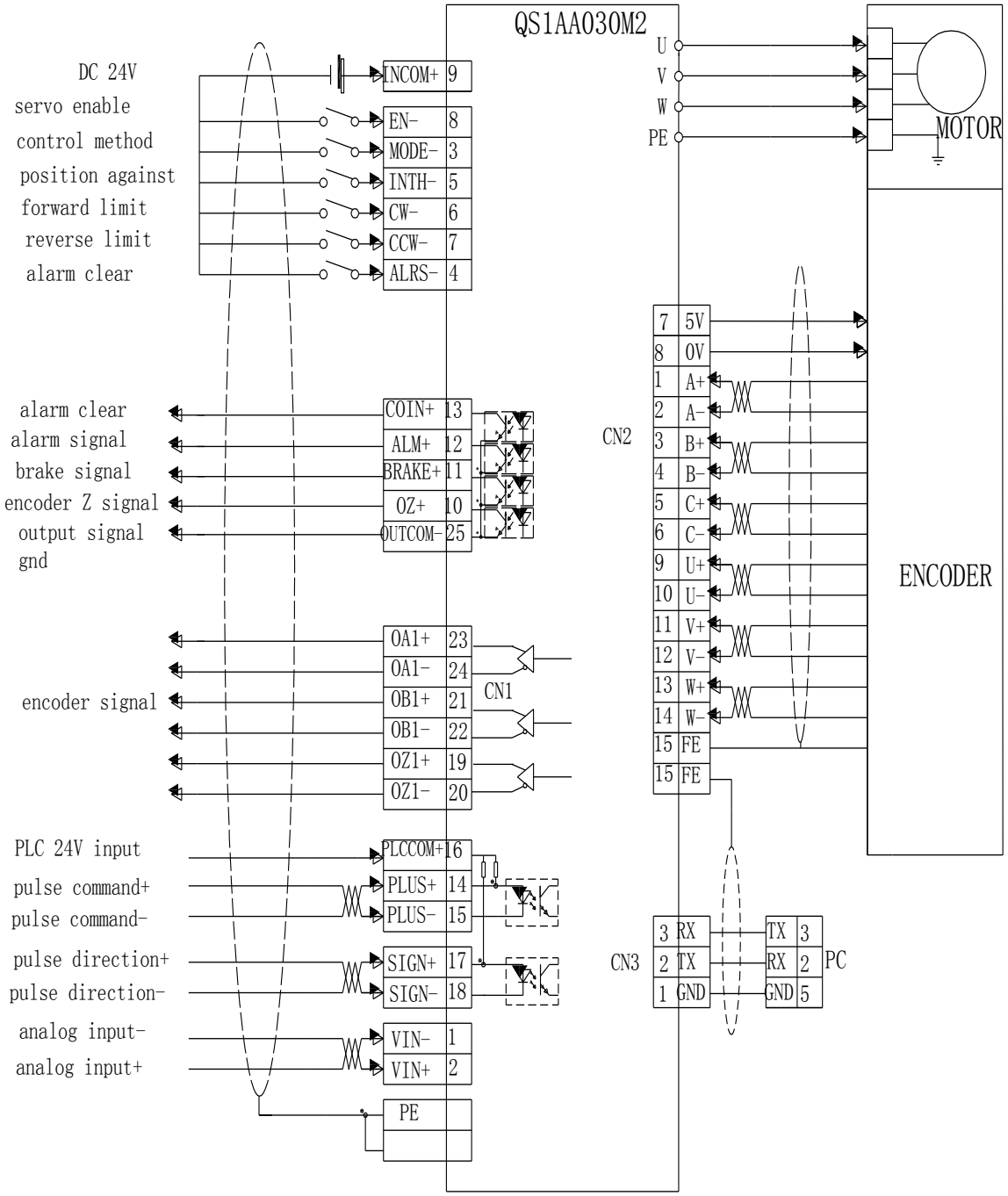
Chapter III Wiring

- Make sure the usage power supply (AC220V one series are available for this drive) for the drive and use isolation transformer.
- Match drive terminals U/V/W with motor U/V/W respectively;
- Consider the security protection measures for design and assembly while using this product, in order to avoid accidences resulted from wrong operations;
- Ensure the good grounding for drive and motor;
- Disconnect the power for more than 5 minutes before disassembling this drive.

3.1 Standard wiring

This AC servo drive wiring is concerned with the used motor and control modes.

1. Wiring of encoders and control uses a stranding with shield layer. In order to reduce interference, the wire is required to be as short as possible. Shielded cable (PE) should be connected, and the maximum wire connection can reach 10M for general application; however, it is not recommended to use more than 10M.
2. Power cords connection uses the corresponding cables with motor current specifications. The high voltage level of cable is required to greater than motor. Shielded cable (PE) is must. The maximum wire connection can reach 10M for general application; however, it is not recommended to use more than 10M.
3. Three-phase voltage requires an extra reactor;
4. Single-phase power supply requires an extra isolation transformer.


QS1AA030M2
DC 24V
servo enable
control method
position against
forward limit
reverse limit
alarm clear
INCOM+ 9
EN- 8
MODE- 3
INTH- 5
CW- 6
CCW- 7
ALRS- 4
U
V
W
PE
MOTOR
ENCODER
CN2
7 5V
8 0V
1 A+
2 A-
3 B+
4 B-
5 C+
6 C-
9 U+
10 U-
11 V+
12 V-
13 W+
14 W-
15 FE
15 FE
alarm clear
alarm signal
brake signal
encoder Z signal
output signal
gnd
COIN+ 13
ALM+ 12
BRAKE+ 11
OZ+ 10
OUTCOM- 25
encoder signal
OA1+ 23
OA1- 24
OB1+ 21
OB1- 22
OZ1+ 19
OZ1- 20
CN1
PLC 24V input
pulse command+
pulse command-
pulse direction+
pulse direction-
analog input-
analog input+
PLCCOM+ 16
PLUS+ 14
PLUS- 15
SIGN+ 17
SIGN- 18
VIN- 1
VIN+ 2
PE
CN3
3 RX
2 TX
1 GND
TX 3
RX 2
GND 5
PC

3.2 Distribution

3.2.1 Power supply terminal

- Diameter of R, S, T, PE, U, V, W terminals should be ≥ 1.5mm ² (AWG14-16).
- Wiring terminals of this product use JUT-2.5-4 cold pressured terminals, which should be made sure to be connected firmly.
- Three-phase isolation transformer power supply should be used to reduce the possibility of electrical injuries. It is better to use noise filter between the city power supply and isolation transformers, to improve anti-jamming capability for the system.
- Please install the non-fuse type (NFB) circuit breakers, so that the external power can be promptly cut off while drive failures happen.

3.3.2 Control signal CN3 terminal and feedback signal CN1 terminal

1） Diameter: The shielded cable (preferably use twisted-pair shielded cable) should be selected; diameter ≥ 0.12 mm ²; the shield layer must connect with PE terminal.

2） Length: cable length should be as short as possible; the control signal CN3 cable should not exceed 3 meters; feedback signal CN1 and cable lengths should not exceed 10 m.

3） Distribution: it should be far away from power lines, to prevent interference.

4） Please install surge absorption components for inductive components (coil) in the relevant lines, e.g. DC coil anti-parallels freewheeling diode, and AC coils connects RC absorption circuit in parallel.

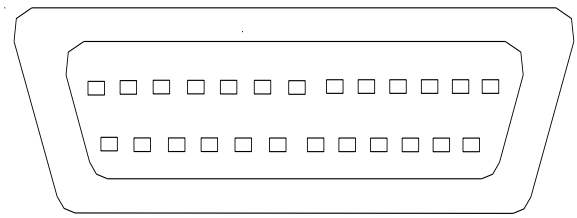
3.3 Terminal function

3.3.1 Power supply terminals: JUT-1.5-4 cold pressured terminal

PIN	Mark	Signal Name	Signal function
1	R	Three-phase or single-phase main power（220v）	AC220V or AC380V 50HZ cannot connect with the motor UVW
2	S		
3	T		
4	PE	Grounding	Connecting with the main power ground
5	U	Servo Motor	Matching motor UVW one by one
6	V		
7	W		
8	PE	Grounding	Connecting motor housing
9	r	220V drive; no such terminal: control power supply	Control power220V 50HZ
10	t		
11	PE	Grounding	Connecting with control power ground

Note: When using AC220V power supply, the drive has no 9,10,and 11 terminals.

3.3.2 Control signal input and output terminal: DB25 connector for CN1 Block

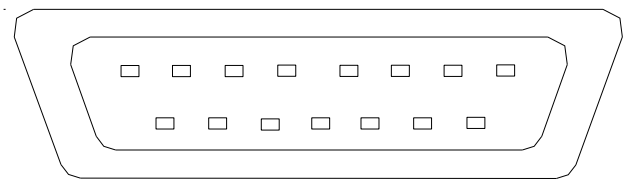


Seeing from the terminal

PIN	Signal Name	Mark	I/O	Signal function
9	Input signal power supply positive	INCOM+	Input	Power supply positive of input terminal is used to drive the opt coupler DC12 ~ 24V of input terminal, current ≥ 100mA
8	Servo Enable	EN	Input	Servo enable input terminals EN ON: allow the drive to work EN OFF: drive off, stop working Motor in a free state Set P5 = 1 to shield this feature Note 1: The motor must be stationary between EN OFF and EN ON. Note 2: To EN ON, at least wait for 50ms and then enter the command
5	Command pulse Eprohibition	INTH	Input	①Position command pulse prohibits input terminals, and the parameter is valid under the position mode. 0: Invalid, does not detect the signal INTH 1: Detection INTH signal effective 2: Test INTH effective and remove the remaining pulses
7	Forward limit	CW	Input	① Motor Forward limit input signal; ② P4 = 7, the motor forward rotating JOG input signal;
6	Reverse limit	CCW	Input	Motor reverse limit input signal; P4=6 the motor reversely rotating JOG input signal;
4	Alarm clear signal	CLR	Input	Alarm clear signal
3	Control method or functional option	MODE-	Input	① Location and speed functional option are valid, and then speed control is selected with P4=4 to set this function; ② Internal speed option is valid to select internal speed with P4=7，P35，P36，P37，P38 to set this function.
14	Pulse signal+	PULSE+	Input	External position control command; Parameter P10 setting mode 0: Pulse + Sign: pulse plus direction 1: CW + CCW: forward and reverse control 2: A + B: 90 °orthogonal pulse
15	Pulse signal-	PULSE-	Input	
17	Direction signal+	SIGN+	Input	
18	Direction signal-	SIGN-	Input	
2	Analog input	Vin	Input	External speed or torque command:0~±10V
1	Analog GND	Vgnd	Input	

13	Orientation completion +	COIN+	Output	① Orientation completion output, and it is valid when location deviation is less than set range; ② The output is valid after completion of internal pulse running ③ Output when torque reaches P45 percentage; Parameter P8 can configure this function.
12	Servo alarm +	ALM+	Output	Servo alarm output is valid.
11	Servo Break out +	BRK+	Output	Servo break out can adjust break control effect by P46, P47 power-on and power-off break delay time regulation.
19	Encoder Signal Z+	OZ+	Output	motor encoder Z signal output
20	Encoder Signal Z-	OZ-	Output	
21	Encoder Signal B+	OB+	Output	Motor encoder B signal output
22	Encoder Signal B-	OB-	Output	
23	Encoder Signal A+	OA+	Output	Motor encoder A signal output
24	Encoder Signal A-	OA-	Output	
10	Encoder Signal Z	OZ	Output	Z encoder Open-collector output
16	PLC+24V input	PLCCOM+	Input	Using for PLC control
25	Output signai gng	OUTCOM-		

3.3.3 Feedback signal terminal of encoder: DB20 connector for CN2 block

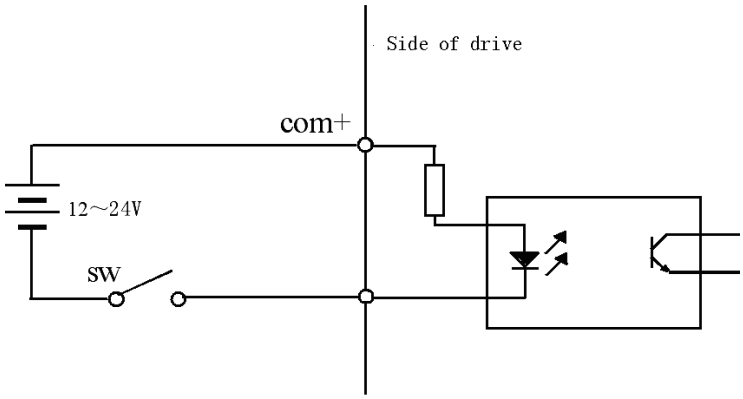


Seeing from the terminal

Pin No.	Name	Description	Pin No.	Name	Description
1	A+	PG input phase A phase	8		PG Power 0V
2	A-	PG input phase /A phase	9	U+	PG input phase U phase
3	B+	PG input phase B phase	10	U-	PG input phase /U phase
4	B-	PG input phase /B phase	11	V+	PG input phase V phase
5	C+	PG input phase C phase	12	V-	PG input phase /V phase
6	C-	PG input phase /C phase	13	W+	PG input phase W phase
7	5V	PG Power +5V	14	W-	PG input phase /W phase
15	PE	Drive inclosure			

3.4 Principles of input and output interfaces

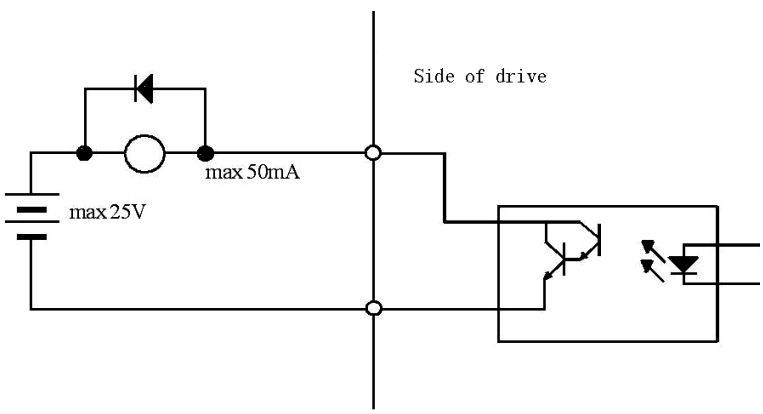
3.4.1 EN, MODE, INTH, CW, and CCW Switch Input Interface



Switch Input Interface

1) Power supply, DC12 ~ 24V, current ≥ 100mA is provided by the user;
2) Please note the reversed current polarity will cause servo drive to fail to work properly.

3.4.2 SRDY, ALM, BRAKE, COIN, and OZ Switch Output Interface

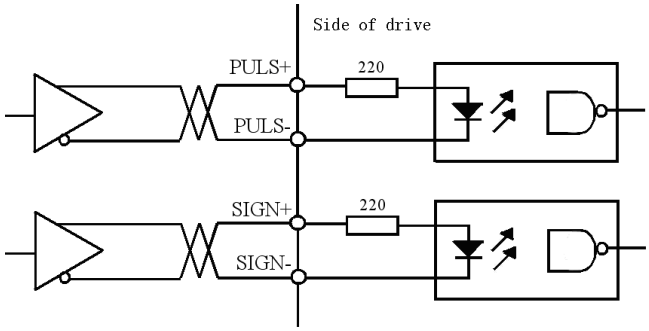


Switch Input Interface

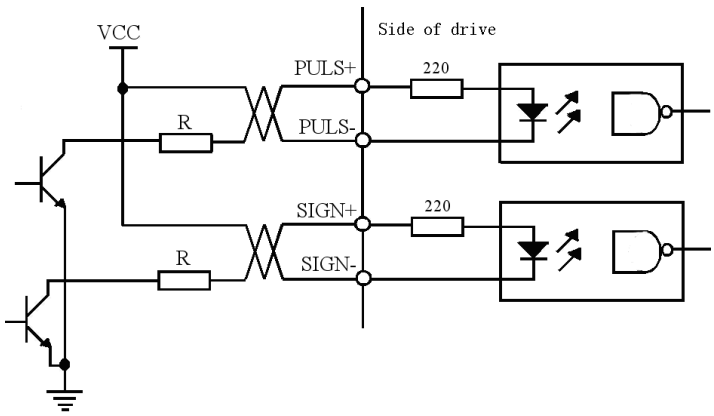
1) External power supply should be provided by the user; however please note the reversed current polarity will lead servo drive to be damaged.
2) Output is open collector form. OZ, SRDY, COIN, and ALM signal maximum current is 20mA; BRAKE signal maximum current is 50mA; therefore BRAKE can directly drive relay, while the OZ, SRDY, COIN, and ALM signal cannot drive relay; an external power supply maximum voltage is 25V. Thereby, the switch output signal of the load must meet the qualification requirements. Excessive limit requirement or output directly connecting with the power supply will cause servo drive to be damaged.

3) If the load is the inductive load with relay etc, you must anti-parallel freewheeling diode at both ends of the load. The reversed freewheeling diode will cause servo drive to be damaged.

3.4.3 Pulse Signal Input Interface:



Pulse signal input interface of the differential drive mode

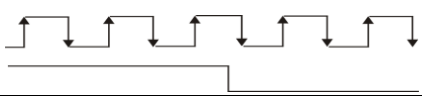
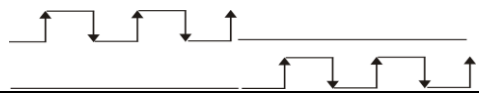
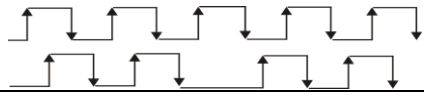


Pulse signal input interface of the single-ended drive mode

1) In order to properly transmit the pulse of traffic data, the differential-driven approach is recommended;
2) After adopting differential drive mode, AM26LS31, MC3487 or similar RS422 line drivers should be used;
3) Please use single-ended drive mode, which will reduce operating frequency. Resistance R values can be determined upon pulse input circuit, drive current 10 ~ 15mA, and external power supply maximum voltage limitation 25V. Empirical data are as follows: VCC = 24V, R = 1.3 ~ 2k; VCC = 12V, R = 510 ~ 820Ω; VCC = 5V, R = 82 ~ 120Ω.
4) Using single-ended drive mode and the external power supply is provided by the user. Please pay attention that the reversed power supply polarity will lead servo drive to be damaged.
5) Please refer to the following table for specific pulse input modes, and required pulse frequency ≤ 500 kHz.

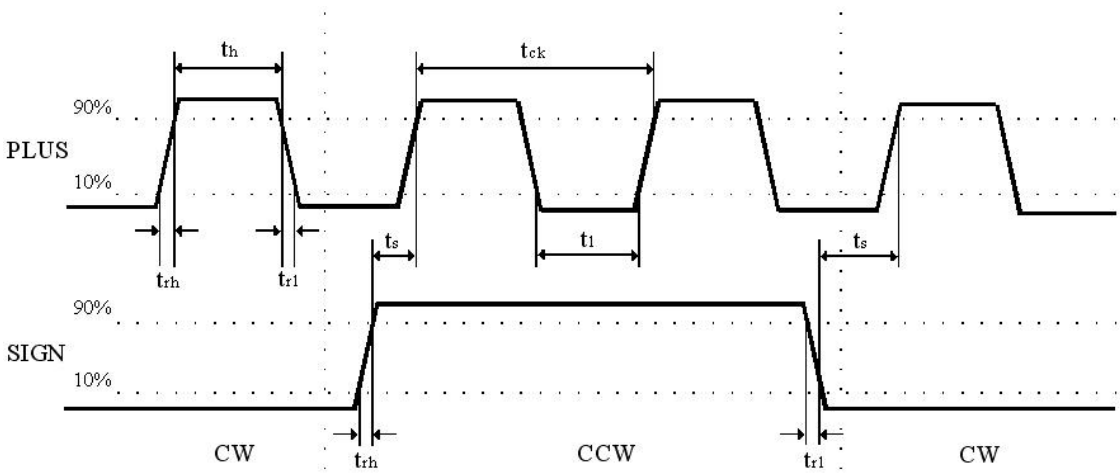
（Duty cycle is 1:1, and actual demand is to be required to pass 0.4US

Pulse Input Modes

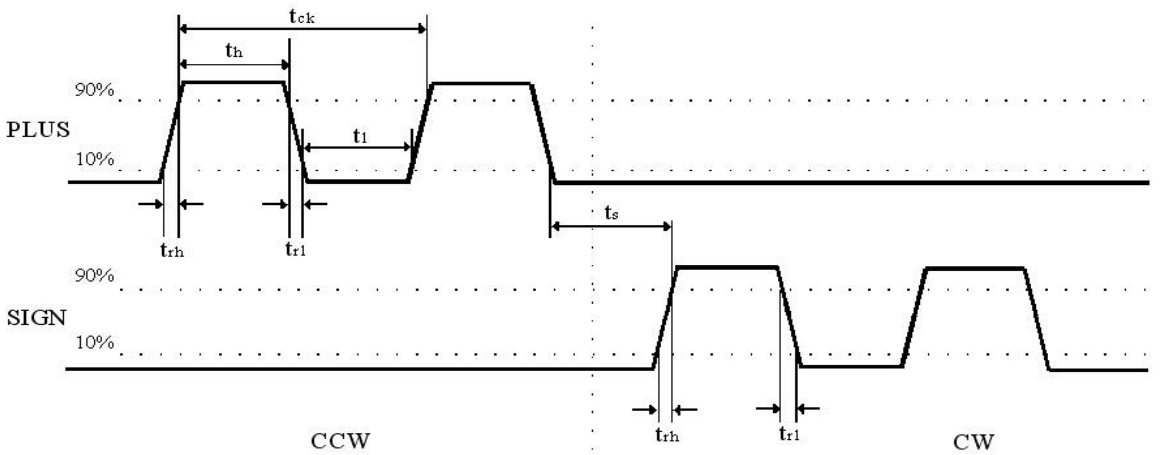
Pulse command	CW CCW	P10 Settings
Pulse + sign	PULS SIGN 	0 Pulse + sign
CCW Pulse CW Pulse	PULS SIGN 	1 CW+CCW Pulse
A + B Pulse	PULS SIGN 	2 A+B 90° Orthogonal pulse

Pulse Input Timing Parameters

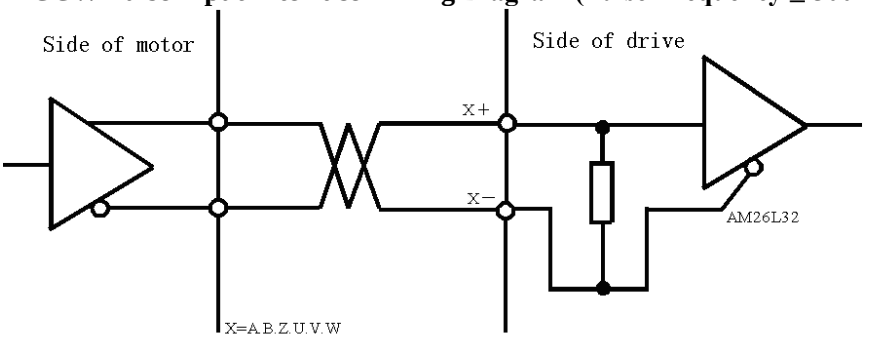
Parameter	Differential Driver Input	Single-ended driven input
tck	>2uS	>5uS
th	>1uS	>2.5uS
tl	>1uS	>2.5uS
trh	<0.2uS	<0.3uS
trl	<0.2uS	<0.3uS
ts	>1uS	>2.5uS
tqck	>8uS	>10uS
tqh	>4uS	>5uS
tql	>4uS	>5uS
tqrh	<0.2uS	<0.3uS
tqrl	<0.2uS	<0.3uS
tqs	>1uS	>2.5uS



Pulse + Sign Input Interface Timing Diagram (Pulse Frequency ≤ 500kHz)



CW + CCW Pulse Input Interface Timing Diagram (Pulse Frequency ≤ 500kHz)



Servo Motor Optical Encoder Input Interface

Chapter IV Parameters

Attention

- Personnel involved into parameter adjustment must understand the meaning of parameters, for the wrong settings may cause equipment damage and personnel injury;
- It is suggested that all the parameters adjustment should be under the situation of the servo motor stationary.

Parameter List:

Parameter No.	Parameter Name	Application Mode	Parameter Range	Factory Default	Unit	Remark
P0	Software version	P, S, T	2015－2050			②
P1	Parameter password	P, S, T	0-9999	0		①
P2	Motor model	P, S, T		400	Motor	①

					power	
P3	Boot display	P, S, T	0－10	0		①
P4	Control mode	P, S, T	0－7	0		①
P5	Servo enable control	P, S, T	0－1	0		①
P6	Servo input signal INTH function	P, S, T	0－1	0		①
P7	Limit input control	P	0－4	0		①
P8	Coin output mode	P, S, T	0－1	0		①
P9	Alarm output mode	P, S, T	0－1	0		①
P10	Pulse mode	P	0－2	0		①
P11	Motor direction	P, S	0－1	0		①
P12	Electronic gear numerator	P,`	1－32000	1		①
P13	Electronic gear denominator	P,	1－32000	1		①
P14	Positioning completion scope	P,	0－32000	5	Pulse	①
P15	Position deviation alarm range	P,	0－32000	0	Pulse	①
P16	Position gain	P,	1－2000	100		①
P17	Position feed-forward	P,	0－32000	0		①
P18	Position smoothing constant	P,	0－1000	0		①
P19	Position acceleration time	P,	0－32000	0		①
P20	Position deceleration time	P,	0－32000	0		①
P21	Speed gain	P, S	1－1000	50		①
P22	Speed integral	P, S	1－32000	10		①
P23	Acceleration time (speed)	S	0 －32000(ms)	100	ms	①
P24	Deceleration time (speed)	S	0 －32000(ms)	100	ms	①
P25	Analog input method	S, T	0－1	0		①
P26	Analog Max. speed	S	1－5000	2000	r/min	①
P27	Torque Max. speed	T	1－5000	2000	r/min	①
P28	Analog input filter coefficient	S, T	0－1000	0		①
P29	Analog input voltage at zero	S, T		0		①
P30	Inertia ration	P, S, T	0-1000	0		①
P31	Analog input percentage	S, T	0-500	0	%	①
P32	Encoder lines frequency splitting	P, S, T	0－127	0		③
P33	Encoder alarm permit	P, S, T	0－1	0		①
P34	JOG speed	S	0－5000	1000		①

P35	Internal speed 1	S	0－5000	100	r/min	①
P36	Internal speed 2	S	0－5000	200	r/min	①
P37	Internal speed 3	S	0－5000	300	r/min	①
P38	Internal speed 4	S	0－5000	400	r/min	①
P39	Internal position 1	P	0－±32000	100	Pulse	①
P40	Internal position 2	P	0－±32000	200	Pulse	①
P41	Internal position 3	P	0－±32000	300	Pulse	①
P42	Internal position 4	P	0－±32000	400	Pulse	①
P43	Communication address	P, S, T	0－255	0		①
P44	Communication baud rate	P, S, T		9600		①
P45	Torque reaching percentage	P, S, T	0－100	100	%	①
P46	Torque percentage of motor stationary	P,	0－100	0	%	①
P47	Start delay of electromagnetic brake	P, S, T	0-3200（ms）	0	ms	①
P48	Stop delay of electromagnetic brake	P, S, T	0-3200（ms）	0	ms	①
P49	Zero speed clamp-on					
P50	Current loop gain	P, S, T	10-4000	600		①
P51	Current loop integral	P, S, T	1-2000	150		①
P52	Encoder lines	P, S, T	1000－6000	2500		③
P53	Encoder type	P, S, T	0－1	0		③
P54	Pole-pairs	P, S, T	2－6	4		③
P55	Drift angle	P, S, T	0—2500	2360		③
P56	Rated current	P, S, T	0－100	28	0.1A	③
P57	Rated torque	P, S, T	0－200	13	0.1NM	③

Remarks:

① It is immediately valid after modification;
② Fixed parameters cannot be modified;
③ I shall be valid when restarting it after modification.

Parameters Detailed table:

SN	Parameter Name	Functional Description	Parameter Range
P0	Software version	● Display different versions	2015-
P1	Parameter password	● The correct password should be input and confirmed when parameter is required to modify after power connection; ● Set to be 0 when delivery from factory; ● 9999 can be input when the password is failure;	0-32000

		● 11111 is the universal password。 ● 22222 can be input to correct the current zero.	
P2	Motor model	● Motor model is entered to directly impact on the following protection features: over-current, overload, and over-speed protections. ● Specification for motor model 101 -------- ACK04010D 201 ------- ACK06020D 400 ------- ACH06040D 401 ------- ACK06040D 700 ------- ACH09075D 801 ------- ACK08080D 1000 ------- ACH13100D 1200 ------- ACH09120D 1500 ------- ACH13150C 2300 ------- ACH13230C 2600 ------- ACH13260C ● 9999 is self-defined type, and please enter it upon the motor specification. P52—Encoder lines P53—Encoder type P54—Pole-pairs P55— Drift angle P56—Rated current P57—Rated torque	
P3	Boot display	0－Rotational speed（RPM） 1－Motor current （A） 2－ Motor loading rate 3－ Motor positions: 4-bit lower 4－ Motor position: 4-bit higher 5－ Input pulse : 4-bit lower 6－Input pulse: 4-bit higher 7－Position deviation 8－Input status 9－Analog input 10－Pulse frequency	0－10
P4	Control mode	0－Position mode: external pulse input; 1－JOG mode: key control; 2－Speed mode: external analog voltage input; 3－Torque mode: external analog voltage input; 4－ Position and speed mode: MODE control; 5－Position and torque mode: MODE control; 6－CW CCW: external signal JOG mode 7－4 sections speed control	0－7
P5	Servo enable control	0－Valid 1－Invalid: forcibly lock shaft	0－1

P6	Servo input signal INTH function	0－Invalid 1－Input pulse prohibition and position deviation clear 2－ Input pulse prohibition and position deviation not clear	0－1
P7	Limit input control	0－Invalid; 1－ Active LOW without alarm; 2－ Active HIGH without alarm; 3－ Active LOW with alarm; 4－ Active HIGH with alarm;	0－4
P8	Coin output mode	0－Orientation completion 1－Torque reaching 2 – Output when speed is less than P49 speed (When P49 < 10rpm, it is handled upon 10rpm.)	0－2
P9	Alarm output mode	0－Normal close type 1－Normal open type	0－1
P10	Pulse mode	● 0－Pulse ＋direction: normal direction; ● 1－Pulse＋pulse: normal direction ● 2－Orthogonal pulse: normal direction	0－2
P11	Motor direction	● 0 － Normal ● 1 － Reverse	0－1
P12	Electronic gear numerator	● Sub-octave of position command pulse is set (E-gear); ● Under the mode of position control, a variety of pulse sources matching can be facilitated through P12 and P13 parameters setup; this value should increase as far as possible under the consideration for drive to accept frequency range less than 500K. ● P×G=N×C×4 P: Pulses entered into the command G: E-gear ration $G=\frac{\text{Numerator of splitting frequency}}{\text{Denominator of splitting frequency}}$ N:Motor rotations C:Optical encoder lines；generally it is 2500 lines ● 〖Example〗When command pulse is required to input 8000，servo motor shall rotate one loop. $G=\frac{N\times C\times 4}{P}=\frac{1\times 2500\times 4}{8000}=\frac{5}{4}$ Then parameter P12 is set as 5，and P13 is set as 4； ● Recommended range of E-gear ratio: $\frac{1}{50}\le G\le 50$	1－32000
P13	Electronic gear	Same as the above parameter P12.	1－32000

	denominator		
P14	Orientation completion scope	● Set orientation completion pulse range under the mode of position control; ● This parameter provides the basis whether the orientation is completed determined by drive under the position control mode; when the remaining pulse in the position deviation counter is less or same as its set value, the drive will determine the orientation is completed, with signal COIN ON; otherwise, will be COIN OFF.	0－32000
P15	Position deviation alarm range	● When it is set as 0, disable position alarm detection is invalid; ● Disable position alarm detection is valid when it is not 0, and this parameter provides the basis whether deviation is too large determined by drive under the mode of position control; When the remaining pulse in the deviation counter is less or same as its set value, the drive will determine the position to not disable without alarm display; otherwise, alarm ER0-04 will occur.	0－32000
P16	Position gain	● Set the proportional gain for position loop regulator; ● Bigger in set value, higher in gain and rigidity. Under the condition of identical frequency command pulse, position lag will be smaller; however, too big value will lead vibration and over-regulation of system; ● The principle of debugging is to possibly adjust this parameter to be bigger, under the situation of guaranteeing the system to operate without vibration and jetter.	1－2000
P17	Position feed-forward	● Set position loop feed-forward coefficient ; ● When it is set as 0, no feed-forward coefficient is added; Bigger in set value, bigger in feed-forward; When position loop fee-forward is bigger, the high-speed response property of control system is better.	0－32000
P18	Position smoothing constant	● Smoothing filter is conducted for command pulse; acceleration and deceleration values with exponential form indicate the acceleration and deceleration. ● Filter will not lose pulse; command delay will exist yet; ● Main applications: Host computer controller has no acceleration and deceleration functions; E-gear sub-octave is large (larger than 8); When motor operational speed is slow, pulse frequency is lower; When step jump happens for motor operation, unstable phenomenon exists. When it is set as 0, filter cannot work.	0－1000
P19	Position acceleration time	Bigger in its value, acceleration time is shorter, and orientation is faster.	0－32000
P20	Position deceleratio	Bigger in its value, acceleration time is shorter, and orientation is faster.	0－32000

	n time		
P21	Speed gain	● Set proportional gain of speed loop regulator; ● Bigger in its set value, bigger in gain and rigidity; the parameter value can be determined upon the specific servo drive model and loading situation. Generally, bigger in load inertia, bigger in its set value; ● It can be possibly set to be bigger under the situation of system without vibration.	1－1000
P22	Speed integral	● Set integral time constant for speed loop regulator; ● Bigger in its set value, faster in integral speed, and stronger in system deviation resistance, i.e. bigger in rigidity; ● However, too big value will produce overshooting. ● It can be possibly set to be smaller under the situation of system without vibration.	1－32000
P23	Acceleration time (speed)	● Setup value refers to the motor acceleration time from 0 to 1000r/min; ● Acceleration and deceleration are characterized with the linear; ● It is valid under the modes of speed control and torque control, and it is invalid under the mode of position control.	0 － 32000(ms)
P24	Deceleration time (speed)	● Setup value refers to the motor deceleration time from 1000 to 0r/min; ● Acceleration and deceleration are characterized with the linear; ● It is valid under the modes of speed control and torque control, and it is invalid under the mode of position control.	0 － 32000(ms)
P25	Analog input method	0－AD input value 1- P35 value fixed to be used;	0－1000
P26	Analog max. speed	It refers to the corresponding speed when analog output reaches the maximum;	1－5000
P27	Torque max. speed	It refers to the limited max. rotation speed under the torque mode.	1－5000
P28	Analog input filter coefficient	0－Prohibition	0－1000
P29	Analog input voltage at zero		
P30	Inertia ratio		0-1000
P31	Analog input percentage	0－equivalent to 100%	0-500
P32	Encoder lines frequency	0- Splitting frequency is not used.	0－127

	splitting		
P33	Encoder alarm allowance	0— Detect encoder 1—Not detect encoder	0—1
P34	JOG speed		0—5000
P35	Internal speed 1		0—5000
P36	Internal speed 2		0—5000
P37	Internal speed 3		0—5000
P38	Internal speed 4		0—5000
P39	Internal position 1		0 — ± 32000
P40	Internal position 2		0 — ± 32000
P41	Internal position 3		0 — ± 32000
P42	Internal position 4		0 — ± 32000
P43	Communication address	1	0—255
P44	Communication baud rate	0-4800,1-9600,2-14400,3-19200,4-	0—7
P45	Percentage of torque arrival	● Set the proportional relation between analog torque input voltage and motor actual operation torque; ● The unit of set value is 0.1V/100%; ● Default value is 100，to correspond to 10V/100%，i.e. 100％ rated torque is produced after 10 V is input.	0—100
P46	Percentage of motor static torque	● Set the torque size of lock shaft when motor stops; ● The unit of its set value: rated torque ×100%; ● Only position loop is valid, with invalid speed loop and torque loop; ● 0 – prohibit this function prohibition; ● Other values - use this function	0—100
P47	Electromagnetic brake ON delay	● It defines the motor enable lock shaft (input terminal SON from OFF to ON); ● Delay time to open brake. (output terminal BRK from OFF to ON) ● This parameter is set to ensure the switch from brake lock shaft to motor enable lock shaft to be stable when the motor with brake is connected to the power.	0—32000（ms）
P48	Electromagnetic brake OFF delay	● It defines the motor enable removal (input terminal SON from ON to OFF); ● Delay time to close brake. (output terminal BRK from OFF to ON)	0—32000（ms）

		● This parameter is set to ensure the switch from motor lock shaft to brake lock shaft be stable when the motor with brake is disconnected to the power; ● This parameter can be prolonged when the motor is from high-speed operation to stop, to enhance the effect of rapid deceleration.	
P49	Zero speed clamp-on	The motor will stop when the value is less than this parameter.	0-2000
P50	Current loop gain	● Current loop proportional gain, and when motor current is bigger, its set value should be adjusted to be bigger appropriately, and the operational sound of motor operation will be louder. Generally it doesn't need to be adjusted. ● Default value is 600.	10-4000
P51	Current loop integral	● Current loop integral gain, and when motor current is bigger, its set value should be adjusted to be bigger appropriately, and the operational sound of motor operation will be louder. Generally it doesn't need to be adjusted. ● Default value is 150.	1-2000
P52	Encoder lines	● Only if motor type is set to be （P2=9999）, this parameter will be valid. ● Encoder lines of input motor is generally 1024,2048, 2500, 3000, 5000. ● Please note that this parameter will be valid after it is modified and saved, and then restart the machine; ● Default value is 2500.	1000 — 6000
P53	Encoder type	● Only if motor type is set to be （P2=9999）, this self-defined parameter will be valid. ● Set value as 0 refers to general non-cable saving encoder; set value as 1 refers to cable saving encoder; ● Please note that this parameter will be valid after it is modified and saved, and then restart the machine; ● Default value is 0.	0－1
P54	Pole-pairs	● Only if motor type is set to be （P2=9999）, this self-defined parameter will be valid. ● Set value refers to the number of pole-pairs; ● Please note that this parameter will be valid after it is modified and saved, and then restart the machine; ● Default value is 4.	2－6
P55	Drift angle	● Only if motor type is set to be （P2=9999）, this self-defined parameter will be valid. ● Set value refers to drift angle between motor angle and zero point; ● Please note that this parameter will be valid after it is modified and saved, and then restart the machine; ● Default value is 2360.	0－2500
P56	Rated current	● Only if motor type is set to be （P2=9999）, this self-defined parameter will be valid.	0－100

		● Set value refers to the motor rated current size, to only impact on the protective function of motor current without impact on motor operational effect; ● Setup unit （0.1A）.	
P57	Rated torque	● Only if motor type is set to be （P2=9999）, this parameter will be valid. ● Set value refers to the motor rated torque size, to only impact on the protective function of torque control without impact on motor operational effect; ● Setup unit （0.1A）. ● Self-defined unit (0.1Nm)	0－200
P61	Drive current type	0 refers to QS6AA015M above; 1 refers to QS6AA010M.	0－1
P62	V-phase current zero correction	It refers to drift value of V-phase current zero	2008 － 2088
P63	W-phase current zero correction	It refers to drift value of W-phase current zero	2008 － 2076

Attention

- It is recommended that all parameter settings and modification should be implemented when the motor is prohibited.
- All parameters (only P2 parameter will be effective after re-electrified when disconnecting power) settings will be effective after just pressing "Enter", without re-electrifying; however, parameter writing should be performed for long-term preservation;
- When the power of drive is OFF, please wait for more than 30 seconds and then re-electrify it.
- When the drive is used fro numerical control system, the parameters P12 and P13 are calculated as follows:

$$\frac{P12}{P13} = \frac{\text{Mechanical reduction ratio} * \text{System pulse equivalent} * 10000}{\text{Screw pitch (mm)}}$$

General CNC pulse equivalent: 0.001mm

Chapter V Error Alarm

Attention

- Do not touch drive and motor within 5 minutes after driver and motor power-off, to prevent person from injury due to electric shock;
- Allow to use drive after drive alarm code troubleshooting while drive failure alarms;
- Show Er0-xx and blinking while error is found, wherein xx refers to alarm code;
- Operate drive to view and modify parameters after alarming.

Alarm List:

Alarm Code	Alarm Content	Cause of Malfunction
ER0-00	Normal	
ER0-01	Motor speed is too high	1) Encoder wiring error 2) Encoder damage 3) Encoder cable is too long, resulting in the low encoder supply voltage 4) Running too fast 5) Input pulse frequency is too high 6) Electronic gear ratio too big 7) Servo system instability causes overshooting 8) Circuit Board Fault
ER0-02	The main circuit supply voltage is too high	1) The supply voltage is too high (more than +20%) 2) Disconnect the brake resistor wiring 4) The internal regenerative braking transistor is broken 5) The internal regenerative braking circuit capacity is too small 6) The circuit board failure
ER0-03	The main circuit power supply voltage is too low or drive temperature is too high	1) The supply voltage is too low (less than -20%) 2) Temporary power outages for more than 200mS 3) Power start circuit failure 4) The circuit board failure 5) The drive temperature is too high
ER0-04	Tolerance alarm	1) Mechanical choked to death 2) Input pulse frequency is too high 3) Encoder zero change in 4) Encoder wiring error 5) P16 position loop gain is too small 6) Less torque 7) P15 parameter setting is too small 8) P15 = 0 shields this feature, resulted in no alarm
ER0-05	Drive temperature is too high	● The ambient temperature is too high ● Bad cooling fan ● Broken temperature sensor

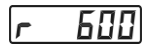
		● Motor current is too big ● Internal regenerative braking circuit failure ● Broken internal regenerative braking transistor ● Circuit Board Failure
ER0-06	EEPROM writing memory error on drive	Chip U19 failed and should be replaced.
ER0-07	CW Motor Forward limit	Hit the forward limit switch, you can set the parameter P7 = 0 to shield this feature or reversely rotate motors.
ER0-08	CCW Motor Reverse limit	Hit the reverse limit switch, you can set the parameter P7 = 0 to shield this feature or reversely rotate motor.
ER0-09	Encoder fault	1) Encoder damage 2) Encoder wiring is damaged or broken 3) P33 = 1 shields this feature, resulted in no alarm 4) Encoder cable is too long, resulting in low encoder supply voltage
ER0-10	Motor overload alarm	Overload excesses the parameters of motor rated torque: More than 150% rated overload: over 10000 ms; More than 300% rated overload: over 1000ms; More than 500% rated overload: over 10ms The machine is stuck for rigidity is adjusted too strong; Speed increase and decrease are too fast.
ER0-11	Power module fault	● Over-current ● Voltage is too low ● Motor insulation is damaged ● Gain parameter is set incorrectly ● Overload ● Temperature is too high ● Module is damaged ● Interference ● Short-circuits occurs among motor cables U, V, and W.
ER0-12	Over-current	1） Short-circuits occurs among motor cables U, V, and W. 2） Imperfect grounding 3） Broken motor insulation

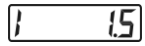
Chapter VI Display and Parameter Settings

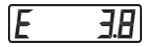
6.1 Drive Displays

Servo System panel comprises 6 LED digital tube displays and 4 keys. Digital tube is used to show the various states and parameters of servo drive; key is used to set and access system parameters.

The servo system is normally displayed with the following 10 methods:

1) Indicating motor speed: parameter P3 = 0, unit: r/min 

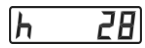
2) Indicating the motor current: parameter P3 = 1, unit: A 

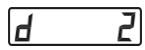
3) Indicating the motor torque percentage: parameter P3 = 2, unit: % 

4）Indicating motor operation position 4-bit lower: parameter P3 = 3,unit:pulse 

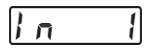
5) Indicating motor operation position 4-bit higher: parameter P3 = 4,unit:pulse

6 Indicating input pulse 4-bit lower: parameter P3 = 5,unit:pulse 

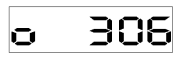
7）Indicating input Pulse 4-bit higher: parameter P3 = 6,unit:x1000pulse 

8）Indicating position deviation: parameter P3=7, unit: pulse 

9) The Input interface diagnoses: 

Hexadecimal number display data means: 

When D0=1, “EN”input is valid； Displaying 1.
When D1=1,“INTH”input is valid； Displaying 2.
When D2=1, “CLR”input is valid； Displaying 4.
When D3=1,“MODE”input is valid; Displaying 8.
When D4=1, “ZO” input is valid; Displaying 16.
When D5=1, “CW” input is valid; Displaying 32.
When D6=1, “CCW” input is valid; Displaying 64.
When D7=1, “RLM” input is valid; Displaying 128.

10）、Analog input: indicating the size of inputted analog: parameter： 

11）、Input pulse frequency：unit： 

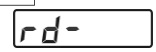
6.2 Keyboard Operation

Drive panel comprises 6 LED digital tube displays and four keys "↑", "↓", "Mode", "Enter" , to display various states of the system and set parameters. Key features are as follows:
"↑": parameter number, value increase, or motor running forward under the JOG mode;
"↓": parameter number, value reduction, or motor running reversely under the JOG mode;
"Mode": function options, or the current digital cursor moving left.
"Enter": function key for confirmation, or data entry confirmation.

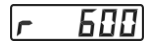
Under normal circumstances, press "Mode" to entry ①'parameters" setting, ②'parameter written", ③'parameter initialization" ， ④ “Alarm display” (it will not be displayed when no alarm), ⑤ “Display state”, all of which can be cycle selected.

①"Parameter": P1～P63 

②"Parameter writing": It is valid when entering right password; 

③"Parameters initialization”: It is valid when entering right password; 

④ “Alarm display” (the picture shows no alarm) 

⑤ “Display state”: Same as indicated content of P3 parameter 

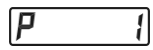
When alarm occurs, please adjust to the alarm screen and press “↓” to eliminate alarm.

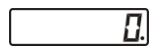
Attention

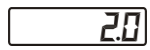
- When password of input system fails to be found, you can access ①'parameters" view, and enter password to modify P3 parameter; however, other parameters cannot be changed.

6.3 Parameter Settings

6.3.1 Parameter settings

1) Under normal circumstances, press "Mode" to entry ① "Parameters" 

2) Press "↑" or "↓" keys to select the parameters number which you want to modify, and then press "Enter". 

3), Press "↑" to auto-add one value, press "↓" key to auto –reduce one value, and press "Mode" key to shift current the current number (decimal point position) to the left, and press "Enter" key for data confirmation. 

Attention

- The data are invalid and the system return display status under the situation of password absence.
- Parameter P1 is input to display “0”; at this situation, “Enter” key can be pressed directly to indicate that system password has been input.

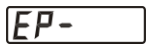
6.3.2 Password input and changes

Password must be entered into the system for system parameter setting of each boot.P1 parameter input is system password input. When the input password is correct, it can set other parameters; otherwise other parameters cannot be set.

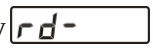
Password changes must enter the old password firstly, and then you can set the P1 parameters. If system password cannot remember, please use universal password: 11111.

When the password is set to "9999", you can modify parameters without password input for the next boot.

6.3.3 Parameter writing:

In the display status, press "Mode" and select to enter  ② "parameter writing": parameter writable state. When changed parameters by user need to save for long term, parameter writing operation should be implemented. Press "Enter" key for three seconds, and the parameters will be written in the internal EEPROM, and then press "Enter" key to return, after writing completion and showing  .

6.3.4 Parameter initialization

In the display status, press "Mode" and select to entry  "parameter initialization" state.

When the user needs to import the factory system parameter values, press "Enter" key for three seconds, and parameters except for password will be initialized to be the factory default values for the system; however these values do not write into the internal EEPROM. If writing is necessary, please implement writing operation.

After completion and showing  , please press "Enter" key to return.

Chapter VII Debugging

Attention

- Drives and motor should be grounded reliably, PE should be reliably connected with motor grounding;
- It is recommended that drive power supply is provided through the isolation transformer, to ensure the safety and anti-jamming capability;
- Power supply can be connected after wiring is checked and confirmed to be correct;
- The failures should be confirmed to be eliminated prior to re-start, after drive failure alarm;
- Do not touch drive and motor within 5 minutes after power-off of drive and motor, in order to prevent electric shock;
- Please pay attention that temperature of drive and motor may be high after they have worked for a while, in order to avoid burning.

7.1 Power Supply Timing

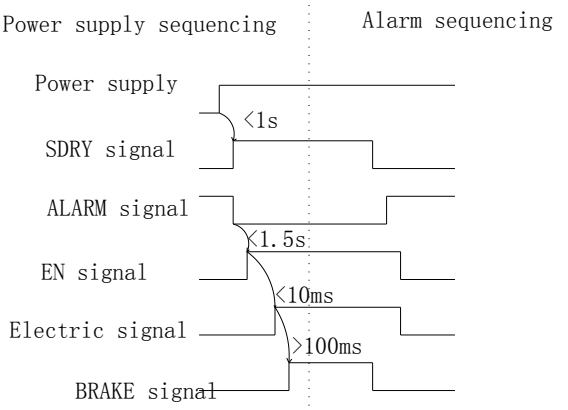
7.1.1 Power supply wiring

Please refer to Diagram 7-1 for power connection, and then connect the power in the following order:

1) The power supply is connected into main circuit power supply input terminal (connecting R/S/T) through the electromagnetic contactor.
2) After Power is connected, wait for about 1.5 seconds delay, and servo ready signal (SRDY) will be effective. Now it can accept the servo enable (EN) signals, and detect servo enable effectiveness, driver output effectiveness, electric incentive, and power-on status. When servo enable is detected to be invalid or alarm occurs, electric incentive circuit will shut down, and the motor is in a free state.
3) When the servo enable can be connected together with the power supply, electric incentive circuit will be connected after approx. 1.5 seconds.
4) Frequent power –on and power –off may damage soft-start circuit and dynamic braking circuit. Therefore, it is better that power-on and power-off frequency should be limited to be 5 times

per hour, and less than 30 times every day. If the drive or motor is overheating, please wait for 30 minutes for cooling after troubleshooting, and then re-connection of power.

7.1.2 Power Sequencing

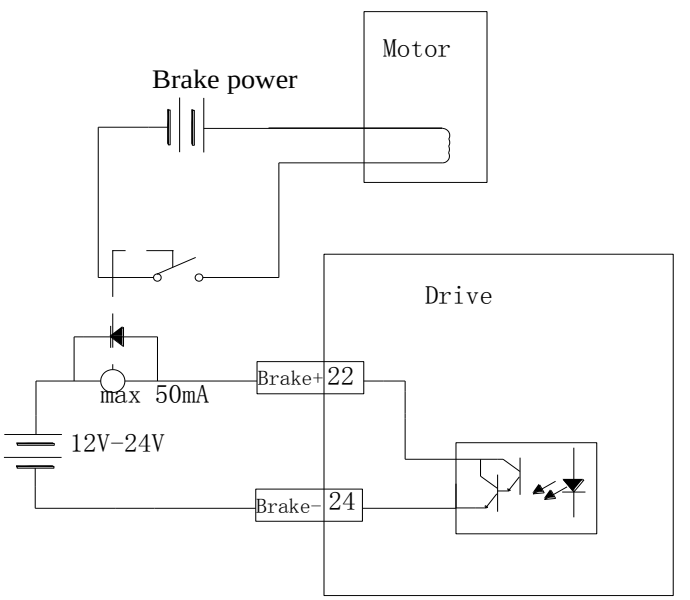


7.2 Use of Mechanical Brake "BRAKE"

Mechanical brake is used to lock the vertical or tilt table connecting motor, to prevent motor from falling down after power-failure. The motor with brake feature should be selected to achieve this function.

BRAKE signal of drive is used to control auxiliary relay, which will start brake power (brake power is provided by the user). BRAKE will be effective in P47 delay time after drive motor incentives power supply is electrified. When power-off or alarm occurs, drive will auto-disconnect BRAKE with signal delay time P48, and then motor incentive power supply will be disconnected.

When this signal is installed, the brake power supply must have sufficient capacity, and must use freewheeling diode as surge absorber. Please see diagram below.



7.3 Operation

7.3.1 Pre-operation checks

After completion of the installation and connection, please check the following items before power-on:

- Whether the power terminal wiring is correct and reliable? Whether the input voltage is correct?
- Whether power lines and motor wires get short circuit or grounding?
- Whether the control signal terminal is connected correctly? Whether power supply polarity and size are correct?
- Whether drive and the motor are fixed firmly?
- Whether motor shaft is not connected to the load?

7.3.2 JOG Control of Servo System

When the system parameter is set to be P4 = 1, the servo system is under the mode of JOG control.

Press "↑", servo motor rotates forward; release "↑", the motor stops. Running speed is determined by the setting values of parameters P34.

Press "↓" servo motor rotates reversely; release "↓", the motor stops. Running speed is determined by the setting values of parameters P34.

JOG control acceleration time constant is adjusted through parameters P23; JOG control deceleration time constant is adjusted through the parameter P24.

7.3.3 Position Control of Servo System

When the system parameters are set to be P4 = 0, P4=4, or P4= 5 and signal is invalid, servo system in under position control mode. Running speed is determined by input pulse frequency; running direction is determined by the input direction and P11; running pulse mode is set by P10.

When P6 = 1,2 , and INTH signal is valid, this function can be terminated.

Electronic gear is determined by P12 and P13.

When P18 confirmed as 0 for position smoothing, it cannot be used, as less use, more effect;

Position control acceleration time is usually regulated through parameter P19; Position control deceleration time is usually regulated through parameter P20;

7.3.4 Speed Control of Servo System

When the system parameters are set to be P4 = 2, or P4 = 4, and MODE is valid, servo system is in the speed control mode. The maximum operating speed is determined by the parameters P26 and P31. The maximum operating speed refers to the operating speed when input voltage is 10V.

Operating speed is determined by Vin1 voltage, and direction is determined by the symbols of Vin 1 and P11. When P15=2, direction is determined by CW and CCW, wherein, CW and CCW respectively refer to motor rotation forward and reversely.

Zero-drift of speed control is adjusted through parameter P29, and adjusting this parameter to set motor speed to be 0 when input voltage is 0V.

Speed control acceleration time constant is adjusted through the parameter P23; speed control deceleration time constant is adjusted through the parameter P24.

When P4 = 4, under the MODE switch, feeding instruction can be transmitted after 10ms delay of MODE reaching.

7.3.5 Torque Control of Servo System

When P4 = 3, or P4 = 5, and MODE is effective, servo system is in torque control mode. Torque is determined by the input voltage Vin1. The direction is determined by the symbols of Vin1and P11. Input voltage is maximum torque when the torque is 10V. The maximum speed specified by the internal rate of P27.

Zero-drift of torque control is adjusted through the parameter P29, and adjusting this parameter to set motor speed to be 0 when input voltage is 0V.

Torque can be adjusted through the parameter P45 to gain size compensation adjustment; bigger value, greater torque.

When the output torque reaches parameter rated current percentage P45, COIN signal is output. COIN is the pulse signal with the width of 10ms.

7.3.6 Internal Speed Control Servo System

When the system parameter is set to be P4 = 7, servo system is in the internal speed control mode.

After the input signal MODE (level signal) is input and valid, the motor starts; after the input signal INTH (NC signal) is input and effective, the motor stops. Speed is determined by the input signals CW and CCW decision. Please see the below table:

MODE signal	INTH signal	CCW signal	CW signal	Motor speed
	0			0
1	1	0	0	P26(the max. rotational rate when Vin=10V)analog control when P35=0;
1	1	0	1	P36
1	1	1	0	P37
1	1	1	1	P38

7.3 Debugging

Attention

- The wrong parameter settings may lead equipment failure and accidents, the parameters should be confirmed to be correct before the start.
- It is recommended that a no-load commissioning is implemented firstly, and load debugging can be conducted.

7.4.1 Gain and Rigidity Commissioning

a) Position loop gain P16 is set to be low value firstly, and then under the premise without abnormal noise and vibration, speed loop gain P21 will be increased gradually and to be maximum value (the determination condition is that there is noise under the situation of motor stationary, when speed loop gain is increased.). After speed loop gain P21 is determined, position loop gain P16 can be adjusted properly.

b) If speed loop gain is reduced and position loop gain is increased, the position loop gain is adjusted to be maximum value under the premise of response without overshooting and no vibration.

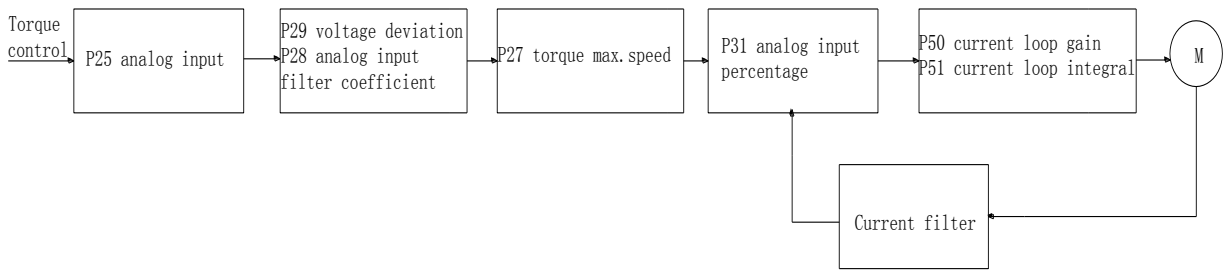
c) Constant of speed loop integral time P22 is specified by positioning time length. This value should try to be reduced under the premise of mechanical system without vibration. Then position loop gain, speed loop gain, and integral time constant can be fine-tuned, and find out the optimum values.

d) Current loop gain P50 and current loop integral P51 have been determined by the motor, and therefore they do not need to be adjusted basically.

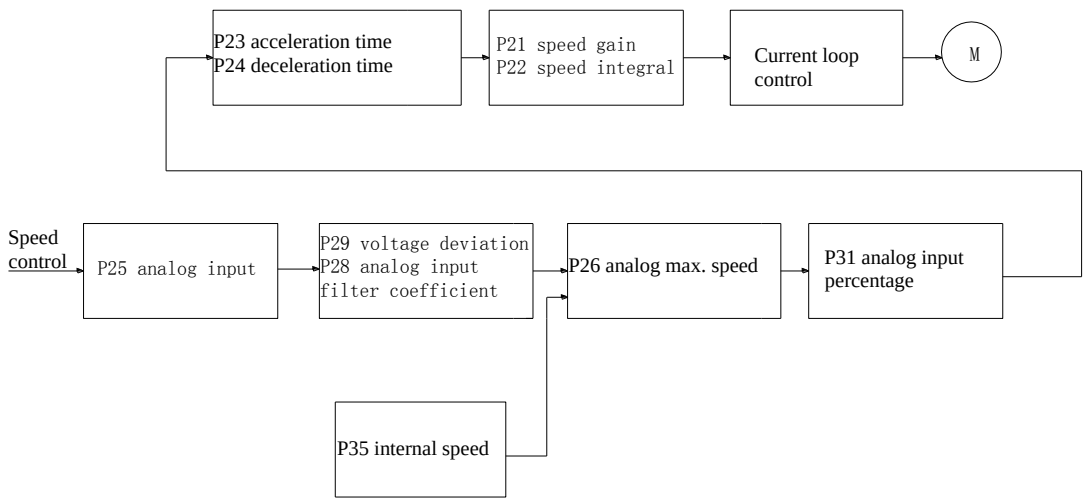
e) If electronic gear is big P12/P13 (more than 10), position filter coefficients P18 should be adjusted properly to ensure the motor to be operated steadily.

7.4.2 Basic Parameters Adjustment Diagrams

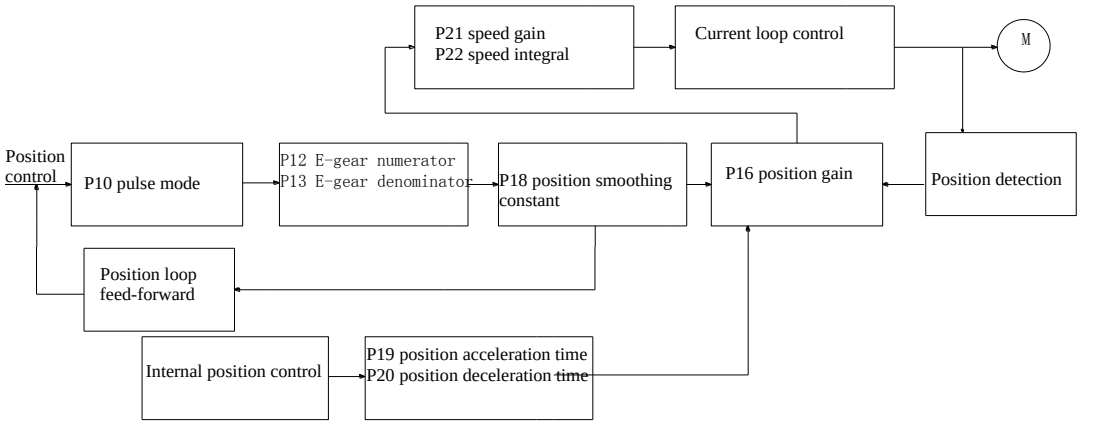
Torque Control Flow Diagram



Speed Control Flow Diagram



Position Control Flow Diagram



7.4.3 Position Resolution and Electronic Gear Settings

Position resolution (an impulse travel) determines the stroke per turn on the servo motor and encoder feedback pulses per turn Pt, which can be expressed with the below formulation:

$$\Delta l = \frac{\Delta S}{P_t}$$

Equation,

Δl: A pulse travel（mm）;

ΔS: Servo motor stroke per revolution（mm/r）;

P_t: Encoder feedback pulses per revolution（pulse/r）。

The system has four multiplier circuit, so $P_t = 4 \times C$, wherein, C refers to the number of lines per revolution of encoder. In this system, C = 2500 lines / turn, so Pt = 10000 pulses / turn.

Command pulses multiplies electronic gear ratio G and then it can be transferred into position control pulse, so a command pulse stroke is expressed as follows:

$$\Delta l^{*} = \frac{\Delta S \times G}{Pt}$$

Equation, $G = \frac{\text{Command Pulse Divider numerator}}{\text{Command Pulse Divider denominator}}$

When the drive is used for numerical control system, the parameters P12 and P13 are calculated as follows:

$$\frac{P12}{P13} = \frac{\text{Mechanical reduction ratio} \times \text{system pulse equivalent} \times 10000}{\text{Screw pitch(mm)}}$$

General CNC pulse equivalent: 0.001mm

7.4.4 Servo Start and Stop Debugging Features

Servo System start-stop feature refers to the time of acceleration and deceleration, which is determined by the load inertia, start, and stop frequency, and also limited by the servo drive and

servo motor performance. Frequent start-stop, too short acceleration and deceleration time, too big load inertia will result in overheating of the drive and motor, overvoltage alarm of main circuit. Therefore it must be adjusted upon the actual conditions.

1) Load inertia and start-stop frequency

When used under the situation of high start-stop frequency, it is necessary to confirm in advance whether the motor is in the allowed frequency range. Allowed frequency range varies in terms of the different motor type, capacity, load inertia, and motor speed. Under the condition of load inertia of m times motor inertia, start-stop frequency and recommended acceleration and deceleration time of servo motor are as follows:

Multiples of the load inertia	Allowed start-stop frequency
m≤3	＞100Times/min：Acceleration and deceleration time constant is 500 or less
m≤5	60～100Times/min：Acceleration and deceleration time is 150 or less
m＞5	＜60Times/min：Acceleration and deceleration time is 50 or less

2) Impact of servo motor

Different types of servo motors permitted start-stop frequency and acceleration and deceleration time vary according to different load conditions, run-time, duty cycle, and ambient temperature. Please refer to electrical specifications and make the adjustment upon specific conditions, to avoid overheating resulted in the alarm or affect the service life.

3) Adjustment method

General load inertia should be less than 5 times of rotator inertia. If always used for large load inertia, the motor may generate over-voltage of main circuit or abnormal braking at the time of slowing down, and then the following methods can be adopted:

- Increase the acceleration and deceleration time. You can set a little too big value firstly and then gradually reduce it to be an appropriate value.
- Reduce the internal torque limit value and lower current limit.
- Reduce the maximum motor speed.
- Use motor with bigger power and inertia.

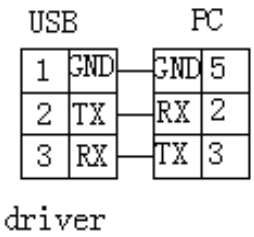
Chapter 8 communication between servo driver and PC

8.1 Communication lines of connection

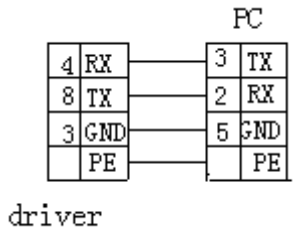
This terminal has special definition，we suggest you use our optional accessory which Special communication line（USB-TO-serial port）。

If through RS-232 port，the driver head’s definition：

warming：different driver terminal have difference connection



apply to QS6AA010/015/020M
QS1AA030M2



apply to QS6AA030M2/050M2

8.2 preparatory work before Communication

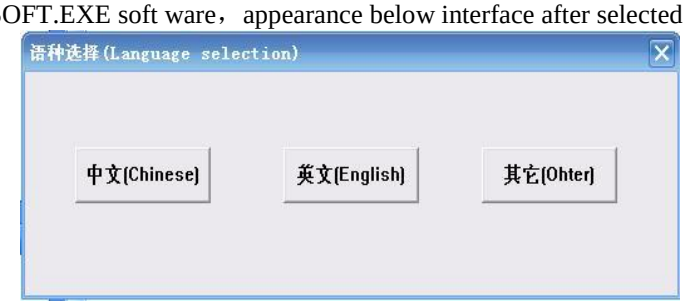
1、confirm the driver's version：means after start the driver，check P0 parameter，the version must be 2024 or advance version；

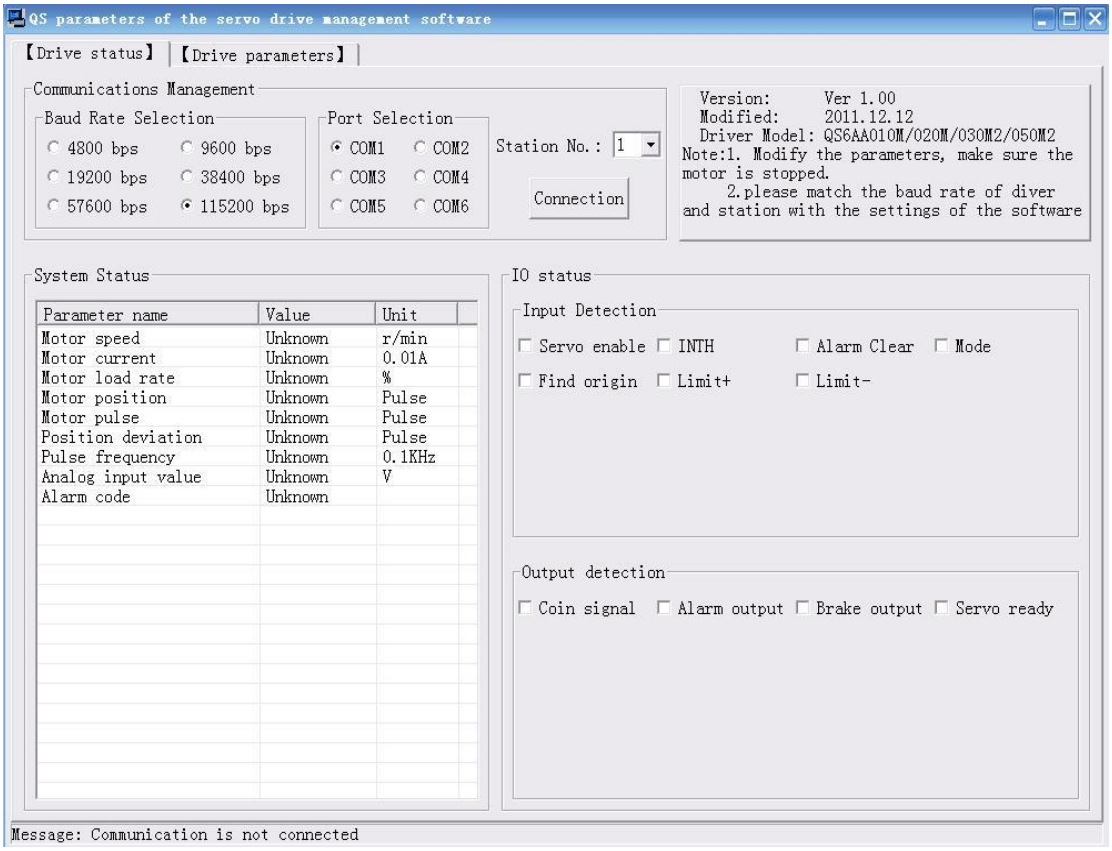
2、confirm communicate spot number of the driver can match computer and communicate baud rate

3、confirm connecting cable available

8.3 communication

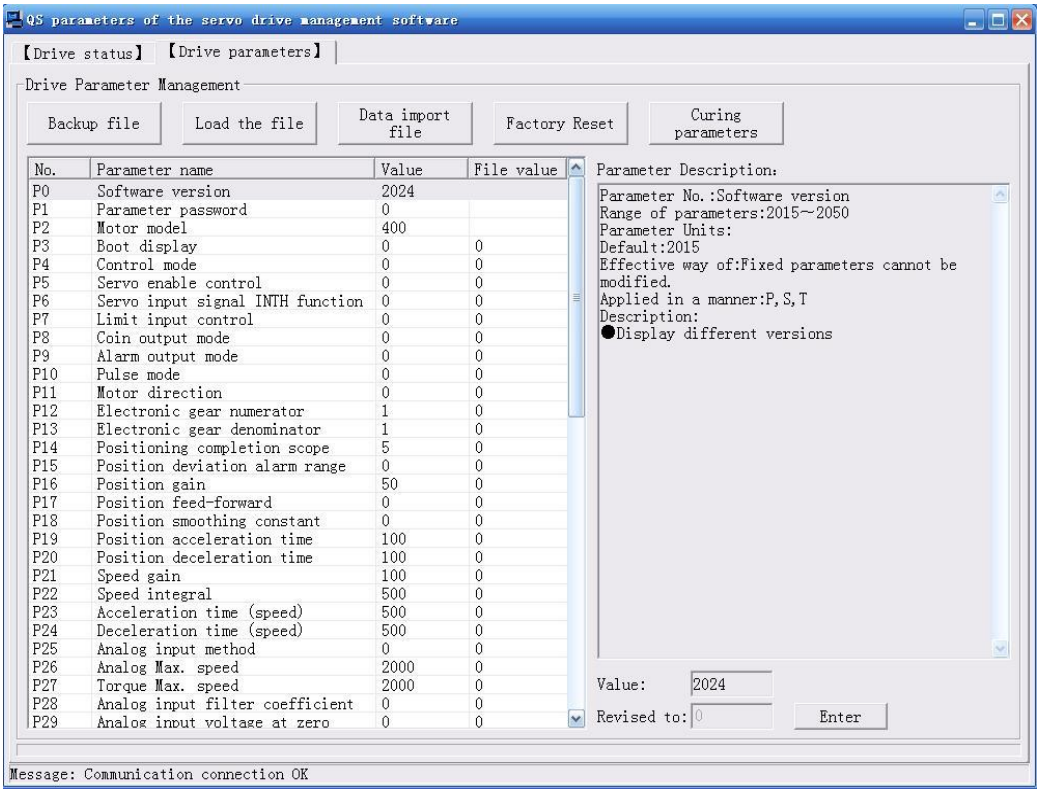
1、open SEVERSOFT.EXE soft ware，appearance below interface after selected language；





2、base on the driver's patameter to change the communicate Baud rate（driver No p44 parameter）、select the port （click my computer—device manager –com and lpt，select a port except com1）and communicate No（driver No p43 parameter），click connect after finish the setting，and then connect succeed，the left bottom of the interface appear "communication link OK"；

3、click driver's parameter，appear parameter setting interface as below：



Can start setting when this interface appear；

8.4 the problem and solution in communication

1、when the driver alarm，sometime the communicate invalid if the configuration is correct

solution：get rid of the dirver alarm, restart the dirver.

2、select wrong baud rate for the servo driver，and the communication invalid

solution：pull up the USB and reconnect，and restart the dirver's communicate sofaware

3、under rapidly and repeatedly pull and plug the USB and repeatedly restart the driver, communicating invalid

solution： USB and driver communicate device need a litter time to reaction, just wait a moment andconnect the communication